SCHOOL OF ECONOMICS

ESSAYS ON FARM HOUSEHOLD CREDIT CONSTRAINT, PRODUCTIVITY AND CONSUMPTION INEQUALITY IN MALAWI

by

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ABSTRACT

Credit has proven to be a necessary tool for economic development affecting positively the welfare of households and individuals. However, one major area in which rural households lack is access to financial markets including credit. The studies included in this thesis contribute to the access to credit literature and the credit constraint/unconstraint impact on some welfare outcomes. The first empirical study examined farm households' access to credit in rural Malawi. Unlike previous empirical studies, particular attention is given to discouraged borrowers who are mostly ignored in such studies. Using the 2010/2011 household survey data from Malawi the study determines the demographic and socio-economic characteristics that distinguish farm households who need credit, who are the discouraged borrowers and who are rejected applicants. A three-step sequential estimation model following a trivariate probit model with double sample selection was adopted. The findings revealed that there were over 7 times more discouraged borrowers than denied applicants. Women were more likely to be discouraged from applying for credit but, if they applied, they were more likely to be successful in obtaining credit than males. This shows that when examining farm households' access to credit discouraged borrowers should be given special consideration.

Capturing discouraged borrowers as also credit constrained, the second empirical study employed a switching model to estimate the impact of credit constraint status on farm productivity for each credit constraint regime. The study further compared the expected production under actual and counterfactual conditions for a household being credit constrained or unconstrained. The findings suggest that a household that is constrained is less productive than a randomly selected household from the sample would but that for the unconstrained household is inconclusive, however, the counterfactual arguments as seen from the analysis shows that being credit unconstrained was beneficial to the increase in productivity.

Studies have shown that undeveloped financial markets have been a major contributing factor increasing inequality, especially in developing countries. The third empirical study examined the impact of household credit constraint on the consumption inequality of rural households in Malawi. Factors that explain the within and between credit constrained and unconstrained status of consumption inequality were examined. The General Entropy (GE) Index and the Regression-Based Inequality Decomposition Methods, Field's (2003) and Blinder-Oaxaca Decomposition were employed. The findings show that inequality was more prominent within the groups than between them. Also, the size of households and the value of assets were the major contributors to the within-group inequalities for credit constrained and unconstrained households. Further, only the endowment component was important in explaining the consumption inequality gap between the credit constrained and unconstrained households. Adjusting the level of endowments of constrained households to that of the unconstrained households increased their welfare by 15.7 percent.

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LIST OF ABBREVIATIONS

ADMARC	-	Agricultural Development and Marketing Corporation
EAs	-	Enumeration Areas
ECLOF – MAL	-	Ecumenical Church Loan Fund, Malawi
FIMA	-	Financial Inclusion in Malawi
FINCA – MWI	-	The Foundation for International Community Assistance
FITSE	-	Finance Trust for the Self Employed
FSAP	-	Financial Sector Assessment Program
FSDS	-	Financial Sector Development Strategy
FSDT	-	Financial Sector Deepening Trust
FSTAP	-	Financial Sector Technical Assistance Project
GPS	-	Global Positioning System
IMF	-	International Monetary Fund
NSSP	-	National Social Support Programme
MGDS	-	Malawi Growth and Development Strategy
MLF MWI	-	Microloan Foundation Malawi
MPRS	-	Malawi Poverty Reduction Strategy
MRFC	-	Malawi Rural Finance Company Limited
MUSCCO	-	Malawi Union of Savings and Credit Cooperatives
NSFI	-	National Strategy for Financial Inclusion
NSFI	-	National Strategy for Financial Inclusion
NSO	-	National Statistics Office
OIBM	-	Opportunity International Bank of Malawi
PSUs	-	Primary Sampling Units
RSCA	-	Rotating Savings and Credits Associations
TPDSS	-	Trivariate probit with double sample selection
UNCDF	-	United Nations Capital Development Fund
VSLA	-	Village Savings and Loan Associations

CHAPTER 1

INTRODUCTION

1.1 Background

Malawi is a landlocked country situated in the East of Africa sharing boundaries with Mozambique, Zambia and Tanzania. It occupies a total land area of 118,484 km^2 with 59.2 percent used for agricultural purposes. The capital city Lingogwe is located in the central region of the country while the countries second city, Blantyre, viewed as the commercial centre of the country is located in the south. The estimated population of Malawi is about 17,964,697 (July 2015 estimate) with a population growth rate of 3.32 percent (Cia.gov, 2016). According to the 2008 population and housing census, the southern region of the country holds the largest population of about 45 percent, followed by the Central (42%) and then the north (13%) (National Statistical Office (NSO), 2008). It is an example of a typical rural sub-Saharan nation with about 85 percent of total population living in the rural areas.

Malawi is one of the poorest countries ranking 174 out of about 187 countries in the 2013 Human Development Index (United Nations Development Programme (UNDP), 2015). About 50.7 percent of the population are poor (those with total consumption below the poverty line of 37,002 Malawi Kwacha) with a rural poverty of 56.6 percent compared to urban poverty headcount of 17.3 percent (NSO, 2012; World Bank, 2015). Apart from the obvious urban-rural disparity in development, the country is easily divided into three regions; northern, central and southern regions. The southern followed by the central region are the most deprived regions. About 49 percent of the poor population live in the southern part of the country and 38 percent of the population in the central region (NSO, 2012).

The economy of Malawi is agriculture-based, employing almost 80 percent of the total labour force in the country with about 90 percent of this population in the rural areas. The export earnings from agriculture are about 90 percent of total export revenue whiles the sector contribution to GDP is about one third (Cia.gov 2016). The real GDP growth

in Malawi was estimated at 5.7 percent in 2014 and this was mainly attributed to the agricultural sector (Mwanakatwe and Kebedew 2015). This makes agriculture the most important sector in Malawi. However, farming in Malawi has remained largely traditional. As noted, majority of farmers are rural and are smallholders who use simple farm tools, such as hoes and cutlasses, for cultivation. They also depend on rainfall for cultivation with about 95 percent of the rainfall occurring between December and April.

Further, the high rural economic dependence on agriculture provides a challenge to rural households who are often unable to diversify their source of income. In addition, the highly seasonal nature of agricultural work, mainly due to the limited rainfall, leaves many rural people underemployed during a large part of the year. This could further be attributed to the inadequate economic and infrastructural development which makes rural areas unattractive location for formal institutions including formal financial institutions and key trading enterprises to be established. This makes access to formal financial services, such as access to credit and savings programs, very limited.

Financial sector development and financial inclusion programmes according to the United Nations Conference on Trade and Development (UNCTAD) (2014) has been seen as an important economic development tool including poverty reduction. The government of Malawi has recognised financial inclusion, which includes making credit available at low cost to the deprived and the low-income groups, as an essential tool for improving agricultural productivity, increasing micro and small enterprises, creating jobs, raising income of households and to also smooth consumption of households (MF Transperency, 2011). This is especially important for the rural areas which are the food basket of the country. With the rural sector characterised by high levels of poverty, access to credit enables farm households in particular to overcome the capital constraints. This helps to reduce households' vulnerability through increasing productivity and yields (Guirkinger and Boucher, 2008 and Ali et al., 2014), increasing technology adoption and income (Zeller et al., 1998), increasing nonfarm and farm income, and food security (Diagne and Zeller, 2001), reducing poverty (Zaman, 1997; Khandker, 1998; Obisesan and Akinlade, 2013) and also reducing inequality (Beck et al., 2004 and Clarke et al., 2006). Furthermore, access to credit allows for efficient

intertemporal transfer of household resources and helps to cope with risk. This enables rural households to overcome the consequences of their low and volatile incomes by smoothening consumption throughout the year (Diagne, 1999). Thus, households are able to enjoy a more stable level of consumption throughout the year without having to forgo current or future productive capacity. As a risk mitigating strategy, access to credit can also be used to manage unexpected shocks in the household and/or on the farm, without which these rural households would be pushed further into the poverty trap.

The importance of credit has also been seen in its diverse usage. According to the Third Integrated Household Survey (IHS3) data, households in Malawi usually access credit for agricultural-related and or non-agricultural related purposes. Luboyeski et al. (2004) has identified that agriculture-related purpose of taking credit is very dominant and is mostly in the form of in-kind inputs of fertilizer and seed. The agriculture-related purpose of taking credit constituted 46.4 percent of total borrowing in rural Malawi (NSO, 2012). Credit was applied for to finance the purchase of land and inputs for the production of food crops, tobacco and other cash crops. Purchase of input for food crop production alone was about 31.1 percent of total purpose for borrowing. About 34.5 percent of households borrowed to finance a business start-up with 10.1 percent borrowing to purchase a non-farm input. Due to the importance of credit, the government of Malawi has included finance programmes including microfinance to its National Social Support Programme (NSSP) so as to increase the outreach capacity of poverty-focused microfinance institutions and further improve on the efficiencies of the operations of microfinance institutions.

Despite the well-acknowledged importance of, and potential demand for credit, financial markets are less developed in rural areas of developing countries implying a credit market failure. Credit market failure exists where credit allocation is not efficient (Besley, 1994). In an ideal world, credit is traded competitively by the forces of demand and supply which determines the cost of borrowing (that is interest rate) (Besley, 1994). It is argued that borrowers use the credit effectively and are able to pay back leaving neither the borrower nor the lender worse-off. However, in a world characterised by uncertainties, not all information about borrowers is known (information asymmetry)

and therefore, it would be difficult for the lender to ascertain that a borrower will use the credit efficiently or direct it towards the purpose for which it was borrowed, raising the issues of adverse selection and morale hazard. This increases the probability of credit defaults and also increases the risk for financial institutions. Furthermore, where cost of monitoring a borrower and also cost of enforcing legal processes on defaulted borrowers are high, lenders will be unwilling to provide credit to borrowers or provide smaller amounts. Besley (1994) is accordingly of the view that, asymmetric information and high monitoring and legal enforcement costs lead lenders to associate greater credit provision with a high probability of default. To reduce the risk inherent in lending, financial institutions use screening processes, interest rate and collateral requirements as tools for identifying 'good' borrowers from 'bad' borrowers; with some consequences of preventing some households from applying or the application of the 'so called credit unworthy applicants' rejected (Kon and Storey, 2003). In another argument, poor households in rural areas are not able to access credit due to their demand for small amount of credit. They engage in small economic activities and hence do not have the potential to demand large credit. Financial institutions bear huge cost in providing small credit to borrowers in such transactions which usually has a lower return. Also, as rural households live in areas with poor infrastructure, it is therefore expensive or unprofitable for financial institutions to establish in rural areas. It is equally expensive for poor households to also reach financial institutions due to the cost involved in reaching a financial institution. Hence, this transaction cost borne by both lenders and borrowers limits credit supply or denies access.

Some households opt not to apply for credit even when they have a productive use for the facility. This may be due to the fear of being denied or possibly because they fear the consequences of their project failing or the prospect of default. With financial institutions being very cautious of the type of borrower they lend to, it is not surprising that even good borrowers could be denied credit due to screening error, hence these borrowers are less likely to apply for credit in future. Also, it is very likely that bad

borrowers are instead given credit. Both situations lead to Type I and Type II errors[1] which are as a result of an ex-ante screening test.

In remote rural settings where interaction and communication between households are important and influential leaders are given reverence, individuals who have had bad experiences with financial institutions or other lenders are very likely to advise their peers against dealing with financial institutions. This peer influence increases the likelihood that households receiving such negative information may be discouraged to apply for credit.

Also, households who need credit would have to overcome some hurdles. These may include providing collateral which is usually inadequate, distance and transactions costs involved in applying for credit and also having to provide personal information to someone they do not know. These and other factors could prevent some households from applying for credit.

Jappelli (1990) and Kon and Storey (2003) define borrowers who do not apply for credit due to the fear of being denied as discouraged borrowers. According to Kon and Storey (2003), this group of borrowers are ignored in the credit constraint studies because they do not make applications. Further, because they do not add to bank risk, they are in these studies unobserved. However, this group of borrowers have been identified as very important in measuring the importance of credit constraints as they potentially lack credit that could usefully be deployed. Levenson and Willard (2000), Brown et al. (2011) and Freel et al. (2012) identified that there are at least twice as much discouraged borrowers as denied applicants through studies of some developed countries, including Eastern Europe. As noted in the theoretical study by Kon and Storey (2003), discouraged borrowers could be even more prevalent in developing countries than in developed ones. This makes this group of borrowers as important as denied borrowers in the study of access to credit. Ignoring this group makes the measurement of credit constraint underestimated.

[1] Type I error is the situation where a bad borrower or credit unworthy borrower is given credit by a lender, while a Type II error is where a good borrower is denied credit.

1.2 Credit market in Malawi

Financial markets in the rural areas of Malawi still remain under-developed leaving the majority of rural households excluded from formal finance. Some explanations are that the majority of rural households are poor and illiterate. In addition, much of the population are located in remote and sparsely populated areas which increases the cost of operation, making rural areas unattractive to formal financial institutions (UNCTAD, 2014). Other explanations emphasise the lack of collateral and assets which could be used as security for borrowing. Missing insurance markets contribute to the exposure to high default risks borne by lenders which, combined with the covariant risks associated with agriculture makes the rural areas relatively unattractive to financial institutions (Rao, 2012). The high transaction costs borne by financial institutions in supplying small amount of credit to poor households which is not met with enough returns to cover the cost is another disincentive to establish in rural areas.

In response to these inherent problems, several financial sector reforms and policies have been implemented in Malawi to help develop the financial market and to increase the provision of financial services, including access to credit, in the rural areas. The Financial Sector Assessment Program (FSAP), which was implemented in 2007 with technical support from the World Bank and International Monetary Fund (IMF), was the first financial assessment done in Malawi. Though the assessment recorded some development in the financial sector, it concluded that not all components of the sector had improved and hence required more efforts to see larger improvement. In the same year, the Financial Inclusion in Malawi (FIMA) was also implemented by the government with the support from the United Nations Capital Development Fund (UNCDF). This aimed to develop an inclusive financial sector. This paved the way for the implementation of the National Strategy for Financial Inclusion (NSFI) implemented between 2010 and 2015 (UNCTAD, 2014).

The Malawian government and other development partners have also benefited from information gathered by the FinScope Consumer Survey on financial inclusion in Malawi (2008 and 2014). This has revealed the extent to which individuals in Malawi are constrained in accessing financial services including credit. Although the report

observed some improvement between 2008 and 2014 in access to credit, access to credit increasing from 20 to 29 percent, much still needs to be done given that 71 percent of the sampled population had no access to any form of borrowing. According to the 2014 report, out of these 29 percent only 1 percent used bank credit products and 3 percent used other formal credit institutions. The rest, 25 percent, borrowed from relatives and friends (10 percent) and other informal sources (15 percent) (FinMark Trust, 2014).

Following the FinScope 2008 report, the government established a Financial Sector Development Strategy (FSDS) to address the issues arising highlighted by the report. Some of these issues included: limited access to financial services, high transaction cost, crowding-out of the private financial sector, capacity constraints and lack of coordination between the initiatives of the public and private financial sector. With support from the World Bank, DFID and USAID, the FSDS of the government of Malawi developed the Financial Sector Technical Assistance Project (FSTAP) and Financial Sector Deepening Trust (FSDT). These were commissioned with the end goal of increasing access to financial services in rural areas and largely increasing financial inclusion (UNCTAD, 2014).

Data from the Microfinance Information eXchange (MIX) shows the existence of several formal financial institutions that support rural households through provision of agricultural credit or credit for non-farm economic activities (MIX 2014). Table 1.1 presents some of these recognised formal institutions in the country reporting their mission statements, gross loan portfolio and number of active borrowers. The Malawi Union of Savings and Credit Cooperatives (MUSCCO) is an apex organisation that oversees the operations of Savings and Credit Cooperatives (SACCOs) in Malawi with over 58 members as at 2010. Similarly, the Malawi Microfinance Network (MAMN) is a legal association of financial institutions of which MUSCCO is a member. It is currently made up of 26 members. It has as its mission to create an enabling environment to develop a sustainable microfinance industry in Malawi through the participation of every stakeholders. A look at Table 1.1 reveals that some financial institutions like Concern Universal Microfinance Operations (CUMO) and FINCA have

clear mission reaching the poor and to improve their livelihoods with special focus on women.

Some of these MFI credit programmes have faced some challenges which include financial mismanagement. For example, the government-owned Malawi Rural Finance Company (MRFC) was reported to be facing liquidation (Malawi Voice, 2013) and this could be attributed to evidence of an accumulated debt of about 2 billion Malawian Kwacha (MWK) [2] (Nyasa Times 2012).

Table 1.1: Financial Institutions in Malawi

Financial Institution	Mission	Reporting year	Gross loan Portfolio (USD) m	Number of active borrowers '000
Concern Universal Microfinance Operations (CUMO)	To improve the lives of the rural poor by taking financial services to the doorsteps of remote and difficult to reach communities, with special focus on women. Vision: To create a viable regional rural microfinance network with capacity to meet the diverse financial needs of remote communities, as part of efforts to reduce poverty	2015	0.92	51.60
Ecumenical Church Loan Fund (ECLOF – MAL)	To provide fair credit to the social/economically disadvantaged and marginalized women, men, youth, churches, church groups and cooperatives for sustainable developments in witness to the Christian faith.	2003	0.40	1.50
FINCA	FINCA provides financial services to the world's poorest families so they can create their own jobs, raise household incomes and improve their standard of living. We deliver these services through a global network of locally managed, self-supporting institutions.	2015	9.36	51.41
Finance Trust for the Self Employed (FITSE)	To improve the standard of living and quality of life of the poor in Malawi through the provision of credit and training to enable them to establish and run viable businesses and through the promotion of microfinance services.	2009	0.21	1.53
MicroLoan Foundation (MLF MWI)	To use microfinance to significantly reduce the depth and breadth of poverty in the communities within which we operate	2014	1.45	29.76
Malawi Rural Finance Company (MRFC)	To provide quality financial services to the widest range of customers in a financially sustainable and responsible matter.	2008	23.78	52.71
Malawi Union of Savings	To develop, promote and safeguard a safe and sound network of Savings and Credit	2008	3.25	56.14

[2] Equivalent to £4.8m using an exchange rate of 1MWK = £0.0024 for 29 June 2012 (Exchange rates UK, 2015) http://www.exchangerates.org.uk/MWK-GBP-29_06_2012-exchange-rate-history.html

and Credit Cooperatives Limited (MUSCCO)	Cooperatives (SACCOs) in Malawi capable of providing quality and affordable services to members in accordance with International Cooperatives Principles.			
NBS BANK	We undertake to add value to all our stakeholders by offering an innovative range of banking products through efficient business processes and empowered and caring staff.	2014	87.01	15.34
Opportunity International Bank of Malawi (OIBM)	Opportunity Bank Malawi is a commercial microfinance bank in Malawi.	2013	17.98	61.45
Promotion of Rural Initiatives and Development Enterprises (PRIDE – MWI)	To develop a solid microfinance company that will provide premier financial services to its clients, delivered by committed and well-motivated staff thereby creating value for its stakeholders.	2009	2.24	

Source: https://www.themix.org/mixmarket/countries-regions/Malawi

One credit programme that is also being practiced in parts of Malawi is the Village Savings and Loan Associations (VSLA) (Ksoll et al., 2016). Village Savings and Loan Association (VSLA) is a collection of individuals who pool their savings together so as to have a lending fund for members. VSLA activities are based on the rotating savings and credits associations (RSCA) model which are practiced in many developing countries including rural Malawi. In this model individuals meet regularly, make contributions to a common pot which is then awarded to a different member of the group at each meeting making all members both lenders and borrowers (Ksoll et al., 2016). The aim of VSLA is to provide simple savings and credit in communities with little or no access to formal financial services. As an improvement on RSCA, VSLAs give credit to members who repay the credit taken with interest after 1 to 2 months. After 10 to 12 months, the accumulated fund is shared out in percentage of members' contributions. One successful credit group in Malawi is the Sanambe village savings and loans club which have supported several enterprises and job creation. Self Help Africa, an NGO in Malawi, has also provided training and technical support to several of such loan groups including Sanambe VSLA. According to Self Help Africa, individuals who have obtained credit through this village groups have been supported to buy livestock, process farm produced goods and establish small shops and stalls. The VSLA which has

come to be known as the Malawi savings and loans programme has accumulated a loan book of almost €80,000 by the end of 2015 and continued to provide thousands of loans to help members with starting their own business and finding job opportunities at the village levels (Self Help Africa, 2016).

Some projects have also been identified that specially target women to improve their financial literacy and access to credit among other objectives. One such project is carried out by CARE Australia, an international humanitarian aid organisation helping to fight global poverty with particular focus on women and girls. According to CARE Australia, women produce about 70 percent of food consumed by the household in Malawi, however, they lack access and control over their level of agricultural education, credit and improved technologies as compared to men (Footprints Network, n.d.). Footprints Network conclude that improving the financial literacy of women and linking them to financial services and institutions would lead to a general increase in their income and welfare translating to an improvement in the nutrition, healthcare and education of their households. Hence, CARE's financial literacy project has aimed to train about 20,000 women in financial knowledge and business management by also linking village savings and loan associations in rural communities to banks, improve mobile phone banking technology and coverage in the beneficial districts (i.e. Lilongwe, Dowa and Kusungu) and also increase radio and video recordings to ease agricultural extension in remote areas in the districts (Footprints network, n.d.).

However, credit sources in Malawi can be described as dualistic, which includes formal financial institutions, as discussed earlier, and informal lenders[3]. VSLA could also be regarded as an informal source of borrowing as this is not regulated by any financial

[3] Formal loans according to the NSO report include any money borrowed from financial institutions which come with interest, security and conditions for payment that is well-laid down while informal loans may refer to borrowing from friends, relatives, private money-lenders mostly known as "Katapila", and communal groups which have no formal agreement describing the terms of payment (NSO, 2012). The report included semi-formal credit providers, like the microfinance institutions and NGOs, as part of formal institutions.

authority or under any formally recognised financial associations like MUSCCO. According to the IHS3 data and report, only 8.3 percent of households obtained credit, and among them over 44 percent of households borrow from relatives and neighbours, and 8.9 percent from money-lenders, but in general 57.4 percent borrow from the informal sector. Credit from the formal banks reached about 33.1 percent of households in the urban areas compared to only 6.4 percent in the rural areas. Further the Malawi Rural Finance Company limited which is a government owned institution meant to provide financial services to rural communities provided credit to just about 4.3 percent of the total borrows. This implies a lower outreach of the formal financial institutions in the rural credit market in Malawi despite the credit programmes mentioned above.

The limited credit access in general poses several challenges to farm households including having to face low farm investments (Carter and Olinto 2003) leading to low farm output (Feder et al. 1990) and hence low farm profit (Carter 1989) which creates a vicious circle. For this reason, increasing access to financial services and markets will enable agriculture to become a viable economic activity for the long term (RSC 2012).

1.3 Causes of credit constraint

Conditions under which credit constraint may occur have been identified and explained in the credit market literature. These include the presence of information asymmetry, high application cost, high monitoring cost and demand for collateral assets (Ghatak and Guinnane, 1999; Levenson and Willard, 2000; Kon and Storey, 2003; Guirkinger and Boucher, 2008). According to the modern contract theory, formal institutions like banks usually decline giving credit to farm households in developing countries in the presence of the aforementioned problems (Petrick, 2005). These issues have been found to create market imperfections which adversely affect productivity and economic growth (Mushinski, 1999). The characteristics of rural farm households make it extremely difficult for banks and other formal lenders to operate efficiently in rural areas.

Usually, formal lenders lack the necessary knowledge about their clients necessary to identify their credit worthiness. These could lead to issues like adverse selection, moral hazard, costly borrower verification and enforcement problems (Ghatak and Guinnane,

1999). As Ghatak and Guinnane (1999) explain, under moral hazards, borrowers tend to have unobservable characteristics which affect their likelihood to pay back loans. In addition, borrowers' actions or inactions determine the level of return on their farm production as they could misappropriate the loan received if there was no collateral requirement. Further, under costly borrower's state verification, banks do not offer credit irrespective of worthiness. Finally, lenders may be faced with credit contract enforcement issues when borrowers default. Lenders usually are limited in their ability to impose contract sanctions on defaulters and this also prevents them from giving out loans.

1.4 Impact of household farm credit on rural farm household outcomes

It is a well-documented fact that rural farm households have inadequate capital and also have limited access to credit. As Feder (1985) states, agricultural output is only realised at the end of the cultivation period but before then capital and variable inputs are required for the various farm activities. In the absence of adequate capital, access to production credit could be essential for farm productivity. Consequently, access to credit does not only affect farm productivity but also various rural households' economic outcomes such as consumption, health, education, income, food security, poverty and inequality. It is also likely that the improvement in one household outcome could lead to improvement in another; they are often interlinked, for example poverty and inequality or productivity and food security.

Several studies have examined the effect of credit access or household credit constraint on rural farm households in developing countries. There is evidence of the positive impact credit have on some outcomes, though the opposite has also been found. This section reviews some relevant and recent empirical studies to reveal what has been documented. The outcomes are mainly focused on farm productivity, consumption and inequality as they are the main issues tackled by this thesis; although in some cases some broader studies are reviewed as well.

Khandker and Faruqee (2003) examined the impact formal credit (specifically from the Agricultural Development Bank of Pakistan), has on the welfare of rural farm

households in Pakistan. The study employed a two-stage method to solve the issue of endogeneity in borrowing before estimating its impact on household welfare. The household welfare outcomes that were examined included annual consumption, crop production cost, net production output, non-land assets, male and female labour supply. The results showed that an increase in formal borrowing increased the welfare of four out of six of the outcomes. Consumption increased by 0.04 percent, production cost, agricultural production and female labour supply all increased by almost 1 percent as borrowing was increased by 10 percent. On a whole, smallholder farmers had a higher welfare gain than the medium and large holders. Given that majority of farmers in Malawi are also smallholders, it could be argued that some positive impact could also be realised as a result of improved credit access of farm households in Malawi. However, some difference still exist as the Pakistani study only looks at a formal source of lending; also, smallholders cultivated on average up to 5.1 hectares of land compared to less than one hectare of land cultivated by smallholder farmers in Malawi.

Similarly, Guirkinger and Boucher's (2008) study in Peru sought to investigate the impact of credit constraint on farm productivity. Their study uses a panel data and applies a switching regression model to solve the problem of selection and unobserved heterogeneity. It uses an expanded definition of credit constraint (quantity rationed, transaction cost rationed and risk rationed credit) in their analysis. They found that constrained households' productivity was affected by households' endowment of land and liquidity, while these endowments had no or little positive endowment effect for unconstrained households. Further, they found that credit constrained households were about 26 percent less productive. Given that households are poor and cultivating on average about a hectare of land, it is expected that any extra endowments would play a significant role in the productivity of both constrained and unconstrained rural households in Malawi. However, it is expected that unconstrained households would be more productive than the constrained households.

Using a switching regression model, Freeman, et al. (1998) investigated the impact of credit on productivity of dairy farms in Ethiopia and Kenya. They used excess demand for loans and rejection of borrowers by the lender as the definition for credit rationing.

They concluded that farmers benefitted from the formal source of credit as they were able to invest in crossbreed cows which enhanced their milk productivity. The study proxy credit with investment in crossbred diary and found that for unconstrained households the marginal return of a 1 percent increase in credit increased productivity by about 0.4 percent in Ethiopia and 0.9 percent in Kenya. Hence, credit is evidenced to be an essential tool for milk production in these countries. Ayaz et al. (2011) in their study using a dummy variable to capture whether a farmer had obtained credit or not, found that among other variables, access to credit increased the technical efficiency of farms by about 0.039 percent in Pakistan.

Using direct elicitation of information on semi-formal credit market access and participation from households, Ali and Deininger (2012) were able to categorise households into credit constrained and unconstrained households in rural Ethiopia. Households that were found to be quantity rationed, transaction cost rationed or risk rationed were categorised as credit constrained. With location being an influencing factor, households' productivity was affected in surplus producing areas such that productivity could increase by 11.4 percentage points if credit constrained was eliminated. However, households in drought prone areas as well as food insecure areas were unaffected by their credit constrained status as they rather practised livestock rearing than crop production, and credit was only for crops. In a similar study, Ali et al. (2014) examined the effect of a household credit constraint status on their choice of income diversification and on agricultural productivity in rural Rwanda. Removing household credit constraint increased agricultural productivity by 17 percent. This was based in the semi-formal credit sector of rural Rwanda.

A common observation from most of the microeconomic studies mentioned above is that a qualitative approach of defining credit rationing was used since households were directly asked to provide information about their credit market involvement. Further to this, definitions of 'credit constraint' differed from one study to the other and this complicates comparison of results. This thesis utilised a qualitative research approach which defined a household as credit constrained if that household had been denied credit or discouraged from applying. Majority of studies have been based on formal and/or

semi-formal credit sectors. This may make comparison to the findings of this current study challenging as there is no differentiation between formal, semi-formal or informal credit in this study. There is no differentiation in this thesis because households that are discouraged from applying for credit do not state which sector they would have applied to. The potential problem of endogeneity caused by the selection process that leads to the characterisation of credit constrained and unconstrained households is recognised in the majority of previous studies and the researchers have resolved this issue through the adoption of an appropriate econometric method. The endogenous switching model was the most commonly used method of estimation. It is also employed in the research reported later in this thesis to investigate the impact credit constraint has on farm food productivity and consumption (in Chapters 3 and 4 respectively).

In a cross-country study, Kai and Hamori (2009) examined the effect of microfinance on inequality in 61 countries. They concluded that while credit constraints were a major cause for high levels of income inequality in most developing nations and that credit provision had the influence of reducing inequality. This makes it a useful tool in bridging the gap between the poor and the rich. In a related study, Hermes (2014) again found that credit reduced income inequality among the rich and the poor in developing countries; albeit a small impact. This was also a cross-country study of a large number of developing countries. Clarke et al. (2006), using credit as a proxy for financial development, also concluded that in the long run inequality falls with the improvement in financial development. Beck et al. (2004) came to a similar conclusion that financial development was capable of lowering income inequality.

A limited number of studies have been carried out in Malawi on the impact of access to credit on income, welfare, food security and technology adoption. Diagne and Zeller (2001) examine the effect access to credit has on farm and non-farm income and also on household food security. The findings from the study, however, did not identify whether an improvement in the access to credit is an effective way of reducing poverty. One main reason was that the portfolio of the credit given was limited to providing high cost fertilizers for the production of hybrid maize. Other reasons were because of insufficient rainfall and scarcity of cultivable land. The study, therefore, drew some conclusions

calling for a more equitable distribution of land and to encourage the use of the available lands efficiently. Further, financial institutions were encouraged to diversify their loan portfolios to incorporate other crops and also provide off-farm activity loans. Financial institutions in providing loans should take into consideration household constraints and demands, so that the contribution of credit to household welfare would be effective. Thus, for any impact to be made, lenders should also look at the other needs and concerns of farmers, and design credit programs that meet their needs.

In an earlier study, Diagne (1999) found that access to formal credit had a marginal effect on household income. The access to formal credit was complemented by a reduction in access to informal credit. The paper concluded that the environment needed for a formal credit sector to have a significant impact on the rural population of Malawi was absent. Using a stochastic frontier analysis, Diagne (2002) also examined the impact of credit access on maize and tobacco production in Malawi. The study revealed that current household borrowers had lower yield per hectare of hybrid maize compared to previous borrowers despite the increase in input intensity. This could be because previous borrowers could have had higher return the year they borrowed and reinvested it in the current year. This may be seen as a dynamic gain. However, comparing to those who never accessed credit, current household borrowers obtained higher yields.

In another related study, Hazarika and Alwang (2003) examined the effect of access to credit and size of plot on the cost efficiency among smallholder tobacco farmers in Malawi. The study adopted a stochastic frontier analysis to estimate the farm-specific cost inefficiency. They found that cultivation of tobacco was less cost inefficient. However, using households' credit limit at credit organisations as the measure of credit, they found that access to credit had an undesirable effect on cost efficiency which was rather inconsistent to a previous study done by Diagne (2002) and Zeller et al. (1997) who found a positive impact of the access to credit on the tobacco growing smallholders in Malawi. Hazarika and Alwang (2003) noted that the valuable outcome of a higher tobacco plot size on cost inefficiency was eroded by the households' access to credit although it was likely to improve tobacco cultivation along the extensive margin.

Matita and Chirwa (2009) examined the causes of the differential in the rural-urban welfare inequalities in Malawi. The study uses the Oaxaca-Blinder (1973) and Nachado-Mata (2005) methods to decompose welfare gap between the rural and urban areas of Malawi using the second round of the Integrated Household Survey of Malawi. Among their findings, they found that socio-economic and demographic characteristics influenced household welfare in both rural and urban areas. Further, the difference in household endowments contributed more to the welfare inequality gap between the two locations. However, in an important finding related to the rural area, they identified that a dummy variable capturing access to credit contributed to a welfare increase of about 9.38 percent. This showed that credit was significantly important in improving household welfare including smoothing consumption.

Those studies which have focused on Malawi, with the exception of that by Matita and Chirwa (2009), are based on data collected by the International Food Policy Research Institute (IFPRI) in 1995 from 404 households in 45 villages in 5 districts in Malawi. This makes evidence from these studies not representative of the entire country and quite old for advising current policy. Financial inclusion and development policies have been implemented ever since and these could surely have affected households' access to credit and impact. Hence, there is a need for further research to provide new evidence using a national representative survey which most of the previous studies lack which is done in this thesis.

1.5 Data

The study uses data from the 2010/2011 wave of the Malawi Living Standards Measurement Survey (i.e. Malawi Third Integrated Household Survey (IHS3)) collected by the National Statistical Office (NSO) of Malawi from March 2010 to March 2011. The first survey was carried out in 1990 and was known as the Household Expenditure and Small Scale Economic Activities (HESSEA). The second (IHS1) and the third (IHS2) of these surveys were conducted in 1997/98 and 2004/05 respectively. The objective of the IHS3 was to collect and provide comprehensive information on key welfare and socio-economic indicators to monitor the progress of the Malawi Growth and Development Strategy and that of the then Millennium Development Goals. Data

collected included information on education, health, labour, agriculture, food security and credit among others.

The IHS3 is a nationally representative household survey. According to the IHS3 reported, the survey was statistically designed to be representative at the national, district, urban and rural levels. This therefore enables the provision of reliable estimates for these levels. The sampling frame used for the IHS3 was based on the listing information and cartography from the 2008 Malawi Population and Housing Census. This consist of the North, Centre and South of Malawi which are the three major regions of the country and these are further stratified into the rural and urban strata. The urban stratum was made up of 4 cities (namely Lilongwe city, Blantyre city, Mzuzu City and Zomba Municipality) and 27 districts from the rural stratum. The target population for the survey included individual households and persons living in those households within all the districts except Likoma and those in institutions such as hospitals, prisons and military barracks.

The survey adopted a two-stage stratified sampling design. The first stage involved selecting the primary sampling units (PSUs) which were the census enumeration areas (EAs). Due to the variability in the number of households for each EA, probability proportional to size (PPS) was used to select the EAs within each district at the first sampling stage. The PSUs were in total 768 enumerations areas (EAs) across the country. After the selection of the IHS3 sample EAs, household listing was done in each sample EA which provided the sampling frame for the second stage selection of the households. To select the households, a random systematic sampling was used to select 16 primary households and 5 replacement households from the listing of households for each sample EA. These households were replaced due to reasons such as dwelling not found or destroyed, or some households refusing not to partake in the survey among other reasons. Though the original sample design meant that 12,288 households were to be selected, 17 households were not recovered during the second visits of the field teams. Deleting these households implies that a total of 12,271 remaining households were obtained implying a response rate of 99.9 percent.

Four types of questionnaires were designed for the IHS3. These included the household questionnaire to gather socio-economic data at the household level and individuals living in this households, agricultural questionnaire, fishery and then the community questionnaires. The household and community questionnaire were designed after the IHS2 and IHS1 questionnaire. The agriculture questionnaire however expanded on that of the IHS2 agricultural modules. Data was collected through a face to face interview using the questionnaire guides.

For the purpose of this thesis, the sample was narrowed to rural farm households. There were 9,477 rural households who lived in the rural areas and were also agricultural households. This accounted for about 77 percent of the total sample and 94 percent of rural households.

1.6 Description of variables

Table 1.2 presents all the variables from the IHS3 data included in the three empirical studies including those that were derived from other variables. These include characteristics of the household head, the household, farm and community characteristics. These variables are further explained into details in the various chapters in which they are used especially on how they relate to the dependent variables of the respective chapters. Among these variables include:

1. Gender of the household head. This is binary variable which is equal to 1 if the head of the household is male and 0 if a female.
2. Age and age-squared of the household head. The age is a continuous variable capturing the age of the household head in years at the date of the interview whiles the squared of the age is meant to capture the life-cycle effect.
3. Household size is measured as the number of members within a particular household.
4. Dependency ratio captures the ratio of the number of dependents aged between 0 and 14 years and over 65 years to those between 15 and 64 years within the household.

5. Illness is obtained from the health section of the data. This is a binary data grouped as 1 if any member of the household had suffered any sickness or injury in the last two weeks and 0 otherwise.
6. Location captures the geographical division of the country. This is a categorical variable with 1 if household is in the rural north, 2 if located in the rural centre and 3 if located in the rural south of the country.
7. Agro-ecological zones are meant to influence farm production. Malawi is divided into 4 ecological zones and this is categorised as 1 Tropic-warm/sub arid, 2 Tropic-warm/ sub humid, 3 Tropic-cool/semi-arid and 4 Tropic-cool/sub humid.
8. Educational level is the level of formal education that the head of the household had obtained. This is also a categorical variable with 1 if no education, 2 primary level of education and 3 higher level of education, that is secondary or tertiary level of education.
9. Network or social group is a continuous variable capturing the number of social groups that the members of a household are involved in. While the agricultural network is a binary variable measured as 1 if the household is in any agricultural group or 0 otherwise.
10. Land or farm size is the hectare of land that the household cultivated during the raining season. The study used the Global Positioning System (GPS) measurements of land provided in the data.
11. Land tenure captures the type of land ownership or acquisition of the land cultivated by the household. Land tenure is captured as 1 where the land is inherited or purchased, and 0 where it was rented or granted by local leaders for cultivation.
12. Home assets are the value of the consumer durable goods of the households measured in Malawi Kwacha. This includes the value of goods such as mortar/pestle, bed, table, chair, television, sewing machine, bicycle, etc.
13. Farm assets are the value of production assets such as farm implements, machinery and structures or buildings used on the farms of the households.

These include the values of hoe, axe, sprayer, ox cart, tractor, livestock kraal, pig sty, etc.

14. Livestock is the total value of livestock owned by the household.
15. Remittances is the total value of all food, in-kind assistance and cash received by the household from their children living outside the household. The binary form of the variable was also used, but not in the same chapter, and captures whether the household had received any help in the form of food, in-kind assistance and or cash from their biological children residing outside the household.
16. House type is a categorical variable that captures the general type of construction materials used for the dwelling of the households. This is categorised as 1 for permanent (mostly modern materials like iron sheets and concrete), 2 semi-permanent, and 3 traditional materials (such as grass and mud).
17. Distance to an MFI is defined as the distance to the nearest place where there is a micro finance institution. This is measured in kilometres (km).
18. Distance to Agricultural Development and Marketing Corporation (ADMARC) is also measured as the distance to the nearest permanent ADMARC market measured in km.
19. Financial institution is a continuous variable that captured the number of formal financial institutions in each district. This variable was however, taken from the microfinance exchange laboratory website.
20. Three dummy variables are used to measure whether households faced any form of shocks. The first is natural shocks which include droughts, floods, bushfires etc. The second is agricultural shocks which include pest and crop diseases, hike in input prices, etc. And finally, household shocks which include the break-up of a household, death of a bread winner, theft, etc.
21. Hired labour is a continuous variable. This was the number of individuals from outside the household that were hired by the household to help in the various aspect of the land cultivation and harvest.
22. Extension officer was captured as a dummy variable to capture the presence of an extension officer in a community.

23. Temperature was obtained from the "geo-variables" section of the data which contains bioclimatic variables derived from monthly temperature and rainfall values. Temperature seasonality (standard deviation *100) used in this study captures the coefficient of variation of mean monthly temperatures. Temperature is a good influence on crop productivity.
24. A dummy variable was used to measure whether a farm household cultivated any other crop apart from maize which is the main staple in Malawi.
25. Two dummy variables were used to identify whether a household used organic fertilizer or inorganic fertilizer respectively.
26. Total value of inputs used for crop cultivation was also measured. The inputs considered included fertilizers, seeds, weedicides and pesticides. The value of the inputs was divided by the hectare of land cultivated hence the variable cost per hectare.
27. A dummy variable was also used to capture whether the household borrowed from a formal or an informal lender. Formal lenders were captured as formal financial institutions including banks, microfinance institutions (MFIs), cooperatives and non-governmental organisations (NGOs). Informal lenders included families, friends, church, business owner, traditional money lenders popularly known as "Katapila" in Malawi.
28. The main dependent variables used in the first empirical chapter of the thesis included; need credit, apply credit and denied credit. These were dummy variables generated from a set of questions from the credit section of the data. The dummy for need credit was measured as 1 if the household was discouraged from applying for credit or applied for credit and 0 if they did not need credit. Apply credit was captured as 1 if the household applied for credit and 0 if the household was discouraged from applying. Denied credit was also measured as 1 if the household's application was rejected by the lender or 0 if the credit was obtained. Details of the construction of these variables are presented in the data section of Chapter 2.
29. Credit constrained was also one of the dependent variables in both the Chapter 3 and 4 of this thesis. A household was credit constrained if they were discouraged

from applying or their applications were rejected. While credit unconstrained household was a household that did not need credit, or was successful in obtaining credit.

30. Output/yield per hectare was the second dependent variable in the second empirical chapter which was the ratio of the total value of food crops harvested per household to the hectare of land cultivated. It represents the productivity of the household.
31. Consumption was the second dependent variable used in Chapter 4. The consumption variable was measured as the ratio of total real annual consumption per household (already calculated in the data) to household equivalent ratio. The total real annual consumption variable was calculated from obtaining the value of both food, including beverages, and non-food items that were deemed to contribute to welfare. The non-food component included consumption of alcohol, tobacco, clothing, footwear, imputed housing rent, per capita utilities, regular maintenance of housing, health, education, entertainment, personal care, transport, communication and the use of durable goods.

