Rural financial markets in Rwanda: Determinants of farmer households' credit rationing in formal credit markets

Courtesy: S. Augustin

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Table of Contents

List of tables

List of figures

List of Acronyms and Abbreviations

BCR	Banque commerciale du Rwanda
BHR	Banque de l' habitat du Rwanda
BK	Banque de Kigali
BNR	Banque Rwandaise de developement
BRD	Banque Nationale du Rwanda
COGEBANQUE	Compagnie Generale des Banques
DEM	Direct Elicitation Method
ECOBANK	Pan African Bank conglomerate
GDP	Gross Domestic Product
Ha	Hectares
MEM	Marginal effect at mean
MEs	Marginal effects
MINECOFIN	Ministry of Finance and Economic Planning
MNL	Multinomial logit Model
NAS	National Agriculture Survey
NUR	National university of Rwanda
NGOs	Non-governmental Organizations
RWF	Rwandan Francs
SACCOs	Saving and Credit Cooperatives
SSFR	Social Security Fund of Rwanda
SRS	Stratified Random Sampling

Abstract

This study investigates whether farm households in Rwanda are credit constrained, and identifies the main factors that influence formal credit provision. To facilitate this, the study examines the role played by collateral and social capital variables in determining credit constraints. Moreover, the research explores the determinants of classifications into five categories of credit provision and rationing, using a multinomial logit model. The results suggest that most farmers are unconstrained. Empirical evidence supports the importance of collateral and social capital variables for improving access to credit.

Key words: Credit rationing, collateral, multinomial logit, social capital and Rwanda

Summary

Agricultural development requires to be followed by farmers' access to credit. For example if farmers are unconstrained, production and consumption decisions get separated such that, credit unconstrained farmers can choose an optimal level of inputs for their production processes. In this way, the input use decision does not depend on credit provision. On the other hand, if farmers are credit constrained, investment decisions will depend on loan provision. As such, access to finance enables investments, which in turn improve economic performance of the farmer by reducing costs through the adoption of a new technology or by increasing income through adapting production to new challenges.

However, existing empirical literature on access to credit for a country like Rwanda is very limited. Yet the issue requires an empirical examination to determine the factors that may influence credit provision in the formal credit markets in Rwanda. The aim of the research presented in this study is to measure access to credit and to empirically determine the factors that may influence farmers' credit constraints in Rwanda. To be more specific, three issues are dealt with: (1) to identify the main factors that influence a famer's access to credit, (2) to determine the role played by the collateral variable in determining credit rationing and (3) to determine the extent to which social capital variables influence a farmer's access credit in the formal lending institutions. These three concerns are afterward dealt with in Chapters 2 to 6.

In approaching these objectives, two innovative methods are used within this study. First, qualitative information collected through interviews is used to identify the following five categories of credit rationing from both the demand and supply side of the credit market. Price rationed borrowers (unconstrained), price-rationed non-borrowers (unconstrained), quantity constrained, risk constrained and transaction costs constrained. Secondly, we use a multinomial logit model that focuses on a single category from mutually exclusive categories that depend on farmer's socio-economic characteristics.

Credit rationing status and its determinants are investigated in Chapter 4. Using data surveyed in 2012 with a sample of one hundred fifteen farmers, the study focuses on the significance of the role played by collateral and social capital variables (number of relationships that a farmer has with farmer cooperatives or other actors involved the values chain) and the length of the farm-bank relationship. The main finding is that both variables reduce borrowers' quantity rationing and transaction-cost and risk rationing.

The results show that 26.1% of the sample felt credit constrained with most farmers,15.5% of the sample being quantity rationed. A much lower share of farmers,1.7% is constrained by transaction costs.

Chapter 5 concludes that the most important variable explaining quantity rationing is land size although its significance is at 10% critical level. Its negative significant effect on the probability of being quantity rationed results from the household's inability to post the required collateral to overcome the information problems within credit transactions. This was anticipated as formal lenders in Rwanda are progressively requiring borrowers to pledge unquestionable collateral. These results support the argument that farmers with less amount of land owned are more likely to be quantity constrained by formal lending institutions. Moreover, both social capital variables namely, cluster(number of relationships that a farmer has with farmer cooperatives or other actors involved in the value chain) and the length of the farm-bank relationship, reduce the probability that a farmer would be risk and transaction-cost rationed. This indicates that higher social capital reduces transaction cost and risk associated with loan contracts.

Consider the farm management skills as proxied by access to training, the findings show that variable access to training presents a statistically insignificant effect on the probability of being quantity constrained, although it seems that the quality of entrepreneurs reduces the probability of being classified as quantity-rationed.

Finally, we consider the variable related to the distance from the bank office. As shown by the results, the probability of being transaction cost or risk constrained increases as the distance increases, although the impact of the variable is not significantly different from zero.

1. INTRODUCTION

1.1 Background

It has been a long-held belief among policymakers that poor households in developing countries lack access to suitable financial services for efficient intertemporal transfers of resources and risk coping, and that without well-functioning financial markets these households do not have much prospect for improving their productivity and living standards in any significant and sustainable way. This is due to the fact that traditional commercial banks normally do not lend to poor rural households given the high transaction costs associated with suitably small loans and the inability of such households to provide collateral (Diagne.A, 1999).

It is often argued that rural development needs to be followed by farmers' access to credit for two major reasons. First, access to credit improves production efficiency at the farm's level. Farmers can separate consumption from production decisions if they are unconstrained and credit unconstrained farmers can optimally choose the inputs level for their production processes(Carter, 1989; and Feder et al., 1990). Secondly, access to credit facilitates investments which, in turn improve the economic performance of the farmer by reducing costs through the adoption of a new technology or by increasing income through adapting production to new challenges posed by catastrophic phenomena like climate change and other natural disasters (Duarte, 2011).