Table 1.2: Description of variables

Variable name	Variable type	Description
Gender of head	Binary	Gender of the household head (1= male, 0=female)
Age of head	Continuous	Age of household head in years
Head Age-squared	Continuous	Age squared captures the life cycle effect.
Household size	Continuous	Number of members in the household
Dependency ratio	Continuous	Ratio of the number of dependents aged 0-14 and over 65 to those between 15 and 64 within the household
Marital Status	Binary	1 Married, 0 otherwise
Illness	Binary	1 suffered illness, 0 otherwise
Location	Categorical	1 rural north, 2 rural centre and 3 rural south
Agro-ecological zones	Categorical	1 Tropic-warm/sub arid, 2 Tropic-warm/ sub humid, 3 Tropic-cool/semiarid and 4 Tropic-cool/sub humid
Education level	Categorical	1 no education, 2 Primary, 3 Higher education
Network/social group	Continuous	Number of networks households are involved in
Network (agric.)	Binary	1 if belong to an agricultural network, 0 otherwise
Land size	Continuous	Total land size cultivated in the rainy season in hectares.
Land tenure	Binary	1 = land title (secured) 0 = no land title
Home assets	Continuous	Value of home assets in Malawi Kwacha (MWK)
Farm assets	Continuous	Value of farm assets (MWK)
Livestock	Continuous	Value of livestock (MWK)
Remittance	Continuous	Remittances sent to the household by children living outside the household
Remittances	Binary	1 = Receives remittances, 0 = otherwise

House type	Categorical	1 = Permanent structure, 2 = Semi-permanent structure and 3 = Traditional structure.
MFI Distance	Continuous	Distance to the nearest microfinance in km
ADMARC distance	Continuous	Distance to the nearest Agricultural Development and Marketing Corporation in km
Financial Institutions	Continuous	Number of financial institutions in each district
Shock (natural)	Binary	Experienced natural shock (floods, drought, etc.)
Shock (agric.)	Binary	Experienced agricultural shock (price increase in inputs etc.)
Shock (household)	Binary	Experienced household shock (death or birth, etc.)
Hired Labour	Continuous	Head count of labour hired onto farm
Extension officer	Binary	1 if there is an extension officer in the community, 0 otherwise
Temperature	Continuous	Temperature seasonality (standard deviation*100): the difference between the annual maximum and minimum temperature
Other crops	Binary	1 if other crops apart from maize was cultivate, 0 otherwise
Organic fertilizer	Binary	1 if organic fertilizer was used, 0 otherwise
Inorganic fertilizer	Binary	1 if inorganic fertilizer was used, 0 otherwise
Variable cost per hectare	Continuous	Total cost of inputs including fertilizers, seeds and cost of transporting these inputs in Malawi Kwacha
Need Credit	Binary	1 discouraged borrowers, rejected borrowers or successful borrowers, 0 no need for credit
Apply Credit	Binary	1 rejected or successful borrower, 0 discouraged borrower
Denied Credit	Binary	1 denied borrower, 0 successful borrower
Output per hectare	Continuous	Output per hectare (value of all food crop cultivated per hectare of land cultivated in raining season) in Malawian Kwacha (MWK)
Consumption	Continuous	Real annual household consumption per adult equivalence in Malawi Kwacha
Credit Constrained	Binary	1 = Credit constrained, 0 = Credit Unconstrained

1.7 Outline of the thesis

The outline of the study will be as follows: The next chapter, Chapter 2 begins the first of the series of empirical studies presented in this thesis. Due to the importance of the discouraged borrowers explained earlier, the objective of the first empirical study in this thesis is to identify the demographic and socio-economic factors that explain the importance of discouraged borrowers. A model is constructed to provide an understanding of households need for credit, discouragement or decision to apply for credit and lastly, characteristics of those who obtained or are denied credit. The analysis uses a three-step sequential estimation model to identify the characteristics of these borrowing decision outcomes. This follows a trivariate probit model with double sample selection for the econometric analysis. The analysis contributes to the rethinking and

expansion of the definition of credit constraint to include those discouraged from applying for credit. Further, there are limited studies that consider discouraged borrowers in the access to credit literature in sub-Saharan Africa. This study therefore, brings to light the prevalence of discouraged borrowers based on a case study of Malawi and contributes to filling this gap in our understanding.

Improving the productivity of farm households, access to credit has been recognised as one important tool for relieving the binding liquidity constraint of farmers, as noted earlier. The second empirical aspect studied in the thesis, that is the third chapter, therefore determines the effect of farm household credit constraints on crop productivity. An endogenous switching model is employed to simultaneously determine household credit constraint status and the impact on farm productivity. In defining credit constraint, the study takes into consideration discouraged borrowers setting this work apart from other recent studies on the topic that have been conducted on Malawi.

Different liquidity constraints and productivity bring about inequalities among farm households. The objective of the research reported in third empirical analysis, which happens to be the fourth chapter, is to determine the effect of households' credit constraint on household consumption inequality. This study employs three decomposition techniques in order to provide analyses of the factors that contribute to differential consumption patterns both within and between credit constrained and unconstrained groups. Firstly, this novel empirical investigation helps to identify where consumption inequality is more prevalent, that is, whether between the groups or within the groups and to assess the degree to which these outcomes are a consequence of discrimination, in its most general form, in underdeveloped credit markets. Secondly, since a multivariate regression analysis is used in two of the decomposition analyses, major factors that contribute to an increase or decrease in consumption inequality are identified for the within group inequality and between group inequality. This generates insights that may help policy makers to focus on the most important factors that could be taken into consideration when drawing policy to reduce the consumption inequality gap in Malawi.

Chapter 5 presents the general conclusions of the study. It summarises the main insights of the study and their policy implications and underlines some limitations and suggestions for future research.

CHAPTER 2

FARM HOUSEHOLDS' ACCESS TO CREDIT: WHO NEEDS AND WHO GETS? EVIDENCE FROM MALAWI

2.1 Introduction

Credit has proven to be a necessary tool for economic development affecting positively the welfare of households and individuals (Atieno, 1995). Studies have laid down three main paths through which credit can affect the welfare of households. Firstly, reducing the capital constraints whereby farmers could have access to agricultural inputs at the right time of production; secondly, making farmers able to cope with and manage risky choices which they would not have considered in the absence of credit; and lastly making it possible to smooth consumption throughout the year without rationing (Zeller et al. 1997; Diagne and Zeller, 2001).

Malawi is among the poorest countries in the world; it moved down the Human Development Index from the 160th position in 2009 to the 170th in 2012 out of 185 countries (UNDP, 2013). Household access to income opportunities, services and assets are extremely unevenly distributed across the country, translating to the high level of poverty in the southern part of Malawi while households in the central part of the country are comparatively less poor.

It has been established that farm households, especially in sub-Saharan Africa, and Malawi in particular, are credit constrained (Diagne and Zeller, 2001). Shocks to household livelihood forces households to take adverse decisions such as sell their assets, withdraw children from school and also reduce their food consumption (IFAD, 2011). In the rural areas of Malawi, where nearly 90 percent of households are employed in agriculture with little economic diversification, only 12 percent manage to access credit (IFAD, 2011). This percentage does not indicate whether those who had access to credit obtained the full amount they had applied for.

Data from the Malawi Integrated Household Survey for 2010/11 shows a slightly higher proportion of successful borrowers than denied borrowers, about 3.1 percent. Further,

there are a greater number of farm households who need credit but are unable to borrow due to, among other reasons, the fear of being denied. These non-applicants are termed as discouraged borrowers (Kon and Storey, 2003). According to Jappelli (1990), ignoring this group from the definition of credit constrained households bias their estimation downward.

Most empirical studies that have looked at farm households' access to credit or credit constraints in sub-Saharan African have generally focused largely on those who actually apply for credit (Diagne and Zeller, 2001; Diagne et al., 2000; Hazarika and Alwang, 2003 and Hazarika and Sarangi, 2008). Others have also looked at the source of the credit, whether it is from a formal or informal source (Diagne, 1999; Jain, 1999; Chakrabarty and Chaudhuri, 2001 and Khandker and Faruqee, 2003). The policy implications of these studies are therefore ignoring households that are discouraged from borrowing. Considering the potential bias in these studies it is necessary to attempt to include discouraged borrowers in studies on access to credit.

This study, considers farm households who need credit; those who are discouraged from borrowing; and those who receive or are denied credit. The objective of this paper is to identify demographic and socio-economic factors that distinguish these groups. In particular, firstly, to identify the factors that explain why some farm households need credit while others do not; secondly, to investigate the factors that determine discouragement versus credit application; and lastly, to identify the characteristics of successful and unsuccessful borrowers. The study uses data from the 2010/11 wave of the Malawi Integrated Household Survey adopting a three-step sequential estimation technique. The study follows studies by Cole and Sokolyk (2016) and Brown et al. (2011) who study small business in the US and across Europe respectively.

The rest of the study is organised as follows: the next section looks at theories and empirical literature on farm household's access to credit and discouraged borrowers, the third section focuses on data and methodology. The fourth section presents the results and the final section concludes with some recommendations.

2.2 Previous studies on rural credit

2.2.1 Access to credit

There have been several studies on rural households' or farm households' demand for, or access to credit. The review of previous studies has shown two main approaches that have been used in the measurement of the access to credit (Diagne et al., 2000). The first is when there is violation of the life cycle hypothesis brought due to the credit constraint (Hall, 1979 and Deaton, 1992). These studies have often used data on household consumption or income to test for the existence of households' constraint to credit. High dependence on transitory income indicates that the household is credit constrained (Browning and Lusardi, 1996). According to Jappelli (1990), among other limitations of this approach, consumers who were credit constrained were unobservable.

The second approach is through a direct collection of information on credit from households. This is done through a survey whereby households directly answer questions on their credit activities in terms of access and participation, thereby drawing inference on the possibility of a household being credit constrained (Diagne et al., 2000). Several studies using data from household surveys have used this approach to determine households' credit constraint (Jappelli, 1990; Feder et al., 1990; Zeller, 1994; Schrieder and Heidhues, 1995; Zeller et al., 1997 and Barham et al., 1996). However, such studies are not without limitations. They are unable to provide or predict the extent to which households are credit constrained (Diagne et al., 2000). The study by Diagne et al. (2000) extended the direct approach with information on how much farm households receive against how much they applied for, thus attempting to find the level of credit constraints.

Following this empirical approach, previous studies have found some factors that determine household access to formal or informal credit. Household demographic and economic characteristics were found to play an important role in explaining access to credit. A study by Mohammed (2003) which looked at access to formal and quasi-formal credit by small farmers and fishermen in Zanzibar, found factors such as sex, age, education and income level to be important in explaining access to credit. The study

concludes that there is limited access to credit in Zanzibar and that women are discriminated against in the credit market.

Similarly, Okurut (2006) found significant effects of factors such as age, sex, education, household size, location, race and expenditure on the accessibility of informal, semi-formal and formal credit over the period 1995 and 2000 in South Africa. He argues for an improved access to a credit market that is organized in a way that the poor and blacks could have easy access. Shimamura and Lastarria (2010) also noticed that female household heads were less likely to participate in credit programs in rural Malawi. The age of the household head, a larger household size and residing in an area with a credit program increased the probability of participation. They found that smaller household size which meant limited household labour supply was unable to stimulate credit activities limiting the availability of credit to the poor.

In addition to some household characteristics, Vaessen (2001) found that the purpose of taking informal credit, access to information and recommendations through networks were significant in explaining access to credit in the northern part of Nicaragua. Dallimore and Mgimeti (2003) also noticed the negative influence of application cost (which includes long distances and transport cost) on rural households' access to formal financial services since these services are mostly situated in urban areas.

In general, this study includes most of these factors in the analyses of those who need credit, discouraged borrowers and those denied credit.

2.2.2 Discouraged borrowers

Stiglitz and Weiss (1981) argued that credit rationing will still persist even in an equilibrium loan market mainly due to information asymmetry. Banks do not have all the information on all of their customers, and especially potential customers, so they use screening methods such as increasing interest rates and/or collateral requirements to detect bad borrowers from good ones. Three situations may occur from this: (1) potential borrowers may borrow less than they initially wanted; (2) some borrowers may be denied credit; and (3) both good and bad borrowers may be discouraged from borrowing.

Until recently, studies on access to credit have given little attention to discouraged borrowers because they do not make any loan application and also because they do not add to bank loan portfolio risk (Kon and Storey, 2003). However, through the review of available literature, studies on discouraged borrowers have become essential for three main reasons (Han et al., 2009). First, As found by Levenson and Willard (2000), Brown et al. (2011) and Freel et al. (2012), discouraged borrowers were identified to be twice as many as denied applicants. This, therefore, increases the number of credit constrained borrowers if discouraged borrowers are considered as credit constrained. Second, being discouraged may vary across some demographic characteristics of borrowers (Vos et al., 2007). Demographic characteristics such as gender or race may give information on discrimination in the credit market. Lastly, viewed as a positive effect mainly for lenders, discouragement is regarded as a self-rationing process whereby those who do not apply for credit upon self-assessment (concluding that they may not qualify) may be considered as bad borrowers (Kon and Storey, 2003).

Jappelli (1990), in his study on credit constraint among households in the US economy, was probably the first to use the term discouraged borrowers. He identified discouraged borrowers in the presence of application cost as consumers with a high likelihood of being denied credit who do not apply because of the perception that they would not be successful. Kon and Storey (2003) attempt a theoretical study on discouraged borrowers and found that the magnitude of discouragement within an economy may depend on the following assumptions: screening errors of banks, magnitude of application costs and the degree by which formal interest rates charged by banks differ from what money lenders charge. However, their study restricts the definition to only creditworthy firms. Han et al. (2009) do not make any distinction between creditworthy and non-creditworthy firms with the argument that it is empirically difficult to do that and therefore include both in their empirical study. Following on that, this study does not also distinguish between creditworthy and unworthy borrowers.

Empirical studies on discouraged borrowers have mostly focused on households (Jappelli, 1990) or on small non-farm enterprises (Cole and Sokolyk, 2016; Freel et al., 2012; Brown et al., 2011; Han et al., 2009 and Levenson and Willard, 2000). Cole and

Sokolyk (2016), using a bivariate probit selection model, find that discouraged firms are small in size, have very poor credit quality and are in urban areas. Concerning owner characteristics, owners of firms that were discouraged were much younger, had very poor credit quality (using owner bankruptcy and delinquencies as a form of measure) and had less wealth.

Freel et al. (2012) identify the importance of increasing firm size and family ownership of business as factors reducing the likelihood of small and medium size firms being discouraged from borrowing in the UK. But on the other hand, discouraged firms were serially owned, were in the industry sector, provided knowledge-intensive service, had no banking relationship and had cost-focused strategies.

Using US data on small firms, Han et al. (2009) examined the causes of discouragement and further tested the hypothesis that discouragement is an effective self-rationing mechanism. Using logit estimation, the study found that the owner and business characteristics affected discouragement. Factors such as firm size, use of financial services, owners' age and wealth were identified to be significant in explaining discouragement. Further, they found that risky borrowers were more probable to be discouraged from applying therefore concluding that discouragement was a good self-rationing tool.

Other studies, such as Jappelli (1990) and Petrick (2004) combined denied applicants with discouraged borrowers as credit constrained borrowers with the assumption that they are homogenous. Jappelli (1990), using a probit estimation model, found that increase in age, income and wealth reduced the probability of being credit constrained. Also, being married, white, owning a home, possessing savings and residing in the North-Central USA reduced the probability to be credit constrained. However, an increase in the family size increased the likelihood of being credit constrained. With a similar estimation process, Petrick (2004) also found that the borrowers' reputation and individual characteristics of the household were important in determining credit access among farmers in Poland.

From this brief literature review it is clear that most of the studies analyse developed countries' situation. A notable exception is the study by Raturi and Swamy (1999) which analyses manufacturing firms in Zimbabwe. This leaves a gap in the literature on developing countries, especially on rural farm households.

2.3 Data and method of analysis

As already stated in Chapter 1, the study focused on only rural farm households. There were 9,477 rural households who lived in the rural areas and were also agricultural households. This accounted for about 77 percent of the total sample and 94 percent of rural households. Accounting for missing data for some households and excluding data on households who were still awaiting response on their credit application reduced the data from 9,477 of total rural farm households to 8,230. The sampling weights were applied to each descriptive statistics and econometric estimations so as obtain the right standard errors and estimated coefficients reliable.

The key variables for this paper were extracted from the credit section of the survey. This section of the questionnaire contained, among others, three main questions on which this paper is centred which are similar to the questions used by Brown et al. (2011). These questions are: [4]

1. "S01. Over the past 12 months, did you or anyone else in this household borrow on credit from someone outside the household or from an institution for business or farming purposes, receiving either cash or inputs?"

   YES…1

   NO….2

2. "S12. During the last 12 months, did you try to borrow from someone outside the household or from an institution and were turned down?"

   YES…1

   NO….2

3. "S19. Why did you not attempt to borrow in the last 12 months?"

   NO NEED…….1

[4] These are found on pages 57 and 58 of the Malawi Third Integrated Household Survey – Household Questionnaire.

BELIEVED WOULD NE REFUSED…….2
TOO EXPENSIVE……...3
TOO MUCH TROUBLE FOR WHAT IT IS WORTH……..4
INADEQUATE COLLATERAL……5
DO NOT LIKE TO BE IN DEBT……...6
DO NOT KNOW ANY LENDER…….…7
OTHER (SPECIFY) ……8

2.3.1 Identifying Household Borrowing Status

Following Cole and Sokolyk (2016) and Brown et al. (2011), three dependent variables were generated from the above questions, after categorising farm households into non-borrowers, discouraged borrowers, rejected (denied) borrowers and successful (approved) borrowers:

1. Non-borrowers (no-need) are farm households who did not take credit on the reason that they did not need credit.
2. Discouraged borrowers are categorised as farm households who require or need credit but did not apply due to the following stated reasons: believed would be refused, too expensive, inadequate collateral, too much trouble for what is worth, and do not know any lender[5].
3. Rejected borrowers are farm households that applied for credit but were denied.
4. Successful borrowers are farm households that applied for credit and were approved (either received the full amount or part of it).

The dependent variables that were therefore generated from the above categorization include:

- *need credit*: a dummy variable which equals one (1) for households that are discouraged borrowers, rejected borrowers or successful borrowers and zero (0) where the household is a non-borrower.

[5] Those who did not borrow because they did not like to be debt were dropped from the sample. Further, unless otherwise stated those who chose "other" reasons without specifying the actual reason were also dropped out of the sample as it was difficult to categorise them under any group.

- *apply credit*: a dummy variable equal to one (1) if the farm household is a rejected or successful borrower and zero (0) if the household is a discouraged borrower.
- *denied credit*: a dummy variable equal to one (1) if the household is a denied borrower and zero (0) if a successful borrower.

2.3.2 Modelling who needs and who gets credit

The problem of the study can be conceptualised through a sequential decision process, where a rural farm household first desires (needs) to take credit, then either proceeds to apply for credit or may be discouraged from applying. Applicants may be either successful in their application or denied credit by the lender. The problem of this study is therefore conceptualised by a three-step sequential process represented by a binary response at each stage. The issue of sample selection is dealt with at the second and third stages. Therefore, this involves modelling a trivariate probit with double sample selection (TPDSS). This is conceptualized in Figure 2.1 below.

The issue of selectivity bias may arise if a specific outcome of a unit of analysis (in this case rural farm households) is to be examined while ignoring the decision process they went through that resulted in the outcome (Fishe et al., 1981). In this case, the estimation of the denied-approved equation for households that applied for credit should also incorporate the decision of whether they needed credit or not. It is postulated that ignoring this decision process may create a selectivity bias in the denied-approved equation.

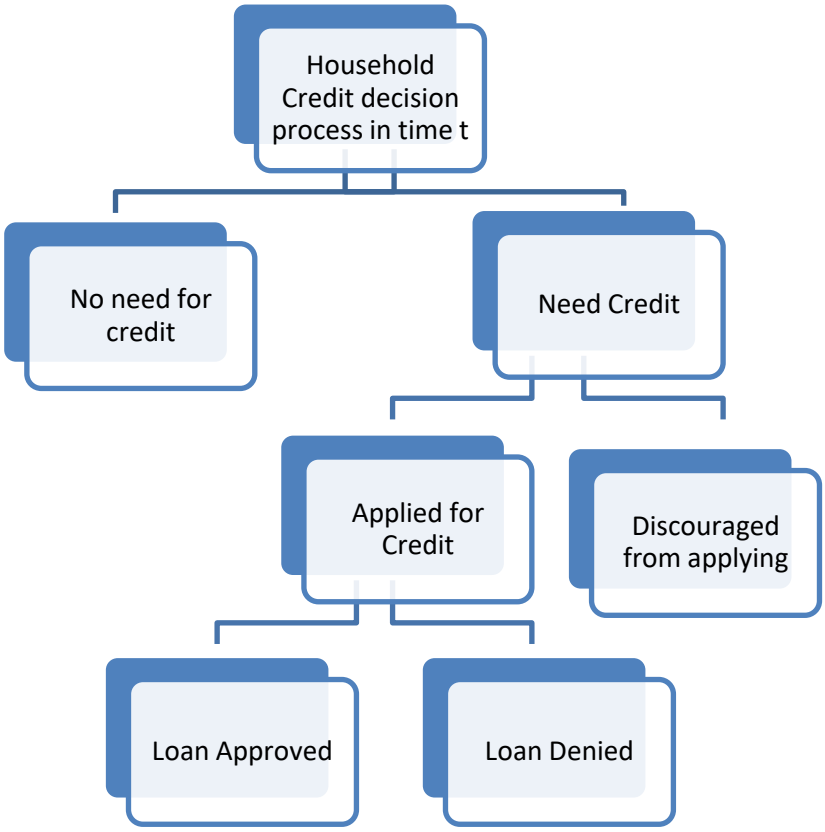

Figure 2.1: A sequential break down of credit access

Following Terracol (2002) and Rosenman et al. (2010), the study considers three binary outcome variables y_1, y_2 and y_3, whereby y_1^* is the unobserved expected utility that a rural farm household obtains from desiring or not needing credit, y_1; y_2^* is the unobserved expected utility obtained from applying for credit or being discouraged, y_2; and lastly the unobserved expected utility obtained from being approved or denied credit, y_3, is y_3^*. The trivariate probit model is represented as:

$$y_j^* = X_j\beta_j + \epsilon_j, \qquad j = 1, 2, 3$$

$$y_1 = \begin{cases} 1 \; if \; y_1^* > 0 & (need \; credit) \\ 0 \; otherwise & (don't \; need \; credit) \end{cases}$$

$$y_2 = \begin{cases} 1 \; if \; y_2^* > 0 & (applied) \\ 0 \; otherwise & (discouraged) \end{cases}, where \; y_1 = 1$$

$$y_3 = \begin{cases} 1 \; if \; y_3^* > 0 & (denied) \\ 0 \; otherwise & (approved) \end{cases}, where \; y_1 = 1 \; and \; y_2 = 1$$

and

$$\begin{pmatrix}\epsilon_1\\ \epsilon_2\\ \epsilon_3\end{pmatrix} \rightarrow N(0, \Sigma)$$

For the scalar identification problem, the variances of the epsilons, ϵ_i, (i.e. the error terms) are assumed to be equal to 1. Also, at least one variable enters into y_1 equation which does not appear in y_2 and a second variable is also excluded in y_3. These variables are chosen such that they are correlated with the dependent variable they appear with but not directly correlated to the equation from which they are excluded. Going by this process resolves the issue of identification in the selection process. Further, due to the sample selection issue, it is not possible to identify $P(y_3|y_1 = 0), P(y_2|y_1 = 0)$ or $P(y_3|y_1 = 1, y_2 = 0)$. A close look at the model reveals two levels of sample selection and two levels of outcomes implying four types of categories. These include sequentially:

1. Households that do not desire/need credit; $y_1 = 0$
2. Households that desire/need credit but are discouraged; $y_1 = 1, y_2 = 0$
3. Households that desire credit, apply and are approved; $y_1 = 1, y_2 = 1, y_3 = 0$
4. Households that desire credit, apply but are denied; $y_1 = 1, y_2 = 1, y_3 = 1$

Following this, full information is obtained for two types of the observation which include those who need to take credit, actually apply and are approved or denied. However, information is lost on those who do not need credit and those who are discouraged.

With the assumption of normal distribution between y_j^* and ϵ_j the trivariate probit model needs to be consistent and asymptotically efficient given full maximum likelihood estimation. The likelihood function is therefore expressed as:

$$L((\beta_1\ \beta_2\ \beta_3)|(y_1\ y_2\ y_3), (X_1\ X_2\ X_3)) = P(y_3|y_2, y_1, X_3)P(y_2|y_1, X_2)P(y_1|X_1)$$

The conditional probabilities corresponding to the four categories are as follows:

1. $P(y_1 = 0) = 1 - \Phi(X_1\beta_1)$

2. $P(y_1 = 1, y_2 = 0) = \Phi(X_1\beta_1) - \Phi_2(X_1\beta_1, X_2\beta_2, \rho_{12})$

3. $P(y_1 = 1, y_2 = 1, y_3 = 0) = \Phi_2(X_1\beta_1, X_2\beta_2, \rho_{12}) - \Phi_3(X_1\beta_1, X_2\beta_2, X_3\beta_3, \rho_{12}, \rho_{13}, \rho_{23})$

4. $P(y_1 = 1, y_2 = 1, y_3 = 1) = \Phi_3(X_1\beta_1, X_2\beta_2, X_3\beta_3, \rho_{12}, \rho_{13}, \rho_{23})$

Where, $\Phi(*)$ is defined as the cumulative distribution function (CDF), $\Phi_2(*)$ is the bivariate CDF with correlation coefficient $\rho_{12} = \text{cov}(\epsilon_1, \epsilon_2|\text{X}_1, \text{X}_2)$ and $\Phi_3(*)$ is the trivariate CDF with correlation coefficients as $\rho_{12} = \text{cov}(\epsilon_1, \epsilon_2|\text{X}_1, \text{X}_2)$, $\rho_{13} = \text{cov}(\epsilon_1, \epsilon_3|\text{X}_1, \text{X}_3)$ and $\rho_{23} = \text{cov}(\epsilon_2, \epsilon_3|\text{X}_2, \text{X}_3)$. Estimation of the likelihood function demands the computation of trivariate normal integrals, estimating three integrals jointly to find the factors that explain each equation. This can also be solved by some simulation techniques.

The GHK (Geweke-Hajivassiliou-Keane) maximum likelihood simulator has been developed to estimate large models such as the problem faced in this study (Geweke, 1989; Hajivassiliou and McFadden, 1998 and Keane 1994). Nevertheless, the estimation of the simulation model is computationally intensive and reaching convergence may be time consuming (Cappellari and Jenkins, 2003, p. 282) and when ρ_{ij} approaches 1 the estimation may not converge (Rosenman et al., 2010, p. 9). Using Heckman's (1979) correction techniques according to Rosenman et al. (2010) may help to overcome these computational problems.

This paper follows Fishe et al. (1981) who extend the Heckman (1976) and Lee's (1976) two-stage modeling procedure to a situation where there are several types of self-selection bias in the data. For this study, the biases are composed of two decisions (i.e. need–no-need credit and applied–discouraged decisions) with the final outcome equation being denied-approved credit which is a dummy variable. The difference is that Fishe et al (1981) had a continuous dependent variable outcome.

In support of the Heckman-Lee two-stage process being extended to a trivariate case, Nicoletti and Peracchi (2001) perform a Monte Carlo simulation in the case of a two-step estimation with sample selection and conclude that this could be easily extended to the situation of a trivariate or multivariate probit model. Arendt and Holm (2006) and

Rosenman et al. (2010) actually extended it to a trivariate model and they found it to be a viable alternative to the complicated trivariate probit model. This alternative is therefore adopted in this study.

In summary (see Arendt and Holm (2006) and Rosenman et al. (2010) for a more detailed explanation), one alternative is to estimate the three equations separately, generating an inverse Mills ratio (IMR) in the first two equations (selection equations) and adding it as an extra explanatory variable in the subsequent equations. In the case where there is a suspicion that the first and the third equations are correlated, the IMR from the first equation can be added to the third equation.

In another approach, a bivariate probit model with sample selection[6] can be estimated either on the first two equations and a probit estimation on the last one or a probit estimation on the first equation and a bivariate estimation with sample selection on the last two. An IMR is calculated in each case and added to the subsequent estimation. While in the first alternative, an IMR is generated from only the second equation where the first equation is not expected to affect the third stage[7] and added as an extra variable in the probit estimation of the third stage, in the second alternative, the IMR from the probit estimation of the first stage is included in the second equation. For this current study, only the IMR generated from the second equation is included in the probit estimation. This is because we do not expect a household needing credit to be correlated with a household obtaining credit or not.

2.3.3 Independent variables

The independent variables used in the estimation are presented and defined in Table 2.1. The choice of the independent variables was informed by various studies on access to credit, where it is hypothesised that households need for credit, applying or discouraged from applying and being rejected or successful depend on household demographics, socio-economic and farm characteristics, assets and community level characteristics.

[6] This is also known as a probit model with sample selection and it is estimated by using the *heckprobit* command in STATA.

[7] Where the first stage is also expected to affect the third stage, an IMR is also estimated from the first stage and added as an extra variable in the third stage.

Table 2.1: Description of independent variables used in the model

Variable name	Variable type	Description
Gender	Binary	Sex of the household head (1= male, 0=female)
Age	Continuous	Age of household head in years
Age squared	Continuous	Age squared captures the life cycle effect.
Household size (hhsize)	Continuous	Number of members in the household
Location		Geographical location of the households
Rural North	Binary	1= rural north, 0 = elsewhere
Rural Centre	Binary	1= rural centre, 0 = elsewhere
Rural South	Binary	1= rural south, 0 = elsewhere
Education level		Educational levels of household head
None	Binary	1= no education, 0 = otherwise
Primary	Binary	1= primary education, 0 = otherwise
Higher	Binary	1= secondary/tertiary, 0 = otherwise
Network/social group	Continuous	Number of networks households are involved in
Land size	Continuous	Total land size cultivated in the rainy season in hectares.
Land tenure	Binary	1 = land title (secured) 0 = no land title
Home assets	Continuous	Value of home assets in Malawi Kwacha (MWK)
Farm assets	Continuous	Value of farm assets (MWK)
Livestock	Continuous	Value of livestock (MWK)
Remittance	Continuous	Remittances sent to the household by children living outside the household
Bank Distance	Continuous	Distance to the nearest bank in km
ADMARC distance	Continuous	Distance to the nearest Agricultural Development and Marketing Corporation in km
Financial Institutions	Continuous	Number of financial institutions in each district
Shock (natural)	Binary	Experienced natural shock (floods, drought, etc.)
Shock (agric.)	Binary	Experienced agricultural shock (price increase in inputs etc.)
Shock (household)	Binary	Experienced household shock (death or birth, etc.)

2.3.3.1 Age of household head

Following the life-cycle hypothesis, it is expected that households' need for credit or participation in credit market would be a concave function of the age of the household head. Thus, younger household heads are more likely to borrow to meet their consumption while older household heads are more likely to depend on their past savings and hence less likely to borrow to meet their consumption (Mpuga, 2010). Gibb and Ritchie (1982) further argue that an increase in age is correlated with a continuous increase in one's experience and assets, all other things being equal. Noting both arguments, though younger household heads compared to the older ones may need credit, they are restricted by their experience and especially assets which could have been used as collateral. Hence, it is expected that younger farm household heads will be

more in need of credit but less successful in their loan applications because of their lack of or inadequate experience (Freel et al., 2012). It is argued by Fabbri and Padula (2004) that borrowing increases with age but also has a quadratic relationship implying a fall in borrowing after a certain age. Hence it is also expected that an increase in age will increase participation in the credit market thus increase application of credit or decrease discouragement. However, this turns negative at a certain age beyond which participation in the credit market falls.

2.3.3.2 Gender of household head

Females are often characterized as lacking self-confidence, have lower capability of managing risk, believe that borrowing brings higher risk and also perceive that banks discriminate against them (Watson, 2006). Demirguc-Kunt et al. (2013) identify a gender gap in borrowing in favour of men which could be explained by legal discrimination and gender norms. Thus, they explain that in an environment where women face legal issues of being unable to work, inheriting assets and legally required to obey their husbands, they are less likely to borrow. Further, most female-headed households cultivate for household consumption and spend much of their time on household chores while their male counterparts cultivated for the market and spent much of their time on productive economic activities (Ilahi, 2001). It is therefore expected that female-headed households would be more discouraged from applying for credit. Also, it is expected that female-headed households who apply for credit will be discriminated against in the credit market and therefore denied credit. Despite this, some studies have also found the contrary. Since women have been seen to be vulnerable and disadvantaged in the society, NGO's and other development organisations have drawn credit schemes to target women as they are seen to be more credit-worthy than their male counterparts (Akudugu, 2012). Implying from this, female-headed households are more likely to receive credit than the males.

2.3.3.3 Education level of household head

Education as a tool for human capital development is expected to be positively associated with firm growth (Storey, 1994) and some knowledge of bank loan application procedure. Higher levels of formal education are mostly restricted to non-

poor households hardly found in the rural areas of Malawi. It is expected that household heads with higher level of education would less likely need credit as they are more likely to have higher levels of income and also engage in other income generating economic activities. However, educated household heads are more likely to participate in the credit market and therefore will apply for credit and not discouraged as they are more likely to have assets that could be used as collateral. Further, household heads with higher levels of education are more likely to receive credit as they could be viewed to be more reliable to properly manage resources in comparison to those with no or lower level of education.

2.3.3.4 Location

Discrimination in the credit market also exists across geographic location (Leyshon and Thrift, 1996). This is mostly observed in deprived areas, such as the rural communities in Africa, where there is lack of economic and infrastructural development and lack of financial institutions. Rural central Malawi is comparatively less poor due to its proximity to the capital city of the country where there is better economic and infrastructural development than other locations of the country. Rural south Malawi is poorer than rural north. The households in very poor locations are expected to be deprived of financial services and may not be able to meet the collateral requirements. It is therefore expected that households in the rural north and south of Malawi will need credit, be discouraged to borrow and less likely to be successful in their application in comparison to the households in rural central of the country.

As part of locational measurement, the distance to microfinance institutions and Agricultural Development and Marketing Corporation (ADMARC) were also included. Different locations imply different distances to financial institutions. Households in deprived communities often have to journey long distances to financial institutions. This increases the cost of applying for credit and therefore may discourage such households from applying although they may need credit. Further, financial institutions like microfinance institutions are more likely to be biased towards households closer to them than those farther away. Hence, it is expected that these households would be more successful to receive credit.

ADMARC is a Malawian parastatal which buys agricultural produce from traders and smallholder farmers through its vast network of markets, procures and sells farm inputs to smallholder farmers which are sometimes subsidised and also plays a key role in the country's food security situation, particularly for maize. A traditional problem of farmers is selling their produce and accessing farm inputs at the right time. With the help of ADMARC farmers may be able to have access to inputs at the required time and also sell their produce for revenue. This therefore gives farm households some secured income flow which may be a substitute to credit. Therefore, the presence of or distance to an ADMARC institution in a rural farm community is likely to reduce households' need for credit or may act as a complement for loan.

2.3.3.5 Household size

Poor rural households are believed to have larger household sizes than the non-poor. With the already high economic pressure of being poor, larger households would require extra resources to survive as a result of the high dependency ratio. Therefore, larger household sizes are expected to be highly in need of credit. As large households are also associated with the poor it is more likely such households are unlikely to accumulate wealth to build up assets that could be used as collateral hence may be discouraged from applying for credit. However, a study by Shimamura and Lastarria-Cornhiel (2010) and Bendig et al. (2009) have concluded that households with larger members are more likely to participate in the credit market. Household size in this study is measured as the number of members within the household.

2.3.3.6 Network/Social group

Some studies have reported the importance of social capital or social ties on the demand for credit (Bastelaer, 2002; Brown et al., 2015; Mohammed et al., 2013). For example, in the absence of physical collateral, lenders, especially informal lenders, rely on their social interaction to provide credit to borrowers as there is some level of trust due to long social interaction. Formal financial institutions, unlike the informal lenders, have less penetration in rural areas due to mainly information asymmetry. There is obviously high level of demand for credit from friends and relations which forms the primary basis of the social interaction or network. These also make taking credit for non-productive

purposes easier as formal lenders hardly provide credit for consumption purposes especially in rural poor communities. Further, high social interaction enables information flow from the more informed to the less informed. Thus, household members who belong to a credit program may influence non-borrowers either positively or negatively depending on their experience from borrowing. Some formal institutions like the Grameen Bank of Bangladesh have also relied on the social groups as a basis for lending credit to borrowers as this reduces the associated problems of information asymmetry like moral hazard, adverse selection, transaction cost and cost of contract enforcement. Social capital is measured based on number of social groups, trust and level of involvement in the social group among others. However, due to lack of information in the data, this study only measures social group as the number of networks that households participate in. The more groups household members are involved in the better their social standing and the more likely they are to receive credit. However, depending on the kind of information received from others about the credit market, household members may be discouraged from or encouraged to apply for credit.

2.3.3.7 Household assets

Household assets are very important in affecting the welfare of a household. This is also used as a proxy for household income since it is argued that the higher the household income, the higher the value of households' assets, increasing the likelihood of demand for credit. Thus, the assets could be used as collateral. According to Diagne (1999) who studied the determinants of households' access to credit in Malawi concluded that the composition of household assets is more important in determining households' access to credit than the total value of assets. Following this, the household assets are decomposed into four main components. These include land asset (farm size measured in hectares), value of agricultural or farm assets which can also be termed as the productive assets (e.g. farm implements, machinery, and structures measured in Malawian Kwacha), value of livestock measured in Malawian Kwacha, and value of non-agricultural or home assets (television, bicycle, sewing machine, etc. measured in Malawi Kwacha). It is expected that households with higher household assets may be in a better position to meet collateral requirements to take up loans and therefore not discouraged from applying and may also be in a good position to be granted credit.

2.3.3.8 *Land tenure*

Following from the farm size, households with secured land ownership or registered land are more likely to use these lands as collateral to obtain credit. Foltz (2004) argues that households' title to land are expected to create much influence on supply of credit rather than demand as it increases collateral and the quality of the applicants. Hence, households with a land that are titled to them are less likely to be discouraged and more likely to be successful in receiving credit.

2.3.3.9 Remittances

Access to remittances by farm households may be considered as an important variable affecting the household's wellbeing. Remittances contribute to household income and could be used to finance both farm and off-farm activities, and can substitute for credit. For this reason, households which are unlikely to receive remittances are more likely to be in need of credit and more likely to apply for credit and not to be discouraged.

2.3.3.10 Shocks

Households may react differently to their demand for credit depending on the type of external shock they experience. Shocks were hence decomposed into three categories: natural shocks such as earthquakes, floods, landslides, and drought, which affect almost all households within the community; agricultural shocks like pest infection, animal diseases, low agricultural output prices and high cost of farm inputs; and household shocks such as death of the income earner, illness, theft etc. It is expected that households which experience certain shocks will be in need of credit and possibly apply for credit to manage the risk of the shocks. However, due to high risk of default especially from natural shocks, households are more likely to be denied credit. As confirmed by Udry (1994), Barslund and Tarp (2008) and Pidé (2013), credit has been very useful for rural folks to shoulder various forms of shocks although Pidé (2013) attests that these shocks could also lead households to default in payment of their credit.

2.3.3.11 Identification

Using a Heckman-like model involves obtaining some variables that could be used as exclusion restriction variables or instruments. The criteria are that the instrument or instruments should be relevant, thus must be correlated with the supposed endogenous

variable, and valid, not directly correlated with the outcome variable. Identifying the instruments for the need credit equation was quite challenging as both equations (need credit and apply credit equations) are related to demand for credit. Hence, it is most likely that a variable used as instrument may be weak or not good instrument. As the first equation, need for credit, is notional demand and the second equation, apply for credit, captures effective demand, finding a variable that affects the need for credit but not applying credit was extremely difficult. A study by Brown et al. (2012) used internal finance as an instrument in their firm level study on the assumption that while this may influence need for credit, it does not affect the likelihood of a firm applying for credit given that they need it. However, using household expenditure as a proxy for internal finance did not meet the criterion for validity. Other variables such as distance to ADMARC branch and shock coping strategies were also used but these also did not meet the criteria.

However, a panel data was used to examine whether the lag of land intensity (measured as the ratio of the hectares of land cultivated in the previous period to total cost of inputs in the same period) would be a good instrument. However, the panel data had a three-year gap which confounded the use of the three-year lag variable which was found to have no statistical significant effect on the current decision of whether a household needs or does not need credit. In addition, very few of the variables in the model were significant. Hence, the study continued with the cross-sectional data.

Finally, the value of home assets was also tried as an instrument. Home assets are durable home goods such as a bicycle, radios and televisions owned by the household. These assets must be saved for, purchased and accumulated over the life time of the members of the household. The value of home assets accumulated over the years is expected to be a reasonable indicator of the level of wealth of the household (the survey captures no other wealth variables). It is expected that poor households would have little choice but to spend on productive farm assets than durable goods and would only spend on home assets where they have more to spend. Hence, the higher the value of home assets the relatively wealthier the household is compared to another household. It could be argued that relatively wealthy households are less likely to be in need of external

credit and therefore may not need to apply for credit especially in areas like rural Malawi where there is lack of formal credit. Hence, the argument that possession of home assets does not affect credit application is built around household's not needing credit. Therefore, it is expected that there would be a negative relationship between home assets and needing credit.

The estimation with home assets as an instrument is tested against an estimation with no exclusion restriction as a robustness check of whether there is a difference between the two estimated results. The estimation without an exclusion follows a study by Allen et al (2016) using a maximum likelihood estimator to jointly estimate the correlated equations (that is, need/no-need equation and applied/discouraged equation) similar to using the STATA *heckprob* command used in this study.

As a three-step model was estimated, an instrumental variable is also required to identify the third-stage probit equation. A variable that influences the accessibility of credit but not whether a household would be denied or approved credit was used. For this study the number of financial institutions within each district was used. It is postulated that the greater the number of financial institutions in a location increases the greater the likelihood that households would increase their application for credit. Although they become accessible, banks and other formal financial institutions go through some sort of screening process to identify worthy borrowers from unworthy ones. Their accessibility or number in a district is therefore not a condition that households would be denied or approved credit in poor areas like rural Malawi. A second instrument was also used, that is distance to an ADMARC market. ADMARC institutions have no role in the distribution of credit but they assist farmers through supplying inputs and also serve as a ready market for farmers. With ready markets, farmers are able to get a secured income and may rely on that income when credit is unavailable. Therefore, this may affect the likelihood of a household applying for credit given need for credit but will not explain if a lender will provide credit to the household.

2.4 Results

2.4.1 Descriptive analysis

Among the entire sample of rural farm households, 80.47 percent required credit indicating the high need for credit for production and also consumption among rural farm households in Malawi (see Figure 2.2 below.) Despite this, only 24.4 percent of those who needed credit actually applied implying a high level of discouragement (75.6 percent). Among households which were discouraged, about 37 percent did not borrow because they did know any lender, followed by those who did not borrow because they were afraid they would be denied credit (25%). Only about 3.5 percent did not borrow because they lacked adequate collateral. Further, only 37 percent of those who applied for credit were denied. As a result, about 15 percent of those who needed credit applied and obtained it. This suggests that among the households that needed credit in rural Malawi, almost 85 percent were credit constrained, a percentage composed of discouraged and denied borrowers. By comparing discouraged and denied borrowers, it was identified that discouraged borrowers were over 7 times more (in number) than those who were denied credit. This is consistent with the assertion of Kon and Storey (2003) who predicted a high prevalence of discouraged borrowers over denied borrowers in developing countries compared with the developed worlds as in Levenson and Willard (2000). Freel et al. (2012) and Levenson and Willard (2000) in their empirical works found about twice the number of discouraged borrowers over denied applicants in a study in some developed countries.