Unfortunately, rural credit markets often work imperfectly in the sense that both formal and informal lending institutions do not meet the demand for loans of rural households. This mismatch between demand and supply can be explained by several market imperfections such as monopolies in credit markets exercised by informal lenders (Bell et al., 1997a), huge transaction costs incurred by borrowers in applying for loans, imperfect information leading to adverse selection and moral hazard problems (Stiglitz and Weiss, 1981; Carter, 1988), and screening, monitoring and enforcement problems faced by lenders (Hoff et al., 1993).

 It is argued by Boucher et al. (2009) that credit rationing can be observed at two stages. First, ex-ante credit constraints prevent individuals from undertaking desired activities that may have high expected return, and discourage poor but talented individuals from starting new businesses. Secondly, ex-post credit constraints prevent individuals from borrowing after investment decisions have been made and production outcomes realized.

 The Rwandan rural credit markets, as in other developing economies, is characterized by information asymmetry and other market imperfections. These imperfections in turn result in

problems associated with screening and monitoring, such as huge transaction costs and a high risk of default in credit transactions. To facilitate the discussion on problems resulting from asymmetric information in rural credit markets, we followed the paper of Boucher et al. (2009), Guirkinger and Boucher (2008), Jappelli (1990) and Feder et al. (1990), all of whom applied the direct elicitation method (DEM) .This methodological approach consists of adding a set of qualitative questions that allow the researcher to directly elicit the household's credit status as either credit constrained or unconstrained. Moreover, several researchers have proceeded in line with DEM, including Petrick (2004) who examined the impact of credit constraints on farm output in Poland, Foltz (2004) who estimated the impact of credit constraints on farm profit in Tunisia, and Carter and Olinto (2003) who examined the impact of credit constraints on investment levels in Paraguay.

However, existing empirical literature on credit rationing of Rwandan farmers is very limited. Nonetheless, limited research shows that credit rationing is a significant problem in Rwanda (Niyonsenga et al., 2007and Habyarimana.S, 2005). Yet the issue requires empirical examination so that determinants of household's credit constraints in the formal credit market can be measured and the significance of the role played by collateral and social capital in the rural credit market can be determined.

The contribution of this study is in twofold: First, we provide a broad description of the concept of credit constraints. To facilitate this description we refer to the approach taken by Boucher and Guirkinger (2008) and Boucher et al.(2009) to explicitly differentiate the problem of asymmetric information and how it gives rise to three types of non-price credit rationing namely quantity rationing, risk and transaction costs rationing. Secondly, we collect qualitative information through interviews to distinguish borrower categories and thus provide a more detailed explanation of credit constraints and their determinants. To narrow our study, more attention is paid to the significance of the role played by the collateral and social capital variables in determining farmer credit constraints.

1.2 Research aims

The aim of this study is to determine whether farm households in Rwanda are credit constrained as well as identify the main factors that influence formal credit provision for farm households in Rwanda.

To achieve the main objective of this study we try to answer the following research questions.

(i)   What are the determinants of farm household' credit constraints in the formal credit markets?

(ii)   How does collateral influence farm household' credit constraints in the formal credit market?

(iii)   To what extent does social capital influence farmer's access to credit?

To answer these research questions two innovative methods are used throughout this study. First, qualitative information collected through interviews is used to identify five categories of credit rationing from both the demand and supply side of the credit markets, specifically price rationed borrowers, price rationed non-borrowers, quantity constrained, risk constrained and transaction costs constrained (Guirkinger and Boucher 2008, Boucher et al, 2009 and Duarte, 2011).

Secondly, we use a multinomial logit model to determine the factors that may influence credit constraint. This approach focuses on a single category from mutually exclusive categories in which the dependent variable is multinomial. In our study, we have five mutually exclusive categories that depend on a set of household socio-economic characteristics. The parameter coefficients we estimate measure the impact of a variable on the probability of being classified as one of the alternatives compared with a reference category. We chose unconstrained borrowers as the reference category.

We considered our methods to be innovative since they represent a new approach in measuring empirically the determinants of credit rationing in Rwanda. Such a methodological approach consists of adding a set of qualitative questions that allow the researcher to directly elicit the farm household's credit status as either credit constrained or unconstrained.

The remainder of this study is organized into six chapters. Chapter 2 includes the relevant literature and concepts related to rural credit markets. The third chapter deals with the description of the study area and the methodology of the study. The fourth chapter identifies the determinants of farm household's credit constraints in formal credit markets. To better understand how rural credit markets function in Rwanda, the determinants of classifying credit provision and rationing into four categories is explored together with the role that collateral and social capital variables play in determining a credit constraint. Chapter 5 discusses the main findings and presents the key conclusions of this study. Finally, chapter 6 points out the recommendations for the development of rural financial markets in Rwanda and makes suggestions for policy implications.

1.3 Overview of agriculture sector

The Rwandan economy is based largely on the rainfed agricultural production of small, semi-subsistence, and increasingly fragmented farms. It has few natural resources to exploit and a small uncompetitive industrial sector. While the production of coffee and tea is well-suited to the small farm, steep slopes, a cool climate and the average family farm size of 0.76 hectare (0,76Ha) is hardly suitable for agribusiness purposes. Agribusiness accounts for approximately 33, 6% of Rwanda's GDP and 45% of exports (BNR, 2008a). In 2010 export earnings were led by tea and coffee followed by minerals, tourism, and pyrethrum. During the 4 years of civil war that led to the 1994 genocide, GDP declined in 3 out 5 years posting a dramatic decline of more than 40% in 1994 the year of genocide. In 1995, the first post war year GDP increased by 9% due to recovery of economic activities and the massive amount of foreign aid inflows (BAA,2012).