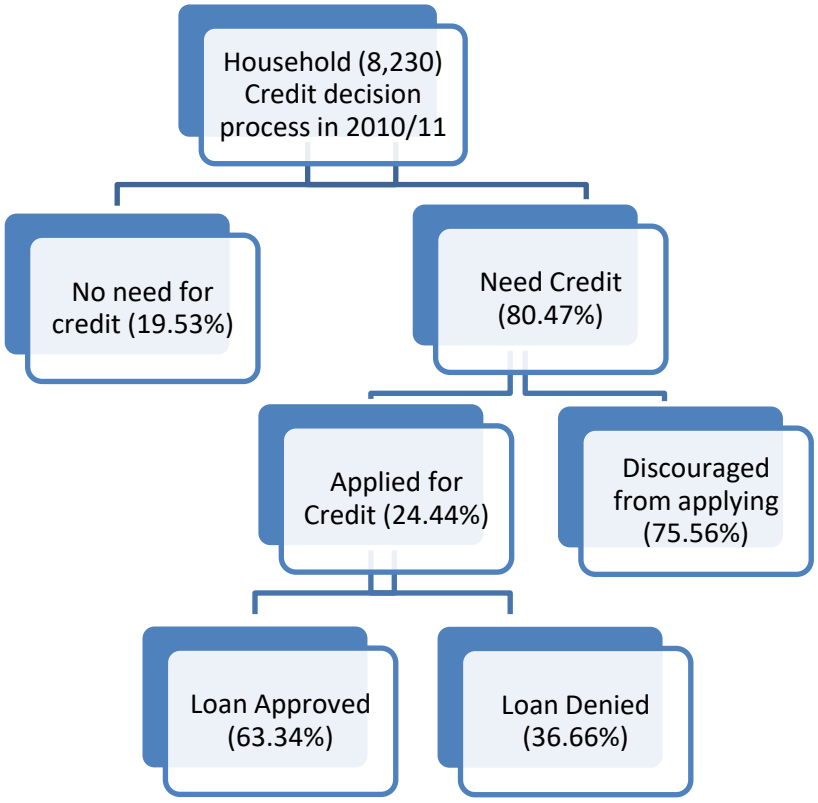

Figure 2.2: Descriptive statistics of the sequential break down of credit access

A correlation coefficient matrix was also generated for the variables to identify possible highly correlated variables. This is necessary as multicollinearity could render the results unreliable. The correlation coefficient matrix is presented in Table A1 of Appendix A of this chapter. Examining the results show that all the variables have a coefficient below 0.5 except for age and age squared which is expected. The variables with coefficients just above 0.4 are the correlation between value of home assets, farm assets and value of livestock and also between remittances and age of the household head. They all have positive coefficients implying a direct association between them. However, the magnitudes of the coefficients are not large enough to worry about multicollinearity. From the correlation table, it can also be seen that, value of home assets used as an instrument is correlated with the credit dependent variables. This therefore makes this instrument an invalid instrument judging from the strong correlations.

To understand who these rural farm households are, Tables 2.2, 2.3 and 2.4 present some descriptive statistics of the characteristics of the rural farm households in Malawi by their borrowing status. Table 2.2 presents the summary characteristics of the total sample and of non-borrowers (those who do not need credit) and those that need credit. Table 2.3 includes the summary characteristics of discouraged borrowers and those who applied for credit and Table 2.4 presents denied and approved borrowers. Two univariate test statistics were also carried out. An Adjusted Wald Test was applied to determine the statistical difference of the weighted mean values of each continuous variable by the paired borrowing status, while the Pearson chi-square (χ^2) test examines whether the categorical or discrete independent variables of rural farm households differ significantly by their borrowing status.

Table 2.2 indicates that about three-fourths of all the respondents were male-headed households. However, the χ^2 test shows no statistically significant difference for household need for credit between a male-headed or female-headed household. The average age of those who do not need credit was 46 years and was significantly different from that of the mean age of households that needed credit (42 years). There were on average about 5 members in each household. Farm land cultivated during the raining season was approximately 0.77 hectare. Generally, non-borrowers had higher home assets, farm assets, value of livestock and also remittances than the household who needed credit. These could easily explain why they are not in need of credit as they are comparably better off. These variables showed a highly significant difference between those who do not need credit and those who needed credit.

Table 2.2 further shows among other information that, just below 50 percent of the respondents resides in the rural south of the country. An overwhelming 81 percent had no formal education. Household heads with higher education were greater in comparison to the other education levels among non-borrowers. Location and the levels of education had highly significant differences comparing the two groups as inferred from their χ^2 values which were significant at 1 percent level. Distance to the nearest microfinance institution (MFI) and ADMARC branch were on average 31 and 8.8 kilometres

respectively, but the test showed no statistically significant difference in mean distance to an MFI between the two groups.

Table 2.2: Descriptive statistics of need credit

Variables	Total Sample	No-need	Need credit	Statistical test
Gender				
Male	0.752	0.197	0.803	0.51
Female	0.248	0.189	0.811	
Head age	42.994	45.66	42.347	35.27***
Household size	4.679	4.489	4.725	11.60***
Location				
Rural North	0.120	0.312	0.688	80.95***
Rural Centre	0.423	0.25	0.75	
Rural South	0.457	0.114	0.886	
Education				
None	0.807	0.183	0.817	13.68***
Primary	0.09	0.233	0.767	
Higher	0.103	0.262	0.738	
Network	3.281	3.415	3.249	6.02**
Land size (hectare)	0.765	0.880	0.735	36.03***
Land tenure				
Unsecured	0.121	0.216	0.784	2.06
Secured	0.879	0.193	0.807	
Home assets (MWK)	17,071.94	31,118.03	13,662.95	20.26***
Farm assets (MWK)	5,861.155	9,731.34	4,921.862	7.74***
Livestock (MWK)	27,634.74	52,523.1	21,594.33	13.02***
Remittances (MWK)	3,194.78	7,081.50	2,251.47	17.66***
MFI Distance (Km)	31.34	30.68	31.50	0.38
ADMARC Distance (Km)	8.761	8.162	8.906	3.70*
Financial Institutions	23.607	32.617	21.420	56.90***
Shock (natural)	0.466	0.150	0.850	53.77***
Shock (agric.)	0.383	0.162	0838	20.55***
Shock (household)	0.443	0.143	0.857	62.75***
Observations	8,230	1,573	6,657	

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 2.3 presents the statistics of discouraged borrowers and those who applied for credit. Female-headed households were more discouraged from borrowing, while a greater proportion of those who applied for credit were in rural centre of the country. Also, a higher percentage of households who applied for credit had a higher level of education. These variables; gender, location, and education, all had statistically significant χ^2 values at 1 percent level showing a strong significant difference between the applicants for credit and the discouraged borrowers.

Discouraged borrowers were older than those who applied for credit (43.3 years and 39.5 years respectively), they also received more remittances but however, had lower value of home and farm assets and value of livestock than applicants. Discouraged borrowers also resided farther from the MFIs and ADMARC branches. The households that applied for credit had on average 5 members each, belonged to more social groups, and cultivated larger farms than those who were discouraged from borrowing. The differences in mean were all statistically significant, as shown in Table 2.3.

Table 2.3: Descriptive statistics of applied/discouraged

Variables	Need Credit	Discouraged	Applied	Statistical test
Gender				
Male	0.750	0.732	0.268	52.65***
Female	0.250	0.827	0.173	
Head age	42.347	43.261	39.521	71.52***
Household size	4.725	4.603	5.10	46.02***
Location				
Rural North	0.102	0.792	0.208	28***
Rural Centre	0.395	0.687	0.313	
Rural South	0.503	0.802	0.198	
Education				
None	0.820	0.779	0.221	34.78***
Primary	0.028	0.675	0.325	
Higher	0.095	0.631	0.369	
Network	3.249	3.090	3.741	119.46***
Land size (hectare)	0.735	0.706	0.824	20.00***
Land tenure				
Unsecured	0.118	0.644	0.356	40.48***
Secured	0.882	0.771	0.229	
Home assets (MWK)	13,662.95	10,342.22	23,931.93	6.07**
Farm assets (MWK)	4,921.86	4,063.64	7,575.82	8.69***
Livestock (MWK)	21,594.33	20,072.94	26,299.06	1.12
Remittances (MWK)	2,251.47	2,665.19	972.103	8.54***
MFI Distance (Km)	31.50	32.252	29.172	5.37**
ADMARC Distance (Km)	8.906	9.119	8.249	3.39*
Financial Institutions	21.420	21.478	21.241	0.05
Shock (natural)	0.492	0.733	0.267	10.07***
Shock (agric.)	0.398	0.700	0.300	48.78***
Shock (household)	0.472	0.705	0.295	57.30***
Observations	6,657	4,946	1,711	

Note: *** p<0.01, ** p<0.05, * p<0.1

The descriptive statistics of the variables for households who were denied or were successful in borrowing are presented in Table 2.4. A greater proportion of female-headed households had their credit applications approved, as compared to the male-

headed households. Further, there were more denied applications in the rural south of the country than in the other locations. As expected, households which obtained credit lived closer to MFIs, cultivated larger farm area, and had a saving or credit institution in their community. Likewise, those who obtained credit suffered more agricultural and household shocks while those who were denied experienced more natural shocks. Surprisingly, households with larger home and farm assets including higher value of livestock and remittances were denied credit in comparison with those who received credit. However, there are no significant differences among majority of these characteristics between households who were denied credit and those who were approved.

Table 2.4: Descriptive statistics of received or denied credit

Variables	Applied	Approved	Denied	Statistical test
Gender				
Male	0.823	0.623	0.377	2.70
Female	0.177	0.681	0.319	
Head age	39.521	39.099	40.250	2.35
Household size	5.100	5.174	4.971	2.50
Location				
Rural North	0.087	0.640	0.360	1.83
Rural Centre	0.505	0.658	0.342	
Rural South	0.408	0.602	0.398	
Education				
None	0.743	0.616	0.384	1.69
Primary	0.114	0.666	0.334	
Higher	0.143	0.696	0.304	
Network	3.741	3.830	3.587	3.95**
Land size (hectare)	0.824	0.839	0.797	0.75
Land tenure				
Unsecured	0.172	0.644	0.356	0.12
Secured	0.828	0.631	0.369	
Home assets (MWK)	23931.93	23,795.3	24,167.98	0.00
Farm assets (MWK)	3.27e+08	1.50e+08	6.34e+08	0.86
Livestock (MWK)	26299.06	23193.25	31664.78	0.33
Remittances (MWK)	972.103	735.922	1380.137	0.65
MFI Distance (Km)	29.172	28.435	30.445	1.73
ADMARC Distance (Km)	8.249	7.615	9.346	5.49**
Financial Institutions	21.241	22.152	19.667	2.56
Shock (natural)	0.538	0.569	0.708	27.61***
Shock (agric.)	0.489	0.624	0.376	0.41
Shock (household)	0.57	0.628	0.372	0.23
Observations	1,711	1,055	656	

Note: *** p<0.01, ** p<0.05, * p<0.1

2.4.2 Multivariate analysis of who needs and who gets credit

As indicated earlier, the econometric estimations follow a three-step sequential process or a trivariate probit model with double sample selection. A bivariate probit model with sample selection using the *heckprobit* STATA command was used to estimate simultaneously the first two stages of the model. An IMR was estimated from the second stage of the equation and added as an extra variable in the third stage. To reiterate, the first equation attempts to determine the factors that influence rural households' need for credit. The second and third equations identify the factors that explain the decision to apply for credit against being discouraged from applying, and subsequently whether a household that applies is successful in gaining credit. The result outputs of the estimated models are presented in Table 2.5[8].

Results from this estimation are compared to an estimation with no exclusion restriction variable. As already stated, this follows a similar estimation by Allen et al. (2016) who jointly estimate two correlated equations using a maximum likelihood. Results are shown in Table A4 in Appendix A. Comparing these results show some great similarity in 1) the variables that were significant, 2) the significance levels and 3) very little difference in the magnitude of some of the variables (mostly evident in the third column which estimates denied/approved). This may show that the results are robust as there is quite significant similarities in results.

2.4.2.1 Determinants of the need for credit

Column 1 of Table 2.5 presents the results of the first stage of the of the *heckprobit* estimation with the dependent variable *need credit* which equals 1 if the household needs credit, and 0 if the household does not need credit. The Wald chi square has a value of 438.30 and is significant at 1 percent level, rejecting the null hypothesis that the

[8] A sensitivity analysis was done reclassifying *need credit* and *discouraged borrowers* with *interest rate* as a stated reason for not borrowing. The results (Shown in Table A3 in Appendix A) showed many significant differences in magnitude and significance of the coefficients in especially the need for credit estimations. For example, gender became significant in the *need credit* with the inclusion of the interest rate component but was not in the need credit without the interest rate component. Farm asset for instance was not significant in the apply credit equation with interest rate component not included in the discouraged borrowers' definition.
Due to these differences and a careful search in the literature, the interest rate reason for not borrowing was added as part of discouraged borrowers for the rest of the study (Mama ad Ewoudou, 2010 & Kon and Storey, 2003).

estimates of the parameters are simultaneously equal to zero. This inference also applies to the second stage regression; apply credit, as they were estimated simultaneously. Further, the estimate of rho which shows the correlation between the selection and the outcome equations that is first and second stage regressions, is statistically significant at 1 percent. It being positive also implies that a household that needs credit is more likely to apply for credit. The statistically significant coefficient of rho implies that estimating a simultaneous-like model was appropriate. This is further supported by the Wald test of independent of equations presented below the table. This is also significant at 5 percent.

Table 2.5: Estimation of who needs and who gets credit

	(1)	(2)	(3)
	Heckprobit		Probit
Variables	Need credit [a]	Apply credit [b]	Denied credit [c]
Male	0.0450	0.143***	0.360***
	(0.0410)	(0.0424)	(0.112)
Head age	0.0152**	0.0133*	-0.0188
	(0.00627)	(0.00763)	(0.0153)
Age squared	-0.000207***	-0.000229***	0.000185
	(6.06e-05)	(7.90e-05)	(0.000183)
Household size	0.0524***	0.0365***	0.0114
	(0.00960)	(0.00962)	(0.0231)
Rural Centre [d]	0.168**	0.354***	0.389*
	(0.0749)	(0.0668)	(0.199)
Rural South	0.655***	0.0384	0.0429
	(0.0786)	(0.0711)	(0.115)
Primary educ. [e]	-0.0522	0.0906	-0.0127
	(0.0594)	(0.0585)	(0.113)
Higher educ.	-0.178***	0.204***	-0.0263
	(0.0523)	(0.0577)	(0.128)
Network	-0.0137	0.0618***	0.0298
	(0.0114)	(0.0112)	(0.0301)
Land size	-0.0797***	0.0367	0.102**
	(0.0272)	(0.0325)	(0.0499)
Land tenure	0.0525	-0.167***	-0.143
	(0.0538)	(0.0574)	(0.115)
Home asset	-0.0364***		
	(0.00624)		
Farm asset	0.00366	0.0249*	0.00681
	(0.0149)	(0.0145)	(0.0262)
Livestock	-0.0139***	-0.00202	-0.0202**
	(0.00449)	(0.00452)	(0.00801)
Remittance	-0.0191***	-0.00977	-0.00621
	(0.00624)	(0.00744)	(0.0167)
MFI Distance	0.0206	-0.0162	-0.00514
	(0.0166)	(0.0170)	(0.0329)
ADMARC Distance	0.0317	-0.0665***	
	(0.0202)	(0.0200)	
FI number	-0.0863***	-0.0708***	-0.121**
	(0.0253)	(0.0220)	(0.0495)

Shock (natural)	-0.109**	0.220***	0.575***
	(0.0436)	(0.0488)	(0.118)
Shock (agric.)	0.230***	0.0738*	0.0768
	(0.0436)	(0.0434)	(0.0888)
Shock (household)	0.282***	0.250***	0.144
	(0.0410)	(0.0398)	(0.130)
IMR apply			1.142**
			(0.581)
Constant	0.418**	-1.564***	-2.023
	(0.196)	(0.207)	(1.239)
Log pseudolikelihood	-7164.15		-1095.83
Athrho	0.523**	(0.208)	
Rho	0.480	(0.160)	
Wald chi2	438.30***		82.55***
Prob>chi2	0.0000		0.0000
Wald test (rho=0)	6.31**		
Prob>chi2	0.0120		
Observations	8,230	8,230	1,711

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[a] Need Credit = 1 if either discouraged, rejected or successful, 0 if non-borrower. [b] Apply credit = 1 if rejected or successful, 0 if discouraged. [c] Denied credit = 1 if denied credit, 0 if successful. [d] Base category for location is Rural North; [e] Base category for education is None.

In terms of the levels of education, only higher level of education is statistically significant and negatively related to the need for credit. This implies that household heads with higher level of education were less likely to be in need of credit as compared with those without any form of formal education. At first glance, this seems counter-intuitive since education brings knowledge, including possibly financial knowledge. But education also provides the opportunity to engage in productive non-farm work, which may make these households relatively stable financially and therefore provide them with some income which decreases their need for credit. This finding is supported by a study by Elhiraika (1999) who also found in rural Sudan that higher level of education reduced the probability of a household demanding credit, specifically informal credit.

The results also show that age increases the need for credit but has a quadratic relationship with the need for credit as the age squared of the household head is negative. This confirms the expectation of the age variable. Thus, rural household need for credit increases as age increases till the age of 37, beyond which the need for credit begins to fall. Thus, households with younger heads have greater necessities and therefore have higher need for resources including credit to meet the necessities of their households while the older heads are presumed to have lesser necessities and therefore may not need credit. This could be related to the life cycle hypothesis that the marginal

propensity to consume reduces beyond a certain age. This is also confirmed by similar results found by Mpuga (2010) in a study conducted in Uganda. He argues that the young are more likely to borrow to meet their needs including smoothing consumption while the old would rather depend on their past savings to survive.

The number of people within a household cannot be overlooked when it comes to household need for capital like credit as is confirmed in this study. Household size was significantly positive in explaining the need for credit. It is argued that the greater the household size the greater the need for food and non-food items. This hence increases the need for resources to meet this increase in demand. Credit has been seen as one such means of supplementing household budget hence the finding is found to be reliable. This is also argued by Bendig et al. (2009) who found in a study in rural Ghana that the size of the household influenced the demand for some financial services such as savings and credit.

Contrary to expectation, households that cultivated relatively larger land areas were less in need of credit. This was also evident for households with higher value of home assets and livestock. This is corroborated by Diagne (1999) who found that higher shares of land and household assets negatively affected the demand for credit; however, this was mostly in demand for formal credit although land was significantly important for informal credit. As found in the descriptive statistics, households which do not need credit own relatively bigger land sizes than those who needed credit. Therefore, the larger the household land size and assets, the less likely the household would need credit. Moreover, some commercial agricultural credit given in rural Malawi is in kind, for example fertilizers, seed and pesticides for hybrid maize provided by Malawi Rural Finance Company (Diagne and Zeller, 2001) and therefore households already having such inputs may not have the need for credit.

Households in the rural centre and south of Malawi were more likely to need credit than those living in the rural north of the country. The coefficients are larger for rural south dwellers. This is not surprising as majority of the poor households reside in the rural south of the country implying that the rural south of Malawi is highly deprived (NSO, 2012). It has been established that financial institutions are more likely to be drawn to

areas which are less deprived, less risky and less costly to serve (Claessens, 2006). Further, it is noticed that there were less financial institutions in the rural south compared to the other locations (Table A2). This confirms that financial institutions are ignoring more deprived areas in Malawi.

Also, it was found that, households that needed credit were more likely to be in districts with less formal financial institutions. Vanroose (2015) concluded from other studies that there were much lower financial services in the rural areas compared to a higher demand for credit in the rural areas. This, he used to buttress the point of location playing a crucial role in the demand for credit and also defining the level of poverty of an area. Thus, an MFI with a pure profit motive is highly drawn to less deprived areas as this reduces the cost of operation, monitoring and risks. Therefore, poorer areas are likely to have greater distance between them and the nearest MFIs although households in these areas are more likely to need credit.

Contrary to the above argument, the presence of savings and credit institutions within an area did not diminish the need for credit as seen from the results of this study. It is found that households living in communities that had the presence of a savings or credit institution also needed credit. Therefore, financial services presence increases households' access to credit by increasing their need for credit. Considering that these are poor areas of the country, the level of development or deprivation is still not satisfied by the few financial institutions available or even by informal lenders. This finding is confirmed by a study in rural Malawi by Shimamura and Lastarria-Cornhiel (2010) who found that presence of credit programs in a location increased the participation of households in the credit market.

The study further showed that households that suffered from household shocks (like death and birth) and agricultural shocks (such as high input prices, pest attacks etc.) were more likely to be in need of credit. In addition to their poor economic situations, rural households which experienced some sort of shock are identified to be in worse economic situations than those who did not experience these shocks. Hence, this increases their need for financial services particularly credit especially in situations where there is no other form of financial support. This finding is supported by studies of

Barslund and Tarp (2008) and Pidé (2013) who found that shocks were important factors to consider when looking at households' demand for credit. Hence shocks could be expected to affect the need for household credit. However, households that suffered from natural shocks were less likely to be need of credit.

2.4.2.2 Determinants of the decision to apply for credit

Column 2 of Table 2.5 presents the results of the second stage of the *heckprobit* estimation of *apply credit* given that the household needs credit. The F statistics that looks at the overall significance of the model and the rho that looked at the correlation between the first two stages have already been discussed to be significantly different from zero. As no exclusion restriction variable is included in the first stage, it is therefore concluded that this model is not identified hence still struggles from endogeneity.

The results showed that although households in the rural south of the country were more likely to need credit, location had no effect on whether they would apply for credit or be discouraged from applying. Only households in the rural centre of the country were more likely to apply for credit compared to those in the rural north of the country; hence they were less discouraged from applying. The central part of Malawi, where Lilongwe the capital of Malawi is located, is the most developed area in the country and would be expected to have more financial institutions than other areas of the country. Rural households located in the central part of Malawi will be closer to these financial institutions which might facilitate loan application as compared to households in the rural north. The findings however are inconsistent with a study by Shimamura and Lastarria-Cornhiel (2010) which reveal that rural south households in Malawi were more likely to participate in credit programs than those in the north but being in the centre had no significant impact on participation.

Among the various assets of the rural household, only value of farm assets was important in determining whether a household would apply for credit or is discouraged from applying. The results reveal that, households with a higher value of farm assets increased the probability to apply for credit hence reducing discouragement. This positive effect on the decision to apply for credit is consistent with the study by Mpuga

(2004). Thus, households with higher value of farm assets required extra form of capital to boost their farm production and therefore were less discouraged but rather would apply for credit. According to Barslund and Tarp (2008), higher value of particularly productive assets increased the likelihood of application for farm credit especially for formal credit so as to increase farm investment. Generally, this is consistent with the assertion by Diagne (1999) that the composition of household assets is more important than the total value of assets as they vary in effect on access to credit.

An increase in age of the household head increased the likelihood of household members applying for credit. However, the negative effect of age squared implies a quadratic effect and also conforming to the life-cycle hypothesis. This implies that much older household heads are more likely to be discouraged from applying for credit and instead rely on accumulated resources (savings). Mpuga (2010) found in Uganda that not only does age increase the demand for credit, it also increased the amount of credit applied for. Further, male headed households were more likely to apply for credit implying female headed households were more discouraged from applying for credit. In most developing countries where the male controlled almost all resources and assets, and engaged in the market and economic activities while the female mostly concentrated on the home, it is most certain that females would be discouraged from borrowing while their male counterparts applied for credit. This is in line with findings of Demirguc-Kunt et al. (2013) who found a significant gender borrowing gap in favour of men.

Large household size increases the needs of a household and therefore increases their need for resources including credit. This was true from the findings in this study with a positive effect of the size of the household on application for credit. Hence, the results showed that a larger household size was a motivating rather than a discouraging factor to applying for credit. This finding is corroborated in other studies such as Nguyen (2007) in rural Vietnam where he found that among other factors household size was important for households' financial activity.

The study further showed the importance of human capital in the participation of a household in the credit market. The study showed that household heads with especially higher level of formal education reduced the probability of a member of the household

being discouraged from applying for credit thus, increasing application for credit. This is consistent with the study by Mpuga (2004) who found that an additional year increase in education increased the application for credit by about 0.3 percent. This could be explained by the fact that some form of formal education increases the understanding of credit application procedures of financial institutions and also the ability to obtain some collateral due to the high possibility of engaging in off-farm economic activities and therefore less likely to be discouraged than those with no level of education. In a study by Chen and Chivakul (2008) only primary level of education impacted participation while higher level of education was documented to have no impact on credit market participation in a study conducted in Bosnia and Herzegovina.

In addition to the above, households' membership in a social group was found to be significantly important in the application for credit. It had a positive effect and significant at 1 percent level. Therefore, membership in an association was an encouraging factor rather than a discouraging factor for the application of credit. This is also noted by a number of studies (Hananu et al., 2015; Mohammed et al., 2013). Therefore, social groups influence access to credit as Hananu et al. (2015) noted that the reason most farmers join social groups includes the need to access credit and other financial facilities.

As confirmed in the need for credit estimation, households that suffer some shocks are highly in need of credit and this further increases their likelihood of applying for credit. All the shock variables are positively significant at 1 percent level making them very important factors to consider when studying households' demand for credit. This again is confirmed by the studies of Barslund and Tarp (2008) and Pidé (2013) who found shocks to be an influencing factor in households' demand for credit.

2.4.2.3 Determinants of denied credit application

The last column of Table 2.5 presents the probit estimation results of whether a household is approved or denied credit, with the variable coded as 1 if household is denied credit, while successful or approved applicants are coded as 0. This decision is conditional on whether a household has applied for credit. Hence, an IMR was estimated

from the apply credit regression and added as an extra variable in the denied credit equation. This was found to be statistically significant at 5 percent. This implies the sample selection issue theoretically discussed in the methodology has been proven to be true in the study. Hence ignoring this sample selection could have biased the results further. The Wald chi square statistic that tests the null hypothesis that estimated coefficients are simultaneously zero is rejected at 1 percent significance level. Also, to make this estimation identified due to sample selection estimation, distance to ADMARC market was dropped from the third stage regression. On the whole, only a few variables were found to be statistically significant in determining households' outcome of credit denial or approval.

While male-headed households were more likely to apply for credit, the results show that they also had a greater probability of being denied credit as compared to their female counterparts. Some credit schemes have targeted females due to the fact that women are seen to be vulnerable, disadvantaged but most importantly more efficient in handling and paying back credit, as such they are considered as lower risk borrowers (Chirwa, 1997; Akudugu, 2012). The age of the household head was negatively significant at 1 percent implying that an increase in age reduces the probability of obtaining credit. Hence, older household heads were more likely to be denied credit than the younger ones. However, age squared was also significant but positive. Therefore, beyond a certain age, which is calculated to be about 50 years, maturity or experience becomes an important indicator as to whether one would be given credit. This is however inconsistent with the findings from Fabbri and Padula (2004) who found that borrowing increases with age but falls after a certain point in time.

Households that were more likely to receive credit also included households with higher value of home assets and livestock. It could therefore be inferred that lenders accept home assets and livestock as collateral for providing credit. This makes these assets very important factors to consider when studying access to household credit. As a proxy for household wealth, it is implied that relatively wealthier households have a higher probability to obtain credit as they may be seen to be more credit worthy than the less

wealthy households. This is validated in the study by Mpuga (2010) where assets played a significant role in both demand for credit and obtaining credit in Uganda.

The only other variable that was also significant in determining if a household is either denied or granted credit is experiencing of a natural shock. Where a household experienced natural shocks such as drought or flood, they are more likely to be denied credit when they apply. As floods and droughts have adverse effect on farm production, it is very unlikely that households would be able to recover from their loss and possibly default when granted credit. This makes them high risk borrowers driving lenders away from such borrowers. Although this argument can be theoretically accepted to be true, it is inconsistent with the findings of Pidé (2013) who found no effect of weather shocks on household borrowing.

The hectare of land cultivated by the farm household was positively significant in the model. This implied that households that cultivated larger land size were more likely to be rejected credit if they applied for credit. While this may be contrary to expectation, it is however consistent with other studies like that of Oyedele et al. (2009) who found that land size increased the probability of a household being credit constrained, thus denied credit in this regards. Also, households in the rural centre of the country are more likely to be denied credit compared to those in the rural north.

The informal credit sector plays a significant role in the development of the rural areas of Malawi. As such it would be good to see its effect on credit application outcome and the differences in the characteristics of households that apply to either the formal of the formal credit sector. Table 2.6 below shows the cross tabulation of credit sources and the application outcomes. The table shows that there more approved applications by the informal lenders than formal lenders however as a percentage of the applications that were made to each of these sectors, formal lenders approved more credit applications than informal lenders. The F-statistics also shows that there is a significant relationship between the source of credit and the whether one is denied or not.

Table 2.6: Source of credit application

Source	Approved	Denied	Total
Informal	760	506	1,266
	(61.31%)	(38.69%)	(100%)
Formal	295	150	445
	(68.88%)	(31.12%)	(100%)
Total	1,055	656	1,711
	(63.34%)	(36.66%)	(100%)
Design-Based F statistics	6.1817**	P=0.0132	

Note: Weighted row percentages in parenthesis

Hence, there is a possibility this may be an important factor in loan application decisions in an econometric estimation. The third stage model therefore may be driven by the source of credit as requirements for credit applications differ from formal lenders to informal lenders. To capture this effect, first, a dummy variable measured as 1 if the credit was approved or denied by a formal lender such as a bank or MFI and 0 by an informal lender was included in the last equation. Second, the data was split into a formal source and an informal source running separate estimations for each source. Results of these estimations are presented in Table 2.7 below.

Table 2.7: Effect of source of credit on credit denial

	(1)	(2)	(3)
Variables	Pooled	Informal	Formal
Male	0.362***	0.244**	0.699***
	(0.111)	(0.122)	(0.257)
Head age	-0.0179	-0.0290*	-0.000338
	(0.0153)	(0.0175)	(0.0323)
Age squared	0.000177	0.000338	-0.000145
	(0.000183)	(0.000208)	(0.000384)
Household size	0.0122	-0.0139	0.0835*
	(0.0231)	(0.0266)	(0.0472)
Rural Centre	0.391**	0.294	0.810**
	(0.199)	(0.222)	(0.389)
Rural South	0.0443	-0.0850	0.575**
	(0.116)	(0.131)	(0.231)
Primary educ.	-0.0122	-0.0923	0.202
	(0.113)	(0.130)	(0.236)
Higher educ.	-0.0141	-0.114	0.210
	(0.128)	(0.151)	(0.249)
Network	0.0311	0.00989	0.0878
	(0.0300)	(0.0331)	(0.0589)
Land size	0.103**	0.171***	-0.0453
	(0.0497)	(0.0601)	(0.112)
Land tenure	-0.143	-0.0485	-0.455*

	(0.115)	(0.129)	(0.235)
Farm asset	0.00812	-0.0160	0.0685
	(0.0263)	(0.0300)	(0.0549)
Livestock	-0.0202**	-0.0246***	-0.00543
	(0.00801)	(0.00908)	(0.0159)
Remittance	-0.00633	0.00237	-0.0289
	(0.0168)	(0.0196)	(0.0327)
MFI Distance	-0.00598	0.00758	-0.0431
	(0.0330)	(0.0343)	(0.0569)
FI number	-0.122**	-0.113**	-0.113
	(0.0494)	(0.0575)	(0.100)
Shock (natural)	0.569***	0.574***	0.621***
	(0.118)	(0.137)	(0.227)
Shock (agric.)	0.0777	-0.000789	0.332**
	(0.0886)	(0.104)	(0.151)
Shock (household)	0.142	-0.0469	0.677**
	(0.129)	(0.141)	(0.282)
Formal Source	-0.0756		
	(0.0782)		
IMR apply	1.145**	0.647	2.584**
	(0.579)	(0.616)	(1.210)
Constant	-2.045*	-0.680	-5.916**
	(1.235)	(1.344)	(2.526)
Log pseudolikelihood	-1095.315	-811.474	-266.495
Wald chi2	83.47***	81.26***	32.75**
Prob>chi2	0.0000	0.0000	0.0359
Chow test		36.14**	P>chi2=0.0148
Observations	1,711	1,266	445

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Column 1 of Table 2.7 presents the results third stage estimation with the dummy of the source of the credit application as an extra variable. The credit source dummy variable however, was not significant at any of the conventional levels. This implies that source of credit application was irrelevant to whether a farm household obtained credit or was rejected credit in rural Malawi. The second set of estimation, attempted to identify if there were any significant difference in the characteristics of households across the sources of credit. This is also reported in Table 2.7 where the informal source estimation is presented in column 2 and column 3 presents the formal source estimation. The chow test of whether the coefficients in the two set of regressions are equal is significant at 5 percent, implying a rejection of equality of coefficients across the models. Hence, the estimated parameters of the separated sources are significantly different from each other. Examining the results, there were generally differences in the variables that were significant in one equation that were not significant in the other. For example, household size, location, and the shock variables were more likely to increase the probability of a

household been denied credit while a household with secured land ownership was more likely to be given credit in the formal source sub-sample only. However, variables that were only significant in the informal source sub-sample included land size, home assets, livestock and the number of financial institutions in the districts. Another major difference between the two models is the that the IMR was only significant in the formal source only.

2.5 Conclusion and implications of the study

This study analyses rural farm households' access to credit, drawing attention to non-borrowers and discouraged borrowers. Using a rich data set from the third wave of the Malawi Integrated Household Survey (2010/2011), a three-step estimation model which captures a Trivariate Probit Model with Double Sample Selection was applied. Specifically, the study addressed three objectives which included determining the demographic and socio-economic factors that influence households': (1) need for credit; (2) discouragement from applying for credit; and finally, (3) being denied/granted credit.

One major observation from the study is that there were over 7 times more discouraged borrowers than denied borrowers, showing a greater percentage of constrained households than would have been the case if only denied borrowers were considered. This is consistent with the findings of Levenson and Willard (2000), Freel et al. (2012) and especially Brown et al. (2011) who found that discouraged borrowers were more than twice as much as denied applicants and also Kon and Storey (2003) who predicted a greater prevalence in developing countries. Hence, this makes an important case for the inclusion of discouraged borrowers in studies of access to credit. This ensures that all those who are credit constrained are analysed to provide a better reflection of the composition of credit constrained households and a more inclusive policy that would be more effective and far-reaching.

Despite the fact that gender played no significant role in explaining whether a household needed credit, female-headed households were more likely to be discouraged from applying for credit but were more likely to be successful if they applied for credit. The

success in obtaining credit could be credited to some financial service programmes being carried out in Malawi targeting women especially. One such programme is by Concern Universal Microfinance Operations which aims at taking financial services to women in remote areas in Malawi. However, as women are still highly discouraged, financial literacy programmes such as that by CARE Australia which attempts to fight poverty by providing women with financial knowledge aiming to increase their access to credit and provide business management skills should be replicated across Malawi. According to CARE the main challenges identified that is preventing the extension and expansion of financial services to women in Malawi has been lack of financial literacy, limited use of technology, lack of loan capital and lack of support in accessing the markets. It has been found that women are able to alleviate the poverty level of the household a lot better than their male counterparts given some financial support (Burjorjee et al., 2002).

Location played an important role. Rural south dwellers, typically with high level of poverty, were more likely to be in need of credit followed by the rural centre as compared to the rural north. Further, rural centre households were also more likely to apply and not discouraged as they were closer to the relatively more developed areas of the country. The households in the rural north of the country therefore were highly discouraged from borrowing. This shows that the rural areas of Malawi are very heterogeneous in their demand for credit. This could be linked to the disparity or unequal development across the country. As financial institutions are more inclined to be established in more developed areas it is realised that the central part of the country had majority of financial establishments as it is found in the IHS3 report that rural centre is the least poor region. This could be due to its proximity to the country's capital. This implies that the rural centre would be much closer to financial institutions than the other locations. The rural south compared to the other locations of the country is densely populated and has the highest level of poverty hence attract the least financial institutions. The dense population will also imply a huge pressure on the few financial institutions in the rural south. As the main driving force to this disparity between location is the level of development across the country, it is recommended that development programmes such as the Malawi Growth and Development Strategy,

Medium Term Expenditure Framework and the Public-Sector Investment Programmes should have location specific development goals. Location specific development goals will help identify specific development issues that needs to be addressed to help bring all locations to a close to equal developed level. For instance, as the south of Malawi is densely populated and also the highly-deprived area of the country, Conscious effort needs to be made to increase the level of development across the country and also create the enabling environment to attract financial institutions to deprived areas of the country. This should go a long way to bridge the poverty gap between the locations and further close up the inequality between the urban and rural areas of Malawi. Hence, there is a need for accelerated financial deepening policies so as increase access to credit across the country especially the north of the country and the south where there is a dense population in addition to high poverty levels. The government of Malawi's Financial Sector Technical Assistance Project financed by the World Bank and the Malawi Financial Sector Deepening Trust also supported by the World Bank, USAID and DFID, for example, which has the end goal of improving access to financial services and increasing financial literacy across the country especially in the deprived areas of Malawi should be properly managed to yield the required outcomes.

The influence of social groups within rural Malawi cannot be underplayed. Since households living within rural areas have closer relationship with each other, information is easily shared amongst them. As a complement to extending financial services to rural communities, it will also be necessary to establish financial social clubs or events where financial literacy can be given. These clubs could be similar or replicate the Village Savings and Loans Associations which are being practiced in some rural areas in the country with successful ones like the Sanambe village savings and loan club in the Karonga South district of Malawi. As earlier explained these associations are made up of a group of individuals who meet regularly, pool money into a common pot which is given to a different member as credit during their meetings. Financial literacy or knowledge obtained during the meetings of such associations could then be passed on from those who attend to those who do not attend and this may further reduce the level of discouragement and increase participation in the credit market. However, this would have to be complemented with increase in the presence of financial institutions to meet

the demand for credit and other financial services.

Households with extra resources should be encouraged to investment in assets such as livestock. The findings from the study showed that these assets increased the chance of a households obtaining credit. This may be because lenders accept these as collateral to advance credit to borrowers. These assets are possibly a proxy for wealth and households with more assets are considered as less risky borrowers. Rural households therefore should be encouraged to invest in livestock farming in addition to their crop farms. It may be in the same light that Self Help Africa, an NGO that has supported a number of village savings and loan associations, have supported individuals who have obtained credit from this programme to purchase livestock and also establish small shops and stalls.

Finally, it is recognised that the open definition given to discouraged borrowers using the Malawi data may differ for another researcher. Despite that, the results are not expected to differ extremely from this study. Further empirical research needs to be done in other regions of sub-Saharan Africa so as to have a correct measure of those who are credit constrained when discouraged borrowers are also identified. The recommendations drawn from the results however are considered weak when considering the fact that the instrument used for the analysis was invalid. Therefore, recommendations drawn should be treated with caution as they may be invalidated because of this problem.

APPENDIX A

Table A1: Correlation coefficient matrix

Variables	1	2	3	4	5	6	7	8	9
1. Male	1								
2. Head age	-0.200***	1							
3. Age squared	-0.209***	0.983***	1						
4. Hhd. size	0.223***	-0.0240*	-0.0954***	1					
5. Location	-0.0671***	-0.0158	-0.00560	-0.0949***	1				
6. Education	0.179***	-0.185***	-0.184***	0.0258*	-0.103***	1			
7. Network	0.106***	-0.0348**	-0.0489***	0.128***	-0.126***	0.100***	1		
8. Land secured	-0.0679***	0.0702***	0.0798***	-0.0601***	0.0378***	-0.134***	-0.184***	1	
9. Land size	0.133***	0.134***	0.103***	0.219***	-0.102***	0.0389***	0.249***	-0.00957	1
10. Home asset	0.273***	0.00860	-0.0187	0.228***	-0.107***	0.224***	0.228***	-0.0988***	0.246***
11. Farm asset	0.234***	0.0763***	0.0353**	0.297***	-0.197***	0.0945***	0.275***	0.01000	0.334***
12. Livestock	0.129***	0.0831***	0.0534***	0.244***	-0.177***	0.0737***	0.342***	0.00963	0.273***
13. Remittance	-0.178***	0.419***	0.417***	-0.0781***	-0.0592***	-0.0630***	0.0202	0.0387***	0.0612***
14. MFI Distance	0.0367***	-0.0105	-0.00952	0.00439	-0.0634***	-0.0438***	0.0226*	0.0324**	0.0733***
15. ADMARC D	-0.00920	0.0143	0.0154	-0.00576	0.0607***	-0.0381***	0.0333**	0.0518***	-0.00875
16. FI num.	0.0313**	0.0210	0.0184	0.00888	-0.126***	0.00663	0.0285**	-0.0477***	0.0311**
17. Shock natural	-0.0427***	0.00502	0.00641	-0.0157	0.297***	-0.0474***	-0.0383***	0.0460***	-0.0783***
18. Shock agric.	0.0236*	-0.00635	-0.0115	0.0756***	-0.133***	0.0102	0.142***	-0.0470***	0.0762***
19. Shock hhd.	-0.0519***	-0.0284**	-0.0264*	0.0147	0.0449***	-0.00335	0.0479***	-0.0288**	-0.00308
20. Need credit	-0.00235	-0.0877***	-0.0938***	0.0476***	0.195***	-0.0613***	-0.0545***	0.0234*	-0.0746***
21. Apply credit	0.0965***	-0.102***	-0.112***	0.101***	-0.0723***	0.103***	0.150***	-0.0952***	0.0807***
22. Denied credit	0.0222	0.0372	0.0541*	-0.0563*	0.0693**	-0.0718**	-0.0603*	0.0271	0.00110

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A1: Correlation coefficient matrix (continued)

Variables	10	11	12	13	14	15	16	17	18	19
10. Home asset	1									
11. Farm asset	0.403***	1								
12. Livestock	0.332***	0.446***	1							
13. Remittance	0.0480***	0.0686***	0.0874***	1						
14. MFI Distance	-0.00612	0.0476***	0.0471***	-0.0172	1					
15. ADMARC D	-0.00311	0.0237*	0.0456***	0.0217*	0.103***	1				
16. FI num.	-0.0207	-0.0300**	-0.0152	0.0114	-0.00432	-0.0288**	1			
17. Shock natural	-0.0390***	-0.0754***	-0.0178	0.0186	-0.00415	0.0584***	-0.200***	1		
18. Shock agric.	0.00429	0.0602***	0.0708***	-0.00565	-0.0269*	-0.0753***	0.0452***	0.0860***	1	
19. Shock hhd.	-0.0552***	-0.0521***	-0.0294**	-0.0194	-0.0304**	-0.0273*	-0.0265*	0.175***	0.367***	
20. Need credit	-0.100***	-0.0671***	-0.0855***	-0.0973***	0.00335	0.0319**	-0.099***	0.0692***	0.0619***	0.121***
21. Apply credit	0.0747***	0.0848***	0.0681***	-0.0542***	-0.0297*	-0.0819***	-0.0148	0.0300*	0.112***	0.108***
22. Denied credit	-0.0947***	-0.0540*	-0.0911***	0.0223	0.0139	0.0488*	-0.0615*	0.144***	-0.00102	0.00848

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A2: Mean of number of financial institutions across location

Location	Mean	Std. Dev.	Freq.	Obs.
Rural North	28.714072	16.097249	255,904	1,305
Rural Centre	31.077113	32.585891	906,542	2,987
Rural South	15.355008	18.257312	979,024	3,938
Total	23.606993	26.279304	2,141,470	8,230

Note: Weighted statistics

Table A3: Sensitivity analysis of interest rate

	(1)	(2)	(3)
	Heckprobit		Probit
Variables	Need credit [a]	Apply credit [b]	Denied credit [c]
Male	0.0688*	0.136***	0.346***
	(0.0380)	(0.0432)	(0.107)
Head age	0.0132**	0.0130*	-0.0199
	(0.00558)	(0.00773)	(0.0150)
Age squared	-0.000187***	-0.000223***	0.000204
	(5.46e-05)	(7.98e-05)	(0.000177)
Household size	0.0468***	0.0352***	0.00822
	(0.00845)	(0.00975)	(0.0219)
Rural Centre [d]	0.130*	0.366***	0.378*
	(0.0690)	(0.0697)	(0.194)
Rural South	0.492***	0.0399	0.0419
	(0.0723)	(0.0730)	(0.115)
Primary educ. [e]	0.0316	0.0888	-0.0195
	(0.0545)	(0.0590)	(0.112)
Higher educ.	-0.145***	0.220***	-0.0252
	(0.0490)	(0.0610)	(0.128)
Network	0.00420	0.0612***	0.0258
	(0.0104)	(0.0114)	(0.0283)
Land size	-0.0736***	0.0402	0.103**
	(0.0273)	(0.0330)	(0.0500)
Land tenure	0.0475	-0.171***	-0.136
	(0.0495)	(0.0607)	(0.113)
Home asset	-0.0190***		
	(0.00539)		
Farm asset	0.0159	0.0218	0.00282
	(0.0127)	(0.0142)	(0.0254)
Livestock	-0.0110***	-0.00125	-0.0195**
	(0.00400)	(0.00460)	(0.00796)
Remittance	-0.0123**	-0.0105	-0.00625
	(0.00591)	(0.00747)	(0.0167)
MFI Distance	0.0221	-0.0180	-0.00567
	(0.0146)	(0.0177)	(0.0329)
ADMARC Distance	0.0307*	-0.0721***	
	(0.0157)	(0.0217)	
FI number	-0.0723***	-0.0694***	-0.116**
	(0.0218)	(0.0228)	(0.0478)
Shock (natural)	-0.0574	0.217***	0.559***
	(0.0392)	(0.0509)	(0.112)
Shock (agric.)	0.141***	0.0760*	0.0741
	(0.0407)	(0.0443)	(0.0882)
Shock (household)	0.256***	0.244***	0.124
	(0.0358)	(0.0407)	(0.121)
IMR apply			1.068**
			(0.541)
Constant	-0.107	-1.494***	-1.818
	(0.182)	(0.220)	(1.137)
Log pseudolikelihood	-7907.569		-1095.8048
athrho	0.572**	(0.233)	
rho	0.517	(0.171)	
Wald chi2	411.93***		82.60***

Prob>chi2	0.0000		0.0000
Wald test (rho=0)	6.02**		
Prob>chi2	0.0141		
Observations	8,230	8,230	1,711

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

[a] Need Credit = 1 if either discouraged, rejected or successful, 0 if non-borrower. [b] Apply credit = 1 if rejected or successful, 0 if discouraged. [c] Denied credit = 1 if denied credit, 0 if successful. [d] Base category for location is Rural North; [e] Base category for education is None.

Table A4: Estimation of who needs and who gets credit

	(1)	(2)	(3)
	Heckprobit		Probit
VARIABLES	Need credit [a]	Apply credit [b]	Denied credit [c]
Male	0.0450	0.143***	0.393***
	(0.0411)	(0.0433)	(0.112)
Head age	0.0152**	0.0133*	-0.0173
	(0.00626)	(0.00762)	(0.0153)
Age squared	-0.000207***	-0.000229***	0.000172
	(6.06e-05)	(7.90e-05)	(0.000183)
Household size	0.0524***	0.0364***	0.0138
	(0.00960)	(0.00972)	(0.0231)
Rural Centre [d]	0.168**	0.354***	0.352*
	(0.0749)	(0.0671)	(0.196)
Rural South	0.655***	0.0379	0.0225
	(0.0786)	(0.0709)	(0.116)
Primary educ. [e]	-0.0522	0.0906	-0.0101
	(0.0594)	(0.0585)	(0.113)
Higher educ.	-0.178***	0.204***	0.00384
	(0.0522)	(0.0578)	(0.129)
Network	-0.0137	0.0618***	0.0315
	(0.0114)	(0.0111)	(0.0298)
Land size	-0.0797***	0.0367	0.113**
	(0.0272)	(0.0325)	(0.0510)
Land tenure	0.0525	-0.167***	-0.154
	(0.0538)	(0.0574)	(0.116)
Home asset	-0.0364***	0.000216	-0.0250**
	(0.00632)	(0.00581)	(0.0105)
Farm asset	0.00365	0.0248*	0.0178
	(0.0149)	(0.0147)	(0.0273)
Livestock	-0.0139***	-0.00203	-0.0180**
	(0.00449)	(0.00454)	(0.00806)
Remittance	-0.0191***	-0.00976	-0.00536
	(0.00625)	(0.00743)	(0.0167)
MFI Distance	0.0206	-0.0162	-0.00757
	(0.0166)	(0.0170)	(0.0327)
ADMARC Distance	0.0317	-0.0665***	
	(0.0203)	(0.0200)	
FI number	-0.0863***	-0.0707***	-0.121**
	(0.0253)	(0.0220)	(0.0495)
Shock (natural)	-0.109**	0.220***	0.566***
	(0.0436)	(0.0487)	(0.118)
Shock (agric.)	0.230***	0.0737*	0.0777
	(0.0436)	(0.0434)	(0.0887)
Shock (household)	0.282***	0.250***	0.135
	(0.0410)	(0.0396)	(0.128)
IMR apply			1.130**
			(0.575)
Constant	0.418**	-1.564***	-1.967
	(0.196)	(0.206)	(1.222)
Log pseudolikelihood	-7164.149		-1092.9118
Athrho	0.519**	(0.205)	
Rho	0.477***	(0.1587)	
Wald chi2	438.55***		91.55***
Prob>chi2	0.0000		0.0000

Wald test (rho=0)	6.38**		
Prob>chi2	0.0115		
Observations	8,230	8,230	1,711

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
This model does not include an exclusion restriction.
[a] Need Credit = 1 if either discouraged, rejected or successful, 0 if non-borrower. [b] Apply credit = 1 if rejected or successful, 0 if discouraged. [c] Denied credit = 1 if denied credit, 0 if successful. [d] Base category for location is Rural North; [e] Base category for education is None.

CHAPTER 3

HOUSEHOLD CREDIT CONSTRAINTS AND CROP PRODUCTIVITY IN MALAWI

3.1 Introduction

According to IFAD (2011), productivity of farmers in Malawi has not improved since the 1970's despite the availability of better technologies. International Fund for Agricultural Development (IFAD) recommends that using improved seed varieties, together with applying fertilizers, adopting better crop husbandry and irrigation systems will potentially increase yields. However, inadequate financing has made this impossible for majority of farmers who live in rural locations in Malawi hindering their ability to produce to their potential.

In addition to falling agricultural productivity, poverty has been one of the major challenges in rural Malawi and the country as a whole. From 2002 to 2011, almost 74 percent of the population were below the income poverty line of $1.25 (UNDP, 2013). There is also little opportunity to engage in non-farm economic activities, so farmers are unable to diversify their source of income making it more difficult to obtain adequate capital for land cultivation. With market failure, typical for credit market, access to formal finance is very limited, hence making it very difficult to access credit. Banks and other financial institutions have no or little interest in lending to the agricultural sector firstly because it is made up of poor households in the rural areas, also due to the covariant risk associated with agriculture, lack of useable collateral by farm households and high transaction cost of delivering small loans, among others (Diagne and Zeller, 2001).

Credit constrained farmers face issues of low farm investment (Carter and Olinto, 2003) leading to low farm output (Feder et al., 1990) and hence low farm profit (Carter, 1989) which creates a vicious circle. Additionally, studies have shown that credit is a significant tool for development especially for the rural poor, helping them undertake important investments to improve their productivity and consumption. For this reason, increasing access to financial services and markets will enable agriculture to become a viable economic activity for the long term (RSC, 2012). As alluded by Diagne et al.

(2000), access to credit alone may not be adequate to alleviate poverty, however, they argue that this may be the only choice available to smallholders to finance production, especially when in the previous season the crop failed and therefore farmers had no other means of finance.

Thus, there is the need to improve access to credit for rural smallholder farmers if productivity is expected to be improved. With agriculture being the most important economic activity in developing countries, especially in Malawi, any credit policy intervention that improves farm productivity would possibly have a great impact on farmers' livelihood. Rural Malawi presents an interesting case because of the level of poverty in the country. At first glance, because of the level of poverty, it would be expected that almost all rural farmers in the country would be credit constrained, but data from the Third Integrated Household Survey (IHS3) used in this study provides evidence of access to credit by some rural farm households; therefore, it would be empirically interesting to investigate whether this actually makes any impact on their farm productivity.

Using an endogenous switching model, this study simultaneously examines the likelihood of a rural farm household being credit constrained or unconstrained and its impact on farm household's crop productivity. Further, expected crop yield, treatment and heterogeneity effects will also be employed to estimate the counterfactual conditions of being in either a credit constrained or unconstrained household and its effect on crop productivity. Data from the Third Integrated Household Survey collected by the National Statistics Office of Malawi is used in the empirical analysis. The survey uses a direct elicitation approach to gather information on households' credit market engagement which this study uses to group households into credit constrained and unconstrained households.

The rest of the chapter is structured as follows: section 2 examines sources and use of credit in rural Malawi. The impact of credit on productivity is presented in section 3. The endogenous switching model used for empirical estimations is then presented in section 4 together with the counterfactual conditions. The data employed for the analysis is also explained briefly together with the variables of interest in section 5. This is

followed by section 6 which presents and discusses the results obtained from the econometric estimation preceded by some descriptive statistics. Section 7 summarizes key findings and some policy implications of the study.

3.2 Impact of agricultural credit

There are a number of studies on the impact of credit access on farm output and productivity. Sial and Carter (1996) in a study in Pakistani Punjab observed that a first-time borrower was able to make a return of 200 percent on the first rupee borrowed, but a randomly selected individual makes a return of 48 percent on an average sized credit. Guirkinger and Boucher (2008) and Ali et al. (2014) found that completely eliminating credit constraint would increase the value of farm output per hectare by 26 percent in Peru and 17 percent in Rwanda.

Duong and Izumida (2002) analysing data from rural Vietnam concluded that households could both increase and optimise their production activities if they could sufficiently finance their production. This conclusion was drawn after they found a high positive elasticity of output with respect to credit. In Tunisia, Foltz (2004) found that higher debts of households brought about increasing profits. This implied that households were willing to take credit which could help them to be productive and hence profitable. However, Freeman et al.'s (1998) study in Ethiopia and Kenya reported locational influence of credit. Using investment in crossbred dairy cows as proxy for credit, they found that in Ethiopia a percentage increase in credit increased productivity by 0.6 and 0.4 percent in constrained and unconstrained households respectively; while in Kenya productivity increased by 1.6 and 0.9 percent.

Some studies have also found a weak significance of the impact credit has on farm productivity. Carter (1989) observed a weak positive impact of credit on the productivity of small farms in Nicaragua. Similarly, Feder et al. (1990) examined the effect of credit on output supply in the northeast part of China and estimated that 1 percent increase in liquidity of credit constrained households would raise their production by 0.04 percent. This impact may be deemed to be quite low given the impacts from other regions or location. Inferring from these few studies, it could be emphasised that the impact of credit on farm productivity differs by geographic location.

In an attempt to explain why credit might have a low impact on productivity, Petrick (2004) found that farmers diverted credit to other purposes instead of production. Further, constrained households may be incapable of using their skills and knowledge adequately, as found by Dong et al. (2010). Their study argued that farmers' capabilities and education were not fully utilized in credit constrained households making them unproductive while improved income for unconstrained households reflected a better use of their abilities and education. This was also evidenced for inputs use for production. Hence, unavailability of credit limits farm households' ability to tap deeper into their innate abilities and acquired education.

The mixed findings on the impact of credit on productivity across some developing countries necessitate country-specific studies to avoid generalizing findings across all developing countries. This has motivated the present study in rural Malawi. This present study is not the first on Malawi, a few related studies have previously been conducted in Malawi. Diagne and Zeller (2001) in their studies on the impact of credit on welfare in Malawi concluded that many smallholder farmers who received credit ended up with lesser net crop income than smallholders who did not participate in the credit market. This implied that farmers were better-off not taking credit. Further, Diagne (2002) also found that the level of access to credit did not contribute to the technical efficiency of households' maize crop production (local and hybrid) except for a small improvement for tobacco production which is only grown in the Central and Northern regions of Malawi. Given these divergent views for Malawi it is necessary to conduct further studies on the impact of credit on productivity. The aforementioned studies are based on data collected in 1995 on only 404 households from 5 districts in Malawi. Hence, this may not be nationally representative and would not capture new evidences due to the year of the data collection. This current study on the other hand uses a representative nationwide survey but concentrates on only food crops.

3.3 Empirical Strategy

3.3.1 Endogenous Switching Model

The easiest way of examining the impact of a household credit status is to add a dummy variable which equals 1 if the household is credit unconstrained and 0 if constrained in

the production function and after apply an ordinary least squares (OLS) estimate to the model to produce the estimated results. However, doing this produces biased estimates because it assumes that the credit status of the household is randomly determined.

Hence, the productivity (output/yield per hectare) of farm households considering their credit status is plagued with issues of heterogeneity and self-selection which leads to a problem of endogeneity. Households in themselves are heterogeneous in their characteristics by way of their endowments such as skills, abilities and resources, while their credit status may be attributed to either households' self-selection decision to either apply for credit or not, or lenders decision to either grant or deny credit to households which may affect their productivity level. Firstly, farm households have a combination of innate abilities and farm skills that could influence their level of productivity. Thus, a household with high level of farm skills and also credit unconstrained is more likely to be productive than a household with less skills and also credit constrained. Also, their endowments which may include collateral assets could influence their ability to obtain credit or even how much credit is obtained. Their level of skill which includes their level of education could determine whether households are able to understand credit contracts and therefore meet the requirements to obtain credit.

Further, households' decision to participate in the credit market is voluntary and may be based on individual self-selection. For example, households may not apply for credit if they consider themselves to be less productive, which could see them may run into debt and thus default in repayment should they take credit. On a counterargument, less productive households though knowing their productivity level to be low and/or being credit unworthy could still apply for credit and possibly obtain credit which is related to the issue of adverse selection. Also, lenders decision to either grant or deny credit applied for raises another issue of credit status being endogeneity. Among other screening procedures, lenders may use information on farmer's level of productivity to screen good borrowers from bad borrowers. Judging rightly, lenders could provide or deny credit to households. Therefore, households credit status is not randomly determined which first raises issues of sample selection and also endogeneity as credit status may depend on other variables. Further, it could be argued that productive farmers

are productive because they had access to credit and inputs that could have improved their output (Freeman et al, 1998). On the other hand, unproductive farmers may have not applied for credit or been denied credit due to their history of low productivity or bad credit history. Also, as stated by Reyes et al. (2012), it is possible that a farm household that is less productive may have higher credit demand as compared to a more productive farm household.

These therefore raises a problem of endogeneity brought about by sample selection bias on the credit constrained status of farm households. A commonly accepted was of avoiding the selection bias is to estimate an extra equation which explicitly models the selection process (Heckman, 1979). A switching regression model is employed to resolve the issues raised above as the assumption is that the relationship between productivity, the variable of interest, and some explanatory variables varies across discrete regimes, thus credit status (Dutoit, 2007). This estimation could be related to the study of Roy (1951) which considered the consequences for the occupational distribution of earnings in the presence of individual heterogeneity in skills and self-selection into occupation (Cameron and Trivedi, 2005). According to Cameron and Trivedi (2005) a number of authors in the 1970's proposed models with similar problems that were estimable with cross-section data and this have been known as the Roy model (Roy, 1951). This model is also known as the "switching regression model with endogenous switching" (Maddala and Nelson, 1975 and Maddala, 1983), or the "endogenous switching model" as explained by Lokshin and Sajaia (2004) or the Tobit type 5 model (Amemiya, 1985).

To present this model formerly based on the problem of this study, we define a latent variable C^*, which is the credit status of the households classified using responses from the survey questions is used to determine which households' productivity are constrained or unconstrained due to credit. Households are said to be credit constrained if they were denied credit or discouraged from applying as discussed in chapter two of the thesis. Further, they are unconstrained if they received credit or did not require credit. This determines whether the outcome (output per hectare) for the unconstrained,

Y_1^*, or constrained, Y_2^*, is observed. Specifically, we observe whether C^* is positive (unconstrained) or negative (constrained),

$$C = \begin{cases} 1, & if\ C^* > 0, \\ 0, & if\ C^* \leq 0, \end{cases} \tag{1}$$

And hence we observe either one of the outcomes, Y_1^* or Y_2^* according to

$$Y = \begin{cases} Y_1^*, & if\ C^* > 0, \\ Y_2^*, & if\ C^* \leq 0, \end{cases} \tag{2}$$

According to Cameron and Trivedi (2005), it is normal to specify a linear model with additive errors for the latent variables, with

$$C^* = z'\alpha + \mu, \tag{3}$$
$$Y_1^* = x_1'\beta_1 + \varepsilon_1, \tag{4}$$
$$Y_2^* = x_2'\beta_2 + \varepsilon_2. \tag{5}$$

Where $z, x_1 and\ x_2$, are vectors of exogenous variables, $\alpha, \beta_1 and\ \beta_2$ are vectors of parameters to be determined, $\mu, \varepsilon_1 and\ \varepsilon_2$ are random disturbance terms. Thus, C^* is known as the sample selection equation and Y_1^* and Y_2^* are continuous dependent variables of the outcome equation. Using OLS to estimate the parameters β_1 and β_2 yield inconsistent results because the expected value of the error term, from Y_1^* and Y_2^*, conditional on the sample selection equation is non-zero hence correlated (Maddala 1983).

Hence, the parametric model for the correlated errors is said to have a joint normal distribution with mean zero and a variance-covariance matrix presented as;

$$\begin{bmatrix} \mu \\ \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \sim N\left[\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \sigma_{\mu 1} & \sigma_{\mu 2} \\ & \sigma_1^2 & \sigma_{12} \\ & & \sigma_2^2 \end{bmatrix} \right], \tag{6}$$

Where the normalization $\sigma_\mu^2 = 1$ is used as the sign of C^* is observed. Further, σ_{12} is said to be equal to zero, $(\sigma_{12} = 0)$, as we cannot observe Y_1^* and Y_2^* together as each is in one state or the other but cannot be in both. The likelihood function for the model, as adopted from Maddala (1983), is expressed as:

$$L(\beta_1, \beta_2, \sigma_1^2, \sigma_2^2, \sigma_{\mu 1}, \sigma_{\mu 2}) = \Pi \left[\int_{-\infty}^{z'\alpha} g(Y_{1i} - \beta_1 X_{1i}, \mu) d\mu \right]^{C_i} \left[\int_{z'\alpha}^{\infty} f(Y_{2i} - \beta_2 X_{2i}, \mu) d\mu \right]^{1-C_1}. \quad (7)$$

Where g is the bivariate normal density function of (ε_1, μ) and f is also the bivariate normal density function of (ε_2, μ). It is usual to estimate this model using a Heckman's two-step method applied to the truncated means,

$$E[Y|x, C^* > 0] = x_1'\beta_1 + \sigma_{\mu 1}\lambda(z'\alpha), \quad (8)$$

$$E[Y|x, C^* \leq 0] = x_2'\beta_2 + \sigma_{\mu 2}\lambda(-z'\alpha), \quad (9)$$

Where $\lambda(\delta) = \phi(\delta)/\theta(\delta)$ and as already shown $\sigma_\mu^2 = 1$. For the first stage, which is a binary model, a probit estimation of whether or not $C^* > 0$ yields an estimate of α and hence $\lambda(z'\hat{\alpha})$. Two separate OLS regressions on the outcome equations yield direct estimates of $(\beta_1, \sigma_{\mu 1})$ and $(\beta_2, \sigma_{\mu 2})$. Further, estimates of σ_1^2 and σ_2^2 is obtained using the squared residuals from the regressions.

Endogenous switching models can be estimated one equation at a time either through a two-step least squares or maximum likelihood estimation process, but, these methods are inefficient and require cumbersome adjustments to derive consistent standard errors (Lokshin and Sajaia 2004). Hence to estimate this model, this study uses the *movestay* STATA command developed by Lokshin and Sajaia (2004) which implements the full-information maximum likelihood method to simultaneously fit binary and continuous parts of the model in order to yield consistent standard errors.

One major issue that must be considered when estimating such a model is the problem of identification. To resolve this, an exclusion restriction condition was imposed on the analysis. To this effect, Z_i should contain at least one variable that is not contained in X_{ji}. This additional variable should directly explain the farm households credit constrained status but not crop productivity.

3.3.2 Conditional expectations, treatment and heterogeneity effects

According to Cater and Milon (2005) and Di Falco et al. (2011) estimates from the endogenous regression model above is used to compare an expected outcome to some household decision yielding treatment and heterogeneity effects. Adapting the analysis to this study, firstly, the results from the endogenous switching model are used to (a) compare an expected crop productivity of rural farm households that are credit unconstrained and (b) to those that are credit constrained, and secondly, to examine the expected crop productivity in the counterfactual hypothetical cases to situations where (c) unconstrained households are considered constrained, and (d) constrained households are also considered as unconstrained. These conditional expectations for the outcome variables in the above scenarios are shown in Table 3.1 and also defined in equation (10) as follows:

Table 3.1: Definition of Conditional expectations, treatment and heterogeneity effects

Sub-samples	Decisions Stage		Treatment Effects
	Unconstrained	Constrained	
Unconstrained Farm households	$(a)\ E(Y_{1i} \mid C_i = 1)$	$(c)\ E(Y_{2i} \mid C_i = 1)$	TT
Constrained Farm households	$(d)\ E(Y_{1i} \mid C_i = 0)$	$(b)\ E(Y_{21} \mid C_i = 0)$	TU
Heterogeneity effects	BH_1	BH_2	TH

Notes: (a) and (b) represent observed expected farm productivity; (c) and (d) capture the counterfactual expected crops productivity.
$C_i = 1$ if rural farm household is credit unconstrained and 0 otherwise.
Y_{1i}: crop productivity if the rural farm household is credit unconstrained
Y_{2i}: crop productivity if the rural farm household is credit constrained
TT: effect of the treatment (credit unconstrained) on the treated (credit unconstrained farm households)
TU: effect of the treatment (credit unconstrained) on the untreated (credit constrained farm households)
BH_i: effect of base heterogeneity for farm households that are unconstrained and are constrained;
$TH = (TT - TU)$, transitional heterogeneity.

$$
\begin{aligned}
&\text{(a) } E(Y_{1i}|C_i = 1, X_{1i}) = \beta_1 X_{1i} + \sigma_{1u}\lambda_{1i} \\
&\text{(b) } E(Y_{2i}|C_i = 0, X_{2i}) = \beta_2 X_{2i} + \sigma_{2u}\lambda_{2i} \\
&\text{(c) } E(Y_{2i}|C_i = 1, X_{1i}) = \beta_1 X_{1i} + \sigma_{2u}\lambda_{1i} \\
&\text{(d) } E(Y_{1i}|C_i = 0, X_{1i}) = \beta_2 X_{1i} + \sigma_{1u}\lambda_{2i}
\end{aligned} \tag{10}
$$

According to Carter and Milon (2005) these expectations can be used to estimate the expected differences in the outcome variable (crop productivity) between the two regimes (credit unconstrained and constrained) as seen from the table. The differences obtained could capture the actual effect of credit status and differences in unobserved heterogeneity (Winship and Morgan, 1999). Distinguishing between these two according to Carter and Milon (2005) enables for good policy prescription. From Table 3.1, cases (a) and (b) are the actual conditions observed in the data sample where (c) and (d) are the counterfactual expected crop production. The effect of credit unconstrained for those who are credit unconstrained is the "effect of the treatment on the treated" (TT) (Carter and Milon, 2005) and this can be calculated as the difference between (a) and (c) expressed as:

$$E(Y_{1i}|C_i = 1) - E(Y_{2i}|C_i = 1) = X_{1i}(\beta_1 - \beta_2) + \lambda_{1i}(\sigma_{1u} - \sigma_{2u}) = TT \qquad (11)$$

This captures the effect of improved crop production of rural farm households that are actually credit unconstrained. Equally, rural farm households who are credit constrained but may be credit unconstrained which is the "effect of the treatment on the untreated" (TU) (Carter and Milon, 2005) can also be calculated from the difference between (d) and (b) also expressed as:

$$E(Y_{1i}|C_i = 0) - E(Y_{2i}|C_i = 0) = X_{2i}(\beta_1 - \beta_2) + \lambda_{2i}(\sigma_{1u} - \sigma_{2u}) = TU \qquad (12)$$

They explain that the parameter from calculating TT and TU produces the expected crop productivity effect of credit status on a randomly chosen household from the credit unconstrained and constrained households respectively. Heterogeneity effects as seen from the table can also be calculated from the expectations. Rural farm households that are unconstrained may more or less be productive than credit constrained households not because of their being credit unconstrained but due to some unobservable characteristics which may include household members' innate ability. The base heterogeneity effect (BH) as described and adopted from Carter and Milon (2005) as the difference in crop productivity between credit unconstrained and constrained households is estimated for two states of nature with the first, BH_1, for households who are credit unconstrained captured as the difference between (a) and (d):

$$E(Y_{1i} \mid C_i = 1) - E(Y_{1i} \mid C_i = 0) = \beta_1(X_{1i} - X_{2i}) + \sigma_{1u}(\lambda_{1i} - \lambda_{2i}) = BH_1 \qquad (13)$$

and the second state, BH_2, for credit constrained households is also calculated as the difference between (c) and (b):

$$E(Y_{2i} \mid C_i = 1) - E(Y_{21} \mid C_i = 0) = \beta_2(X_{1i} - X_{2i}) + \sigma_{2u}(\lambda_{1i} - \lambda_{2i}) = BH_2 \qquad (14)$$

Another type of heterogeneity captured is the transitional heterogeneity (TH) described in this study as whether being credit unconstrained increases or decreases productivity for farm households that are actually credit unconstrained or in the counterfactual case for households who are constrained but deemed to be unconstrained. This is the difference between TT and TU (difference between BH_1 and BH_2 also produces similar result).

3.4 Data

By the scope of the study, only rural farm households who cultivated and harvested any food crop within the 12 months prior to the period of the data collection are included and analysed. After deleting households with missing information, the sample used for the study reduced to 5,071 rural farm households.

Though a panel data exists for the Malawi survey, after careful consideration and some trial estimations done, it was considered that given the time lag between the years, the effect of credit taken would have faded off after three years. Further, among households that provided information on the duration of their loans, it was realised that about 89.73 percent of the recorded loans were short-term loan as they were to be repaid within 0 to 12 months. Hence, the credit obtained were to yield whatever return possible to be repaid within a year. Hence, it was possible for credit borrowed to have an impact within the same period it was obtained and that remaining in year plus 3 may be small. Hence, the productivity obtained, among other factors, is also influenced by the inputs purchased using the credit obtained. It is also important to note that agricultural-related credit in Malawi is chiefly in-kind of inputs of fertilizer and seeds (Luboyeski et al, 2004). Further, consumption purpose unlike productivity purpose of borrowing has an even immediate effect on a households' welfare as consumable goods, tangible or non-tangible goods, can be obtained immediately credit is obtained.

Data contained information on individual, household, and community levels. Relevant to this study was information on demographics, education of head of household, access to credit, value of assets, membership of social groups and household crop production among others. The dependent variable for the first stage maximum likelihood regression is the credit status of the household. This was constructed from responses to some credit-related questions. Majority of information in the data were obtained through direct elicitation approach through which information concerning households' engagement in the credit market was also obtained. The information was used to categorise households into either credit constrained or unconstrained households.

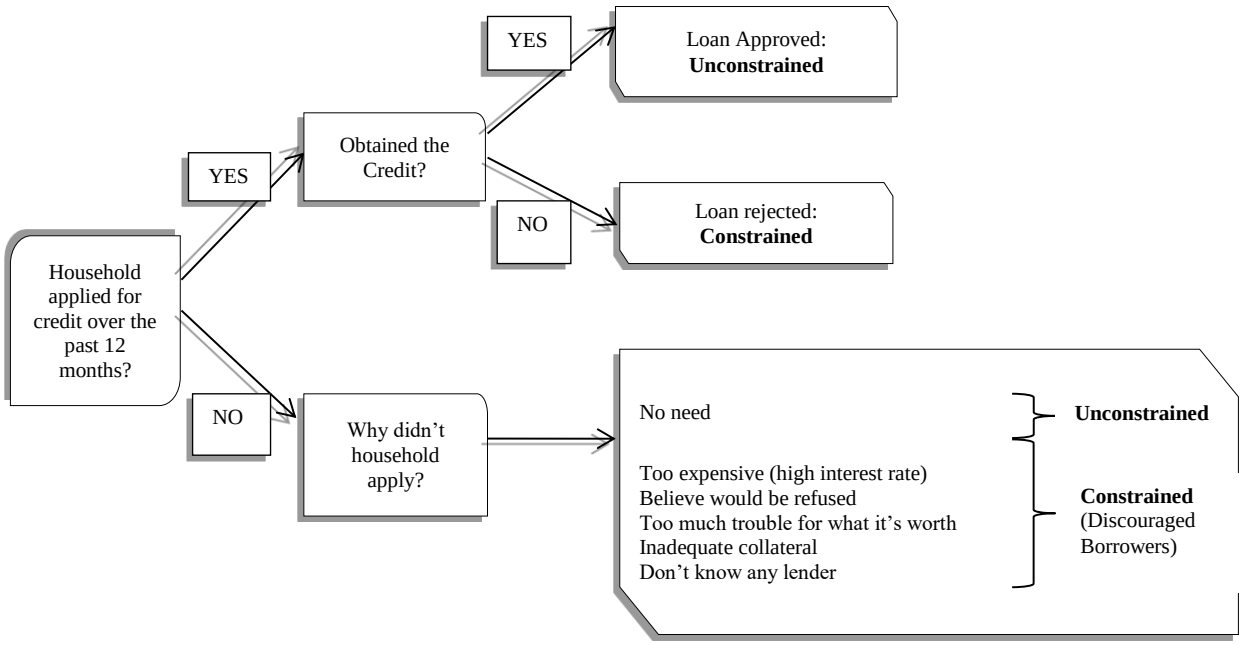

Figure 3.1: Classification of constrained household based on IHS3 data

Figure 3.1 presents the sequence of questions and how the categorisation was done. Households that applied for credit were asked whether they obtained credit or were denied. For this study, successful applicants were categorised as unconstrained households while denied borrowers were classified as constrained households. Some households did not apply at all and were split under credit constrained and unconstrained depending on their reason for not applying for credit. Those who stated that they did not need credit or were restricted by the high interest rate were categorised

as unconstrained. However, those who stated reasons such as: fear of been refused, inadequate collateral, do not know any lender, were classified as constrained.

The second stage regression captures the effect of the credit constrained status on farm productivity. Productivity has been measured in several ways but according to Dharmasiri (2012), it has been in defined in agricultural geography and economics as "output per unit of input" (p. 26). Thus, Productivity is measured as the ratio of the quantity harvested (output) to the quantity of resource used in the course of production (input/factor). Output is the outcome of a production process (crop and/or livestock products) while input implies land, labour, pesticides, fertilizers, physical capital, etc. used in producing output. Productivity measures the efficiency of a production system. Hence, a higher productivity indicates producing more output from a given level of inputs. Productivity is measured in two ways: either in an aggregate level known as total factor productivity (TFP) or on an individual level known as partial factor productivity (PFP). For TFP all inputs used in the production process are considered while PFP measures the effectiveness of the individual factors of production. Hence for PFP we could have labour productivity, land productivity, etc. In measuring agricultural-production performance, labour and/or land productivity are normally used as PFP is easy to measure (IFPRI, 2013). Further, the prices of all inputs are needed to calculate TFP which are not always available in survey studies making it easier to use the hectare of land cultivated for land productivity or the labour hours for labour productivity. As land and labour are the most common factors in rural areas, it is important to determine how efficient they are being used. Hence, this study uses yield productivity that shows output per hectare of land cultivated (Zepeda, 2001).

The agricultural section of the survey instrument gathered questions on the final output of crops cultivated and harvested. This information was used to generate the household yield productivity variable for each household. Farm yield productivity was calculated as the value of farm crop output harvested per hectare during the last raining season[9].

[9] Farm yield productivity was measured as the sum of the value of food crops harvested in each household per hectare of land cultivated (Diskin, 1997). Output of farm households were collected at the plot level. Most households owned multiple plots hence, the sum of harvested crops for all plots within each household were aggregated to total output at the household level. As output harvested were reported in

According to Diskin (1997), this is the most common indicator for agricultural productivity. As these are multiproduct farms, the value of farm production is an aggregate of total crops harvested by each farm household. The study only looked at food crops. Food crops cultivated within the households included maize, which is the staple food cultivated by majority of households in the sample, soybean, groundnut, and sorghum among others.

3.4.1 Credit Constraint Determinants

Variables used in the study are presented and defined in Table 3.2. Some household head demographic characteristics included age, gender and level of education. Increase in age is accompanied with rising experience with respect to the benefit and risk of taking credit. It is expected that older household heads, given their long-standing relationship especially with informal lenders, are more likely to be unconstrained. Household heads with no level of education compared to those with some level of education are also likely to be credit constrained. Higher education levels capture a higher human-capital endowment as those with higher level of education are more likely to be productive, obtain non-farm economic jobs that could offer a secured income which increases access to credit (Bendig et al., 2009).

Table 3.2: Description of Variables

Variable	Type	Definition
Output per hectare (yield)	Continuous	Output per hectare (value of all food crop cultivated per hectare of land cultivated in raining season) in Malawian Kwacha (MWK)
Head age	Continuous	Age of household head
Educational level	Categorical	1 no education, 2 Primary, 3 Higher
Head Gender	Binary	1 if household head is male, 0 if female
Household size	Continuous	Number of members within the household
Agro-ecological zones	Categorical	1 Tropic-warm/sub arid, 2 Tropic-warm/ sub humid, 3 Tropic-cool/semiarid and 4 Tropic-cool/sub humid
Network (agric.)	Binary	1 if belong to an agricultural network, 0 otherwise
Land size	Continuous	Total plot size cultivated during raining season in hectares (GPS-measured)
Land tenure	Binary	1 if secured land ownership and 0 otherwise

different quantity units (like Kilogram, 50 KG Bag, 90 KG bag, pail, base, etc.) for similar and different crops, a common unit was needed to make productivity comparable between households therefore, prices of crops were used to estimate the value of farm output in Malawian Kwacha. Average Enumeration Area (EA) prices were estimated per crop per different quantity units. These were estimated from sale values of crops cultivated within each area. Also, total area cultivated by households were all converted from the various units of measurements to hectares.

Hired labour	Continuous	Head count of labour hired onto farm
Farm asset		Total value of farm assets in MWK
Livestock value	Continuous	Total value of household owned livestock in MWK
ADMARC Distance	Continuous	Distance to a permanent ADMARC (Agricultural Development and Marketing Corporation) branch
Extension officer	Binary	1 if there is an extension officer in the community, 0 otherwise
Temperature	Continuous	Temperature seasonality (standard deviation*100): the difference between the annual maximum and minimum temperature
Other crops	Binary	1 if other crops apart from maize was cultivate, 0 otherwise
Organic fertilizer	Binary	1 if organic fertilizer was used, 0 otherwise
Inorganic fertilizer	Binary	1 if inorganic fertilizer was used, 0 otherwise
Variable cost per hectare	Continuous	Total cost of inputs including fertilizers, seeds and cost of transporting these inputs in Malawi Kwacha
MFI Distance	Continuous	Distance to a microfinance institution
Financial Inst	Continuous	Number of financial institutions in each district

Male headed households are likely to be less constrained than their female counterparts. Female-headed households are considered the poorer lacking many economic resources including land and other assets that could be used as collateral. Household size and location of the household were also considered. A larger household size may imply higher dependency ratio therefore, could increase households' liability. Therefore, a larger household would require more credit and would be more constrained than a smaller household. Location for this particular study was captured using the agro-ecological zones of the country. As seen from Table 3.2 there are four agro-ecological zones within Malawi.

Network groups enable social interaction between members and also transfer information and knowledge. Chloupkova and Bjønskov (2002) conclude that through existing social structures like farmers' social capital, agricultural credit can be improved. Members of an agriculture group may not only focus on farm production but also share information on credit sources or even provide credit to each other. Hence, it is expected that being a member of an agricultural network would likely reduce credit constraint. A relatively larger land size could be used as collateral for particularly own land. Hence, it is likely that a household that has a large farm size and legally owns land could be credit unconstrained. Thus, access to land was seen to be negatively related to household credit constraint status in a study by Baiygunhi et al. (2010).

The value of assets which is disintegrated into value of farm assets, value of home assets and value of livestock are used as determinants of household credit constraint. Value of assets may be an indication of the relative wealth of the household. It is expected that relatively richer households would be credit unconstrained as these could be used as collateral for obtaining credit. This is similar to the expectation of Baiyegunhi et al. (2010) in their study in South Africa. Distance to Agricultural Development and Marketing Corporation (ADMARC) branch was also included as an explanatory variable. With the crucial role that ADMARC plays as an agricultural marketing board, households in communities with ADMARC are expected to have ready markets for their produce and more likely to be unconstrained as they may be deemed to be credit worthy to pay back loans.

3.4.2 Productivity Determinants

In addition to the above variables, other variables that directly affect farm productivity but not credit statuses were included in the productivity estimation equations. The presence of an agricultural extension officer in the community could indicate households' access to some farming advice to boost productivity. It is expected that, the presence of agricultural extension officer would imply the existence of an agricultural extension program which could increase farmers' knowledge and skills while also promoting improved technology for an increase in productivity (Elias, 2013). Hence it is expected that the presence of extension officer in the community would positively influence farm productivity. Temperature seasonality was also included as a productivity determinant. Temperature seasonality is measured as the standard deviation of annual average temperature. High seasonal temperatures have been found to be detrimental to agricultural productivity (Battisti and Naylor, 2009) therefore an increase in temperature is expected to have a negative effect on farm productivity.

Cultivating other food crops apart from maize on the same piece of land could increase productivity. Nitrogen fixing crops like soybean, intercropped with maize and other food plants could increase the soil quality and hence lead to higher productivity. However, Oseni et al. (2015) expected multi-cropping to reduce productivity as single crop farmers were more skilful and also experienced in cultivating single crops.

Application of organic and inorganic fertilizers is also necessary for increase in productivity (Oseni et al., 2015). Application of fertilizers increase the soil quality of farm lands by increasing the nutrients and minerals in the soil which help plants to withstand the negative effects of crop diseases and pests, produce healthier crops, and further produce plentiful yield. It is therefore hypothesized that application of organic and inorganic fertilizers would have a positive effect on productivity. However, it is also expected that as inorganic fertilizer is an improved technology its application would lead to higher productivity than organic fertilizer. Further, expenditure on variable inputs like seeds and chemicals, such as herbicide and pesticide, is expected to also improve farm productivity. This variable was vital in a productivity study by Freeman et al. (1998).

Land is the most important capital for farm production without which nothing can be cultivated. The size of land cultivated has been found to play a crucial role in the productivity of farms. Several studies in especially developing countries have noted an inverse relationship between farm size and production or output per hectare (Sen, 1975; Berry and Cline, 1979; Eastwood et al., 2010; Ali and Deininger, 2012 and Ali et al., 2014). According to Lipton (1993), the main argument for this inverse relationship is that small farm holders avoid transaction cost, such as search, screening and supervision costs, in the labour market as they depend mostly on family labour thereby using more labour per hectare thus increasing output per hectare. With an increase in farm size, family labour is used in search for hiring labour, screening and supervision of labour thus increasing cost of production and also reducing labour per hectare. Further, poor rural households in developing countries lack the necessary capital to cultivate large lands therefore, are better at managing smaller farms and obtaining higher output per hectare. Hence it is also hypothesized in this study that land size will be inversely related to output per hectare.

Place (2009) recognises that there is a heterogeneous effect of land tenure on agricultural productivity in the economics literature. Deininger and Jin (2006) in their study in Ethiopia found that a stronger land transfer rights had a significantly direct effect on farm investment and further on farm productivity. However, a study in Kenya by Hunt (2003) found that a land registration program had no significant impact on

productivity due to an undeveloped credit system. Further, a study in Malawi found no effect of land security on farm productivity although there was an increase in farm investment (Place and Otsuka, 2001). Hence the effect of land tenure on productivity in this study is also uncertain.

Location of farms was captured by the agro-ecological zones as these zones have the potential of affecting farm productivity. Agro-ecological zones are areas divided into smaller units based on distribution of soil, land surface and climate. Further, these are geographical areas that exhibit same climatic conditions that govern their ability to support rain fed agriculture. According to Wood-Sichra and Wood (2014) tropical arid zones have some of the lowest production per hectare whiles subtropical arid and humid zones observe high productivity per hectare. However, the productivity effect of each is ambiguous as they could also be affected by other factors.

The study used a head count of hired labour to measure the extent of labour from outside of the household that was employed on the farm. Hours worked by hired labour were not provided in the data hence the use of the head count. Households that are able to employ more additional labour to the family would be able to have more labour per hectare of land which would likely increase productivity. It is expected that households that are less constrained will employ more external labour due to cost involved. Hence, this is expected to result in a higher productivity for unconstrained households especially. This variable is also used in the study by Oseni et al. (2015) to explain productivity.

Membership of an agricultural group has been noted to affect productivity of households as it endows farmers to achieve higher productivity (Godtland et al., 2004). In the study by Godtland et al. (2004), they found that participation in farmer-field school increased participants' knowledge in integrated pest management (IPM) compared to the non-participants and further increased their potato productivity. It is therefore expected that farmers in agricultural groups would have increased knowledge in good farming practices that could increase their productivity.

3.4.3 Identification

Two variables were used as instrument to satisfy the exclusion restriction criteria or for identification purposes. The other two variables may be argued to be credit supply factors that would directly affect credit constraint status of the household but not farm productivity. These included the number of financial institutions within each district and the distance in kilometres from the community to a microfinance institution in the nearest community[10]. The greater the number of financial institutions in a district, the more accessible they are to communities and hence households. Therefore, the less credit constrained households might be. The same analogy is applied to the distance of a microfinance institution from a community. Where households or communities are closer to microfinance institution (MFI), the transaction cost of accessing the MFI reduces encouraging households to apply for credit. Further, a lesser distance implies that MFI's are able to better monitor borrowers at a relatively lesser cost. The distance may also slightly reduce information asymmetry as MFIs closer to their clients may have more and slightly accurate information about their clients than those farther away from them. As stated by Presbitero and Rabellotti (2014) physical distance between borrowers and MFIs is considered as a proxy for agency costs, cost of monitoring and easing moral hazard. It is therefore expected that the farther away a community is to an MFI, the more constrained the households in that community would be. This variable hence is expected to directly affect access to credit more than on crop productivity. Data for the number of financial institutions in each district was obtained from the Financial Inclusion Laboratory (Finclusion Lab) made available by the Microfinance Information Exchange (MIX) (Finclusion Lab, 2014).