In the aftermath of the genocide and associated conflicts (1996-2000), real GDP grew at 10% per year as the economy recovered from a low base. This was followed by the period of stabilization (2001-2006) from which real growth fell to an annual rate of 6.54 %(MINECOFIN, 2007a).

Since 2002, GDP growth rate ranged from 3% to 11% annually and inflation ranged between 2 and 9% per year. In 2009 the agricultural sector performed strongly and pushed the economic growth to 4% which was above the sub-Saharan average growth rate for the year (BAA, 2012).

Characteristics of Rwandan agricultural sector

The agricultural sector constitutes an important part of the Rwandan economy and contributes greatly to the country's overall economic growth. In 2008, the agricultural sector has contributed as much as 11.2 per cent to the national economic growth rate (MINECOFIN, 2009). The sector also provides a means of living for about 80 per cent of the total population. Several parts of the country are mountainous with steep slopes and fragmented land. It decreases the productive capacity of the land to support the food demands of a population of more than ten millions inhabitants, a population which continues to grow at a rate of about 2.6 per cent per annum (MINECOFIN, 2007). In order to increase agricultural production, farmers need access to credit to facilitate investments which, in turn can enhance the economic performance of the farmer through the adoption of new technology, the use of fertilizer or by increasing income through adapting production to new challenges. As argued by Zeller (1997), promoting access to finance is one of the measures to stabilize income and consumption and to address chronic and transitory food insecurity. The national agricultural survey of 2008 reports that the average area of farmland per capita was 0.76 Ha and 80% of the farmland per household measures no more than 1Ha each (NAS, 2008). Table 1 provides the overview of farm characteristics per province.

Table 1 Distribution of farm holdings and number of blocks per household

Province	Total area by province	Area under agricultural holdings (Ha)	Area coverage rate of agricultural holdings (%)	Average area by agricultural household (Ha)	Average Number of blocks by household
Kigali City	72 985	32 959	45.20%	0.65	3
South	596 352	327 047	54.80%	0.71	4
West	588 173	269 964	45.90%	0.62	4
North	327 550	211 576	64.60%	0.65	5
East	946 250	439 204	46.40%	1.10	3
Total	2 531 310	1 280 750	50.60%	0.76	4

Source: National institute of statistic of Rwanda(NIS) from National agricultural survey 2008

2. THEORETICAL FRAMEWORK

2.1 Definitions and concepts of credit markets

The definition of credit has been explained by a number of authors, professionals and accountants. Credit is defined as "a legal contract between the lender and the borrower, where the latter receives resources or wealth with a promises to repay in the future" Credit refers to terms and conditions associated with deferred payment arrangements. According to Schumpeter (1934) "credit is essentially the creation of purchasing power for the purpose of transferring it to the entrepreneurs". Access to credit narrows down the gap between production and consumption (Schumpeter and Backhaus). Access to credit is primarily seen as a tool to increase agricultural output and productivity, adoption of new technologies, stabilizing household's income, improving farm's inputs such as fertilizer, increasing rural employment and reducing poverty.

According to Braven and Guasch (n.d) rural credit is aimed at reaching many objectives which are sometimes conflicting. Promoting rural credit by providing access to financial services was seen as one of the measures to stabilize income and consumption or to alleviate chronic and transitory food insecurity (Zeller, 1997).

2.2 Asymmetric information and credit constraints

In a great deal of theoretical literature, it is argued that the presence of asymmetric information between banks and borrowers results in problems of adverse and moral hazard which in turn may hinder the performance of credit markets((Stiglitz and Weiss, 1981; Jappelli., 1990 and Boucher et. al,2009). The paper of Boucher and Guirkinger(2008) demonstrates that credit

constrained individuals are those whose participation in the credit market is restricted as a result of asymmetric information.

Boucher et al .(2009) provide five categories of borrowers as follow:

An individual is considered as a price-rationed borrower (Unconstrained) if he or she is unaffected by the credit limit from the formal lending institutions and obtains the requested amount. An individual is considered as a price rationed non-borrower (Unconstrained) if he or she is not affected by credit limit, but rather chooses not to borrow in the formal credit market because the price of available credit or interest rate associated with the available credit is too high. Therefore, the individual does not undertake profitable projects that would require a formal credit. An individual is considered as quantity rationed if his participation in the formal credit market is involuntarily restricted. He presents excess demand for credit that is not met by banks in two ways: (1) his application is either rejected or (2) accepted but he receives less than requested. A household is considered as transaction cost rationed if he or she chooses not to participate in the credit market because of the high transaction costs associated with the loan contract. Finally, a household is considered as risk rationed if he or she chooses not to participate in the credit market because the risk associated with available credit is too high.

2.2.1 Adverse selection

As mentioned earlier, the presence of asymmetric information between borrowers and lenders leads to the problems of adverse selection and moral hazard which may significantly hinder the performance of credit markets (Stiglitz and Weiss, 1981; Jappelli., 1990 and Boucher et. al,2009).

The term credit rationing can be defined as a situation in which among loan applicants who seems to be identical some receive loans and others do not. The rejected applicants would not get the loan although they accepted to pay a high interest rate. There is also another group of individuals in the community who cannot obtain a loan even if the supply of loan in credit market has increased significantly (Stiglitz and Weiss, 1981).