3.5 Empirical results

3.5.1 Descriptive results

In general, about 20 percent of the rural farm households sampled applied for credit with just about 63 percent (13 percent of total sample) of them obtaining credit. About 66 percent borrowed from informal sources and only 4.3 percent borrowed from a commercial bank. This confirms the dominance and importance of the informal lenders

[10]A community with the presence of a microfinance institution was given a distance value of zero.

in contributing to the rural development of Malawi. On the whole, about 37 percent of the reasons for taking credit were related to agricultural purposes which included purchasing inputs while 24 percent borrowed for consumption purposes. The rest included borrowing for a business start-up capital among other reasons. For those who were denied credit, 24 percent of them wanted the credit for agricultural related reasons, 51 percent as business start-up capital and 15 percent for household consumption.

Rural households in developing countries including Malawi are considered to be both producer of goods and consumers of these goods. They are also typically poor and constrained by a tight overall budget which must be allocated between immediate consumption and production. Therefore, decisions taken on one inevitably affects the other. Thus, poor households especially are unable to separate their production decisions from their consumption decisions. Hence, when a household borrows for production purposes (to purchase inputs) for example, it also frees some income or resources for consumption purpose which otherwise would have not been possible without credit. Hence, whether credit was obtained for production or consumption purpose, it ultimately has an effect on the other.

Table 3.3 presents the descriptive statistics of variables used in the study. The means, standard deviations, minimum and maximum of the variables are grouped under credit constrained and unconstrained households. On the average, household heads are 43 years of age slightly similar across both groups. Illiteracy, that is people with no level of formal education, is a major phenomenon in deprived areas, especially in rural areas of developing countries, and this is seen in the data. Almost 79 percent of the rural farm household heads were illiterate, and it is about 5 percent higher for constrained households as compared to unconstrained households. With a low level of formal education, adoption rate might be low and being able to understand formal loan application procedures might be difficult hence very likely to affect productivity. This may also account for the high levels of informal borrowing, among other factors.

More than 74 percent of the household heads are male, with an average household size of approximately 5 members across all types of households. Majority of the households are located in the tropical warm semi-arid agro-ecological zone of the country. Social

capital enables transfer of knowledge and information. On the average 8 percent of unconstrained households are in an agricultural related group about 1 percent higher than constrained households. A greater percentage, 88 percent, of the cultivated land can be described to be legally owned through inheritance or purchase. Unconstrained households had a little larger land size than the constrained households; both types of households cultivated on average less than a hectare.

The amount of hired labour by constrained household was approximately 5 persons compared to 9 for the unconstrained households. Additionally, unconstrained households had on average about two times more value of livestock. Distance to the nearest ADMARC branch was approximately 8 kilometres for the total sample. About 30 percent of the communities had a farm extension officer. Also, 65 percent of the households cultivated other crops apart from maize. About 17 percent of all rural farm households used an organic fertilizer, while 86 percent of unconstrained households compared to 81 percent of constrained households used inorganic fertilizers. This may be linked to the fertilizer subsidy program of the government making fertilizer less expensive for both households. Finally, constrained households lived further away from microfinance institutions and also had on average lower number of financial institutions within their districts of abode.

Table 3.3: Descriptive Statistics of Variables

	Constrained				Unconstrained				Pooled			
Variable	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Productivity	84412.1	181055.3	14.1203	3320080	110759.8	205095	95.04046	2503381	93161.75	189763.2	14.1203	3320080
Head age	42.72453	16.32659	15	110	43.06413	16.41704	16	96	42.83731	16.35585	15	110
No education	.8178329	.3860392	0	1	.7309976	.4435729	0	1	.7889963	.4080613	0	1
Primary	.0912312	.2879801	0	1	.111639	.3150153	0	1	.0980083	.2973552	0	1
Higher	.0909359	.2875604	0	1	.1573634	.3642512	0	1	.1129955	.3166185	0	1
Male	.7304399	.4437968	0	1	.7719715	.4196857	0	1	.7442319	.4363351	0	1
Household size	4.676115	2.147933	1	17	4.759501	2.212104	1	16	4.703806	2.169591	1	17
Warm/semiarid	.4960142	.5000579	0	1	.4091449	.4918221	0	1	.4671662	.49897	0	1
Warm/subhumid	.3483909	.4765309	0	1	.3313539	.4708398	0	1	.3427332	.47467	0	1
Cool/semiarid	.104222	.3055935	0	1	.1478622	.3550688	0	1	.1187143	.3234839	0	1
Cool/subhumid	.0513729	.2207898	0	1	.111639	.3150153	0	1	.0713863	.2574944	0	1
Network (agric.)	.0628875	.2427964	0	1	.0700713	.2553429	0	1	.0652731	.2470315	0	1
Land size	.7455303	.5956611	.0121406	7.122474	.8681692	.7224516	.0161874	8.081579	.7862568	.6430833	.0121406	8.081579
Land secured	.8960732	.3052106	0	1	.8610451	.3460022	0	1	.8844409	.319727	0	1
Hired labour	5.054621	18.54089	0	450	8.538599	24.53703	0	630	6.211595	20.78782	0	630
Farm asset	4429.323	17142.62	0	532000	9282.378	71781.27	0	2704650	6040.947	43725.15	0	2704650
Home asset	12731.51	54097.44	0	1588000	27932.45	126849.5	0	2586548	17779.51	85715.39	0	2586548
Livestock	20185.1	89331.18	0	3100000	39686.25	138859.4	0	3119200	26661.13	108694.7	0	3119200
ADMARC Dist.	8.139962	5.161903	.13	33.74	8.007024	5.211189	.11	31.55	8.095815	5.178187	.11	33.74
Extension Off.	.2849129	.4514396	0	1	.314133	.4643075	0	1	.2946164	.4559151	0	1
Temperature	2335.128	201.8605	1410	2967	2271.556	267.1171	1410	2942	2314.016	227.5857	1410	2967
Other crops	.6530853	.4760586	0	1	.6508314	.476849	0	1	.6523368	.4762754	0	1
Org. fertilizers	.1685858	.3744409	0	1	.1947743	.3961445	0	1	.1772826	.3819453	0	1
Inorg. fertilizers	.8113375	.3912981	0	1	.861639	.3453811	0	1	.8280418	.3773813	0	1
Input cost	4170.12	10330.58	0	177450	8153.407	18009.33	0	257370	5492.907	13507.69	0	257370
MFI Distance	29.09943	24.36749	0	200	29.26802	24.91837	0	200	29.15541	24.54947	0	200
Financial Institutions	18.79274	24.36749	2	87	22.14192	26.79613	2	87	19.90495	24.8865	2	87
Observation	3387				1684				5071			

3.5.2 Econometric results

3.5.2.1 Determinants of household credit constrained status

Table 3.4 presents estimated results from the Endogenous Switching model. The Wald chi square shows the overall significance of the estimated coefficients. This is statistically significant at 1 percent level. Hence, at least one of the estimated coefficients is significantly different from zero. The correlation coefficients (rho) are both negative but significant for only the correlation between the credit constraint status equation and the productivity equation for the constrained households. Inferring from the explanation from Lokshin and Sajaia (2004), since rho is positive and significant in the constrained equation, it suggests that a household that is constrained is less productive than a randomly selected household from the sample would but that for the unconstrained household is inconclusive. However, a Wald test for joint independence of the three equations was reported in the results table and shown to be significant. This is performed to test the null hypothesis that there is no significant correlation coefficient between the errors of the selection equation (credit constraint status) and the outcome equations (productivity equations) for the two regimes. From the estimates of the Wald tests of independence, it can be concluded that the null hypothesis of independence of equations between the selection equations and the outcome equations is rejected at 1 percent significance level. Hence, the estimation of the Endogenous Switching Model is the right econometric technique for the estimation of the model in this study.

Column 1 of Table 3.4 presents estimates from the first stage probit equation of the determinants of the credit constraint status of the households. To improve the identification of the equation, two variables were included which included the distance to the nearest microfinance institution and the number of financial institutions within a district. The number of financial institution within a district was statistically significant at 5 percent level. Inferring from the results, households in districts with fewer financial institutions were more likely to credit constrained. The summary statistics showed that there were as little as two financial institutions in some of the districts which could imply less outreach increasing the chance of borrower discouragement due to not knowing any formal institution to apply to leading to a household being constrained. Though not significant the negative sign of the distance to the nearest MFI implies distance could contribute to a household

being credit constrained. This is corroborated by the study of Presbitero and Rabellotti (2014) who found that distance increased the operation cost of financial institutions including MFIs and therefore reduced the likelihood of credit being granted to borrowers. However, considering the correlation coefficient matrix presented in Table B1, the instruments (MFI distance and financial institutions) are argued to be invalid as they are correlated with the outcome variables, thus the productivity dependent variables, violating the assumptions under which an instrument should be valid. Hence, results might be influenced by endogeneity.

Table 3.4: Determinants of Credit Constraints and Farm Productivity

	(1)	(2)	(3)
		Productivity	
	Selection	Constrained	Unconstrained
Age	-0.00869	0.0314	-0.181
	(0.0652)	(0.0733)	(0.116)
Primary education [a]	0.181**	0.0550	-0.286*
	(0.0767)	(0.0875)	(0.161)
Higher education	0.254***	0.0351	-0.215
	(0.0662)	(0.0923)	(0.168)
Male	-0.0215	0.0730	0.103
	(0.0564)	(0.0586)	(0.109)
Household size	-0.00914	0.0752	0.164**
	(0.0440)	(0.0525)	(0.0780)
Tropic-warm/sub humid [b]	0.0448	0.164*	0.193
	(0.0749)	(0.0950)	(0.122)
Tropic-cool/semiarid	0.214**	-0.115	-0.139
	(0.107)	(0.0934)	(0.186)
Tropic-cool/sub humid	0.381***	-0.143	-0.338
	(0.114)	(0.154)	(0.246)
Network (agric.)	-0.00849	0.269***	0.0260
	(0.0929)	(0.0989)	(0.175)
Land size	0.0397	-0.347***	-0.274***
	(0.0381)	(0.0494)	(0.0691)
Land tenure	0.00174	-0.338***	-0.207*
	(0.0657)	(0.0787)	(0.110)
Hired labour	0.0893***	0.105***	0.00685
	(0.0209)	(0.0264)	(0.0698)
Farm asset	0.0304	0.0606***	-0.0276
	(0.0210)	(0.0196)	(0.0393)
Home asset	0.0121	0.0253***	0.0463***
	(0.00743)	(0.00821)	(0.0168)
Livestock	0.00369	0.0246***	0.0197**
	(0.00524)	(0.00523)	(0.00879)
ADMARC Distance	-0.101**	0.00772	-0.0422
	(0.0394)	(0.0476)	(0.0969)
Extension Officer	0.0909	0.173**	0.000265
	(0.0730)	(0.0742)	(0.121)
Temperature	-0.626*	-1.654***	-1.151*
	(0.356)	(0.453)	(0.589)
Other crop	-0.0158	0.437***	0.402***
	(0.0573)	(0.0692)	(0.130)
Org. fertilizers	0.0412	-0.0171	-0.00879
	(0.0593)	(0.0599)	(0.106)
Inorg. fertilizers	0.0359	0.368***	0.241**

	(0.0627)	(0.0692)	(0.116)
Input cost	0.00864	0.0190***	0.0144
	(0.00557)	(0.00695)	(0.0115)
MFI Distance	-0.0309		
	(0.0249)		
Financial Institutions	0.137**		
	(0.0564)		
Constant	3.779	21.33***	20.65***
	(2.724)	(3.614)	(4.189)
lnsigma ($\ln\sigma$)		0.212***	0.434
		(0.0184)	(0.282)
athrho ($\operatorname{atanh}\rho$)		-0.326**	-1.027
		(0.144)	(0.761)
Sigma		1.236	1.543
		(0.023)	(0.435)
Rho		-0.315	-0.773
		(0.129)	(0.307)
Log pseudolikelihood		-2891500.7	
Wald chi2 (22)		125.6***	P>chi2=0.0000
Wald test [c]		8.71***	P>chi2=0.0032
Wald chi2 (5) [d]		4.83	13.85**
		P>chi2=0.4372	P>chi2=0.0161
N			5071

Notes:
Robust Standard errors in parentheses;
P-value of significance: *** p<0.01, ** p<0.05, * p<0.1;
Credit constrained: A household is defined as credit constrained if it is discouraged from borrowing or denied credit within the survey period and also defined as unconstrained if it received credit or does not need credit.
All continuous variables are in logs hence their coefficients are interpreted as elasticities in the productivity equations in column 2 and 4.
Base categories: a. Education: No education; b. Ecological Zone: Tropic-warm/sub arid;
Selection equation: For constrained households, positive coefficients imply variables increase likelihood of being credit constrained and negative reduces likelihood of being constrained. Similarly, for unconstrained households, positive coefficients increase likelihood of being credit unconstrained and negative sign coefficients reduces the likelihood of being credit unconstrained.
c. Wald Test of Independent Equations
d. Wald chi2 on whether the demographic factors be excluded from the productivity equations.

The levels of education were statistically significant in explaining the credit constraints of the household. The estimated results showed that household heads with some level of education were less likely to be constrained compared to those with no level of formal education. This increased with the level of education with those with higher education having a higher likelihood to be unconstrained than those with primary level of education. Highly educated household heads are expected to be relatively better in financial literacy and hence would be more likely to apply for credit. The results are confirmed by Ali et al. (2014) who found that education reduced all forms of credit rationing. Chen and Chivakul (2008) explain that lenders may be using higher level of education as a proxy for permanent income and therefore included it as a factor in their decision making.

3.5.2.2 Credit Status and Productivity

This section looks at the impact of credit constrained status on food crop productivity. The estimates are from the second stage results of the Endogenous Switching Model, reported in Columns 2 and 3 of Table 3.4. Column 2 captures that for the credit constrained household while column 3 reports that for the credit unconstrained households. Results show that some variables were significant in one type of household but not in the other. Also, the significance levels often differed for variables that were statistically significant in both equations. This shows heterogeneity exists between the two household groups. A Wald chi-square test was also estimated with the null hypothesis that the demographic factors (age, gender and education of the household heads) including the household size were not important in the productivity equations. This was conducted as most of the variables, especially in the constrained households, were insignificant. The result from the test revealed that the demographic factors including the household size are jointly not significant in the constrained households but significant at 1 percent in the unconstrained households. This implies that these variables can be excluded from the constrained productivity function.

First, the results also showed that an increase in the household size resulted in a positive effect on the productivity of unconstrained households. Thus, larger household sizes contributed to higher family labour supply, increase in labour per hectare and consequently higher productivity as evidenced in the study of Thapa (2007). The result shows that household size elasticity of productivity was about 0.16 percent. However, as this is significant for only unconstrained households, it is likely that credit status also played a crucial role in affecting productivity. Unconstrained households are therefore able to smooth consumption in a relatively larger household which could translate into higher productivity. Similar result was found in the study by Duong and Izumida (2002) who linked number of adults to the family labour force and this was only found to be positively significant in the output supply of unconstrained household.

Further from the productivity estimates in Table 3.4, it is found that tropic warm (sub humid) zones were more productive than the tropic warm (sub arid) zones for constrained only. Thus, a household in the tropic warm (sub humid) zone had an

increase in crop productivity by about 16 percent in the constrained household. This is thus supported by the findings of Wood-Sichra and Wood (2009) who found the tropical humid zones to be highly productive. It could be explained that, given favourable agro-ecological conditions, constrained households would capitalise on nature or their environment to be productive in the absence of credit.

The membership in agricultural group increased the productivity of credit constrained households by about 27 percent but had no effect on the crop productivity of unconstrained households. It is deduced from the positive effect that constrained households are better empowered through their membership in agricultural groups which make them more productive. Thus, it could be possible that members support each other on their respective farms through the supply of farm labour or other inputs to compensate for being credit constrained. Although Godtland et al (2004) did not decompose households into credit constrained and unconstrained households, they generally found a positive effect of agricultural group membership on productivity. Similarly, the presence of an extension officer in the community was significant for only constrained households increasing productivity by about 17 percent. Constrained households could be deduced to utilise effectively the knowledge and skills acquired from their contact with an extension officer to increase their farm productivity in the absence of credit. The positive effect of an agricultural extension on productivity is also found by Elias et al. (2013).

Similarly, an increase in the variable cost of inputs increased productivity for both constrained and unconstrained households. This is expected as purchasing inputs is seen as an investment which is more likely to increase farm productivity. As this is significant in both households, it is therefore evident that any purchase of inputs for production purpose is vital for farm productivity. However, this finding is contrasted in a study by Freeman et al. (1998) who found expenditure on variable inputs to be significant in productivity function for only constrained households in Ethiopia but insignificant for both credit statuses in Kenya.

Value of household livestock also has the capacity to increase crop productivity. This improved crop yield between 2 to 2.5 percent for the households. It is likely that in the absence of credit to buy inputs or hire extra labour, constrained households especially use some of their livestock as animal traction and/or the livestock

droppings as manure which may have increased their farm productivity. Reardon et al (1997) found that households that used livestock as animal traction were allocative efficient as this allows them to cultivate at the right time of the season and provide farmers the chance to clear land for cultivation.

On the contrary, 1 percent increase in land size decreased farm productivity by 0.35 percent for constrained households and 0.27 percent for unconstrained households. This is corroborated by similar results found by Reardon et al. (1997), Ali and Deininger (2012) and Ali et al. (2014) all in Rwanda where cultivating on a smaller farm land was more productive than on a larger farm. Carter (1989) records four possible reasons for this to happen. Firstly, smallholders are deemed to be technically more efficient thus producing more output from given levels of inputs; decreasing returns to scale could be a feature of agricultural production; smallholders utilise greater quantities of variable inputs per hectare compared to relatively larger farms; and lastly, the inverse relationship witnessed could be because of higher quality of land on small farms. However, Dorwad (1999) in a study on farm size and productivity among smallholder farmers in Malawi identified a positive relationship between farm size and productivity in the 1980's which he attributes to failures in land, capital and product market with severe capital constraints which consequently affects the capital and labour inputs of smallholders.

Similarly, land tenure was observed to have a negative effect on the productivity of both type of households Thus, households that had land security were about 34 percent (constrained) and 21 percent (unconstrained) less productive than a household without land security. This finding, in reference to credit unconstrained households is not supported by the study of Place and Otsuku (2001) who found no effect in a study on Malawi. However, the results may be consistent with the economics literature as noted by Place (2009) that there is both divergent and convergent views on the effect land tenure on agricultural production in Africa. The contradiction in results with that of Place and Otsuku (2001) could imply that land tenure, although important in land ownership, have a heterogeneous effect on productivity which may depend on some household characteristics such as endowments.

High temperature levels decreased the productivity of both constrained and unconstrained households. High temperatures induce droughts implying less rainfall. As farmers in Malawi are dependent on rainfall for irrigation, their productivity is likely to be very poor during periods of high temperature. This is corroborated by Battisti and Naylor (2009) who stated that high seasonal temperatures have been established to be damaging on agricultural productivity.

Further, cultivation of other crops apart from maize increased the productivity of both credit groups. Hence, the estimates confirm the well-known fact that multi-cropping is more productive and efficient way of farming compared to single-cropping. Cultivating multiple crops increased productivity of households by about 42 percent for both credit constrained and unconstrained households. This is contrary to the findings of Oseni et al. (2015) who found no evidence of the effect of multi-cropping on productivity. Applying inorganic fertilizers also increases productivity by as much as 37 percent for constrained households and 24 percent for credit unconstrained households. This result could be reflective of the government fertilizer subsidies given to farmers in rural Malawi. Hypothetically, where the main inputs needed by constrained households is fertilizer, obtaining such fertilizer subsidy is more likely to have a much larger impact on their productivity than for unconstrained households who possibly have the means of obtaining fertilizer. This positive effect was expected as this is an improved technology that would shift the production frontier outwards. This is consistent with the findings by Okoye et al. (2007) and Ukoha et al. (2010).

3.5.2.3 Expected crop production, treatment and heterogeneity effects

Table 3.5 presents the expected crop output produced per hectare under actual and counterfactual conditions for rural farm households in Malawi. These are obtained from estimates from the endogenous switching model. Figures in the table labelled (a) and (b) are the actual observed crop output per hectare from the data sample used. Expected output for households that were unconstrained was 10.77 just a little higher than households that were constrained with an output of 10.48. To conclude from this comparison that unconstrained households are more productive than constrained households may be misleading, as other unobserved characteristics that may impact productivity have not been accounted for (Carter and Milon, 2005). To overcome

this, the last row of Table 3.5 adjusts for the base heterogeneity and shows the differences in expected productivity. With the counterfactual condition that the constrained households were instead unconstrained, the households that were actually unconstrained would be expected to be about 1.81 percent less productive. Likewise, on the counterfactual condition that the unconstrained households were constrained, the unconstrained household were again about 0.44 percent less productive. In either condition, unconstrained households are less productive than the constrained households. The differences, inferring from the study by Carter and Milon (2005), reflect systematic causes of deviation between the two types of households that may not otherwise be entirely accounted for in the observable determinants of crop productivity.

Table 3.5: Expected Crop Output, Treatment and Heterogeneity Effect

Sub-samples (farm households)	Credit Status		Treatment Effects
	Unconstrained	Constrained	
Unconstrained	(a) 10.77128	(c) 10.04152	0.7297555*** (0.0060793)
Constrained	(d) 12.57943	(b) 10.48305	2.09638*** (0.0039932)
Heterogeneity effects	−1.808152*** (0.014481)	−0.4415279*** (0.0161742)	−1.3666245

Note: Standard errors in parentheses; P-value of significance: *** p<0.01, ** p<0.05, * p<0.1

The treatment effect of credit constrained as the expected change in productivity in each credit status is presented in the third column of Table 3.5. For the households who are credit unconstrained, the mean effect of being credit unconstrained, that is the effect of the treatment on the treated (TT), saw an increase in productivity by 0.73 percent. Similarly, constrained households who are considered credit unconstrained, that is effect of the treatment on the untreated (TU), will have their productivity also increase by 2.1 percent. In both cases, productivity increased implying that being credit unconstrained increases or improves productivity or crop yield. However, the transitional heterogeneity effect, which shows whether the difference in the TT is greater or lesser than the TU, is negative (thus, TU is higher than TT) which implies that the effect of being credit unconstrained is higher for constrained households should they become credit unconstrained.

Although impact may be marginal, it makes a good policy argument for the development of the credit market in rural Malawi which could drastically improve

productivity in Malawi. This finding is however not consistent with the study of Diagne and Zeller (2001) who found in their assessment of the impact of credit on welfare in Malawi concluded that households who choose to borrow were instead disadvantaged as they obtained lesser net crop income compared to those who did not borrow. However, as it has been more than a decade since that study, it could be argued that some improvement has occurred in the rural credit market for which this benefit is being observed.

3.5.2.4 Robustness Checks

As a robustness check, the study replicated the crop productivity determinants using output per labour as the dependent variable. This is presented in Table B2 in the appendix section. The output per labour is the total value of food crop harvested divided by the number of members within the household. Similar to the preliminary results from the output per hectare model, the rhos ($\rho's$) are both negative but only significant for the credit constrained households. However, the Wald test of joint independence of the three equations was significant at 1 percent level rejecting the null hypothesis that the three equations are not correlated. Results of the determinants were quite similar to that of the output per hectare results with respect to direction of effect. However, there were some extra variables such as age of the household head and belonging to an agricultural network that were also significant but maintained the same sign.

The treatment effects using output per labour was also conducted and is presented in Table B3 in appendix B. Though the magnitudes are different, similar results are obtained generally as in Table 3.5. The treatment on the treated and on the untreated were both positive implying an improvement in productivity with that of the untreated, that is constrained households, being larger than that of the of unconstrained results. This also leads to a negative transitional heterogeneity effect implying that the constrained households would be more productive should they become credit unconstrained. This results therefore buttresses the point on improving the access to credit in rural Malawi.

3.6 Conclusion

Using a cross-sectional national representative household survey, the study examined the impact of credit status on crop productivity in rural Malawi. The usable sample

included 5,071 rural farm households who had cultivated and harvested food crops in the previous year's rainy season. The study employs an endogenous switching model using a Heckman selection model to simultaneously examine the determinants of household credit status and its impact on farm productivity. In utilizing this model, the study is able to address the problem of sample selection bias and endogeneity.

The study makes some general observations. Firstly, the results show that credit unconstrained groups had some differing characteristics compared to the credit constrained households. Hence the model for the analysis which separates the two types of credit status households makes this an efficient method of estimation. On the contrary, should a dummy variable capturing the credit status be added to an OLS estimation of productivity (ignoring the fact that it suffers from sample selection bias), these differences between the credit statuses of households would not have been noticed. As an example, the household size increase the productivity of unconstrained households, while no observed was found for the constrained households. Further, value of farm asset and livestock, presence of an extension officer in the community, participation in agricultural group and hired labour affected constrained households' productivity but had no effect on the productivity of unconstrained households.

Secondly, the variables used as exclusion restriction variables were considered invalid judging from the correlation coefficient matrix. Thus, they were highly correlated with outcome variables violating the validity assumption of instrumental variables. Also, the study recognises that there is a possible issue of endogeneity caused by reverse causality. This is because, it is possible for farm productivity to also affect household credit constraint status. Thus, lenders are more likely to give credit to only productive households. These issues therefore, renders the recommendations drawn from the findings in the analysis weak and hence should be treated with caution.

Agricultural networks were identified to be a key determinant in increasing productivity especially for constrained households. It can be implied that these households could be benefiting from members supporting each other through supplying farm labour to each other. Hence, it is recommended that in areas in rural Malawi that are yet to have developed or any credit markets in their location,

agricultural networks could be formed so as members could share resources, such as labour and farm inputs, among each other. It is further recommended that the members in these social networks as an addition to supporting each other in-kind could also pull savings together which is given to a different member of the network at some regularly periods. Thus, following the model of the rotating savings and credit associations (ROSCA) or the village savings and loan associations (VSLA) which is an improvement of ROSCA. Thus, through this, members become both lenders and borrowers at different points in time. The VSLA as a social network practised in some rural areas in Malawi has been found to be an essential tool for improving household welfare (Ksoll et al., 2016).

Further, as the presence of extension officers has significant impact on the productivity of constrained households mostly, it is also recommended that extension programmes should be intensified in areas with little or no credit market. More extension officers should be trained and deployed to rural areas to reduce the farmer-extension officer ratio. The Government of Malawi's public extension service has about 2,175 staff as at 2011 serving farmers at the national level (GFRAS, 2016). It is likely this may be smaller on the local level due to lack of resources. However, the government of Malawi's pluralistic extension policies have influenced an increase in the participation of the private sector including NGO's, multilateral organisations and farm based organisations among others in extension programmes to farmers in Malawi (GFRAS, 2016). Adequately harnessing this extra support from the private sector should increase the impact on both credit constrained and unconstrained households.

One other important factor that increases productivity of food crop production was inorganic fertilizer application. It was found that constrained households had a greater productivity than unconstrained households who applied inorganic fertilizers to their farms. The government of Malawi's farm input subsidy programme which gives subsidized fertilizers and seeds to farmers is probably what has increased the use of fertilizers by constrained households. There is also evidence of its significant impact, that is increasing the national maize production and productivity which led to an increase in real wages and reduction in poverty (Dorward and Chirwa, 2011). It is therefore recommended that the government subsidy programme should be carefully managed and also directed to areas with little or no credit markets as it may

be that fertilizers are mostly what some constrained households need to become productive as seen in this study. Further, it is recommended that extension programmes or officers should propagate the benefits of intercropping as it has been identified to increase farm productivity. Nitrogen-fixing crops, such as soybeans and peanuts, should be intercropped with food crops like maize to increase the yield of the food crops and also gain extra harvest from these nitrogen-fixing plants.

Livestock was also identified as an important factor to increasing farm households' productivity in both households. Livestock are used sometimes as a store of wealth and especially as farm inputs (for example oxen) for ploughing. The droppings from some livestock are also used as manure, that is organic fertilizer, though this was not significant in this study. Given this importance of livestock, it is recommended that farmers use part of any gain from the farm or credit obtained to purchase some livestock if they can afford them.

The study also shows that there is a positive effect of a household being credit unconstrained on productivity. The findings suggest that a household that is constrained is less productive than a randomly selected household from the sample would but that for the unconstrained household is inconclusive however, the counterfactual arguments as seen from the analysis shows that being credit unconstrained was beneficial to increasing productivity. The effect of the treatment on the treated and the untreated all show that productivity would increase due to a household being credit unconstrained. Thus, credit constrained is a great limitation to the improvement in farm productivity. Also, as there is limited access to credit in rural areas due to credit market failure, it implies that those obtaining credit may not be obtaining the maximum credit needed to achieve the optimum potential of their farm productivity. Hence, as these gains have been marginal, it is argued that an improvement in the rural credit market could see further increase in productivity and other household welfare indicators. Therefore, it is recommended that the government should plan and implement credit programmes that could provide credit to these poor rural farm households to increase their productivity. Also, the already existing government credit programme like the Malawi Rural Finance Company should be tasked to improve on its outreach activities so that its core mandate of providing credit to rural areas of Malawi to promote economic development are achieved. Further, as recommended in Chapter 2, village savings and loans

associations should be encouraged in rural areas in the short term until the formal credit markets are developed in these areas. These associations could be a way of avoiding paying the high interest rates charged by the traditional informal lenders as in this association farmers would pool savings together and give out as credit to each other one at time. Hence, they become their own lenders.

Further, it was also found that distance to microfinance institutions had an inverse effect on the credit constrained status of households. Households which lived in locations with relatively more financial institutions were less credit constrained. This presents a case for the government to provide the enabling environment that would increase the outreach of other formal financial institutions within rural Malawi. This will increase the financial institutions, provide diverse financial services and also bring financial markets closer to the rural households.

Lastly, in agreeing with Freeman et al. (1998) that borrowers are not homogenous in their demand for credit, it is further argued that constrained and unconstrained groups are also not homogenous within themselves as they are aggregation of several credit statuses. It will be interesting to find the effect each disintegrated or identifiable credit status has on productivity and whether the aggregation hides vital information of the actual effect of credit on productivity.

APPENDIX B

Table B1: Correlation coefficient matrix

	1	2	3	4	5	6	7	8	9
1. Constrained	1								
2. Land productivity	0.109***	1							
3. Labour Productivity	0.0844***	0.697***	1						
4.Head age	0.0116	-0.0207	-0.0359*	1					
5. Education	0.108***	0.101***	0.130***	-0.167***	1				
6. Male	0.0448**	0.0810***	0.0131	-0.185***	0.165***	1			
7. Household size	0.0120	0.0805***	-0.0538***	-0.0267	0.0416**	0.261***	1		
8. Agro-ecological zones	0.130***	0.0375**	0.0343*	0.00685	0.0334*	0.0356*	0.0187	1	
9. Network (agric.)	0.0137	0.0525***	-0.00642	0.0350*	0.0272	0.0177	0.0317*	-0.0139	1
10. Land size	0.0752***	-0.0140	-0.0608***	0.183***	0.0289*	0.159***	0.243***	0.106***	0.0468***
11. Land secured	-0.0516***	-0.112***	-0.0976***	0.0620***	-0.137***	-0.0550***	-0.0517***	0.0528***	-0.0493***
12. Hired labour	0.149***	0.182***	0.186***	0.0525***	0.171***	0.0118	-0.0490***	0.0434**	0.0536***
13. Farm asset	0.111***	0.158***	0.0450**	0.128***	0.0929***	0.254***	0.295***	0.114***	0.0475***
14. Home asset	0.121***	0.203***	0.163***	0.0392**	0.232***	0.282***	0.209***	0.0383**	0.0474***
15. Livestock	0.0946***	0.180***	0.0652***	0.128***	0.0707***	0.140***	0.225***	0.0802***	0.0243
16. ADMARC D.	-0.0299*	-0.0349*	-0.0386**	0.0147	-0.0146	0.0155	0.000975	0.00918	-0.0248
17. Extension Officer	0.0302*	0.0156	0.0441**	-0.0242	0.0882***	0.0398**	0.0231	0.0138	0.00260
18. Temperature	-0.140***	-0.177***	-0.130***	-0.0269	-0.0304*	-0.00352	-0.00845	-0.255***	0.0261
19. Other crops	-0.00223	0.122***	-0.0598***	0.0120	-0.0564***	-0.0104	0.0141	-0.0251	0.0202
20. Organic fertilizer	0.0323*	0.0357*	-0.0303*	0.0320*	0.0238	0.0461**	0.0702***	0.00809	0.0383**
21. Inorganic fertilizer	0.0628***	0.149***	0.0798***	0.0649***	0.101***	0.0634***	0.0922***	0.0585***	0.0633***
22. Input cost	0.113***	0.164***	0.0878***	-0.0963***	0.196***	0.202***	0.158***	0.111***	0.0894***
23. MFI Distance	-0.00173	-0.0355*	-0.0650***	-0.0230	-0.0320*	0.0504***	-0.00266	0.109***	-0.0305*
24. Financial Inst.	0.0763***	0.0721***	0.0847***	0.0306*	0.0202	0.0501***	0.0288*	0.0196	-0.0194

Table B1: Correlation coefficient matrix (continued)

	10	11	12	13	14	15	16	17	18
10. Land size	1								
11. Land secured	-0.00191	1							
12. Hired labour	0.259***	-0.128***	1						
13. Farm asset	0.404***	-0.000304	0.197***	1					
14. Home asset	0.281***	-0.110***	0.259***	0.407***	1				
15. Livestock	0.312***	0.00925	0.176***	0.451***	0.315***	1			
16. ADMARC D.	0.0134	0.0521***	-0.0221	0.0339*	-0.0107	0.0426**	1		
17. Extension Officer	0.0297*	-0.0465***	0.0320*	0.00863	0.0320*	-0.0227	-0.0667***	1	
18. Temperature	0.0262	-0.00417	-0.0680***	-0.116***	-0.0738***	-0.150***	-0.0862***	0.113***	1
19. Other crops	0.181***	0.0366**	0.0442**	0.0983***	0.0468***	0.119***	-0.00329	-0.0650***	0.0191
20. Organic fertilizer	0.135***	0.0192	0.0771***	0.139***	0.0742***	0.140***	-0.0115	0.0205	0.0758***
21. Inorganic fertilizer	0.169***	-0.0192	0.130***	0.179***	0.173***	0.151***	-0.0474***	0.0584***	0.0133
22. Input cost	0.264***	-0.121***	0.251***	0.240***	0.263***	0.172***	-0.0482***	0.0498***	0.0207
23. MFI Distance	0.106***	0.0483***	-0.00997	0.0473***	0.0131	0.0538***	0.149***	0.00273	0.00782
24. Financial Inst.	0.0349*	-0.0954***	0.0648***	0.00633	-0.0000879	-0.0301*	-0.0705***	-0.0144	0.112***

Table B1: Correlation coefficient matrix (continued)

	19	20	21	22	23	24
19. Other crops	1					
20. Organic fertilizer	0.0613***	1				
21. Inorganic fertilizer	0.0316*	0.0446**	1			
22. Input cost	-0.0232	0.0903***	0.236***	1		
23. MFI Distance	0.0432**	0.0215	-0.0279*	-0.0153	1	
24. Financial Inst.	-0.115***	0.0389**	0.0136	0.0637***	0.0157	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B2: Determinants of credit constraint and crop labour productivity

	(1)	(2)	(3)
		Land Productivity	
	Selection	Constrained	Unconstrained
Age	-0.0114	-0.0594	-0.311**
	(0.0641)	(0.0826)	(0.127)
Primary education [a]	0.181**	0.0582	-0.335*
	(0.0770)	(0.0970)	(0.198)
Higher education	0.254***	0.120	0.123
	(0.0664)	(0.105)	(0.225)
Male	-0.0130	-0.0270	-0.155
	(0.0582)	(0.0685)	(0.122)
Household size	-0.0188	-0.129**	-0.207**
	(0.0431)	(0.0568)	(0.0933)
Tropic-warm/sub humid [b]	0.0376	0.321***	0.330**
	(0.0793)	(0.104)	(0.135)
Tropic-cool/semiarid	0.209*	-0.0820	-0.0270
	(0.109)	(0.125)	(0.242)
Tropic-cool/sub humid	0.395***	-0.0619	-0.181
	(0.113)	(0.206)	(0.329)
Network (agric.)	0.00845	0.00716	-0.264
	(0.0945)	(0.113)	(0.213)
Land size	0.0390	-0.224***	-0.219***
	(0.0377)	(0.0512)	(0.0742)
Land tenure	-0.00123	-0.193**	-0.265**
	(0.0663)	(0.0904)	(0.126)
Hired labour	0.0955***	0.127***	0.113*
	(0.0212)	(0.0334)	(0.0656)
Farm asset	0.0336	0.00995	-0.00745
	(0.0205)	(0.0236)	(0.0410)
Home asset	0.0136*	0.0426***	0.0446**
	(0.00727)	(0.00952)	(0.0176)
Livestock	0.00286	0.0112*	0.00474
	(0.00543)	(0.00648)	(0.0119)
ADMARC Distance	-0.100***	-0.0329	0.000592
	(0.0389)	(0.0526)	(0.117)
Extension Officer	0.103	0.164*	0.0906
	(0.0721)	(0.0941)	(0.138)
Temperature	-0.602*	-1.179**	-0.381
	(0.357)	(0.465)	(0.630)
Other crop	-0.0183	-0.176**	-0.0977
	(0.0564)	(0.0795)	(0.134)
Org. fertilizers	0.0507	-0.109	-0.115
	(0.0595)	(0.0740)	(0.130)
Inorg. fertilizers	0.0338	0.123*	0.312**
	(0.0625)	(0.0716)	(0.131)
Input cost	0.00814	-0.00510	0.00734
	(0.00565)	(0.00759)	(0.0131)
MFI Distance	-0.0501**		
	(0.0223)		
Financial Institutions	0.134**		
	(0.0591)		
Constant	3.648	12.01***	8.798*
	(2.724)	(3.685)	(4.610)
lnsigma ($\ln\sigma$)		0.314***	0.590**
		(0.0228)	(0.298)
athrho ($\operatorname{atanh}\rho$)		-0.407***	-1.028
		(0.154)	(0.800)
Sigma		1.369	1.803

	(0.031)	(0.537)
Rho	-0.386	-0.773
	(0.131)	(0.322)
Log pseudolikelihood	-3037249.2	
Wald chi2 (22)	83.87***	P>chi2=0.0000
Wald test [c]	12.16***	P>chi2=0.0005
Wald chi2 (5) [d]	8.20	15.52***
	P>chi2=0.1452	P>chi2=0.0083
N		5071

Notes:

Robust Standard errors in parentheses;

P-values of significance: *** p<0.01, ** p<0.05, * p<0.10;

Credit constrained: A household is defined as credit constrained if it is discouraged from borrowing or denied credit with the survey period and also defined as unconstrained if it received credit or does not need credit.

All continuous variables are in logs hence their coefficients are interpreted as elasticities in the productivity equations in column 2 and 4.

Base categories: a. Education: No education; b. Ecological Zone: Tropic-warm/sub arid;

Selection equation: For constrained households, positive coefficients imply variables increase likelihood of being credit constrained and negative reduces likelihood of being constrained. Similarly, for unconstrained households, positive coefficients increase likelihood of being credit unconstrained and negative sign coefficients reduces the likelihood of being credit unconstrained.

c. Wald Test of Independent Equations

d. Wald chi2 on whether the demographic factors be excluded from the productivity equations.

Table B3: Expected Crop Output, Treatment and Heterogeneity Effect (labour productivity)

Sub-samples (farm households)	Credit Status		Treatment Effects
	Unconstrained	Constrained	
Unconstrained	(a) 3.430344	(c) 2.518708	0.911636*** (0.0064907)
Constrained	(d) 5.522574	(b) 3.223149	2.299426*** (0.0040488)
Heterogeneity effects	−2.09223*** (0.0167054)	−0.7044404*** (0.0136136)	−1.38779

Note: Standard errors in parentheses; P-value of significance: *** p<0.01, ** p<0.05, * p<0.1

CHAPTER 4

DECOMPOSITION ANALYSES OF CREDIT CONSTRAINT AND HOUSEHOLD CONSUMPTION INEQUALITY IN MALAWI

4.1 Introduction

Unequal distribution of income in Malawi has contributed to the low level of development in the country. With the poorest 20 percent of the population earning less than 6 percent of the total income and the highest 20 percent earning more than 50 percent, Malawi could be described as country with high income inequality (Povertydata.worldbank.org, 2015). Inequality connotes the existence of several development issues and it is of no surprise that Malawi ranks 173 out of 188 countries on the Human Development Index (HDI) (UNDP, 2015).

There is a high inequality between the rural and urban areas of the country, as those on the lower end of the income distribution are found in the rural areas and those at the higher end in the urban areas. Statistics indicate that the rural areas account for 85 percent of the population of Malawi and almost 95 percent of the poor live there (NSO, 2012). Consequently, there is a need to investigate the factors that account for low income or consumption in rural Malawi. One such factor is that about 90 percent of the rural dwellers engage in farming and this is generally a very low return sector. These rural dwellers also lack other economic opportunities to diversify their source of income. As a result, they have unequal access to education, services, assets and financial markets as compared to the urban areas of the country.

One major area in which rural households lack access is to financial markets. Literature has shown that undeveloped financial markets have been a major contributing factor to the increase in inequality, especially in developing countries (Kai and Hamori, 2009). Claessen (2006) notes that finance, which includes access to credit, contributes to smoothing individual and household income, insuring against risk and increasing investment opportunities. Hence, it is an important tool that could help reduce poverty and inequality. However, in a typical rural agrarian setting, financial institutions face an exacerbated problem of information asymmetry. This leads to issues of moral hazard, adverse selection, costly borrower verification and contract enforcement problems (Ghatak and Guinnane, 1999). This poses a great challenge to the establishment of formal financial institutions in rural Malawi and

this negatively impacts rural areas and the ability of rural households to access credit.

Rural credit has been identified to be a welfare enhancing tool (Rui and Zhu, 2010; Baiyegunhi et al., 2010). In the absence of adequate internal resource accumulation, credit has been used as a substitute. Studies have concluded that households that have access to credit, i.e. credit unconstrained households, are able to increase their farm investment (Carter and Olinto, 2003), farm productivity (Ali and Deininger, 2012) and also raise their household income (Dong et al., 2010). Therefore, credit unconstrained households are at an advantage of improving their welfare compared to credit constrained households. This is backed by economic theory which proposes that poor households that are credit constrained could experience significant negative consequences on their income and also on their general welfare (Boucher et al., 2009).

While looking to reduce the rural-urban inequality gap, comparing rural households' inequality by their credit constrained status can produce useful insights into the role of imperfect credit market in rural areas. One way to approach this comparison is by employing decomposition procedures to determine the important factors that contribute to increasing or decreasing inequality within and between the credit constrained statuses of rural households.

The objective of the study is threefold. The first objective investigates whether inequality is greater between or within credit constrained or unconstrained groups. The second objective is to identify the key determinants of rural inequality within each credit constrained group and also the inequality shares of each factor. This employs Fields (2003) method of decomposition. The third objective is to find the differential gap that exists between the two statuses and further explain the gap by decomposing it into an endowment component and a residual component. This employs Blinder-Oaxaca decomposition method (Blinder, 1973 and Oaxaca, 1973). One main benefit of using the Blinder-Oaxaca decomposition is that it helps identify any source of discrimination that may exist within the credit market.

Determining the within and between differences in consumption as stated in the first objective will be estimated by decomposing the General Entropy Index. The within and between decomposition analyses using the General Entropy (GE) index is more

of a descriptive analysis which only considers a variable or a factor at a time. This is similar to doing descriptive statistics or a univariate analysis. However, the regression based decomposition approaches takes into consideration the effect of other variables and or confounding factors when estimating the within and between analyses. The Fields' approach is to the within decomposition analysis and the Oaxaca-Blinder decomposition is to the between analysis both considering other factors that the GE fails to consider. Hence,

4.2 Effect of Credit on Inequality

Ahlin and Jiang (2008) observe that access to credit by poor individuals or households enable them to engage in income-generating activities so as to improve their income levels. Some studies have found that improvement in access to financial services alleviates credit constraints on the poor allowing them access to inputs to increase their productivity, thereby reducing both poverty (World Bank, 2011; Jalilian and Kirkpatrick, 2002; Kai and Hamori, 2009a; cited in Kai and Hamori, 2009b) and inequality (Beck et al., 2004).

A number of studies have examined the effect and impact of credit on some household outcome variables such as agricultural productivity (Guirkinger and Boucher, 2008 and Ali et al., 2014), profitability (Foltz, 2004), technology adoption, income (Zeller et al., 1998), food consumption (Muayila and Tollens, 2012), nonfarm and farm income and food security (Diagne and Zeller, 2001), education (Sorokina, 2013) and poverty (Zaman, 1997; Khandker, 1998 and Obisesan and Akinlade, 2013). Similarly, there have also been studies on the impact of credit on inequality, but the majority have been at the macro level and sometimes employed cross country analysis (see Beck et al., 2004; Clarke et al., 2006; Tchouassi, 2011 and Hermes, 2014).

Based on a cross country analysis, Beck et al. (2004) find that financial development through access to credit reduces inequality as it disproportionately increases the incomes of the poor. In a similar study, Hermes (2014) finds that participation in credit programs helps reduce the income gap between the poor and the rich, however, the effect is relatively small. Further to this, Kai and Hamori (2009) conclude that credit has an equalizing effect and as such could be used as a redistribution tool to lower the inequality gap. Other studies that support a positive

impact of credit on decreasing inequality include Clarke et al. (2006) and Tchouassi (2011).

However, there are fewer studies that focus on the micro level (e.g. Nguyen et al., 2007; Mukhopadhyay, 2014; Viet and Van den Berg, 2014). Mukhopadhyay (2014) examines the impact of access to credit on consumption inequality at various percentiles using a panel data of slum households in Andhra Pradesh, India. He finds that access to credit rather worsened consumption inequality and this was primarily driven by non-food expenditure. However, in the long-run where all households were assumed to have equal access to credit, there was no impact on consumption inequality. Similarly, Viet and Van den Berg (2014) investigate the impact of informal credit on poverty and inequality using a panel data of Vietnam between 2004 and 2006. Their results show that although access to informal credit by households reduced both poverty and inequality, the impact on inequality was relatively small. Nguyen et al. (2007) also find a small impact of subsidized credit on inequality which they link to the issue of lack of penetration of credit programs into the rural part of Vietnam. However, Copestake (2002) concludes that although credit could reduce poverty in the short term, the opportunity cost of that happening is an increase in inequality. Results as seen from these empirical studies do not give a unifying conclusion on the impact of credit on inequality. As the results have also been mixed, this restricts the possibility of generalizing the findings across developing nations. Hence, this calls for more studies on the micro level.

According to the IHS3 report, 14.2 percent of households in Malawi have had some interaction with the credit market with 8.3 percent being successful in their loan application. However, not every household requires credit while others do not even attempt borrowing because of the fear of being denied although they may require credit (discouraged borrowers) or some other reasons such as not possessing adequate collateral. Given this information, households in this study are grouped into credit constrained and unconstrained. Constrained households include both households whose applications have been rejected and also those households which are defined as “discouraged borrowers” (Jappelli, 1990). Similarly, unconstrained households also include those who did not require credit and those who were successful in their application.

The remainder of the study is structured as follows: the next section discusses the methodologies, followed by a brief explanation of the data and variables used in section 3. Results and discussions are included in section 4 and conclusions are drawn in section 5.

4.3 Methodology

Inequality studies at national levels are mostly adequate for comparison with other countries. Spatial analysis within a country or micro factor analysis that seeks to examine inequality in-depth could provide more useful policy conclusions. Therefore, it is usually useful to analyse inequality at a detailed level, especially when investigating the main determinants of inequality (Mckay, 2002). According to Cowell and Fiorio (2011), the main determinants of inequality are better understood through a decomposition analysis. It helps to provide useful and more focused policies that could reduce inequality as the contributors to inequality are clearly seen from decomposition analysis. This section therefore presents some decomposition methods used in this study.

4.3.1 Index Decomposition of Inequality by population sub-group

There are several measures of inequality but only a few align themselves to decomposition. One such measure is the General Entropy (GE) class of indices which particularly has the property for decomposition of consumption inequality into population sub-groups. The general formula is captured as follows:

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right] \quad (1)$$

where n is the number of households (or the unit of measurement of the study) within the sample, y_i and $\overline{y}$ are respectively the consumption of the households and the arithmetic mean consumption. GE ranges from 0 (equal distribution of consumption) to ∞ (higher levels of inequality). The parameter α captures the weight given to the distances between incomes at different areas of the consumption distribution and can take on any real value. GE is more sensitive to changes in the lower tail where there are lower values of α and highly sensitive to changes in the upper tail where there are higher values of α. The commonly used values of

parameter α are 0 (giving more weight to distances between incomes in the lower tail), 1 (giving equal weights across the distribution) and 2 (giving more weights to distances between incomes in the higher tail). For $GE(0)$, the GE index is called the Theil's L and also usually referred to as the mean log deviation measure and expressed as (Haughton and Khandker, 2009);

$$GE(0) = \frac{1}{n}\sum_{i=1}^{n} \ln\left(\frac{\bar{y}}{y_i}\right). \tag{2}$$

Further, for $GE(1)$, the measure is called the Theil's T index and also expressed as;

$$GE(1) = \frac{1}{n}\sum_{i=1}^{n} \frac{y_i}{y} \ln\left(\frac{y_i}{y}\right) \tag{3}$$

Firstly, the GE inequality index can be decomposed based on differences in household characteristics such as gender, location, race, age, and other factors including their credit status. This helps to identify the major contributors to inequality. However, this is done without considering the effects of other factors. Secondly, the GE inequality index helps to decompose inequality into an explained part which is inequality between-groups and an unexplained (residual) part capturing the inequality within groups (Salardi, 2002). Decomposing into these components is useful for policy purposes so that for example, where majority of the inequality is attributable to disparities across groups, that is between groups, then policy may be drawn to focus on the economic enhancement of the less deprived group. However, where the majority inequality is more within-group than between-group, then household it could be said that there is more household heterogeneity within the groups than between the groups.

Equation (1) measures the between-group inequality while the within-group is expressed as (Salardi, 2002):

$$I_w = \sum_{i=1}^{n} w_j GE(\alpha)_j \tag{4}$$

where $w_j = \mathrm{y_j^{\alpha} n_j^{1-\alpha}}$. The term w_j is a weight of each subgroup that depends on y_j as the income share and n_j the population share for each partition j. As a general rule, the sum of between-inequality and within-inequality is total inequality.

GE inequality index is considered as a summary measure of inequality as it provides the distribution of consumption over the population rather than the causes of inequality. Therefore, it acts as sign post to where consumption is greatest and lowest which is also true for the within and between group inequality decomposition obtained from the index. Hence, it does not provide a casual factor effect as this considers a factor at a time which falls short of estimating the simultaneous effects of all possible factors contributing to consumption inequality.

4.3.2 Regression Based Decomposition of Inequality

Unlike the GE inequality index decomposition, the use of a regression based decomposition (RBD) processes have the advantage of determining simultaneously the contribution of each factor to total inequality through an econometric model. Hence, it is possible and easy to establish a casual effect of factors on inequality and simultaneously identify the contribution of each factor to total inequality using the RBD approaches. The process of the RBD approaches start by econometrically estimating a consumption function. The results from the econometric analysis are then used in specific formulas of each RBD approach adopted (Salardi, 2002). Although there are various RBD methods, this study adopts two methods, i.e. the Fields' (2003) approach as elaborated by Fiorio and Jenkins (2007), and the Blinder (1973)-Oaxaca (1973) decomposition approach.

4.3.2.1 Fields' Decomposition Technique

As stated, the decomposition approach involves an initial estimation of the consumption as a function of a number of contributing factors. It is generally written in the form:

$$Y_i = \beta_0 + \sum_{j=1}^{k} \beta_{ji} X_i + \mu_i \tag{5}$$

where Y_i is the logarithm of household consumption per adult equivalence (henceforth consumption) for each household i with $i = 1 \dots n$, and X_i are the consumption determining factors. As presented in equation (5), the consumption function is a semi-log function, but can also be estimated in a level form. β_0 is a constant and β_{ji} are the coefficients to be estimated using OLS. As usual, μ_i is the residual or the error term.

Before applying the OLS estimation, it is argued that the main variable of interest, the credit constrained status, is endogenous and, thus, suffers from sample selection bias as it is not randomly determined. Following similar argument by Khandker and Faruqee (2003), the study argues that households demand for credit and also their credit constrained status is determined by household and community characteristics which also affect the supply of credit giving rise to selection bias. Consequently, households make their own decision whether or not to apply for credit after considering their own economic situations influenced by their household characteristics and community factors. Some other households may decide not to borrow because they do not desire to take credit (credit unconstrained), while others may also not borrow because they do not have adequate or usable collateral, and in some instances, may fear that they will be denied credit (discouraged households). In the study of those who apply for credit some may be denied credit (credit constrained) or may be successful (credit unconstrained). The application outcomes are, however, determined by the lender through screening processes which most often are subjective, especially in rural areas due to information asymmetry. Hence, credit constrained statuses of households are not randomly determined causing the estimates of household consumption to be inconsistent if this is not taken into consideration.

The credit constrained statuses are also assumed to be heterogeneous following Feder et al. (1990) who argue that the credit constrained groups are not homogenous regarding their credit demand. It is also expected that unconstrained households would be comparatively more productive and, hence, with higher consumption than constrained households due to the advantage of having credit. As a result of this their slope coefficients may differ providing an argument for separate estimation equations for both credit statuses. To resolve the above issues, an endogenous switching model is therefore estimated which involves running separate estimations models for each credit constrained group. This is equivalent to running two separate Heckman selection models one for either status which was followed in this particular study. For this part of the estimation, the analysis follows a study by Freeman et al. (1998).

As the estimation involves a selection equation (credit constrained status) and an outcome equation, the selection equation is estimated first using a Probit Maximum

Likelihood Estimation method. The credit constrained status is a dummy variable written as a function of household and community characteristics:

$$C_i^* = \alpha_i + Z_i\gamma + u_i \tag{6}$$

$$C_i = \begin{cases} 0 \; if \; C_i^* \leq 0 \\ 1 \; if \; C_i^* > 0 \end{cases} \tag{7}$$

where C_i takes on the value 1 if the household is credit constrained and 0 if unconstrained; Z_i are the credit constrained determining factors, which include all variables in the consumption equation and some extra variables which act as instruments to satisfy the exclusion restriction or the identification condition of the model; and u_i is the error term with zero mean and a constant variance. The parameter γ is estimable up to a scale factor, i.e. an assumption of $var(u_i) = 1$ must be provided (Maddala, 1983).

The consumption functions for the two household types are written as follows:

$$\begin{aligned} Y_{ui} &= \beta_{u0} + \sum_{j=1}^{k} \beta_{ui} X_{ui} + \mu_{ui} \\ Y_{ci} &= \beta_{c0} + \sum_{j=1}^{k} \beta_{ci} X_{ci} + \mu_{ci} \end{aligned} \tag{8}$$

Parameters are as defined for equation (5) above, however, the subscript c represents constrained household and u is unconstrained household. Inferring from the earlier discussion on endogeneity and sample selection, estimating parameters β_{ci} and β_{ui} in equation (8) using OLS yields inconsistent results as the expectation of the error term conditional on the selection equation is nonsingular (Maddala, 1983). Further, the error terms μ_{ci}, μ_{ui} and u_i are assumed to be trivariate normally distributed having a zero mean and a non-zero covariance. Maximizing the likelihood function for this model is cumbersome as it involves a bivariate probit estimation hence Lee's (1976) simple two stage process is followed to estimate equations (7) and (8) (Maddala, 1983).

Following Lee's (1976) process the conditional expectations of the error terms of the equation (8) are written and estimated as:

$$E(\mu_{ui}|u_i \leq Z_i\gamma) = E(\sigma_{ui}u_i|u_i \leq Z_i\gamma) = \sigma_{ui}\frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)} = \sigma_{ui}\lambda_{ui} \quad (9)$$

and

$$E(\mu_{ci}|u_i \leq Z_i\gamma) = E(\sigma_{ci}u_i|u_i \leq Z_i\gamma) = \sigma_{ci}\frac{\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)} = \sigma_{ci}\lambda_{ci} \quad (10)$$

Where ϕ is the normal density function and Φ is the cumulative normal distribution function, subscripts are as already defined and, σ_{ui} and σ_{ci} are the variances for unconstrained and constrained household consumption functions. The ratios defined as $\lambda_{ui} = \frac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}$ and $\lambda_{ci} = \frac{\phi(Z_i\gamma)}{1-\Phi(Z_i\gamma)}$ are the inverse Mills ratio. These are included in equation (8) as an extra variable which is re-specified as;

$$\begin{aligned} Y_{ui} &= \beta_{u0} + \sum_{j=1}^{k}\beta_{ui}X_{ui} + \sigma_{ui}\lambda_{ui} + \varepsilon_{ui} \\ Y_{ci} &= \beta_{c0} + \sum_{j=1}^{k}\beta_{ci}X_{ci} + \sigma_{ci}\lambda_{ci} + \varepsilon_{ci} \end{aligned} \quad (11)$$

Where ε_{ui} and ε_{ci} are the new error terms which have zero conditional means (Maddala, 1983). This can now be estimated using OLS yielding consistent estimates of the parameters. A statistically significant lambda or inverse Mills ratio in the OLS regression of equation (11) indicates the presence of selection bias, otherwise the equations break down to a simple OLS model.

However, before the OLS estimation is done, following Forio and Jenkins (2007) the functions from equation (11) are re-written as:

$$\begin{aligned} Y_{ui} &= \beta_{u0} + \sum_{j=1}^{k}G_{ui} + \sigma_{ui}\lambda_{ui} + \mu_{ui} \\ Y_{ci} &= \beta_{c0} + \sum_{j=1}^{k}G_{ci} + \sigma_{ci}\lambda_{ci} + \mu_{ci} \end{aligned} \quad (12)$$

Where G_{ui} and G_{ci} are composite variables corresponding to the product of each regression coefficient, β_i, and its characteristic or factor, X_i. OLS estimation of the above equations yield the equations below which can then be decomposed;

$$Y_{ui} = \hat{\beta}_{u0} + \sum_{j=1}^{k}\hat{G}_{ui} + \sigma_{ui}\hat{\lambda}_{ui} + \hat{\mu}_{ui} \quad (13)$$

$$Y_{ci} = \hat{\beta}_{c0} + \sum_{j=1}^{k} \hat{G}_{ci} + \sigma_{ci}\hat{\lambda}_{ci} + \hat{\mu}_{ci}$$

These are estimated using OLS which is further used for the decomposition analysis. According to Krstic and Reilly the effect of each factor variable on consumption can be separated making it easier to measure the main determinants of inequality using the consumption function above (cited by Salardi, 2002, p. 14). Following closely Shorrocks' formula, where he proved a number of axioms resulting in a unique additive and exact decomposition rule (see Shorrocks, 2013), Fields (2003) estimated the determinants of inequality, thus, the contribution of each factor to inequality. Shorrocks' formula used to decompose income inequality can be expressed as:

$$S_j[\mathrm{Y}] = \frac{cov[\hat{\beta}_j, X_j, \mathrm{Y}]}{\sigma^2 \mathrm{Y}} = \frac{\hat{\beta}_j * \sigma(X_j) * cor(X_j, \mathrm{Y})}{\sigma \mathrm{Y}} \quad (14)$$

Where $S_j[\mathrm{Y}]$ is defined as the share of the jth factor to total inequality or as Field's terms as the relative factor inequality weight, $\hat{\beta}_j$ captures the estimated coefficients from the OLS regression in equation (13), $\sigma(X_j)$ is the standard deviation of the regressors and $\sigma[\mathrm{Y}]$ is the standard deviations of the dependent variable which is the estimated total inequality of the consumption. Also, $cor(X_j, \mathrm{Y})$ captures the correlation between the factors and the estimated consumption variable.

4.3.2.2 Blinder-Oaxaca Decomposition of Consumption

The Blinder-Oaxaca decomposition analysis attempts to decompose the mean gap of an outcome variable between, usually, two groups in a counterfactual argument which is based on linear regression models (Jann, 2008). This decomposition method is mostly applied in the field of labour economics and discrimination literature, but nonetheless can also be applied in other areas of economics. Analogously, this study follows a similar methodology used by Heitmueller (2006) and others in a Labour Economics related study. They do this by estimating an Endogenous Switching Model which estimates two separate equations for each group correcting for heterogeneity in the groups, as well as endogeneity and sample selection before applying the Blinder-Oaxaca decomposition.

Using the Blinder-Oaxaca decomposition methodology, the study attempts to determine how much of the difference in the mean outcome variables is explained by the group differences in the explanatory variables (Jann, 2008). For this study, a two-part decomposition method is adopted in which the inequality mean gap between the credit constrained and unconstrained group is decomposed into:

1) A part that is obtained from the differences between individual characteristics of the groups known as the endowment (explained) term, and

2) An unexplained or residual part that is estimated from the differences between the estimated coefficients of the groups.

The initial step is to formulate consumption equations for credit constrained and unconstrained households similar to that of equation (8). The estimations from equation (7) to equation (11) are adopted for the initial process of the Blinder-Oaxaca decomposition. Subsuming the constant term into the general slope coefficients and ignoring the summation sign, gives the following expression of equation (11):

$$\begin{aligned} Y_{ui} &= \beta_{ui} X_{ui} + \sigma_{ui}\lambda_{ui} + \varepsilon_{ui} \\ Y_{ci} &= \beta_{ci} X_{ci} + \sigma_{ci}\lambda_{ci} + \varepsilon_{ci} \end{aligned} \tag{15}$$

Estimating equation (11) yields consistent estimates used for further analysis. Thereafter, the mean consumption gap between the credit constrained households and the unconstrained households is estimated using the Blinder-Oaxaca decomposition method (Blinder, 1973 and Oaxaca, 1973). According to Neuman and Oaxaca (2004), correcting the selection bias yields a gap that can be divided into three parts and written as:

$$\bar{Y}_{ui} - \bar{Y}_{ci} = \hat{\beta}_{ui}(\bar{X}_{ui} - \bar{X}_{ci}) + \bar{X}_{ci}\left(\hat{\beta}_{ui} - \hat{\beta}_{ci}\right) + (\sigma_{ui}\lambda_{ui} - \sigma_{ci}\lambda_{ci}) \tag{16}$$

Where $\bar{Y}$ is the predicted mean log consumption, $\bar{X}$ is the mean vector of the observed consumption determining variables, $\hat{\beta}$ is a vector of the estimated returns to consumption determinants, and λ captures the estimated mean of the inverse Mills ratio. The first term is the Endowment or Explained term which captures the part attributable to the differences between the two groups stemming from the observed

characteristics, while the second term corresponds to the differences obtained from the estimated coefficients termed the unexplained term (or the discrimination term as popularly known in Labour Economics in the gender/racial wage gap analysis). It has not been very obvious as to how to treat the last term in the above equation (Nueman and Oaxaca, 2004) and it is common practice not to assign a particular interpretation to it. One way of treating this last term is subtracting it from the left-hand side of the equation leaving one with the familiar Oaxaca decomposition (Heitmueller, 2006).

4.4 Data

This study restricts the analysis to rural farm households in Malawi which accounts for 9,477 households making up approximately 75 percent of the total sample. However, due to missing information for some households, final data used covered 8,216 rural farm households.

4.4.1 Variables

There are several indicators of welfare when measuring poverty or inequality. These includes income, consumption, calories per person per day, food consumption as a proportion of total expenditure and nutritional status which is measured by stunting or wasting (Haughton and Khandker, 2009). This study uses the consumption.

There is growing support among economists for the use of consumption as a superior measure of economic welfare than income (Hassett and Mathur, 2012). Hassett and Mathur (2012) argue that, unlike income, individuals and households are able to smooth their consumption over their lifetime, which makes consumption a more useful indicator in inequality studies. Further, consumption remains relatively stable over the course of life as households engage in borrowing during period of low income and save in periods of high income. In similar arguments, the World Bank development report of 2000/2001 explains that consumption is a much-preferred measure of welfare to income as it is more reliable and also able to capture the long-run welfare levels (World Bank, 2001). In terms of measurement, Meyer and Sullivan (2003) show that poor households are much better in measuring their consumption than they do for income and therefore consumption is less likely to suffer from under-reporting.

According to the IHS3 report, calculating the consumption aggregate was guided by theoretical and practical considerations. The first consideration was that consumption must be very inclusive as much as possible per the available information and thus omitting certain component implies that it does not have any effect on household welfare. Further, both market and non-market transactions were included. Perishable goods like food were assumed to be all consumed while for other goods and services such as education, housing and durable goods had to be adjusted to capture their length of use. A reference period was chosen due to the frequency of purchases of some goods. For example, education had a 12-month reference period while food was the last 7 days. All components of the consumption aggregate were converted into annual figures and some consistency checks were performed to all the components so as to avoid including extreme figures. In general, the consumption aggregate was made up of four components which included; food, non-food, durable goods and housing. The consumption components were collected on the household level through face to face interviews. For this study, consumption per adult equivalent[11] was used instead of consumption per capita so as to capture the differences between individuals, such as age, gender, and the economies of scale in consumption within the household.

Variables included on the right hand side are presented in Table 4.1 and include age of the household head and age squared to capture the life cycle effect, a dummy variable for the gender of the household head, a categorical variable for household head's level of formal education, dependency ratio (the number of people age 0-14 and over 65 divided by the number of people between age 15 and 60 in the household) and household size, total farm area per adult equivalence cultivated during the rainy season, land tenure is a dummy variable indicating whether the land cultivated is securely owned (purchase with land title, inherited, etc.) or property rights over land are secure. Location of the household was also included in order to capture the geographical differences in Malawi. Other variables included the value of home assets per adult equivalence, the receipt of remittances, and a categorical variable for house dwelling type.

[11] The household consumption per adult equivalence was measured as the ratio of the total real annual consumption per household to the adult equivalent ratio. Both variables were provided in the data.

Table 4.1: Definition of Variables

Variable	Type	Definition
Credit constrained	Binary	1 = Credit constrained, 0 = Credit Unconstrained
Log consumption	Continuous	Log consumption per adult equivalence
Head age	Continuous	Age of head of households
Age squared	Continuous	Age squared of head of household
Education	Categorical	0 = No education, 1 = Primary, 2 = Secondary and 3 = Tertiary.
Male	Binary	1 = Male, 0 = Female
Illness	Binary	1 = Suffered Illness, 0 = otherwise
Household size	Continuous	Number of members within the household
Dependency ratio	Continuous	Ratio of the number of dependents age 0-14 and over 65 to those between 15 and 64 within the household
Location	Categorical	1 = Rural North, 2 = Rural Centre and 3 = Rural South
Remittances	Binary	1 = Receives remittances, 0 = otherwise
Network (agric.)	Binary	1 = Member of agriculture group, 0 = otherwise
Farm size	Continuous	Hectares of land cultivated per adult equivalence
Land secured	Binary	1 = Secured land ownership, 0 = otherwise
Log home assets	Continuous	Log home assets per adult equivalence
Log livestock	Continuous	Log livestock per adult equivalence
House type	Categorical	1 = Permanent structure, 2 = Semi-permanent structure and 3 = Traditional structure.
MFI Distance	Continuous	Distance to microfinance institution
FI number	Continuous	Count of Financial institutions in each district

4.4.2 Identification

Finding good instruments for an instrumental variable estimation is a herculean task. The principle is that the variable(s) chosen as instrument(s) should explain or be correlated with the selection variable but not with the error term in the outcome equation. Two variables were identified as instruments for this study. Factors that influence the supply or availability of credit are expected to influence directly the demand for credit but not the household consumption. Therefore, households' proximity to financial markets and the number of formal financial institutions within an area could largely affect the demand for credit. The first instrument used is the distance to the nearest microfinance institution in the community. Distance to financial institutions limits the ability of households to borrow or the likelihood to be successful in obtaining a loan. It was concluded in a study by Pedrosa and Do (2011) that very poor households are more likely to be left out of the credit markets as they reside farther from economic centres and are largely involved in economic activities that are not deemed to be creditworthy, such as farming in this case.

The second instrument used is the count of financial institutions within each district. It is postulated that the larger the number of financial institutions in a geographical

area, the greater the accessibility and availability of credit to households. This will eventually increase the demand for credit. These variables are not expected to affect the consumption of the household directly but possibly indirectly through household credit constraint status. The data for the number of financial institutions was obtained from the Financial Inclusion data base of the Microfinance Information Exchange (FINclusion Lab, 2014).

4.5 Results and discussions

4.5.1 Descriptive Statistics

Table 4.2 presents the summary statistics for each variable used in the analyses. There were 2,620 and 5,596 unconstrained and constrained households respectively. Majority of the variables are binary hence their means can be interpreted as percentages when multiplied by 100. A t-test for the continuous variables and a design based F-test for factor variables are also presented in column 4 of the table. These tests examine the differences that may exist between the credit constrained and unconstrained groups per factor. Though the number of observation is different from the previous chapter, the summary statistics are quite similar hence will not be in this chapter except for consumption.

The comparison of the mean of the of household consumption per adult equivalence between the two credit groups reveals a difference of 10,491.01 Malawian Kwacha in favour of unconstrained households. Further, the test that examines the difference between the credit unconstrained and constrained groups was statistically significant at a 1 percent level. This suggests that in rural Malawi there is a significant difference between the consumption of credit unconstrained and constrained households.

Table 4.2: Summary statistics and test of explanatory variables

Variables	Unconstrained	Constrained	Pooled	Test
Consumption	61,108.54	50617.53	53,966.31	6.81***
Head age	43.15587	42.95899	43.0218	0.44
Age square	2133.715	2120.697	2124.853	0.26
Education				
No education	0.7408	0.8372	0.8065	76.55***
Primary	0.1129	0.0795	0.0901	17.63***
Secondary	0.1301	0.0794	0.0955	41.74***
Tertiary	0.0162	0.0040	0.0079	27.52***
Male	0.7827	0.7403	0.7538	14.09***
Household size	4.7601	4.6454	4.6820	2.03**
Dependency	1.2009	1.2723	1.2495	-2.63***
Illness	0.0420	0.0300	0.0339	6.24**
Location				
Rural North	0.1514	0.1049	0.1198	19.97***
Rural Centre	0.5353	0.3707	0.4233	85.70***
Rural South	0.3133	0.5243	0.4570	155.93***
Remittances	0.1203	0.0946	0.1028	9.13***
Network (agric.)	0.0594	0.0647	0.0630	0.53
Farm size	0.2490	0.2110	0.2231	5.27***
Land secured	0.8496	0.8929	0.8791	23.09***
Home asset	6951.086	3109.332	4274.366	5.14***
Livestock	10,235.1	5240.387	6834.721	3.20***
House type				
Permanent	0.3000	0.1793	0.2178	99.37***
Semi-Permanent	0.2428	0.2496	0.2474	0.28
Traditional	0.4572	0.5711	0.5347	56.04***
MFI Distance	29.7765	32.0641	31.3339	-2.29**
FI number	28.4847	21.2987	23.5925	7.19***
Observation	2,620	5,596	8,216	

Note: *** 1%, ** 5% and * 10 %. a: t-test for continuous variables and a design-based F test for binary variables.

4.5.2 Empirical Results

4.5.2.1 Index Decomposition of Credit Constraint

Table 4.3 presents the results from the GE index considering the three commonest weights, $(\alpha = 0,1,2)$, given to distances between the consumption at different parts of the consumption distribution. Thus, GE(0) is highly sensitive to changes in the lower tail of the distribution, GE(1) equal weights and GE(2) is more sensitivity to changes in the upper tail of the distribution. The figures in the rural households' column in the table show that there is increasing consumption inequality from the lower part of the tail (0.20) to the upper part of the tail (0.28). This is more pronounced in the urban areas increasing from 0.34 to 0.71 being greater than that of the general population across all weights. This clearly shows that a change in consumption in the upper tail would have a greater increase in total inequality, thus

widen the inequality gap more, than a change in consumption in the lower tail. This is identified to be greater in the urban regions than the rural regions. The general indication from the data suggests that consumption inequality, in the rural areas compared to the urban areas of Malawi, was quite low in the period 2009-2010 as presented in Table 4.3 below. This is consistent with findings from Mussa (2013) in his study of spatial comparison of poverty and inequality in Malawi. This can be attributed to the low level of income and/or consumption across the rural areas of Malawi. According to the IHS3 report, 56.6 percent of rural households are poor[12] with almost 95 percent of the total population of the poor residing in rural Malawi. Due to this, it is not expected to see a wide gap in consumption among rural households. However, the expectation is that credit unconstrained households will have some (marginal) advantage over the credit constrained households due to the extra resources gained by credit. Additionally, there might be a greater level of inequality within unconstrained households due to the varying level of credit obtained.

Table 4.3: Summary Statistics of Inequality Indexes

Inequality	Rural	Urban	Population
GE(0)	0.2053	0.3459	0.2424
	(0.0051)	(0.0000)	(0.0088)
GE(1)	0.2136	0.3825	0.2717
	(0.0063)	(0.0631)	(0.0170)
GE(2)	0.2845	0.7120	0.4794
	(0.0132)	(0.2454)	(0.0963)
No. of observations [a]	9,477	924	10,401

Note: Standard Errors in Parenthesis. a. This table used the actual number of farm households within the data without deleting missing observations of other variables.
Source: Author's own calculation from IHS3.

This is confirmed by the decomposition of consumption into the credit constrained statuses. As seen in Table 4.4, the first two rows show that there is higher consumption inequality for unconstrained households than constrained households in rural Malawi. Further, observation from the decomposition of consumption inequality into within and between credit constrained groups shows that there is higher within-group inequality than between-group inequality for all weights of decomposition. This shows that there is greater level of heterogeneity within the groups than between groups. That is, there is greater consumption disparity within

[12] According to the IHS3 report, any population with total consumption below 37,002 MWK was classified as poor (NSO, 2012).

the credit statuses than between them. This could also support the argument of a low consumption disparity among rural households even comparing between credit statuses. Hence, for formulating effective policy implications, after the difference between the credit statuses have been considered, each group also has to be studied individually and policies should be drawn on the basis of factors that cause the disparity within each sub-group. Addressing the consumption inequality both within and between the groups would increase the efficacy of any policy to bridge the consumption inequality gap caused by credit. However, as this type of decomposition does not give information on casual effects, the results obtained may not be a perfect guide for policy making (O'Dennell et al., 2008). Thus, results from the GE index are indications of where inequality is more considering a single factor such as credit status as shown in Table 4.4 but does not indicate the possible factors that contribute to the inequality that exist within and between the credit statuses. This necessitates a decomposable regression analysis that considers several causal factors simultaneously, which is incorporated in both decomposition methods used further in this study.

Table 4.4: Decomposition of inequality by credit constrained sub-group in rural Malawi

	GE(0)		GE(1)		GE(2)	
Credit	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Unconstrained	0.2323	0.0092	0.2405	0.0112	0.3325	0.0240
Constrained	0.1849	0.0047	0.1912	0.0056	0.2345	0.0086
Within	0.1939	0.0051	0.2011	0.0063	0.2685	0.0132
Between	0.0030	0.0000	0.0030	0.0000	0.0031	0.0000

Source: Author's own calculation from IHS3.

4.5.2.2 Determinants of Household Credit Constraint and Consumption

Table 4.5 presents the results from the Probit Maximum Likelihood Estimation (column 1) which examines the determinants of the household credit constrained status and the OLS estimations (columns 2, 3 and 4) which examines the determines the causes of consumption. The results from the OLS regression are used as the bases for the decomposition process as explained in the methodology. The F-test of the probit model shows the overall significance of the model is statistically significant at 1 percent level.

Table 4.5: Determinants of Household Credit Constrained and Consumption

	(1)	(2)	(3)	(4)
	Probit		Consumption (OLS)	
Variables	Selection	Unconstrained	Constrained	Pooled
Head age	0.00987	-0.0226***	-0.00685**	-0.0110***
	(0.00656)	(0.00508)	(0.00314)	(0.00265)
Age squared	-9.18e-05	0.000170***	1.72e-05	5.73e-05**
	(6.47e-05)	(5.10e-05)	(3.07e-05)	(2.64e-05)
Primary	-0.175***	0.298***	0.0526	0.142***
	(0.0583)	(0.0474)	(0.0336)	(0.0243)
Secondary	-0.207***	0.361***	0.182***	0.250***
	(0.0587)	(0.0476)	(0.0391)	(0.0237)
Tertiary	-0.562***	0.929***	0.232	0.583***
	(0.187)	(0.131)	(0.191)	(0.109)
Male	0.00809	-0.0635*	-0.00416	-0.0228
	(0.0441)	(0.0356)	(0.0200)	(0.0187)
Household size	-0.00349	-0.0985***	-0.112***	-0.107***
	(0.0102)	(0.00817)	(0.00543)	(0.00473)
Dependency	0.00988	-0.0494***	-0.0265***	-0.0324***
	(0.0217)	(0.0146)	(0.00846)	(0.00752)
Illness	0.204**	-0.198***	-0.0224	-0.0889***
	(0.0898)	(0.0663)	(0.0448)	(0.0341)
Rural North	-0.452***	0.0739	-0.110*	-0.0641**
	(0.0740)	(0.0859)	(0.0574)	(0.0319)
Rural Centre	-0.473***	0.429***	0.121**	0.201***
	(0.0524)	(0.0890)	(0.0566)	(0.0270)
Farm size	-0.0579**	0.0939***	0.0602***	0.0734***
	(0.0263)	(0.0203)	(0.0133)	(0.0108)
Land tenure	0.0994*	-0.131***	-0.0323	-0.0702***
	(0.0533)	(0.0437)	(0.0320)	(0.0255)
Permanent	-0.346***	0.451***	0.197***	0.275***
	(0.0501)	(0.0578)	(0.0456)	(0.0208)
Semi-permanent	-0.0754*	0.0642*	0.0689***	0.0586***
	(0.0448)	(0.0369)	(0.0196)	(0.0179)
Network (agric.)	0.110	0.0177	0.135***	0.102***
	(0.0775)	(0.0445)	(0.0327)	(0.0251)
Remittances	-0.0961	0.208***	0.0135	0.0833***
	(0.0646)	(0.0471)	(0.0329)	(0.0263)
Home asset	-0.0264***	0.0747***	0.0446***	0.0530***
	(0.00635)	(0.00708)	(0.00364)	(0.00312)
Livestock	-0.0136***	0.0296***	0.0153***	0.0207***
	(0.00509)	(0.00413)	(0.00278)	(0.00211)
MFI Distance	0.00280***			
	(0.000824)			
FI number	-0.00367***			
	(0.00105)			
Lambda		-0.730***	0.453**	0.00550
		(0.212)	(0.213)	(0.0103)
Constant	0.279	10.74***	10.99***	11.36***
	(0.250)	(0.282)	(0.184)	(0.101)
Observations	8,216	2,620	5,596	8,216
R-squared		0.427	0.398	0.405
F(21, 603)	405.28***	64.70***	137.23***	182.50***
Prob. > F	0.0000	0.0000	0.0000	0.0000
Chow Test		50.34***	0.0000	

Note: Robust standard errors in parentheses; P-values significance: *** p<0.01, ** p<0.05, * p<0.1

The OLS results, which are the second stage estimations in columns 2, 3 and 4 of Table 4.5, show that the explanatory variables in the unconstrained model explain 43 percent of the variation in consumption, while the explanatory variables in the constrained model explain 40 percent of the variation in the model. Inferring from the F-statistics, the null hypothesis that all the estimated parameters are equal to zero, is rejected at 1 percent level for all three results. Hence, at least one of the explanatory variables is different from zero, as observed in the table. Judging from the results of a Chow test, the null hypothesis that the coefficients in the estimated models were similar in the constrained and unconstrained group was also found to be statistically significant at 1 percent level therefore we reject the null in favour of the alternative hypothesis that they differed between the two credit statuses. The two instruments (MFI distance and FI number) were not included in these equations in order to make the equations identified. From the estimated results, it could be noticed that the Inverse Mills Ratio (lambda) is statistically significant in all models. This suggests the presence of selection bias in the data which could have led to biased and inconsistent results had it not been accounted for.

Across all estimation models, the age of the household head had a significant effect on the welfare of the household. Households with older heads had lower consumption than younger heads *ceteris paribus*. Male-headed households compared to the female headed households had about 8 percent higher consumption within constrained households but gender had no effect on the welfare within unconstrained households. It has been documented that women in developing countries are at a disadvantage due to their level of poverty and have less access to financial services which can be attributed to their limited social and economic mobility (Khandker, 1998). This therefore raises another problem of gender inequality within Malawi as alluded to by the Gender, Equity and Rural Employment Division of the Food and Agricultural Organisation (FAO, 2011). According to the FAO report, a contribution to this problem may be from the fact that women own fewer resources than their male counterparts with an example that women own only 32 percent of farm lands and over half of them own less than half a hectare of land. In another study, also in Malawi, it was found that although women smallholders owned lesser land, their labour supply was 10 percent less than that of the males (Takane, 2008) with majority also requiring the help of male labour for ploughing (Gilbert et al., 2002).

These and many other constraints inhibit women from accessing external resources like credit. This calls for increase in the economic empowerment of women within Malawi to bridge the welfare gap between men and women. For example, credit programs targeting women, such as Concern Universal Microfinance Operations which specially targets rural poor women in Malawi, could be established to provide capital to women to engage in off-farm economic activities. Further, non-farm training programmes could be established for women with no or little non-farm skills so as to empower these women economically. These activities unlike farming can be engaged in throughout the year without only have to rely on farming which is very seasonal.

Human capital plays a crucial role in increasing the welfare of households. As noticed from the results, education increases the households' consumption in credit unconstrained households with only secondary level of education being significant in the constrained households. More evidence is the fact that the higher the level of education, the higher the consumption of the household in the unconstrained and even in the constrained households though not all of the levels of education are significant. The impact on unconstrained households ranges between 30 to 93 percent and 5 to 23 percent for the constrained households. This result supports the argument that investment in education reduces over time in households with limited resources and therefore exacerbates poverty (Kumar et al., 2013) as returns to education are expected to be lower due to lack of investment in constrained households. The positive effect of education on welfare is also corroborated in a study in Malawi by Matita and Chirwa (2009) who found that education increases the welfare of households. Another human capital variable is health, captured in this study as illness. It is found that if an unconstrained household member suffered any ailment during the period of the survey resulted in a fall in their welfare by about 16 percent. However, this was inconclusive for constrained households as it was insignificant. As poor health, which could be an unforeseen shock, could cause farm households to divert production credit to a consumption purpose such as solving an immediate problem of treating the illness, it is therefore highly probable this could reduce the welfare of the household in the short-run. The diversion of production credit to other uses has been captured in the credit literature (Oboh and Ekpebu, 2011).

The results further suggest that increases in the size of the household and the number of dependants were contributing factors to the reduction in household welfare; the coefficients are significant and negative for all credit groups. It is expected that households with larger sizes have more members to feed. This put a strain on the household's budget which in general is relatively small. The finding corroborates other studies. Lanjouw and Ravallion (1995) report a strong negative relationship between household size and consumption. Matita and Chirwa (2009) find a similar result for households in rural Malawi. It is recommended that the ministry of health in Malawi should initiate family planning and birth control campaigns in remote areas of the country so as influence especially young members in the rural communities to have lesser children. This will help families or households to have extra resources to provide the household a better quality of life as lesser family size increases household resource per person thereby increasing their standard of living hence bridging the inequality gap. Rapid population growth has been identified as an important development challenge in Malawi and curbing this through family planning would enhance the general wellbeing of the households (USAID, 2016).

Location is an interesting factor as results on location could also explain the spatial development differences that exist within the rural country-sides. The nearer an area is to a developed location, e.g. a capital city, the better the welfare of households is expected to be. This is what was found for both credit statuses. Location in rural centre of Malawi, which is the closest to the capital, increased consumption by about 43 percent for unconstrained households and 12 percent for constrained households as compared to the rural south. While rural north compared to the south had no impact on unconstrained households, it reduced the consumption of constrained households by about 11 percent. Government development policies should see to redistribution of wealth across the Malawi. Economic development programmes like the Malawi Growth and Development Strategies should give more consideration to the north and the south of the country so as to have these areas developed just like the centre of the country.

It was also discovered that a percentage increase in land size cultivated during the rainy season was estimated to increase the households' consumption by 0.09 percent for unconstrained households and 0.06 percent for constrained households. As land is the major asset of these rural households, a positive relationship between the land

area cultivated and the consumption is identified to be very important for improving welfare; this outcome is also observed by Mukherjee and Benson (2003). A striking result in the study however is that households with secured landholdings, acquired through purchase or inheritance, had a fall in their consumption by 13 percent for unconstrained households, but had no impact on constrained households although having a negative relationship.

Among constrained households, those living in permanent and semi-permanent structures were found to have a better welfare compared to those living in traditional houses. Those in permanent house structure had about between 39 percent (unconstrained households) and 13 percent (constrained households) higher consumption than those in a semi-permanent structure. Households that were part of an agricultural group were estimated to observe an increase in their welfare in both households. For constrained households, this could be argued that, as they do not have credit they instead exchange information, knowledge and also receive support on their farms as a substitute to credit which enables them to have an increase in welfare. Further, only unconstrained households benefitted from remittances which were estimated to increase their welfare by about 21 percent.

The value of home assets per adult equivalence of households was also a significant contributor to the consumption of households. This is estimated to increase by 0.07 percent and 0.04 percent in unconstrained and constrained households respectively due to a percentage increase in the value of household assets. This was also true for value of livestock owned with unconstrained households having a higher increase in consumption than constrained households. The positive effect of the value of assets on welfare is also found by Matita and Chirwa (2009) for all rural households in general which is also found for our pooled estimate. Therefore, as assets could be deemed as a proxy for wealth of the household, households with more assets including livestock are able to increase their general welfare.