As shown by Stigltz and Weiss (1981) equilibrium quantity rationing arises from lender unwillingness to increase the interest rate to clear excess demand because doing so would result in adverse selection of the borrower groups .This paper shows that the interest rate charged by banks may itself affect the riskiness of loan and may lead to two major problems. First, the direct effect of raising the interest rate leads to the increase of the bank's return, but there is an indirect effect, adverse selection acting in the opposite direction and it may outweigh the direct

effect. To observe this, we simply assume that there are two groups of individuals, the safe group who borrow only if the interest rate is low, and the risky group who borrows when interest rate is increased. Secondly, under an asymmetric information regime, the risky borrower gets a loan at a lower level of interest rate than under perfect information. The opposite happens for a good or a safe borrower. This because an increase of the interest rate punishes good borrowers and subsidizes bad ones. In credit markets, simply increasing the rate of interest would change the behaviour of borrowers and induce them to undertake risky investments (Stigltz and Weiss, 1981). A higher interest rate will negatively affect the behaviour of borrowers because risky projects become more attractive at a higher interest rate.

The paper of M. Rothschild and Stiglitz (1970) provides also the theoretical explanations of credit rationing in stating that the probability of default for a given borrower rises as the amount borrowed increases. It is difficult to identify good borrowers, if so, very costly to the lender and thus, lender decides to ration credit rather than increasing interest rate.

2.2.2 Moral hazard

Moral hazard arises when individuals do not take full responsibility for their actions. However, it is very difficult and costly for the banks to directly control all the actions of borrowers. It needs to frame the terms of the loan contract such that it induces the borrowers to take actions which are in the interest of the lender and attracts low-risk borrowers (Hoff and Stiglitz, 1990).
 Stiglitz and Weiss (1981) show that banks rationing behaviour arises from lender unwillingness to increase the interest rate to clear excess demand. If the bank raises the interest rate, this would result in changing the borrower's behaviour as well, because an increase of the interest rate raises the relative attractiveness of the riskier projects, for which the return to the bank becomes low. Thus increasing the interest rate may lead the borrowers to undertake actions that are contrary to the benefit of the lender, leading to another incentive for the bank to ration credit rather than increasing the interest rate in case of excess demand of credit. Therefore, the interest rate cannot equate demand and supply in credit markets (Stiglitz and Weiss, 1981).

Collateral can also be used by the lender as a screening mechanism inducing the borrower to undertake full responsibility of his action, and thereby solve the moral hazard problem (Udry and conning, 2005). Thus, to solve this moral hazard problem the lender asks borrower to bear a minimum of risk by pledging his collateral. Moreover, it is argued that both adverse selection and moral hazard arise directly from asymmetric information that characterises credit markets

of developing countries. This in turn may lead to the absence of formal lending institutions. This problem may be even larger since the poor cannot offer collateral and enforcement mechanisms are weak or even absent. A policy aimed at overcoming credit constraints must identify the relatives effect of credit rationing mechanisms. The first phase to undertake is to identify which individual is credit constrained and by which mechanism the individual is constrained.

The remainder of this chapter is organized as follows: Section 2.3 explains the role played by collateral in the determination of credit rationing. Section 2.4 presents the role played by social capital in the formal credit market. Section 2.6 describes the types of rural financial markets. Section 2.6.1 describes the formal financial sector .Finally, section 2.6.2 describes the informal credit market.

2.3 Collateral and credit constraint

The lack of collateral is often viewed as a bottleneck to improve access to credit (Diana.F, 2008). Inadequate collateral or lack of it implies that the borrower is likely to become credit constrained. Collateral can signal the quality of borrower (Bester, 1985 and Duarte, 2011) and the availability of collateral may decrease moral hazard problem (Hoff and Stiglitz, 1990; Boucher and Guirkinger, 2008). Most of the time banks are more likely to provide a loan if the borrower can pay back the loan by pledging a collateral. As indicated by Duarte(2011), an increase in the availability of land owned by the household should reduce the probability of being rationed.

Diana.F (2008) pointed out that households that have more wealth are expected to have high returns and show higher demand for credit. They are likely to have better access to credit as they may appear to lenders as less risky borrowers. Thus, less paperwork is required by banks to provide loans to them probably because they can pay back the loan by pledging a collateral. Lenders often demand collateral in order to evaluate the borrower's credit worthiness and to increase the risk- adjusted return to the loan. In previous research, collateral requirement has been regarded as important in the lender's decision to ration credit(Binswanger, McIntire, and Udry, 1989). It is argued that formal lenders require collateral to reduce moral hazard problem.

2.4 Social capital and credit constraint

Social capital is a wide concept which is defined differently across literature. Some scholars define social capital in terms of cultural values, for instance, by taking into account the degree of altruism in a society. Fukuyama (1995) and Putnam (2000) explain social capital as connections among individuals, social networks and the norms of reciprocity and trustworthiness that arise

from them. According to most definitions, social capital is strongly related to trust. It refers to the set of rules, norms and values that allow people to work with each other, and trust each other. The significance of social capital is important since developmental issues are strongly related to a lack of mutual confidence and trust (Duarte, 2011). A commercial transaction has within itself an element of trust, especially in credit markets since these transactions are conducted over a period of time (idem).

There are various sources of literature on the importance of social capital in credit markets, including for example Durlauf(2002);Bowles and Gintis(2002)and Duarte(2011). These papers show the significant role of social capital, especially when other institutions fail to correct the market failure. This phenomenon is observed especially in credit markets of developing economies, which are characterised by asymmetric information, and later leads to adverse and moral hazard problems. Social capital is important and the reason is that, social capital in the form of networks may help to screen and to monitor borrowers and thus improve access to credit. In credit markets where an efficient information service is absent, social capital may facilitate the development of information sharing between borrowers and lenders. Literature on social capital considers the length of the farm-bank relationship to increase the probability of being unconstrained borrower because the bank increases the precision of the information about the creditworthiness of the farmer and reduces the associated monitoring costs (Degryse and Ongena, 2005; Baas and Schrooten, 2006). It is also argued that the bank would like to expand a loan if its relationship with farmer were longer. This argument suggest that the transactions costs related to loan application decreases because the borrower can probably provide less information to the bank or perhaps because the borrower is more familiar with filling out the bank form or loan application. Degryse and Ongena (2005) also suggest that to obtain a loan, a new borrower may have to visit the bank office between two and three times, whereas a regular customer is not requested to do so.

Business clusters in the agricultural sector

A cluster is widely defined as a group of supply chain players, input suppliers, traders, processors, farmer cooperatives, extension agencies, and banks that interact frequently. Within these clusters, different organizations such as farmer cooperatives and service providers work together in order to increase productivity, getting access to loans and marketing their products (Duarte, 2011). Creating a business cluster can be taken as a mechanism that enables firms to share their experiences. It fosters information sharing between them and between its partners. In such clusters, input supplying firms, processing firms and seed supplier cooperatives provide to farmers inter-linked loans for working capital, technical assistance, and crop inputs in exchange for the farmers' promise to provide the harvest that would later be purchased by the processing companies (Duarte, 2011). Credit for farmers primarily finance acquisition of improved seeds, fertilizers and other types of farm inputs. The provision of improved seeds such as maize, cassava and bananas is organized through seed supplier cooperatives in collaboration with government extension agencies (Bingen, J. and Munyankunsi, L., 2002). Usually seed supplier cooperatives work closely with government extensions agencies for the intensification of some specific crops. These cooperatives not only sell inputs, such as seeds and fertilizers, but also offer technical assistance and training courses. Therefore, the business clusters are important as facilitators of information sharing among its members and partners, especially when government institutions fail to correct the market failure. For example, a borrower being a member of more clusters can increase information sharing between lenders and borrowers because lenders can easily collect more information related to the borrower through other members of the cluster or through different clusters that the borrower belongs to.

2.6 Types of rural credit markets

Rural credit institutions can be broadly characterized into formal institution and informal institutions. Formal institutions are licensed and regulated by central banks. This sector comprises commercial banks, microfinance institutions, credit cooperatives, development banks and insurance companies. The informal sector is not regulated by any formal institution and the lending conditions are often flexible. This sector comprises local moneylenders, landlords, traders, Roscas, friends and relatives. Other types of rural credit include semi-formal institutions, consisting of non-governmental and international organisations. The formal sector depends on deposits while, the informal sector relies more on its own funds.

According to Ghate (1992), the scale of operation is much larger for the formal sector and they are often subject to a variety of regulations relating to capital, reserves, liquidity and interest rates. The problem with the formal sector is the lack of perfect information about their borrowers. This leads formal lenders to frequently insist on collateral in order to reduce the risk of default. Collateral is often lacking or insufficient for poor borrowers. For the informal sector, the collateral requirement is not a problem. They will be willing to accept collateral in the form of standing crops or a small quantity of land or labour. According to Ray(1998), this can solve the problem of information constraints and informal lenders are often considered as "doing much a better job".

Banks may use the interest rate as a screening device to offset losses from default but simply raising interest rate may attract risky borrowers (Stieglitz and Weiss, 1981). For the informal sector, this problem can be solved because of their personal knowledge of the characteristics of their borrowers. Sometimes, interest rate in the informal sector is hidden. This interest is paid in secondary forms through interlinked transactions (Ray, 1998).

2.6.1 Formal credit markets

The Rwandan financial sector is made up of nine commercial banks, a development bank, a housing bank and two hundred thirteen (213) microfinance institutions, from which two hundred are cooperatives; thirteen are public limited companies and a private limited company. Among other financial institutions operating in Rwanda, there are five insurance companies and a social security funds of Rwanda(SSFR) (BNR, 2008b). The banking activity has been strongly weakened by the 1994 civil war and genocide, which has been followed by the massive inflow of capital during the emergency period. The inflow of capital has generated a short time effervescence of the economy (BNR, 2010).

In 1995 when the economic activity recovered, the credit activity of financial institutions has been highly stimulated and outstanding credits moved up at a high speed between 1995 and 1998. The presence of numerous NGOs stimulated the local market, real estate in particular, and led financial institutions to finance hotels, buildings and residences for rental use (see Figure 1).

The gradual exit of a significant number of NGOs since the end of 1996 has had a number of consequences. For instance, the number of unoccupied houses increased while the price of renting significantly decreased. Additionally the periods of drought, the decline in the price of coffee and tea on world markets and the gradual increase of oil prices have adversely affected

the country's economic life since 1998. As a result, several   borrowers could not afford their obligations (BNR, 2008b).

 Rwanda's survey of 2008 revealed that only 21 % of adults have access to formal financial services and that 52% of Rwandans are financially excluded. To address this problem, the government of Rwanda held a national dialogue meeting in December 2008 that proposed a strategy of integration of the rural population into the financial system. The aim of this strategy was to set up at least a SACCO per each sector (county) throughout the country. Moreover, the main objectives of this strategy include sensitizing the population in the organizing of all rural activities through cooperatives, providing support to existing SACCOs and allowing unbanked but bankable people to have access to financial services at low transaction costs, (BNR,2008a).