4.5.2.3 Field's Regression-Based Inequality Decomposition

The above OLS estimates do not provide information about the share of each factor in explaining the inequality in consumption. To be able to estimate the factor share, the transformed or estimated variables from the OLS estimation are fed into Fields' formula (equation (14)) presented in the methodology section which can then be

decomposed. This helps to answer the important question of "how much of inequality in consumption per adult equivalence can be accounted for by the various characteristics included in the model?" Thus, this decomposition technique helps to estimate the contribution of each factor to the consumption. The decomposition technique is employed for each credit constrained status separately, which would be termed as a within-group decomposition. In doing this, the factors that contribute to consumption inequality within the credit groups are identified simultaneously. This is of much importance because of the larger within credit status inequality that was noticed from the GE index decomposition. Therefore, a detailed analysis of this finding using a regression based decomposition analysis is very useful for understanding which variables contribute more to the within-group inequality which is deemed important for policy purpose. The results from Field's decomposition are presented in Table 4.6.

Table 4.6: Field's Regression Based Decomposition of Total Inequality

Factors	Unconstrained	Constrained	Pooled
Head age	10.4185	5.6615	7.5436
Age square	-6.2110	-0.1411	-3.1380
Primary Education	3.9756	0.5344	1.6949
Secondary Education	8.3230	3.7499	5.6010
Tertiary Education	7.2812	0.4486	2.5545
Male	-0.5589	-0.0291	-0.1924
Household size	20.6187	35.8573	29.5855
Dependency	3.5807	2.7073	2.9853
Illness	0.3777	0.0292	0.1554
Rural North	-0.6210	0.2553	0.2409
Rural Centre	6.3137	3.4507	5.2951
Farm size	7.6826	5.7582	6.8081
Land secured	2.3086	0.2741	0.8913
Permanent	20.0527	5.7211	10.1695
Semi-Permanent	-0.8266	0.2773	-0.1449
Network (agric.)	0.1003	0.7107	0.5400
Remittance	1.6780	0.0502	0.4849
Home asset	31.0140	18.6125	22.8393
Livestock	8.2099	4.2618	6.0763
Lambda	-23.7147	12.810	0.0099
Total	100	100	100
N	2,620	5596	8216

Source: Author's own calculation from the Third Integrated Household Survey of Malawi

As these are factor shares, the coefficients in the table should be interpreted as the contribution of each factor to total consumption inequality. The signs of the factor shares give an indication of the direction of contribution. Thus, factors with positive

coefficients contribute to an increase in the total consumption inequality, that is have a dis-equalizing effect or widening the inequality gap, while negative coefficients imply a contribution to the fall in total consumption inequality, hence an equalizing effect or reducing the inequality gap.

The first observation is that the factors included in the analysis account for about 40 and 43 percent of household consumption for credit constrained and unconstrained households respectively. This is in reference to their respective R-squares in the OLS regression models in Table 4.5. These R-squares are consistent with other studies using similar methodological approach who also found relatively small percentages in their studies (see Fields, 2003; Cain et al., 2010; Manna and Regoli, 2012; Pandey, 2013). Further, Matita and Chirwa (2009) using consumption found the R-square in their study on rural-urban welfare inequalities to be 41 percent for the rural household consumption equation which is very close to the R-squares found in this study. Finally, given that this is a cross-sectional data study, the low R-squared is common and does not imply that the OLS regression is not informative (Wooldridge, 2013).

The second observation is that the highest contributing factor to total consumption inequality in the credit unconstrained households is the value of home assets per adult equivalence (30%) followed by the size of the household (21%). This is true for the constrained households as well, however, with household size carrying the greater share of 36 percent followed by the value of home assets contributing 19 percent. As already observed, a large household size puts a lot of strain on the limited resources of already poor households. It is also generally known that larger households are typically poorer (Lanjouw and Ravallion, 1995). Hence, it is not surprising that it is an increasing factor of inequality. As similarly recommended above, to reduce this effect, the ministry of health in Malawi should be tasked to increase family planning campaigns and services to especially the rural areas of Malawi. This in one way may reduce future fertility rates and consequently population growth rates and also reduce the pressure on the limited resources owned by these poor households. This increase in resources could enable poorer households to obtain some home assets which could bridge the inequality gap. Further, the government should create an enabling environment to attract formal institutions and development in the rural areas. This could create employment for poorer households,

increasing their wealth hence assets and also reducing household size as being less poor is positively correlated with small household size.

The educational levels of the household head (added together) contribute almost 20 percent to overall consumption inequality for unconstrained households and about 5 percent for constrained households. This is clearly seen as majority of households in the rural areas have no level of formal education therefore, the few who have some formal education would be in a better position to understand credit application procedures to access formal credit and also access formal jobs over the majority. Hence, the government through its education ministry should be tasked to increase access to education to rural areas through the provision of educational facilities and educational resources to increase child education. Further, adult education programmes should also be established to provide formal education including financial literacy programmes to older members of rural areas. This will increase the literacy rate of the rural areas of Malawi and potentially help them obtain non-farm jobs implying some diversity of their source of livelihood. Also, these poor households are more likely to understand formal credit application processes which could increase access to credit. This would further enable more households to obtain assets, due to increase in real income, to bridge the gap in consumption inequality.

Regarding the house type, the inequality share of permanent house structures for unconstrained households also contributes about 20 percent of overall consumption inequality which is more than thrice the factor share in the constrained sub-sample. Dwelling structures also give a signal of the level of poverty of households. Permanent structures are made of modern building materials which can only be afforded by relatively non-poor households. Hence, improving rural development including provision of credit by the government and its development partners in the rural areas would increase the economic strength of these households which could translate into more poorer households being able to afford modern building materials.

However, age squared, which is a proxy for experience, reduced overall consumption inequality by about 6 and 0.1 percent for credit unconstrained and constrained households respectively. Marginally reducing total inequality in the unconstrained

sample were also male headed households (0.56%), residing in rural north of Malawi (0.62%) and living in a semi-permanent structure (0.83%).

Lambda, or the inverse Mills-ratio, was used as a proxy for households' credit status in each model. Therefore, an unconstrained household contributed to a decrease in overall consumption inequality by about 24 percent. However, a credit constrained household contributed to an increase in overall inequality by about 13 percent. This implies that there is greater benefit for being a credit unconstrained household over constrained households as this has the potential of reducing consumption inequality. Therefore, there is need for an increase in the credit access of rural households. The already established formal financial institutions should be encouraged to increase their outreach to rural households. However, the onus lies on the government to provide the enabling environment for these formal institutions to establish in these areas. As discouraged borrowers were identified to be more in the constrained group, factors such as collateral and high interest rate that discourages them from borrowing should be addressed. For example, group borrowing should be introduced which acts as a good deterrent for loan defaults as this is the main reason formal financial institutions avoid poor households or risky borrowers. In line with the group borrowing, individuals forming village savings and loans associations in the community as already explained in the thesis could be useful to obtaining credit through a collective effort.

While majority of the factors were statistically significant in determining the levels of consumption or welfare, their importance in total consumption inequality differed substantially as observed in Table 4.6. According to Fields (2003), this relative importance would have been hard to appreciate from a standard regression analysis. Further, this helps to identify the causes of the within inequality that was observed in the within credit status using the GE inequality index. These results therefore have identified factors such as household size, home assets, education and permanent dwelling structure which were factors contributing to the increase in consumption inequality. These factors should therefore be given high consideration on the policy agenda which when targeted could see a decrease in consumption inequality.

4.5.2.4 Blinder-Oaxaca Decomposition

Results from the Blinder-Oaxaca decomposition are presented in Table 4.7. These are results from the decomposition of the welfare gap between the credit unconstrained and constrained households. Predicted means of log consumption for the credit unconstrained households is 10.78 and 10.63 for the constrained households. These are natural logarithms, transforming these into the original scale of measurement shows that the (geometric) means are 45,860.18 MWK for unconstrained households and 41,479.93 MWK for constrained households. The estimated gap between the means is approximately 15.4 percent. The estimated mean gap between unconstrained and constrained households implies that unconstrained households have some advantage in consumption over constrained households due to their credit status. This finding contradicts that found by Diagne and Zeller (2001) whose study on the impact of the access to credit on welfare in Malawi concluded that households were left worse-off when they borrowed. However, as their conclusion was based on statistically insignificant results; the finding in this current study is argued to be more reliable. To corroborate this is the study by Matita and Chirwa (2009) in Malawi who found that, access to credit in rural part of Malawi contributed to a 9.38 percent higher welfare for borrowers. This is a little lower than what is found in this study. Hence, improvement in households' access to credit is an effective tool in improving household welfare by providing households with resources for production and consumption smoothing.

Though the between group inequality found using the GE inequality index was small, using a regression based approach reveals some significant level of difference between the credit constrained and unconstrained status on consumption inequality. Hence, this gap cannot be ignored in light of this finding. To make this more relevant policy-wise, the gap needs to be further discussed to understand what factors cause this gap.

Table 4.7: Blinder-Oaxaca decomposition

Log Consumption	Coefficient	Exp.(b)
Prediction (Unconstrained)	10.78***	47,860.18***
	(0.0149)	(711.0908)
Prediction (Constrained)	10.63***	41,479.93***
	(0.00907)	(376.4144)
Difference (gap)	0.143***	1.1538***
	(0.0174)	(0.02009)
Decomposition		
Explained	0.146***	1.1567***
	(0.0170)	(0.01969)
Unexplained	-0.00253	0.9974709
	(0.00320)	(0.00319)
Observations	8,216	8,216

Note: *** p<0.01, ** p<0.05, * p<0.1

The welfare gap between the two groups is decomposed into an explained and unexplained component. As mentioned previously, the explained component is attributed to the characteristics or endowment of the households, while the unexplained component is attributed to the unobserved characteristics and also possibly to discrimination in the credit market of rural Malawi. Doing this decomposition helps to identify the major cause of the gap between credit constrained and unconstrained households. The results indicate that the explained component is the only statistically significant component of the two. The result suggests that adjusting constrained households' endowments levels to that of unconstrained households would increase the consumption or welfare of constrained households by about 15.7 percent. The results further show that there remains a negligible and insignificant component of the gap which is left unexplained. Hence, the differences in the observed characteristics of the households are more relevant than the differences in the unexplained component when determining the welfare differentials between constrained and unconstrained households.

Table 4.8 presents the factors that contribute to the explained component of the gap and also the unexplained component. The coefficients from the explained components reveal that value of home assets and livestock, education, location in the rural centre of the country, permanent structure and farm size are the major characteristics contributing to the welfare gap. Matita and Chirwa (2009) found assets to be one of the largest contributors to the welfare gap in their study. Thus, the possession of factors such as home assets and livestock by some households increases their wealth which makes them better off than those without them hence

widening the inequality gap. Therefore, enabling most household to obtain such assets could bridge the inequality gap. It is recommended that increasing the access to credit and improvement in the development structures of the rural areas be a top priority on the government rural development agenda. This would enable high productivity on the farm as households are able to access productive farm tools and diversify their source of income. This may increase the wealth of most poor households enabling them to increase their home assets and livestock among others.

Table 4.8: Detailed Results of the Explained and Unexplained Component of the welfare gap

	(1)	(2)
VARIABLES	Explained	Unexplained
Head age	-0.00218	-0.680***
	(0.00435)	(0.241)
Age squared	0.000746	0.325***
	(0.00228)	(0.118)
Primary	0.00475***	0.0247***
	(0.00125)	(0.00520)
Secondary	0.0127***	0.0198***
	(0.00220)	(0.00593)
Teritary	0.00713***	0.00700***
	(0.00193)	(0.00210)
Male	-0.000967	-0.0457
	(0.000745)	(0.0298)
Household size	-0.0123**	0.0642
	(0.00552)	(0.0439)
Dependency	0.00231***	-0.0279
	(0.000889)	(0.0198)
Married	0.00106*	-0.345**
	(0.000564)	(0.142)
Illness	-0.00298***	0.0257**
	(0.00105)	(0.0102)
Rural North	0.0331***	0.152***
	(0.00337)	(0.0377)
Rural Centre	0.0106***	-0.0598
	(0.00197)	(0.0381)
Farm size	0.00304***	-0.0855**
	(0.00110)	(0.0414)
Land secured	0.0332***	0.0667***
	(0.00360)	(0.0159)
Permanent	-0.000400	-0.00119
	(0.000607)	(0.00913)
Semi-Permanent	-0.000545	-0.00713**
	(0.000591)	(0.00326)
Network (agric.)	0.00214**	0.0216***
	(0.000856)	(0.00561)
Remittance	0.0444***	0.187***
	(0.00438)	(0.0424)
Home assets	0.0182***	0.0632***
	(0.00256)	(0.0180)

Livestock	-0.00838	0.545***
	(0.0132)	(0.175)
Lambda	-0.00218	-0.680***
	(0.00435)	(0.241)
Total	0.146***	-0.00253
	(0.0170)	(0.00320)
Constant		-0.252
		(0.266)
Observations	8,216	8,216

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

4.6 Conclusion

The study aimed at determining the factors that affect consumption inequality in rural Malawi with a major focus on the credit constrained statuses of farm households. Three main objectives were examined, these included: (1) investigating whether inequality was greater between or within credit constrained or unconstrained groups. This provides a summary of the distribution of consumption inequality by credit status using the GE index which matters for an initial examination of inequality before any detailed analysis is performed; however, to understand the causes of the consumption inequality beyond the summary results which only considers the credit status, objective (2) simultaneously determined the effect and contributions of possible factors to total consumption inequality within each credit constrained group; and objective (3) decomposed the consumption inequality gap between the credit constrained statuses into an explained or endowment component and a residual or unexplained component. Fields' (2003) regression based decomposition method was used for the second objective and the Blinder-Oaxaca decomposition analysis was adopted for the third objective. The study used data from the Third Integrated Household Survey of Malawi concentrating on only rural farm households.

One of the major findings of the study was that, after decomposing the GE index, consumption inequality was found to be greater within credit constrained and unconstrained households than between them. Thus, the inequality that exists in rural Malawi, considering the credit statuses of households, was mostly as a result of inequality within the credit groups. This implies that any policy that wants to target inequality should also focus on factors that affect inequality within the credit statuses. To identify these factors, further analysis using Fields' RBD approach was adopted. Results from using the GE index are considered to be descriptive giving an

indication of the distribution of inequality and where inequality is greater using a factor at a time. However, the RBD approach delved deeper to estimate the actual causes and contributors to increasing or decreasing within-group inequality.

Some socio-demographic and economic factors were identified to influence the consumption of constrained and unconstrained households. The majority of the factors including educational level of the head of households, household size, dependency ratio, marital status, farm size, home asset among others were influential in explaining the welfare in both credit constrained and unconstrained households. However, male headed households only contributed to an increase in welfare in constrained households, including factors like semi-permanent residence and households' participation in agricultural groups. Being in the north of rural Malawi reduced the welfare of constrained households only. For unconstrained households, only remittances played an important role in improving welfare while a member of the household reporting ill reduced household welfare.

Results from Fields' decomposition show that household size and value of home assets were the two major contributors to inequality within both credit constrained and unconstrained households. This was found not surprising especially that of the household size as a larger household is mostly associated with poorer households. A large household reduces the wealth or resource per person within the household increasing the pressure on the limited resources of the household hence pushing them further into the poverty trap. On assets, very few households possess these durable home assets hence widening the consumption gap. It is recommended that the government through the ministry of health should intensify family planning and birth control programmes to reduce the fertility rate and consequently population growth rate of rural areas which could increase the wealth per person within the household. This is because there will be lesser individuals within the household to share the limited resource of the household. Further, government should enhance the economic development of the rural areas through the provision of credit and also creating the enabling environment for the thriving of both farm and non-farm economic activities especially in the formal sector. This would increase the wealth of household translating to increase in home assets.

Also, the education level variables together had a 20 percent contribution to increasing inequality in unconstrained households and a 5 percent in constrained households. Providing educational facilities and resources are recommended to increase the level of education in rural areas and that could empower rural households to find non-farm jobs and also understand credit application procedures increasing the access to credit which has been deemed to be an essential tool for rural economic development. This may therefore reduce the level of discouraged borrowers as through education more households may be willing to participate in the credit market or lenders willing to provide credit to more educated households instead. Also, education increases likelihood of obtaining off-farm jobs that increases real income and assets and would enable households to have collateral assets for obtaining credit. Further, experience, captured by age square of the household head reduced inequality by 6 percent for unconstrained households but only 0.14 percent for constrained households. This implies that the experience of household heads cannot be overlooked when considering reducing the inequality of households in rural Malawi. These experiences may be from farming or other non-farm activities.

The study also identified that welfare inequalities existed between the credit constrained and unconstrained households. There was as much as 15.4 percent consumption inequality gap between unconstrained and constrained households using the Oaxaca-Blinder decomposition analysis. Majority of this gap came from the endowment component of the gap. These endowments included home assets and livestock. Thus, the possession of these endowments widened the inequality gap between credit constrained and unconstrained groups. These endowments may enable households to be able to access credit as they could be used as collateral for applying for credit. Hence, creating an enabling environment for poor households to engage in productive economic activities could increase their purchase of home assets and livestock hence bridging the gap in consumption inequality. From the results, it is possible to conclude that if the levels of endowment of constrained households were adjusted to the level of unconstrained households, the welfare of constrained households would increase by as much as 15.7 percent. Thus, endowments of constrained households could be increased through the provision of credit. Where farm households are able to access credit, access to farm inputs may increase leading to higher productivity and income. Hence, they would be through

accessing credit increase the welfare of the households, increase their assets, raise the level of education, nutrition and health within the household.

The findings from this study as seen hold some important policy implications for targeting inequality within rural Malawi. In brief, firstly, while it is recommended that policies should focus on both inequality within and between credit constrained groups, factors such as access to assets and education and household size should be targeted first if a major impact is to be made on reducing inequality. Secondly, credit market interventions by government and other agencies (NGOs) should be improved to increase rural farm households' access to credit as it has been estimated that being credit unconstrained reduces total consumption inequality. This may further help more households to acquire assets so as to reduce the disparity that exists as a result of assets. However, results and recommendations drawn from this study should be taken with caution. This is because of the problem of invalidity of the instruments used in the analysis. The instruments were correlated with the outcome variable after testing for validity of results and therefore invalid hence a problem of endogeneity might exist.

APPENDIX C

Table C1: Correlation coefficient matrix

Variables	1	2	3	4	5	6	7	8	9	10
1. Constrain	1									
2. Consumption	-0.110***	1								
3. Head age	-0.0105	-0.0963***	1							
4. Age squared	-0.00815	-0.0752***	0.983***	1						
5. Education	-0.112***	0.271***	-0.180***	-0.180***	1					
6. Male	-0.0443***	0.0544***	-0.203***	-0.212***	0.176***	1				
7. Household size	-0.0254*	-0.334***	-0.0244*	-0.0958***	0.0261*	0.223***	1			
8. Dependency	0.0253*	-0.250***	0.111***	0.121***	-0.104***	-0.199***	0.329***	1		
9. Illness	0.0289**	-0.0256*	-0.00995	-0.0137	0.0133	0.0410***	0.0142	-0.00181	1	
10. Location	0.185***	-0.0729***	-0.0155	-0.00539	-0.105***	-0.0666***	-0.0942***	0.0215	0.0397***	1
11. Farm size	-0.0688***	0.300***	0.139***	0.150***	0.00622	-0.0110	-0.343***	-0.185***	-0.00453	-0.0595***
12. Land secured	0.0683***	-0.107***	0.0709***	0.0803***	-0.149***	-0.0684***	-0.0603***	0.0300**	-0.0134	0.0374***
13. House type	0.118***	-0.220***	-0.110***	-0.0897***	-0.212***	-0.0392***	-0.128***	0.0205	-0.0109	0.0163
14. Network (agric.)	0.000984	0.0634***	0.0136	0.00580	0.0173	0.0257*	0.0349**	-0.00452	0.0105	-0.00579
15. Remittance	-0.0364***	0.0386***	0.425***	0.422***	-0.0672***	-0.181***	-0.0787***	0.00445	-0.0492***	-0.0550***
16. Home asset	-0.132***	0.344***	-0.00130	-0.0193	0.241***	0.256***	0.112***	-0.113***	0.0204	-0.0997***
17. Livestock	-0.114***	0.160***	0.0861***	0.0601***	0.0725***	0.118***	0.188***	-0.0184	-0.00212	-0.176***
18. MFI Dist.	0.0154	-0.0584***	-0.00185	-0.000646	-0.00854	0.0560***	0.00583	-0.00482	-0.0157	-0.132***
19. Financial	-0.0704***	0.0364***	0.0216	0.0189	0.00656	0.0321**	0.00921	-0.0109	0.00309	-0.125***

Table C1: Correlation coefficient matrix (continued)

Variables	11	12	13	14	15	16	17	18	19
11. Farm size	1								
12. Land secured	0.0379***	1							
13. House type	-0.0313**	0.0931***	1						
14. Network (agric.)	0.0393***	-0.0462***	-0.0180	1					
15. Remittance	0.104***	0.0399***	-0.109***	0.0103	1				
16. Home asset	0.158***	-0.0978***	-0.329***	0.0595***	0.0429***	1			
17. Livestock	0.170***	0.0136	-0.162***	0.0496***	0.0894***	0.311***	1		
18. MFI Dist.	0.0865***	0.0166	0.0523***	0.00699	-0.00197	0.00725	0.0559***	1	
19. Financial	0.0195	-0.0481***	-0.0481***	-0.0339**	0.0109	-0.0214	-0.0139	-0.0262*	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

CHAPTER 5

CONCLUSION AND POLICY RECOMMENDATION

5.1 Introduction

This thesis contributes to the literature on the importance of access to credit and credit constraints on the process of economic development of the rural areas of developing countries in general, in particular Malawi. The importance of this work is seen in the fact that the rural areas of the developing nations are the home to a significant number of the world's poor. Malawi presents a good case study country due to its high level of poverty and its effort to improve the welfare of its citizens. Between 2002 and 2011 about three-quarters of Malawians were below the poverty line of $1.25 a day (UNDP, 2013). In addition, the World Bank reported that the lowest quintile of the population of Malawi had less than 6 percent of the total income while those in the highest quintile enjoyed more than half of total income (Povertydata.worldbank.org, 2015). This shows the level of income disparity that exists within Malawi.

The rural part of Malawi has been the most impoverished with about 95 percent of the poor residing in the rural areas. Together with being an agricultural based area, with the agricultural sector still facing the traditional problems such as heavy dependence on rainfall, the rural areas are highly unattractive to formal institutions including the formal financial institutions increasing credit market failure. Hence, the domination of the rural areas by the informal sector.

Credit has been identified as an important tool for improving welfare in rural areas. It provides farmers with the ability to purchase farm inputs and materials to improve production and productivity, and to also smooth consumption. Households who are credit constrained have lagged behind in production and other welfare outcomes like education, health, food security, and consumption. Nevertheless, the accurate measurement of credit constrained households is very important if the true magnitude and effect of being credit constrained is to be seen. In order to consider the power of rural credit to alleviate rural poverty and to improve other household welfare outcomes the three empirical studies in this thesis examined the decision taken by households as to whether to engage in the credit market, and how credit

impacts on farm crop productivity and consumption inequality. All three empirical chapters bring unique insights to the problems. The next section presents the main findings from each of the empirical chapters and their policy implications.

5.2 Summary of results

The first empirical chapter examined the characteristics of rural households who needed credit against those who did not. This work identified the characteristics of households who are discouraged from applying for credit against those who applied and considered which characteristics explain why some households are denied credit while others are successful in obtaining credit. This part of the study helps to fill the gap in the credit literature on discouraged borrowers in rural sub-Saharan Africa.

In general, the overriding conclusion from the first empirical chapter was that discouraged borrowers ignored in the credit literature until recently were found to be numerically more important than denied borrowers in the scale of the problem of credit constrained households. The study found that there were about 7 times more discouraged borrowers than denied credit applicants. Some studies in developed countries (including Eastern Europe) found discouraged borrowers to be about twice the number of denied borrowers (Levenson and Willard, 2000; Brown et al., 2011 and Freel et al., 2012). These findings compared to the current study support the prediction by Kon and Storey (2003) that discouraged borrowers were most likely to be more prevalent in developing than the developed countries. The implication of this finding is that, in examining households' access to credit discouraged borrowers should be given a special consideration as disregarding them may underestimate the credit constraint measurement.

Another major finding from the first empirical chapter showed that the characteristics of borrowers differed from one borrower type to another. Hence showing the heterogeneity in borrower types. Those who needed credit included households with older household heads, large households, and those who resided in the rural south of the country. Further, those who applied for credit included households that had some level of education, membership in a social group or network, and households who experienced some household and natural shocks. However, characteristics of households who obtained credit included female-headed households and older household heads. In addition, households with a higher value

of home assets and livestock were more likely to obtain credit as lenders may be accepting these as collateral.

The findings on the female-headed households obtaining credit is considered a key finding from the study. In a rural African setting, where women are usually underprivileged, this study showed that although women were discouraged from applying for credit, if they apply, they were more likely to obtain credit in comparison to men. According to literature, women are much poorer than men as they lack productive assets but they are better at ploughing back extra income obtained to improve the health and the nutrition of the household and children's education than the men (Burjorjee et al., 2002). Hence, economically empowering women through provision of credit could have a rippling effect on the welfare outcomes of households and possibly have a spill-over effect on the rural economy at large. Women, therefore, should be encouraged to apply for credit. The findings of this study suggest that lenders have noticed the commercial and developmental potential of this differential behaviour of the genders, even though peers and influential friends continue to discourage women from seeking credit.

After augmenting the definition of credit constraint with discouraged borrowers as proposed in the first empirical chapter, it was essential to identify its impact on some household outcomes. The second empirical chapter simultaneously examined the likelihood of a rural farm household being credit constrained or unconstrained and its impact on farm household productivity. Further, expected crop yield, treatment and heterogeneity effects were employed to estimate the counterfactual conditions of being either a credit constrained or unconstrained household.

The results from the second empirical study showed that, the presence of financial institutions in an area was more likely to make households in that area credit unconstrained as their presence enabled households' easy access to, and awareness of, financial services, including credit. The study found that households in areas (districts) with fewer financial institutions were more likely to be credit constrained. Further, the proximity of financial institutions to communities was also crucial as households in communities distant to financial institutions increased the likelihood of being credit constrained. The above findings were an indication of the importance of distance to lenders and borrowers in one way due to transaction cost. Distance

increases the transaction cost of credit application to borrowers. Presbitero and Rabellotti (2013) also found that distance increased the cost of MFIs' operations, hence, reducing the probability of households been approved credit. The government should therefore, improve the enabling environment that would increase the outreach of formal financial institutions within rural Malawi. This will first and foremost have the consequence of reducing the transaction of costs of borrowing which usually discourages borrowing or increases rejection rate. Further, it will enable rural households to access credit that could help them improve their welfare.

Another major finding from the second empirical chapter was that there was a positive effect of credit on crop productivity. A randomly selected household from the population was likely to be less productive than an unconstrained household but more productive than a constrained household. The counterfactual arguments confirmed the importance of being credit unconstrained as it increased productivity. The effect of the treatment on the treated and the untreated showed that productivity would increase due to a household being credit unconstrained, thus indicating the significance of being credit unconstrained. Therefore, implementation of financial inclusion policies should not be taken lightly by the government as the expanded credit availability would have a significantly positive effect on farm productivity.

In line with the second empirical chapter, the third empirical chapter further looked at the impact credit has on household welfare. The third empirical chapter employed three decomposition methods to determine the factors that contribute to differences in household consumption within and between credit constrained and unconstrained groups. This work contributes toward our understanding of the role of credit markets in the perpetuation or reduction of household consumption inequality in rural Malawi. One of the major findings was that consumption inequality was greater within the credit constrained and unconstrained group than between them. Thus, factors that contribute to increasing inequality within the credit statuses should be identified and addressed so as to reduce inequality and in effect poverty. Household size and total value of household assets were found to be the major contributing factors to consumption inequality within each credit group. The human capital variable (that is, educational level) was also a significant contributing factor to increasing inequality in the credit unconstrained group. Experience, proxied by age squared, however decreased inequality especially in the credit unconstrained group.

These variables therefore, are good targets for policy makers if they would like to reduce inequality. For example, as formal education is one of the main commodities that rural areas lack, the government should increase access to education by providing the facilities and resources to make schools affordable and attractive to the children of rural households. Formal adult education should also be introduced to older household members who could have some form of formal education which they missed out when they were younger. This would increase the level of literacy and increase the chance of obtaining non-farm jobs. Hence, households can diversify their source of income which may lead to increase in assets for majority of rural households with the possibility of bridging the inequality gap.

Another major finding was that there is as much as 9.5 percent of the consumption inequality gap attributed to credit status. Majority of this gap came from the endowment component confirming that most inequality in consumption is derived from the endowment of households. The result suggested that if the level of endowment of constrained households were adjusted up to the level of unconstrained households, the welfare of constrained households would increase by as much as 9.7 percent. This generally supports the call for credit to be used as a tool for reducing poverty since credit can be used to replace endowment. Therefore, the onus lies on the government to create the enabling environment to improve access to credit in the rural parts of Malawi.

5.3 Recommendations

The main objective of this thesis was to analyse the effect of credit constraints on the productivity and welfare of rural households in Malawi. From the analyses carried out interesting results which have policy implications were discovered. In this section I present a summary of these findings for policy formulation and implementation.

A key finding from this thesis is that women are more discouraged than men from borrowing. Thus, since the objective of the government is to develop all sectors of the economy, it will be commendable to establish financial programmes targeting women. One such programme that is currently in operation is the Concern Universal Microfinance Operations, (an NGO), that targets remote areas and difficult-to-reach communities with special focus on women. Such important organizations should be

supported through financial assistance from the government and development agencies to enable them reach and promote financial literacy and credit among women and other marginalised and vulnerable people in the country more effectively.

As the main driving force to economic disparity between the locations in Malawi is the difference in the level of development across the country, it is recommended that the government should increase its development programmes across Malawi paying closer attention to the more deprived areas of the country like the south of Malawi. Increasing physical infrastructure such as roads, electricity, water and communication across the country could attract formal institutions including financial institutions to all areas of the country which will help develop the areas further. This would help bridge the poverty and inequality gaps between the urban and rural areas of Malawi. Policies such as the Malawi Growth and Development Strategy, Medium Term Expenditure Framework and the Public-Sector Investment Programmes among others should have location specific development goals. Location-specific development goals will help promulgate bespoke developmental interventions. In addition, government should enhance the economic development of the rural areas through the provision of credit through the Malawi Rural Finance Company and also creating the enabling environment for the thriving of both farm and non-farm economic activities especially in the formal sector. This would increase the wealth of household translating to increase in home assets.

Agricultural networks should be formed in areas in rural Malawi that are yet to have any shape or form of credit markets in their location, so that members could share resources, such as labour and farm inputs, among each other. Furthermore, it is recommended that financial social clubs such as the village savings and loan associations be encouraged among farmers in rural areas where financial literacy and credit will be given to members through some collective efforts. Thus, following the village savings and loan association, farmers could pool savings together which will be given to a different member as credit at some regular intervals. The financial knowledge obtained during the meetings could then be passed on from members to non-members increasing the overall financial literacy across the rural areas. This may further reduce the level of discouragement and increase participation in the credit market due to increased knowledge.

Households which are endowed with more resources should be encouraged to invest in assets such as livestock in addition to their crop farms. The findings from the study showed that these assets increase the chance of obtaining credit. This may be because lenders accept these as collateral to advance credit to borrowers. These assets are possibly a proxy for wealth and households with more assets are considered as less risky borrowers. Where farm households are able to access credit, access to farm inputs may increase leading to higher productivity and income, leading to improvement in the level of education, nutrition and health within the household.

Another recommendation based on the findings from this thesis is that the government, through the ministry of education, should increase access to formal education by providing the facilities and resources to make schools affordable and attractive to the children in rural areas. Formal adult education including financial literacy courses should also be introduced to older household members who have no formal education. This would increase the level of literacy and increase the chance of obtaining non-farm jobs and also increase credit market participation. Hence, households can diversify their source of income which may lead to increase in assets for majority of rural households with the possibility of bridging the inequality gap.

A related finding from this thesis suggests a strong and positive correlation between access to credit and productivity. Also, farmers with access to credit have higher productivity and are more likely to access more credit. Therefore, it would be beneficial to focus on improving the productivity of the farmers through extension efforts. Extension programmes or officers should propagate the benefits of intercropping as it has been identified to increase farm productivity. Nitrogen-fixing crops, such as soybeans and peanuts, should be intercropped with food crops like maize to increase the yield of the food crops and also gain extra harvest from these nitrogen-fixing plants. To achieve this, it would be beneficial that more extension officers are trained and extension programmes intensified in areas with little or no credit markets to increase the level of productivity among constrained households especially. Extension programmes could also include credit information as extension officers have regular contacts with farmers. The government of Malawi's pluralistic extension policies which have influenced an increase in the private sector participation in farm extension programmes in Malawi should be sustained and

promoted by continuously creating an enabling environment and also creating a public-private partnership.

The government of Malawi's farm input subsidy programme which gives subsidized fertilizers and seeds to farm households should also be maintained and strengthened to be more effective. The evidence of the positive impact of the programme implies if well managed both credit constrained and unconstrained households would be more productive and thereby increase their welfare. It is therefore recommended that the government subsidy programme should be carefully managed and also directed to areas with little or no credit markets.

5.4 Limitations of the studies

The literature and empirical studies reviewed as part of this research showed a wide range of definition of key variables like discouraged borrowers and credit constrained households. Measuring discouraged borrowers using the Malawi data differed from other studies which has restricted comparisons to these studies. Measurement of discouraged borrowers in this research was expanded to include not only those who did not borrow because they feel they will be denied credit, but also those who did not apply for other reasons such as inadequate collateral, which the researcher thought could be a source of discouragement. Similarly, for credit constrained measurement, the definition for this study (given the data used) differed from several others as reviewed by Petrick (2005) who gave some summary of the definitions used in literature. This study could only use households who were denied credit together with those discouraged. However, it is possible that those who obtained credit may have not received the entire amount they requested and therefore still quantity constrained in credit.

This raises an issue of omitted variable bias. Important variables not collected in a survey makes restricts the estimation of certain models. The major issue this could cause is the estimation biases. This could be confounding variables that when not included in an estimation could damage the internal validity of some estimated results. This therefore could raise issues of omitted variable bias or confounding bias. Some variables were deemed to be very important but were not collected in the survey. These variables included set of information on the credit history of the

households, credit limit, interest rates, collateral assets, household saving decision and earnings from non-farm work.

Credit history provides important set of information on the households' previous years' participation in the credit market. From this we can know whether the household had defaulted or delayed in repaying a loan, been denied in the past, and their general experience in the credit market among others. This information would have properly help to put the estimation into proper context and these could have also acted as excellent instrumental variables for our econometric estimations. The data provided no information on the Amount of credit households needed and whether they obtained the full amount or a partial amount. The lenders credit limit below the amount borrowers requested raises further issues of credit constraint. However, since this information was missing, the study had a limited definition for a credit constrained household as already highlighted above. Also, information on credit interest rates were missing from the data including collateral assets requested by lenders, what these collateral assets were and their values.

Another important information that could have been useful was whether the household operated a bank account and therefore had some savings or had some sought of financial insurance. This could possibly give much clearer understanding to why certain households did not need credit thus relying on these savings rather than borrowing. While households' participation in non-farm economic activities was captured in the data, earnings from these activities were not collected in the survey which was limited estimating the effect of off-farm work on the credit status, productivity and consumption of households. Using a dummy for off-farm participation would have raised further sample selection and endogeneity issues which may complicate the analysis.

Data was not obtained on any form of group borrowing. However, it was found in the literature that village savings and loans associations were one very important ways that groups of individuals meet regularly to pool some savings into a common pot which is then given to a different member at each meeting as a loan. This is seen as a limitation to the study as this has been identified to play a crucial role in providing the necessary credit and also increasing household food security and improving household income indicators (Ksoll et al., 2016).

5.5 Areas of further research

While the effect of credit constraints on productivity and consumption was studied, it is recommended that the effect of the various credit statuses, such as no need for credit, discouraged, denied, and approved, on household outcomes should be studied as these statuses may be more homogeneous than when households are grouped as credit constrained and unconstrained. Also, the use of the cross-sectional data did not allow for time and dynamic effects to be considered. The dynamic gains of building on success from credit obtained in a previous year may not be accounted for using a cross-sectional data which could raise measurement issues about cause and effect. Hence, further studies can be explored using panel data to capture these dynamic gains. Although, panel data is currently available, the current studies did not use it as the study was in an advance stage prior to its release. An alternative is to employ a randomised control trial (RCT) to conduct a field experiment that seeks to answer the objectives of this thesis. An RCT has been identified as a powerful tool in measuring and comparing outcomes of two or multiple interventions. Though the researcher could have collected his own data which could have avoided the restriction in the definition of credit constraint, it would have fallen short of being nationally representative.

Given the omitted variable issue identified as a limitation to the study, it is recommended that the next round of surveys should capture further important information in all aspect of the data. For the credit section of the data especially, information on credit history and credit limit especially should be gathered. Also, information on the interest rates of borrowing, collateral assets requested by lenders and used by borrowers should also be gathered in subsequent surveys. A broader section on participation in the financial market including saving with the bank or any formal or informal financial service and insurance could be useful in determining the level of financial knowledge or financial inclusion of households in the rural areas of Malawi. This could generally give good background information on households as it is also more likely participation in the credit market and other financial services like savings are correlated. Hence, for further research and provided broader financial market information are collected in future surveys, a study could be undertaken to determine if households' participation in the credit market is correlated with participation in other financial services like operating a bank account.

It is recommended first that future survey should also include information on group borrowing from both the formal source (following the Grameen Bank model) or from the informal source (following the village savings and loans association model where group members are both lenders and borrowers). This should provoke further research on how this influences credit market participation in Malawi and which impacts effectively on households' wellbeing.

REFERENCES

Ahlin, C., & Jiang, N. (2008). Can micro-credit bring development? *Journal of Development Economics, 86*(1), 1-21. doi:http://dx.doi.org/10.1016/j.jdeveco.2007.08.002

Akudugu, M. (2012). Estimation of the determinants of credit demand by farmers and supply by rural banks in Ghana's upper east region. *Asian Journal of Agriculture and Rural Development, 2*(2), 189.

Ali, D. A., & Deininger, K. (2012). *Causes and implications of credit rationing in rural ethiopia: The importance of spatial variation* The World Bank. doi:10.1596/1813-9450-6096

Ali, D. A., Deininger, K., & Duponchel, M. (2014). Credit constraints and agricultural productivity: Evidence from rural Rwanda. *The Journal of Development Studies, 50*(5), 649-665. doi:10.1080/00220388.2014.887687

Allen, F., Demirguc-Kunt, A., Klapper, L., & Martinez Peria, M. S. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation, 27*, 1-30. doi:http://dx.doi.org/10.1016/j.jfi.2015.12.003

Arendt, J. N., & Holm, A. (2006). *Probit models with binary endogenous regressors* Syddansk Universitet.

Asogwa, B. C., Abu, O., & Ochoche, G. E. (2014). Analysis of peasant farmers' access to agricultural credit in Benue state, Nigeria. *British Journal of Economics, Management & Trade, 4*(10), 1525-1543.

Atieno, R. (2001). Formal and informal institutions' lending policies and access to credit by small-scale enterprises in Kenya: An empirical assessment. *African Economic Research Consortium Nairobi, 111*.

Atieno, R. (1995). Institutional credit and the efficiency of resource use among small scale farmers in Kenya. *African Review of Money Finance and Banking,* (1/2), 61-80.

Ayaz, S., Anwar, S., Sial, M. H., & Hussain, Z. (2011). Role of agricultural credit on production efficiency of farming sector in Pakistan-a data envelopment analysis. *Pak.J.Life Soc.Sci, 9*(1), 38-44.

Baiyegunhi, L. J. S., Fraser, G. C. G., & Darroch, M. A. G. (2010). Credit constraints and household welfare in the eastern cape province, south Africa. *African Journal of Agricultural Research, 5*(16), 2243-2252.

Barham, B. L., Boucher, S., & Carter, M. R. (1996). Credit constraints, credit unions, and small-scale producers in Guatemala. *World Development, 24*(5), 793-806. doi:http://dx.doi.org/10.1016/0305-750X(96)00001-0

Barslund, M., & Tarp, F. (2008). Formal and informal rural credit in four provinces of Vietnam. *The Journal of Development Studies, 44*(4), 485-503.

Battisti, D. S., & Naylor, R. L. (2009). Historical warnings of future food insecurity with unprecedented seasonal heat. *Science (New York, N.Y.), 323*(5911), 240-244. doi:10.1126/science.1164363.

Baydas, M. M., Meyer, R. L., & Aguilera-Alfred, N. (1994). Discrimination against women in formal credit markets: Reality or rhetoric? *World Development, 22*(7), 1073-1082.

Beck, T., Demirguc-Kunt, A., & Levine, R. (2004). Finance, inequality, and poverty: Cross-country evidence. *National Bureau of Economic Research,*

Bell, C., Srintvasan, T. N., & Udry, C. (1997). Rationing, spillover, and interlinking in credit markets: The case of rural Punjab. *Oxford Economic Papers, 49*(4), 557-585.

Bendig, M., Giesbert, L., & Steiner, S. (2009). Savings, credit and insurance: Household demand for formal financial services in rural Ghana. *GIGA Working Papers, 94*

Berger, A. N., & Udell, G. F. (1992). Some evidence on the empirical significance of credit rationing. *Journal of Political Economy, 100*(5), 1047-1077. doi:10.2307/2138634

Berry, R. A., & Cline, W. R. (1979). *Agrarian Structure and Productivity in Developing Countries,*

Besley, T. (1994). How do market failures justify interventions in rural credit markets? *The World Bank Research Observer, 9*(1), 27-47.

Besley, T. (1995). Savings, credit and insurance. *Handbook of Development Economics, 3,* 2123-2207.

Bierlen, R., Barry, P. J., Dixon, B. L., & Ahrendsen, B. L. (1998). Credit constraints, farm characteristics, and the farm economy: Differential impacts on feeder cattle and beef cow inventories. *American Journal of Agricultural Economics, 80*(4), 708-723.

Blanchflower, D. G., Levine, P. B., & Zimmerman, D. J. (1998). *Discrimination in the Small Business Credit Market,*

Blinder, A. S. (1973). Wage discrimination: Reduced form and structural estimates. *The Journal of Human Resources, 8*(4), 436-455.

Bose, P. (1998). Formal–informal sector interaction in rural credit markets. *Journal of Development Economics, 56*(2), 265-280. doi:http://dx.doi.org/10.1016/S0304-3878(98)00066-2

Boucher, S. R., Guirkinger , C., & Trivelli, C. (2009). Direct elicitation of credit constraints: Conceptual and practical issues with an application to Peruvian agriculture. *Economic Development & Cultural Change, 57*(4), 609-640.

Bradshaw, S., Castellino, J., & Diop, B. (2013). Women's role in economic development: Overcoming the constraints. *Sustainable Development Solutions Network,*

Briggeman, B. C., Towe, C. A., & Morehart, M. J. (2009). Credit constraints: Their existence, determinants, and implications for US farm and nonfarm sole proprietorships. *American Journal of Agricultural Economics, 91*(1), 275-289.