To improve the credit provision in rural credit markets, a credit bureau[1] has been thought to allow credit institutions to make faster decisions based on reliable information from credit reference services. Indeed, this new system helps commercial banks in credit risks mitigation and reduces the number of non-performing loans. However, this information cannot be accessed by the whole industry because the emerging microfinance institutions cannot afford the large costs associated with accessing this information (NBR, 2010).

The Rwandan Rural credit market, as in other developing countries, is characterised by market imperfection which results in the lowering of the rural credit allocation. In fact, the total credit provision of commercial banks, BRD and BHR to the agricultural sector from 2006 to 2008 was very small 2.86%, 3.68% and 2.01% respectively. In comparison to trade, restaurants and hotels which received a total credit provision of 47.96%, 44.39% and 40.12% respectively (see figure1). Figure 1 presents statistics data on loans per sector granted by the 6 commercial banks as well as from BRD and BHR from 2006 to 2008.

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[1] Credit bureau is an entity that collects information from creditors on a borrower's credit history.
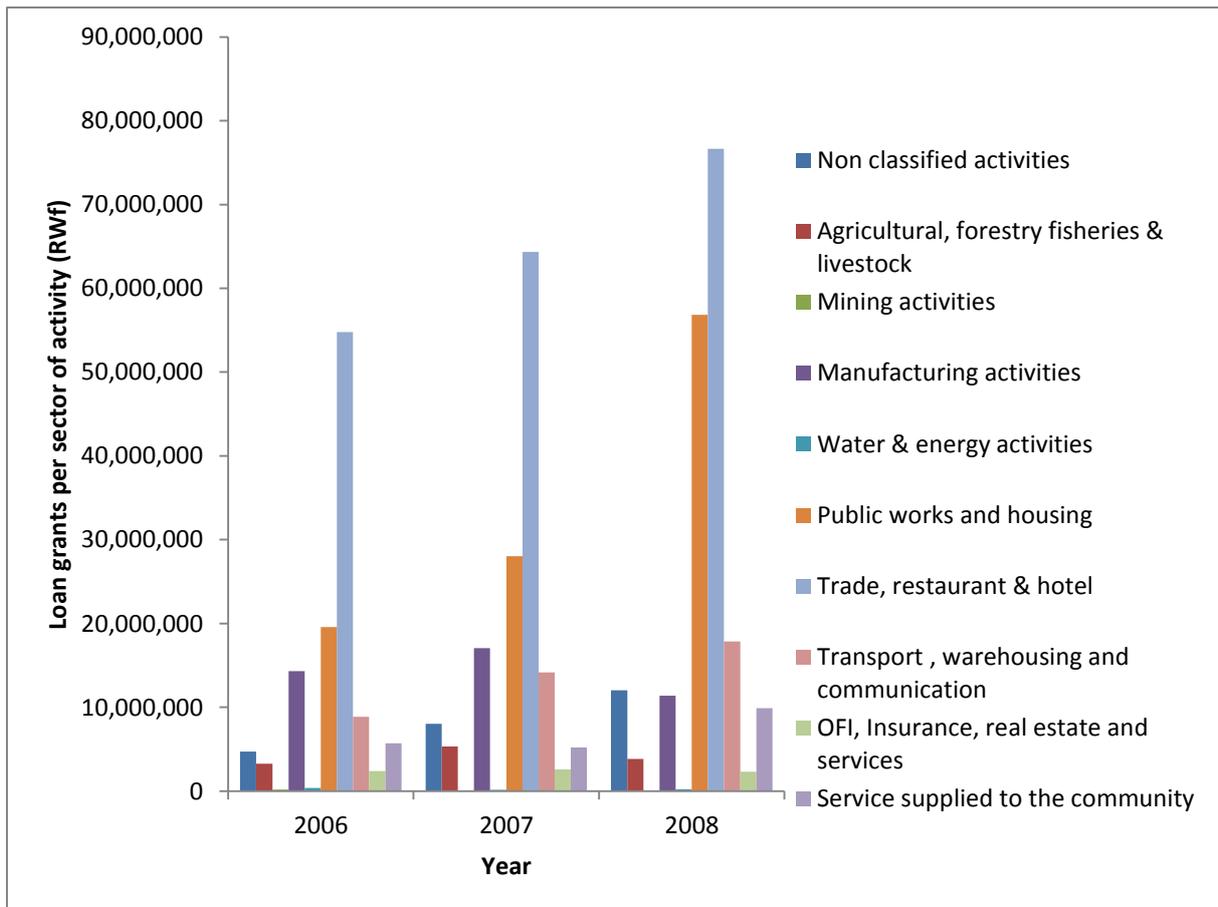
Figure 1 Statistics data on loans per sector granted by the 6 commercial banks as well as from BRD and BHR from 2006 to 2008

Source: Banque Nationale du Rwanda (BNR) annual report on financial stability, 2008

2.6.2 Informal credit markets

Informal credit markets refer to those markets which are not licensed and regulated by central authority(Timberg and Aiyar,1984). They include transactions between moneylenders, landlords, traders, friends and relatives. Besly.T(1994) identifies five forms of informal providers of credits as follows: credit from friends, relatives and community members, rotating savings and credit associations (ROSCAs), money lenders and informal banks, tied credit and pawning. In between these two ends of the range are financial nongovernment organizations, self-help groups, small financial cooperatives, and credit unions.

Although, we recognize that the restrictions between formal and informal lenders are often indistinct, we distinguish formal financial institutions as those which are licensed and supervised by a central authority. In fact, in many respects these firms operate today in much the same influential way that informal trade-money lenders have operated in Rwanda and elsewhere in the world (Conning and Udry, 2007).

13

3. RESEARCH METHODOLOGY

3.1 Study area

This study was carried out in Kamonyi district of the southern province. The study area selection is based on the fact that the district's economy is primarily based on agriculture and livestock farming while other economic sectors are being developed progressively.

Figure 2 Map of Rwanda showing the study area

Kamonyi District is one of the eight districts that make up the Southern Province. It is located in the central region of the country. It is composed of 12 sectors, with a population of 265,365 inhabitants over a total surface area of 655.5 square kilometres (km²). The District of Kamonyi shares its borders with Ruhango District in the South, Muhanga District in the West, Bugesera and Nyarugenge districts in the east, and Gakenke and Rulindo districts in the North.

Major crops in Kamonyi District are cassava, sweet potatoes, maize, beans, sorghum, soy bean, peas, bananas, Irish potatoes, rice, groundnuts, and vegetables with cassava, sweet potatoes, sorghum and maize dominating the production (Republic of Rwanda, n.d)

3.2 Survey and data collection

This research was based on the primary data collected from individual farmers receiving credit both from formal and informal institutions as well as those who do not. Formal institutions considered in this study are commercial banks, non-bank financial institutions, Non-Government Organisations (NGOs) and microfinance institutions. Similarly, informal sector actors included

are local moneylenders, friends & relatives, Roscas, landlords, traders, shopkeeper and input suppliers.

The survey was carried out from 1st December 2011 to 4th February 2012 in two counties of Kamonyi district : Runda and Rukoma. The selection of the sample is based on Stratified Random Sampling (SRS). A total of one hundred fifteen households(115) were surveyed with fifty seven(57) households from Runda sector[2] and another fifty eight(58) households from Rukoma sector[3]. Out of the original sample of 120 farmers, five could not be surveyed, two from Runda sector refused at all to participate in the survey, and three from Rukoma sector were away from home at the time that the interviews were carried out due to other agricultural activities.

In this survey we encountered different problems that can be grouped into two categories.

First, at low administration level (county or sector level) records were either not updated or not complete. In some cases, selected farmers refused to participate in the survey. This may cause a sample selection problem if the willingness to participate in the survey could be correlated with the likelihood of being credit constrained. However, measures have been taken by selecting every third household in case of missing observations or non-participatory households to avoid sample selection bias.

Secondly, other households, especially those who were not selected to be part of the survey approach the respondent while he or she was being interviewed. This was seen as a threat to the respondent especially with respect to core questions relating to the reasons for not getting a loan, whether the household has defaulted on previous loans, use of loan facilities and reasons why a household had not applied if he or she was certain that a formal bank would approve his or her loan.

In this study, household heads or their representatives (a person old than 18 years) were interviewed. The interview on average took between fifty to sixty minutes per interviewee depending on aptitude of the interviewee to understand the question.

Before we did the final version of our survey we did two pre-test surveys and we collected information from 15 farmers located in two sectors(counties) from which 8 farmers were taken from Rukoma and 7 from Runda respectively. The pre-test and the final version of the survey were conducted by myself with two other well-trained students from the department of statistics of the national university of Rwanda (NUR). In this pre-test we also aimed to collect information about the credit history of the household.

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[2] Runda sector : County of Kamonyi Distric
[3] Rukoma sector: County of Kamonyi District

However, due to the fact that the question related to the credit history variable involved asking whether the farmer had defaulted on previous loans, all farmers interviewed were strongly sceptical about this question. Therefore, we decided to leave out this question.

The final version of the survey consists of 4 sections. Section 1 covers the identification of the respondent and general information about the farm, as well as information about production activities including; main crops, yield and sales channels. Section 2 includes questions dealing with the household's socio-economic characteristics. Section 3 includes questions dealing with saving behaviour. Section 4 includes the core questions dealing with credit behaviour including information on loan sources and use, loan applications, credit from friends & relatives, traders, suppliers and collateral. Section 5 looks for information about social capital including the number of networks that the farmer has, the quality of that networks and the level of trust among these networks.

Secondary data from government agencies and non-government organizations was also obtained through accessing their websites. The household is taken as the research unit given that it is a platform where social and economic interdependencies largely occur(Ellis, 2000).

Finally, data collection may suffer from some degree of sample selection bias. Although farmers were randomly selected from each sector, in some cases farmers refused to answer the questionnaire and had to be replaced by other farmers. This may cause a sample selection problems because the willingness to participate in the survey could be correlated with the likelihood of being credit constrained. For more details about the entire questionnaire used in this survey(see appendix 1).

3.3 Multinomial logit model

3.3.1 Determinants of credit constraints

According to literature, credit rationing occurs when the demand for credit exceeds its supply at the prevailing interest rate Petrick(2004b) and Duarte(2011). Therefore, it is within this circumstance that some people get credits while other identical people that are willing to borrow at exactly the same terms do not Duarte (2011). These types of borrower are either rejected or receive smaller loan than requested.

According to Petrick(2005) credit rationing results from the fact that banks are not interested in offering credit to farm households in underdeveloped rural areas because it is difficult to overcome asymmetric information and resulting screening, monitoring and enforcement

problems. It is due to the fact that clients are poor, have few assets to collateralize, act in a risky environment, and give rise to high transaction costs (Binswanger and Rosenzweing, 1996, Hoff and stiglitz, 1993). The credit constraints may thus be due to the unsolved problem of adverse selection, moral hazard and costly state verification of information asymmetries in the credit market or due to a lack of enforcement mechanisms(Ghatak and Guinnane, 1999).