Brown, S., Ghosh, P., & Taylor, K. (2015). Household finances and social interaction: Bayesian analysis of household panel data. *Review of Income and Wealth,*

Brown, M., Ongena, S., Popov, A., & Yeşin, P. (2011). Who needs credit and who gets credit in eastern Europe? *Economic Policy, 26*(65), 93-130.

Browning, M., & Lusardi, A. (1996). Household saving: Micro theories and micro facts. *Journal of Economic Literature, 34*(4), 1797-1855.

Burjorjee, D. M., Deshpande, R., & Weidemann, C. J. (2002). *Supporting women's livelihoods: Microfinance that works for the majority: A guide to best practices* United Nations Capital Development Fund, Special Unit for Microfinance.

Cain, J. S., Hasan, R., Magsombol, R., & Tandon, A. (2010). Accounting for inequality in India: Evidence from household expenditures. *World Development, 38*(3), 282-297. doi:http://dx.doi.org/10.1016/j.worlddev.2009.11.014

Cappellari, L., & Jenkins, S. P. (2003). Multivariate probit regression using simulated maximum likelihood. *The Stata Journal, 3*(3), 278-294.

Carter, M. R. (1989). The impact of credit on peasant productivity and differentiation in nicaragua. *Journal of Development Economics, 31*(1), 13-36.

Carter, M. R., & Olinto, P. (2003). Getting institutions "right" for whom? credit constraints and the impact of property rights on the quantity and composition of investment. *American Journal of Agricultural Economics, 85*(1), 173-186.

Carter, D. W., & Milon, J. W. (2005). Price knowledge in household demand for utility services. *Land Economics, 81*(2), 265-283.

Carter, S., Shaw, E., Lam, W., & Wilson, F. (2007). Gender, entrepreneurship, and bank lending: The criteria and processes used by bank loan officers in assessing applications. *Entrepreneurship Theory and Practice, 31*(3), 427-444.

Chakrabarty, D., & Chaudhuri, A. (2001). Formal and informal sector credit institutions and interlinkage. *Journal of Economic Behavior & Organization, 46*(3), 313-325. doi:http://dx.doi.org/10.1016/S0167-2681(01)00180-9

Chen, K. C., & Chivakul, M. (2008). What drives household borrowing and credit constraints? evidence from bosnia & herzegovina. *IMF Working Papers*, 1-34.

Chirwa, E. W., Kumwenda, I., Jumbe, C., Chilonda, P., & Minde, I. (2008). Agricultural growth and poverty reduction in Malawi: Past performance and recent trends. *ReSAKSS-SA Working Paper, 8*

Chirwa, E. W. (1997). An econometric analysis of the determinants of agricultural credit repayment in Malawi. *African Review of Money Finance and Banking,* (1), 107-122.

Chloupkova, J., & Bjønskov, C. (2002). Counting in social capital when easing agricultural credit constraints. *Journal of Microfinance/ESR Review, 4*(1), 17-36.

Cia.gov. (2016). The world factbook. Retrieved from https://www.cia.gov/library/publications/the-world-factbook/fields/print_2119.html

Claessens, S. (2006). Access to financial services: A review of the issues and public policy objectives. *The World Bank Research Observer, 21*(2), 207-240.

Clarke, G. R. G., Xu, L. C., & Zou, H. (2006). Finance and income inequality: What do the data tell us? *Southern Economic Journal, 72*(3), 578-596.

Cole, R. A. (2010). Who needs credit and who gets credit? evidence from the surveys of small business finances. *Munich Personal RePEc Archive,*

Cole, R., & Sokolyk, T. (2016). Who needs credit and who gets credit? evidence from the surveys of small business finances. *Journal of Financial Stability, 24,* 40-60. doi:http://dx.doi.org/10.1016/j.jfs.2016.04.002

Copestake, J. (2002). Inequality and the polarizing impact of microcredit: Evidence from Zambia's copperbelt. *Journal of International Development, 14*(6), 743-755. doi:10.1002/jid.921

Cowell, F., & Fiorio, C. (2011). Inequality decompositions—a reconciliation. *The Journal of Economic Inequality, 9*(4), 509-528. doi:10.1007/s10888-011-9176-1

Cressy, R. (1999). Small business failure: Failure to fund or failure to learn. *Entrepreneurship, Small & Medium-Sized Enterprises and the Macroeconomy*, 161-185.

Cressy, R. (2002). Introduction: Funding gaps: A symposium. *The Economic Journal, 112*(477, Features), F1-F16.

Crook, J. (1996). Credit constraints and US households. *Applied Financial Economics, 6*(6), 477-485. doi:10.1080/096031096333926

Dallimore, A., & Mgimeti, M. (2003). *Democratic banking in the new south Africa: Challenging contemporary banking practices at grass roots* University of Natal, School of Development Studies and Centre for Civil Society.

De Gregorio, J., & Guidotti, P. E. (1995). Financial development and economic growth. *World Development, 23*(3), 433-448. doi:10.1016/0305-750X(94)00132-I

De Maio, F. G. (2007). Income inequality measures. *Journal of Epidemiol Community Health, 61*(10), 849-852.

Deaton, A. (1992). *Understanding consumption*. Oxford: Oxford University Press.

Deaton, A. (1997). *The analysis of household surveys: A microeconometric approach to development policy* World Bank Publications.

Deininger, K., & Jin, S. (2006). Tenure security and land-related investment: Evidence from Ethiopia. *European Economic Review, 50*(5), 1245-1277.

Demirgüç-Kunt, A., Klapper, L. F., & Singer, D. (2013). Financial inclusion and legal discrimination against women: Evidence from developing countries. *World Bank Policy Research Working Paper,* (6416)

Deraniyagala, S., & Kaluwa, B. (2011). *Macroeconomic policy for employment creation: The case of Malawi.* (No. 93). Geneva: International Labour Office.

Dharmasiri, L. (2012). Measuring agricultural productivity using the average productivity index (API). *Sri Lanka Journal of Advanced Social Studies, 1*(2)

Di Falco, S., Veronesi, M., & Yesuf, M. (2011). Does adaptation to climate change provide food security? A micro-perspective from Ethiopia. *American Journal of Agricultural Economics, 93*(3), 829-846. doi:10.1093/ajae/aar006

Diagne, A. (1999). Determinants of household access to and participation in formal and informal credit markets in Malawi. *Food Consumption and Nutrition Division Discussion Paper, 67*

Diagne, A. (2002). Impact of access to credit on maize and tobacco productivity in malawi. *International Food Policy Research Institute*, 241-265.

Diagne, A., Zeller, M., & Meyer, R. (2002). Impact of access to credit on maize and tobacco productivity in Malawi. *The Triangle of Microfinance: Financial Sustainability, Outreach, and Impact*, 241-265.

Diagne, A., & Zeller, M. (2001). Access to credit and its impact on welfare in malawi. *International Food Policy Research Institute,* (116)

Diagne, A., Zeller, M., & Sharma, M. (2000). Empirical measurements of households' access to credit and credit constraints in developing countries: Methodological issues and evidence. *Food Consumption and Nutrition Division Discussion Paper, 90*

Diskin, P. (1997). Agricultural productivity indicators measurement guide. Retrieved from http://agris.fao.org/agris-search/search.do?recordID=US201300124187

Dong, F., Lu, J., & Featherstone, A. M. (2010). *Effects of credit constraints on productivity and rural household income in china* CARD Working Papers. Paper 507.

Dorward, A. (1999). Farm size and productivity in Malawian smallholder agriculture. *The Journal of Development Studies, 35*(5), 141-161.

Dorward, A., & Chirwa, E. (2011). The Malawi agricultural input subsidy programme: 2005/06 to 2008/09. *International Journal of Agricultural Sustainability, 9*(1), 232-247.

Duong, P. B., & Izumida, Y. (2002). Rural development finance in Vietnam: A microeconometric analysis of household surveys. *World Development, 30*(2), 319-335.

Dutoit, L. C. (2007). Heckman's selection model, endogenous and exogenous switching models, a survey.

Eastwood, R., Lipton, M., & Newell, A. (2010). Farm size. *Handbook of Agricultural Economics, 4*, 3323-3397.

Elhiraika, A. B. (1999). An econometric analysis of farm household participation in the rural credit market in Sudan /analyse économétrique de la participation des ménages paysans au marché du crédit rural au Soudan. *Savings and Development, 23*(2), 193-213.

Elias, A., Nohmi, M., Yasunobu, K., & Ishida, A. (2013). Effect of agricultural extension program on smallholders' farm productivity: Evidence from three peasant associations in the highlands of ethiopia. *Journal of Agricultural Science, 5*(8), 163-181.

Eswaran, M., & Kotwal, A. (1990). Implications of credit constraints for risk behaviour in less developed economies. *Oxford Economic Papers, 42*(2), 473-482.

Fabbri, D., & Padula, M. (2004). Does poor legal enforcement make households credit-constrained? *Journal of Banking & Finance, 28*(10), 2369-2397. doi:http://dx.doi.org/10.1016/j.jbankfin.2003.09.009

Feder, G. (1985). The relation between farm size and farm productivity: The role of family labor, supervision and credit constraints. *Journal of Development Economics, 18*(2), 297-313.

Feder, G., Lau, L. J., Lin, J. Y., & Luo, X. (1990). The relationship between credit and productivity in chinese agriculture: A microeconomic model of disequilibrium. *American Journal of Agricultural Economics, 72*(5), 1151-1157. doi:10.2307/1242524

Fields, G. S. (2003). Accounting for income inequality and its change: A new method, with application to the distribution of earnings in the united states. (pp. 1-38) Emerald Group Publishing Limited. doi:10.1016/S0147-9121(03)22001-X

Fields, G. S. (2012). Introduction to "accounting for income inequality and its change: A new method, with application to the distribution of earnings in the united states". (pp. 673-677) Emerald Group Publishing Limited. doi:10.1108/S0147-9121(2012)0000035021

Finclusion Lab. (2014). Transforming financial data into insight. Retrieved from http://finclusionlab.org/country/Malawi/analytics?title=Supply-and-Demand-Map

FinMark Trust. (2008). *Finscope malawi 2008.* (Survey report). Randjespark, South Africa: Finmark Trust.

FinMark Trust. (2013). *finscope msme survey malawi 2012.* (Survey Report). Randjespark, South Africa: Finmark Trust.

FinMark Trust. (2014). *FinScope consumer survey malawi 2014*. FinMark Trust.

Fiorio, C., & Jenkins, S. P. (2007). Ineqrbd: Regression-based inequality decomposition, following fields (2003). Paper presented at the *UK Stata User Group Meeting, 10*

Fishe, R. P. H., Trost, R. P., & Lurie, P. M. (1981). Labor force earnings and college choice of young women: An examination of selectivity bias and comparative advantage. *Economics of Education Review, 1*(2), 169-191. doi:http://dx.doi.org/10.1016/0272-7757(81)90043-1

Foltz, J. D. (2004). Credit market access and profitability in Tunisian agriculture. *Agricultural Economics, 30*(3), 229-240.

Food and Agricultural Organisation (FAO). (2011). *Gender inequalities in rural employment in Malawi: An overview*. (). Rome, Italy: The Gender, Equity and Rural Employment Division of the Food and Agricultural Organisation (FAO). Retrieved from http://www.fao.org/docrep/016/ap092e/ap092e00.pdf

Footprints network. (n.d.). Project report: Women's financial literacy, Malawi. Retrieved from https://www.footprintsnetwork.org/project/107/womens-financial-literacy-malawi.aspx

Freel, M., Carter, S., Tagg, S., & Mason, C. (2012). The latent demand for bank debt: Characterizing “discouraged borrowers”. *Small Business Economics, 38*(4), 399-418. doi:10.1007/s11187-010-9283-6

Freeman, H. A., Ehui, S. K., & Jabbar, M. A. (1998). Credit constraints and smallholder dairy production in the east African highlands: Application of a switching regression model. *Agricultural Economics, 19*(1), 33-44.

Geweke, J. (1989). Bayesian inference in econometric models using monte carlo integration. *Econometrica, 57*(6), 1317-1339.

GFRAS. (2016). World wide extension study, Africa, eastern Africa, Malawi. Global Forum for Rural Advisory Services (GFRAS). Retrieved from https://www.g-fras.org/en/world-wide-extension-study/africa/eastern-africa/malawi.html

Ghatak, M., & Guinnane, T. W. (1999). The economics of lending with joint liability: Theory and practice1. *Journal of Development Economics, 60*(1), 195-228. doi:http://dx.doi.org/10.1016/S0304-3878(99)00041-3

Gibb, A., & Ritchie, J. (1982). Understanding the process of starting small businesses. *International Small Business Journal, 1*(1), 26-45.

Gilbert, R. A., Sakala, W. D., & Benson, T. (2002). Gender analysis of a nationwide cropping system trial survey in Malawi. *African Studies Quarterly, 6*, 1-2. Retrieved from http://www.africa.ufl.edu/asq/v6/v6i1-2a9.pdf

Godtland, E. M., Sadoulet, E., De Janvry, A., Murgai, R., & Ortiz, O. (2004). The impact of farmer field schools on knowledge and productivity: A study of potato farmers in the Peruvian Andes. *Economic Development and Cultural Change, 53*(1), 63-92.

Goetz, S. J. (1992). A selectivity model of household food marketing behavior in sub-Saharan Africa. *American Journal of Agricultural Economics, 74*(2), 444-452.

Gordon, A., Craig, C., Natural Resources Institute (Great Britain)., & Great Britain. Dept. for International Development. (2001). *Rural non-farm activities and poverty alleviation in sub-Saharan Africa* Natural Resources Institute.

Gordon, A., & Goodland, A. (2000). Production credit for african small-holders: Conditions for private provision / du crédit pour les paysans africains: Qu'est-ce qu'il faut pour que le secteur privé le fournisse? *Savings and Development, 24*(1), 55-84. doi:10.2307/25830714

Guirkinger, C., & Boucher, S. R. (2008). Credit constraints and productivity in peruvian agriculture. *Agricultural Economics, 39*(3), 295-308.

Hajivassiliou, V. A., & McFadden, D. L. (1998). The method of simulated scores for the estimation of LDV models. *Econometrica, 66*(4), 863-896.

Hall, R. (1979). Stochastic implications of the life cycle-permanent income hypothesis: Theory and evidence. *NBER Working Paper,* (R0015)

Han, L., Fraser, S., & Storey, D. J. (2009). Are good or bad borrowers discouraged from applying for loans? evidence from US small business credit markets. *Journal of Banking & Finance, 33*(2), 415-424. doi:http://dx.doi.org/10.1016/j.jbankfin.2008.08.014

Hananu, B., Abdul-Hanan, A., & Zakaria, H. (2015). Factors influencing agricultural credit demand in northern Ghana. *African Journal of Agricultural Research, 10*(7), 645-652.

Hanley, A., & Girma, S. (2006). New ventures and their credit terms. *Small Business Economics, 26*(4), 351-364.

Hassett, K. A., & Mathur, A. (2012). A new measure of consumption inequality. *AEI Economic Studies,* (2)

Haughton, J. H., & Khandker, S. R. (2009). *Handbook on poverty and inequality* World Bank Publications.

Hazarika, G., & Alwang, J. (2003). Access to credit, plot size and cost inefficiency among smallholder tobacco cultivators in Malawi. *Agricultural Economics, 29*(1), 99-109. doi:10.1111/j.1574-0862.2003.tb00150.x

Hazarika, G., & Sarangi, S. (2008). Household access to microcredit and child work in rural Malawi. *World Development, 36*(5), 843-859. doi:10.1016/j.worlddev.2007.05.008

Heckman, J. J. (1976). The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. *Annals of economic and social measurement, volume 5, number 4* (pp. 475-492) NBER.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica, 47*(1), 153-161.

Heckman, J., Tobias, J. L., & Vytlacil, E. (2001). Four parameters of interest in the evaluation of social programs. *Southern Economic Journal, 68*(2), 210-223.

Heitmueller, A. (2006). Public-private sector pay differentials in a devolved Scotland. *Journal of Applied Economics, 9*(2), 295-323.

Hermes, N. (2014). Does microfinance affect income inequality? *Applied Economics, 46*(9), 1021-1034. doi:10.1080/00036846.2013.864039

Hunt, D. (2005). Some outstanding issues in the debate on external promotion of land privatisation. *Development Policy Review, 23*(2), 199-231.

Ibrahim, G., Kedir, A. M., & Sebastián, T. (2007). Household-level credit constraints in urban Ethiopia.

IFAD. (2011). *Enabling poor rural people to overcome poverty in Malawi*. Rome, Italy: International Fund for Agricultural Development.

IFPRI. (2013). *2012 global food policy report* Retrieved from http://www.ifpri.org/publication/2012-global-food-policy-report

Ilahi, N. (2001). Gender and the allocation of adult time: Evidence from the Peru LSMS panel data. *World Bank Policy Research Working Paper*, (2744)

Jaffee, D. M., & Russell, T. (1976). Imperfect information, uncertainty, and credit rationing. *The Quarterly Journal of Economics, 90*(4), 651-666.

Jain, S. (1999). Symbiosis vs. crowding-out: The interaction of formal and informal credit markets in developing countries. *Journal of Development Economics, 59*(2), 419-444. doi:http://dx.doi.org/10.1016/S0304-3878(99)00019-X

Jalilian, H., & Kirkpatrick, C. (2002). Financial development and poverty reduction in developing countries. *International Journal of Finance & Economics, 7*(2), 97-108. doi:10.1002/ijfe.179

Jann, B. (2008). The Blinder-Oaxaca decomposition for linear regression models. *The Stata Journal, 8*(4), 453-479.

Jappelli, T. (1990). Who is credit constrained in the U. S. economy? *The Quarterly Journal of Economics, 105*(1), 219-234. doi:10.2307/2937826

Kai, H., & Hamori, S. (2009). Microfinance and inequality. *Research in Applied Economics, 1*(1)

Keane, M. P. (1994). A computationally practical simulation estimator for panel data. *Econometrica, 62*(1), 95-116.

Khandker, S. R. (1998). *Fighting poverty with microcredit: Experience in Bangladesh.* Oxford University Press.

Khandker, S. R. (1998). *Using microcredit to advance women.* (). Washington, DC: World Bank.

Khandker, S. R., & Faruqee, R. R. (2003). The impact of farm credit in Pakistan. *Agricultural Economics, 28*(3), 197-213. doi:10.1111/j.1574-0862.2003.tb00138.x

Kim, G. O. (2006). Do equally owned small businesses have equal access to credit? *Small Business Economics, 27*(4), 369-386.

Kimhi, A. (2009). Land reform and farm-household income inequality: The case of georgia. *The Center for Agricultural Economic Research Discussions Paper, 10.09*

Kochar, A. (1997). Does lack of access to formal credit constrain agricultural production? evidence from the land tenancy market in rural India. *American Journal of Agricultural Economics, 79*(3), 754-763.

Kohansal, M. R., Ghorbani, M., & Mansoori, H. (2008). Effect of credit accessibility of farmers on agricultural investment and investigation of policy options in Khorasan-Razavi province. *Journal of Applied Sciences, 8*(23), 4455-4459.

Kon, Y., & Storey, D. J. (2003). A theory of discouraged borrowers. *Small Business Economics, 21*(1), 37-49. doi:10.1023/a:1024447603600

Ksoll, C., Lilleør, H. B., Lønborg, J. H., & Rasmussen, O. D. (2016). Impact of village savings and loan associations: Evidence from a cluster randomized trial. *Journal of Development Economics, 120*, 70-85. doi:http://dx.doi.org/10.1016/j.jdeveco.2015.12.003

Kumar, C. S., Turvey, C. G., & Kropp, J. D. (2013). The impact of credit constraints on farm households: Survey results from India and china. *Applied Economic Perspectives & Policy, 35*(3), 508-527. doi:10.1093/aepp/ppt002

Kwengwere, P. (2011). Inequality in Malawi. *Jaunch H and Muchena D (2011). Tearing Us Apart: Inequalities in Southern Africa,* , 122-179.

Lanjouw, P., & Ravallion, M. (1995). Poverty and household size. *The Economic Journal, 105*(433), 1415-1434.

Latruffe, L. (2005). The impact of credit market imperfections on farm investment in poland. *Post-Communist Economies, 17*(3), 349-362.

Lee, L. (1976). *Estimation of limited dependent variable models by two stage methods* University of Rochester.

Lee, L. (1978). Unionism and wage rates: A simultaneous equations model with qualitative and limited dependent variables. *International Economic Review, 19*(2), 415-433.

Levenson, A. R., & Willard, K. L. (2000). Do firms get the financing they want? measuring credit rationing experienced by small businesses in the US. *Small Business Economics, 14*(2), 83-94.

Leyshon, A., & Thrift, N. (1996). Financial exclusion and the shifting boundaries of the financial system. *Environment and Planning A, 28*(7), 1150-1156. doi:10.1068/a281150

Lianto, G. M. (1988). Rural credit policy: Do we need to target?/La politique de crédit rural: Les objectifs sont-ils nécessaires? *Savings and Development, 12*(2), 145-161. doi:10.2307/25830146

Lin, J. Y., & Sun, X. (2006). Information, informal finance, and SME financing. *Frontiers of Economics in China, 1*(1), 69-82.

Lipton, M. (1993). Land reform as commenced business: The evidence against stopping. *World Development, 21*(4), 641-657. doi:http://dx.doi.org/10.1016/0305-750X(93)90116-Q

Litchfield, J. A. (1999). Inequality: Methods and tools. Retrieved from http://www.worldbank.org/poverty/inequal/index.htm

Lokshin, M., & Sajaia, Z. (2004). Maximum likelihood estimation of endogenous switching regression models. *Stata Journal, 4*, 282-289.

Luboyeski, V., Debjani, B., & Muwuso, C. (2004). Microfinance sector assessment in the republic of malawi. *USAID-US Agency for International Development,* Retrieved from http://pdf.usaid.gov/pdf_docs/Pnacx006.pdf

Lundahl, M., & Msambichaka, L. A. (1989). Agricultural credit in Tanzania 1961-1966 / le crédit agricole en Tanzanie 1961-66. *Savings and Development, 13*(2), 149-168. doi:10.2307/25830183

Maddala, G. S. (1983). *Limited-dependent and qualitative variables in econometrics* Cambridge university press.

Maddala, G. S., & Nelson, F. D. (1974). Maximum likelihood methods for models of markets in disequilibrium. *Econometrica, 42*(6), 1013-1030.

Malawi Voice. (2013). Malawi rural finance company in liquidation. Retrieved from http://www.malawivoice.com/2013/11/25/malawi-rural-finance-company-in-liquidation/

Manna, R., & Regoli, A. (2012). Regression-based approaches for the decomposition of income inequality in Italy, 1998–2008. *Rivista Di Statistica Ufficiale,* (1)

Matita, M. M., & Chirwa, E. W. (2009). Rural-urban welfare inequalities in Malawi: Evidence from a decomposition analysis. *University of Malawi Chancellor College, Department of Economics, Working Paper No. 2009/05*

Matovu, J., & Okumu, L. (2010). Credit accessibility to the rural poor in Uganda.

McKay, A. (2002). Inequality briefing. *Briefing Paper, 1*, 1-6.

Meyer, B. D., & Sullivan, J. X. (2003). Measuring the well-being of the poor using income and consumption. *The Journal of Human Resources, 38*(, Special Issue on Income Volatility and Implications for Food Assistance Programs), 1180-1220.

Meza, D. D., & Webb, D. C. (1987). Too much investment: A problem of asymmetric information. *The Quarterly Journal of Economics, 102*(2), 281-292.

Meza, D. D., & Southey, C. (1996). The borrower's curse: Optimism, finance and entrepreneurship. *The Economic Journal, 106*(435), 375-386.

MF Transparency. (2011). *Country survey: Malawi.* (No. 103). Retrieved from https://www.mftransparency.org/wp-content/uploads/2012/05/MFT-RPT-103-EN-Country-Survey-Malawi.pdf

Millimet, D. (2001, October 2001). What is the difference between “endogeneity” and “sample selection bias”. Retrieved from http://www.stata.com/support/faqs/statistics/endogeneity-versus-sample-selection-bias/

MIX. (2014b). Mix market: Malawi market profile. Retrieved from http://mixmarket.org/mfi/country/Malawi

Mohamed, K. (2003). *Access to Formal and Quasi-Formal Credit by Smallholder Farmers and Artisanal Fishermen: A Case Study of Zanzibar.Tanzania: Mkuki Na Nyota Publishers,*

Mohammed, S., Egyir, I. S., & Amegashie, D. (2013). Social capital and access to credit by farmer based organizations in the Karaga district of northern Ghana. *Journal of Economics and Sustainable Development, 4*(16), 146-155.

Mpuga, P. (2004). Demand for credit in rural Uganda: Who cares for the peasants? *A Paper Presented at the Conference on Growth, Poverty Reduction and Human Development in Africa. Centre for the Studies of African Economies,*

Mpuga, P. (2010). Constraints in access to and demand for rural credit: Evidence from Uganda. *African Development Review, 22*(1), 115-148.

Muayila, K., & Tollens, E. (2012). Assessing the impact of credit constraints on farm household economic welfare in the hinterland of Kinshasa, democratic republic of Congo. *African Journal of Food, Agriculture, Nutrition and Development, 12*(3), 6095-6109.

Mukherjee, S., & Benson, T. (2003). The determinants of poverty in Malawi, 1998. *World Development, 31*(2), 339-358. doi:http://dx.doi.org/10.1016/S0305-750X(02)00191-2

Mukhopadhyay, J. P. (2014). Does access to microfinance affect consumption inequality?: Evidence from a randomized controlled trial in Andhra Pradesh, India. *Munich Personal RePEc Archive,* Retrieved from https://mpra.ub.uni-muenchen.de/58674/

Mushinski, D. (1999). An analysis of loan offer functions of banks and credit unions. *The Journal of Development Studies, 36*(2), 88-112.

Mussa, R. (2013). Spatial comparisons of poverty and inequality in living standards in Malawi. *South African Journal of Economics, 81*(2), 192-210. doi:10.1111/saje.12013

Mwanakatwe, P., & Kebedew, G. A. (2015). *Malawi - African economic outlook.* African Development Bank (AfDB), Organisation for Economic Co-operation and Development (OECD) and United Nations Development Programme (UNDP).

Mwaura, F. (2014). Effect of farmer group membership on agricultural technology adoption and crop productivity in Uganda. *African Crop Science Journal, 22,* 917-927.

Neuman, S., & Oaxaca, R. L. (2004). Wage decompositions with selectivity-corrected wage equations: A methodological note. *Journal of Economic Inequality, 2*(1), 3-10. doi:10.1023/B:JOEI.0000028395.38694.4b

Nguyen, C. H. (2007). Determinants of credit participation and its impact on household consumption: Evidence from rural Vietnam. *Paper Presented at the 3rd Leicester PhD Conference on Economics, 18* 21.

Nguyen, C., Bigman, D., Van den Berg, M., & Vu, T. (2007). Impact of micro-credit on poverty and inequality: The case of the Vietnam bank for social policies. *Munich Personal RePEc Archive,* (54154)

Nguyen, B. T., Albrecht, J. W., Vroman, S. B., & Westbrook, M. D. (2007). A quantile regression decomposition of urban–rural inequality in Vietnam. *Journal of Development Economics, 83*(2), 466-490. doi:http://dx.doi.org/10.1016/j.jdeveco.2006.04.006

Nicoletti, C., & Peracchi, F. (2001). Two-step estimation of binary response models with sample selection. *First British Household Panel Survey Research Conference Held in Colchester, July.*

NSO. (2008). *2008 population and housing census preliminary report*. Zomba, Malawi: National Statistics Office. Retrieved from http://www.mw.one.un.org/wp-content/uploads/2014/04/Malawi-Population-and-Housing-Census-Preliminary-Report-2008.pdf

NSO. (2012). *Integrated household survey 2010-2011*. Zomba, Malawi: National Statistical Office (NSO). doi:http://www.nsomalawi.mw/images/stories/data_on_line/economics/ihs/IHS3/IHS3_Report.pdf

Nuryartono, N. (2007). Credit rationing of farm households and agricultural production: Empirical evidence in the rural areas of central Sulawesi, Indonesia. *Jurnal Manajemen & Agribisnis, 4*(1), 15-21.

Nyasa Times. (2012, 10 May , 2012). Malawi rural finance comapany going bust. *Nyasa Times*

Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International Economic Review, 14*(3), 693-709.

Oaxaca, R. L., & Ransom, M. R. (1994). On discrimination and the decomposition of wage differentials. *Journal of Econometrics, 61*(1), 5-21. doi:http://dx.doi.org/10.1016/0304-4076(94)90074-4

Obisesan, A. A., & Akinlade, R. J. (2013). Credit constraints and poverty among Nigerian farming Households . *Agricultural Journal, 8,* 94-100. doi:10.3923/aj.2013.94.100

Oboh, V. U., & Ekpebu, I. D. (2011). Determinants of formal agricultural credit allocation to the farm sector by arable crop farmers in Benue state, Nigeria. *African Journal of Agricultural Research, 6*(1), 181-185.

Odoh, N. E., Nwibo, S. U and Odom, C. N. (2009). Analysis of gender accessibility of credit by smallholder cassava farmers in Afikpo-north local government area of Ebonyi state, Nigeria. *Continental Journal of Agricultural Economics, 3*, 61-66. Retrieved from http://www.academia.edu/661585/ANALYSIS_OF_GENDER_ACCESSIBILITY_OF_CREDIT_BY_SMALLHOLDER_CASSAVA_FARMERS_IN_AFIKPO-NORTH_LOCAL_GOVERNMENT_AREA_OF_

O'Donnell, O., Van Doorslaer, E., Wagstaff, A., & Lindelow, M.Analyzing health equity using household survey data: A guide to techniques and their implementation. 2008. *Washington, DC: The World Bank Google Scholar*,

Okoye, B., Onyenweaku, C., & Asumugha, G. (2007). Allocative efficiency of small-holder cocoyam farmers in Anambra state, Nigeria. *The Nigerian Agricultural Journal, 38*, 70-81.

Okurut, F. N. (2006). Access to credit by the poor in south Africa: Evidence from household survey data 1995 and 2000. *Department of Economics, University of Botswana Stellenbosch Economic Working Papers, 13*(06)

Omonona, B., Jimoh, A., & Awoyinka, Y. (2008). Credit constraints condition and welfare among farmers in Egbeda local government area of Oyo state, Nigeria. *European Journal of Social Sciences, 6*(3), 422-432.

Omonona, B., Lawal, J., & Oyinlana, A. (2010). Determinants of credit constraint conditions and production efficiency among farming households in southwestern Nigeria. *The Social Sciences, 5*(4), 326-331.

Oseni, G., Corral, P., Goldstein, M., & Winters, P. (2015). Explaining gender differentials in agricultural production in Nigeria. *Agricultural Economics, 46*(3), 285-310. doi:10.1111/agec.12166

Our Africa. (2016). Climate & agriculture. Retrieved from http://www.our-africa.org/malawi/climate-agriculture

Oyedele, G., Akintola, J., Rahji, M., & Omonona, B. (2009). Credit constrained condition of farm households and profitability of agricultural production in nigerian agriculture. *Agricultural Journal, 4*(4), 192-201.

Pandey, A. (2013). Inequality in consumption expenditure at household level in Uttar Pradesh: Regression based inequality decomposition (RBID). *Journal of Global Economy, 9*(2)

Pauw, K., Thurlow, J., & van Seventer, D. (2010). Droughts and floods in Malawi. *Assessing the Economywide Effects. International Food Policy Research Institute (IFPRI) Discussion Paper, 962*

Pedrosa, J., & Do, Q. (2011). Geographic distance and credit market access in Niger. *African Development Review, 23*(3), 289-299. doi:10.1111/j.1467-8268.2011.00287.x

Petrick, M. (2002). *Farm investment, credit rationing, and public credit policy in poland: A microeconometric analysis.* Discussion paper//Institute of Agricultural Development in Central and Eastern Europe.

Petrick, M. (2004). Farm investment, credit rationing, and governmentally promoted credit access in Poland: A cross-sectional analysis. *Food Policy, 29*(3), 275-294. doi:http://dx.doi.org/10.1016/j.foodpol.2004.05.002

Petrick, M. (2005). Empirical measurement of credit rationing in agriculture: A methodological survey. *Agricultural Economics, 33*(2), 191-203. doi:10.1111/j.1574-0862.2005.00384.x

Pidé, L. (2013). *The role of rural credit during the global financial crisis: Evidence from nine villages in Cambodia, CDRI.*

Pitt, M., & Khandker, S. . (1998). The impact of Group-Based credit programs on poor households in bangladesh: Does the gender of participants matter? *Journal of Political Economy, 106*(5), 958-996.

Place, F. (2009). Land tenure and agricultural productivity in Africa: A comparative analysis of the economics literature and recent policy strategies and reforms. *World Development, 37*(8), 1326-1336. doi:http://dx.doi.org/10.1016/j.worlddev.2008.08.020

Place, F., & Otsuka, K. (2001). Tenure, agricultural investment, and productivity in the customary tenure sector of Malawi. *Economic Development and Cultural Change, 50*(1), 77-99. doi:10.1086/321918

Povertydata.worldbank.org. (2015). *Poverty & equity data | Malawi | the world bank*. Retrieved from http://povertydata.worldbank.org/poverty/country/MWI

Presbitero, A. F., & Rabellotti, R. (2014). Geographical distance and moral hazard in microcredit: Evidence from Colombia. *Journal of International Development, 26*(1), 91-108. doi:10.1002/jid.2901

Rao, D. S. (2012). Credit market failures and microfinance. *International Journal of Research in Management & Technology, 2*(3), 294-297.

Raturi, M., & Swamy, A. (1999). Explaining ethnic differentials in credit market outcomes in Zimbabwe. *Economic Development and Cultural Change, 47*(3), 585-604.

Reardon, T., Kelly, V., Crawford, E. W., Jayne, T. S., Savadogo, K., & Clay, D. C. (1997). *Determinants of farm productivity in Africa: A synthesis of four case studies* Department of Agricultural Economics and the Department of Economics, Michigan State University.

Reddy, V. K., & Findeis, J. L. (1988). Determinants of off-farm labor force participation: Implications for low income farm families. *North Central Journal of Agricultural Economics, 10*(1), 91-102.

Reimers, C. W. (1983). Labor market discrimination against hispanic and black men. *The Review of Economics and Statistics, 65*(4), 570-579.

Roodman, D. (2009). Estimating fully observed recursive mixed-process models with cmp. *Center for Global Development Working Paper, 168*, 1-57.

Rosenman, R., Mandal, B., Tennekoon, V., & Hill, L. G. (2010). Estimating treatment effectiveness with sample selection. *Washington State University Http://faculty.Ses.Wsu.edu/WorkingPapers/Rosenman/WP2010-5.Pdf*,

RSC. (2012). *Increasing Africa's agricultural productivity.* (Report). London, UK: The Royal Society of Chemistry (RSC).

Rui, L., & Xi, Z. (2010). Econometric analysis of credit constraints of Chinese rural households and welfare loss. *Applied Economics, 42*(13), 1615-1625.

Sahn, D. E., & Stifel, D. C. (2003). Urban–Rural inequality in living standards in africa. *Journal of African Economies, 12*(4), 564-597. doi:10.1093/jae/12.4.564

Salardi, P. (2002). How much of Brazilian inequality can we explain? *An Attempt of Income Differentials Decomposition using the PNAD,*

Schrieder, G., & Heidhues, F. (1995). Reaching the poor through financial innovations. *Quarterly Journal of International Agriculture (Germany).*

Self Help Africa. (2016). Malawi savings group supporting hundreds of small businesses. Retrieved from https://selfhelpafrica.org/ie/malawisavings/

Sen, A. (1975). Employment, technology, and development.

Shimamura, Y., & Lastarria-Cornhiel, S. (2010). Credit program participation and child schooling in rural Malawi. *World Development, 38*(4), 567-580. doi:http://dx.doi.org/10.1016/j.worlddev.2009.11.005

Shorrocks, A. F. (2013). Decomposition procedures for distributional analysis: A unified framework based on the Shapley value. *Journal of Economic Inequality,* , 1-28.

Sial, M. H., & Carter, M. R. (1996). Financial market efficiency in an agrarian economy: Microeconometric analysis of the Pakistani Punjab. *The Journal of Development Studies, 32*(5), 771-798.

Simtowe, F., & Zeller, M. (2006). The impact of access to credit on the adoption of hybrid maize in Malawi: An empirical test of an agricultural household model under credit market failure.

Sorokina, O. V. (2013). Parental credit constraints and children's college education. *Journal of Family and Economic Issues, 34*(2), 157-171.

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review, 71*(3), 393-410.

Storey, D. J. (1994). Understanding the small business sector. *Small Enterprise Development, 6*(2), 55-58.

Swain, R. B. (2007). The demand and supply of credit for households. *Applied Economics, 39*(21), 2681-2692. doi:10.1080/00036840600749516

Takane, T. (2008). Labor use in smallholder agriculture in Malawi: Six village case studies. *African Study Monographs, 29*(4), 183-200.

Taylor, J. E., Mora, J., Adams, R., & Lopez-Feldman, A. (2005). Remittances, inequality and poverty: Evidence from rural Mexico. *Department of Agricultural & Resource Economics, UCD,*

Tchouassi, G. (2011). Microfinance, inequality and vulnerability: Empirical analysis from central African countries. *Journal of Development and Agricultural Economics, 3*(3), 150-156.

Terracol, A. (2002). Triprobit and the GHK simulator: A short note. *STATA Documentation, (Http://fmwww.Bc.edu/repec/bocode/g/GHK_note.Pdf),*

Thapa, S. (2007). The relationship between farm size and productivity: Empirical evidence from the Nepalese mid-hills. Paper presented at the Montpellier, France. Retrieved from https://mpra.ub.uni-muenchen.de/7638/1/MPRA_paper_7638.pdf

Udry, C. (1994). Risk and insurance in a rural credit market: An empirical investigation in northern Nigeria. *The Review of Economic Studies, 61*(3), 495-526.

Ukoha, O., Okoye, B., & Emetu, J. (2010). Analysis of the determinants of total factor productivity among small-holder cassava farmers in Ohafia LGA of Abia state. *Munich Personal RePEc Archive.MPRA Paper,* (26125)

UNCTAD. (2014). *Access to financial services in Malawi: Policies and challenges*. United Nations Conference on trade and development. Retrieved from http://unctad.org/meetings/en/Presentation/ciem6_2014_Malawi_en.pdf

UNDP. (2011). Table 5: Multidimensional poverty index. United Nations Development Programme (UNDP). Retrieved from

https://data.undp.org/dataset/Table-5-Multidimensional-Poverty-Index/7p2z-5b33

UNDP. (2013). *Human development report 2013. the rise of the south: Human progress in a diverse world.* United Nations Development Programme (UNDP).

UNDP. (2015). *Human development index 2015: Work for human development*. United Nations Development Programme (UNDP).

Uphoff, N., & Wijayaratna, C. M. (2000). Demonstrated benefits from social capital: The productivity of farmer organizations in gal Oya, Sri Lanka. *World Development, 28*(11), 1875-1890. doi:http://dx.doi.org/10.1016/S0305-750X(00)00063-2

USAID. (2016). Malawi family planning and reproductive health fact sheet. Retrieved from https://www.usaid.gov/malawi/fact-sheets/malawi-family-planning-and-reproductive-health-fact-sheet

Vaessen, J. (2001). Accessibility of rural credit in northern Nicaragua: The importance of networks of information and recommendation. *Savings and Development*, 5-32.

Van Bastelaer, T. (2002). Does social capital facilitate the poor's access to credit? *Understanding and Measuring Social Capital: A Multidisciplinary Tool for Practitioners*, 237-264.

Vanroose, A. (2015). Which factors drive the regional expansion of microfinance institutions? evidence from Peru. *Journal of International Development,* , n/a-n/a. doi:10.1002/jid.3082

Viet Nguyen, C., & van den Berg, M. (2014). Informal credit, usury, or support? A case study for Vietnam. *The Developing Economies, 52*(2), 154-178. doi:10.1111/deve.12042

Von Pischke, J. D., & Adams, D. W. (1980). Fungibility and the design and evaluation of agricultural credit projects. *American Journal of Agricultural Economics, 62*(4), 719-726.

Vos, E., Yeh, A. J., Carter, S., & Tagg, S. (2007). The happy story of small business financing. *Journal of Banking & Finance, 31*(9), 2648-2672. doi:http://dx.doi.org/10.1016/j.jbankfin.2006.09.011

Wan, G., & Zhou, Z. (2005). Income inequality in rural china: Regression-based decomposition using household data. *Review of Development Economics, 9*(1), 107-120. doi:10.1111/j.1467-9361.2005.00266.x

Watson, J. (2006). External funding and firm growth: Comparing female-and male-controlled SMEs. *Venture Capital, 8*(1), 33-49.

Weichselbaumer, D., & Winter-Ebmer, R. (2005). A meta-analysis of the international gender wage gap. *Journal of Economic Surveys, 19*(3), 479-511. doi:10.1111/j.0950-0804.2005.00256.x

Wiggins, S., & Leturque, H. (2010). *Raising agricultural productivity in Africa: Options for action, and the role of subsidies.* (Policy Brief). Geneva, Switzerland: Africa Progress Panel.

Wignaraja, G. (2003). *Competitiveness strategy in developing countries: A manual for policy analysis* Routledge.

Winship, C., & Morgan, S. L. (1999). The estimation of causal effects from observational data. *Annual Review of Sociology, 25*, 659-706.

Wood-Sichra, U., & Wood, S. (2014). *Land productivity for staple food crops.* ().International Food Policy Research Institute (IFPRI). doi:http://dx.doi.org/10.2499/9780896298460_14

Wooldridge, J. M. (2013). *Introductory econometrics: A modern approach* (5th ed ed.). Mason: Ohio South-Western Cengage Learning.

World Bank. (2011). Measuring inequality. Retrieved from http://go.worldbank.org/3SLYUTVY00

World Bank. (2015). World development indicators. Retrieved from http://data.worldbank.org/country/malawi

World Food Programme. (2010). *Rural Malawi comprehensive food security and vulnerability analysis.* (). Rome, Italy: World Food Programme.

Yaron, J. (1992). *Rural finance in developing countries* Agriculture and Rural Development Department.

Zaman, H. (1997). *Poverty and BRAC's microcredit programme: Exploring some linkages* BRAC-ICDDR, B Joint Research Project.

Zaman, H. (1999). *Assessing the impact of micro-credit on poverty and vulnerability in Bangladesh* The World Bank. doi:10.1596/1813-9450-2145

Zeller, M., Diagne, A., & Mataya, C. (1997). Market access by smallholder farmers in Malawi. *International Food Policy Research Institute,*

Zeller, M., Diagne, A., & Mataya, C. (1998). Market access by smallholder farmers in Malawi: Implications for technology adoption, agricultural productivity and crop income. *Agricultural Economics, 19*(1), 219-229.

Zeller, M. (1994). Determinants of credit rationing: A study of informal lenders and formal credit groups in madagascar. *World Development, 22*(12), 1895-1907. doi:http://dx.doi.org/10.1016/0305-750X(94)90181-3

Zepeda, L. (2001). Agricultural investment, production capacity and productivity. *FAO Economic and Social Development Paper*, 3-20.