In line with Boucher et al.(2009) ; Guirkinger and Boucher(2008) we apply the direct elicitation method(DEM) to determine the borrower category for each farmer household. The direct elicitation approach allow us to classify farm households as constrained or unconstrained in the formal credit market and if constrained, to further identify the constraint status resulting from price, quantity, transaction cost and risk rationing(Boucher et al.,2009). Examples of this approach include Foltz (2004), Petrick (2004), and Carter and Olinto (2003).This approach applies a combination of observed outcomes and qualitative questions to detect the constraint status. The first step is to separate households that applied from those who did not apply from formal lending institutions. Applicant farmers were classified as quantity rationed (supply side constrained), if their applications have been rejected or did not obtain the amount requested. Those whose applications were accepted were classified as price-rationed borrowers (unconstrained).

To better understand the reasons why some famers were non- applicants we divided them into three categories. First, those who did not apply because the interest rate was too high or they have sufficient liquidity or simply because they did not have a profitable investment project, were classified as price-rationed non-borrowers (unconstrained). Secondly, those who said that, the time, paperwork, and application fees were too costly to them were classified as transaction cost rationed (demand side constrained). Finally, those who stated that they had fearful of losing their land were classified as risk rationed (demand side constrained). As suggested by Boucher et al.(2009) the main objective of this method is to gather additional information on the credit market perceptions of non-borrowers. However, to determine constraint status requires learning why some households choose not to borrower even though they believe they qualify for a loan.

3.3.2 Econometric specification

The present model differentiates five categories of borrowers: price-rationed borrowers, price-rationed non-borrowers, and quantity-, risk-, and transaction cost-rationed borrowers.

The percentage of risk- and/or transaction cost-rationed farmers is very low, so we merged these categories, which simplified the analysis significantly without affecting the main results.

Thus, in our econometric analysis we focus on the following four categories: price-rationed borrower(unconstrained); price-rationed non-borrower(unconstrained);quantity rationed(supply side constrained), and transaction cost and risk-rationed(demand side constrained). We use a multinomial logit model to determine the main factors that influence credit constraints in the rural credit market of Rwanda. In the framework we use the single equation multinomial logit model.

CRi is a categorical variable that takes values 0, 1,...,J and that represents the observed credit market rationing outcome of household i. We define CRij as the observed propensity of household i to be in rationing category j. The equation can be specified as follow:

$$CRi = f(\beta 1\, COLT + \beta 2\, SOCP + \beta 3 CONTLS + \varepsilon ij) \qquad (1)$$

Where CRi is credit rationing; COLT is the collateral variable; SOCP is the social capital variable; CONTLS are control variables and ε ij is the unobserved component of the i'th household's propensity to be in category j. The probability that household i is in rationing category j is

$$Prob(CRi = j) = \frac{\exp(X'i\beta j)}{\sum_{k=1}^{j} \exp(X'i\beta k)} \quad , for\ j = 1\ldots\ldots., j \qquad (2)$$

Where X_i is a vector of household characteristics; βj is a vector of parameters associated with the j'th category; and ε ij is the unobserved component of the i'th household's propensity to be in category j. The model is operationalized by assuming that the J + 1, and ε ij terms are independent and identically distributed.

To estimate equation (2), we use the mlogit command from Stata 11. The coefficients we estimate measure the effect of a variable on the probability of being classified as one of the alternatives compared with a reference category (see Table A1-2 in the appendix 3).

However, the parameter coefficients of Multinomial logit models are difficult to directly interpret which implies that its analysis is not straightforward and depends on whether the categories are ordered or unordered (Cameron. A and Trivedi.K,2009). Since the present model has unordered outcomes, there is no single conditional mean of dependent variables. Instead there are j alternatives, and we model the probabilities of these alternatives. Our interest lies in marginal impacts of each regressor on the probability of the Mean household being observed in each rationing category. The marginal effects (MEs) of interest measure the impact of observing

each of several outcomes rather than the impact on the single conditional mean. For the multinomial logit model (MNL), the marginal effects (MEs) can be shown to be:

$$\frac{\partial P_{ij}}{\partial X_i} = P_{ij}(\beta_j - \beta_i) \tag{3}$$

Where $\beta_i = \sum_l P_{il}\beta_l$ is a probability of weighted average of the β_l. The marginal effects vary with point of evaluation, X_i, because P_{ij} varies with χ_i. To estimate equation (3), we use the margins, dydx(*) command to estimate the marginal effects at mean(MEM), with separated computations for each alternative. The dydx(*) option requires that Stata 11 estimates the marginal effect for each regressor (Cameron. A and Trivedi.K, 2009).The regressors, their means and their standard deviation are summarized in table 2. In contrast with the coefficients estimation which measures the effect of a variable on the probability of being classified as one of the alternative compared with a reference category, the marginal effect estimation does not need a reference category since the estimation of the marginal effect of each rationing category is possible (Boucher et al., 2009).

The first explanatory variable in the equation (1) is the measure of household's productive endowments and tenure security represented by the amount of land in hectares owned by the household .The second variable is the measure of a household's social capital including Cluster(measured as number of relationships that the farmer has with farming cooperatives or other groups involved in the value chain) and Length (measured as the length of farm bank-relationship in years) .The remaining two variables are included to control for potential demand for credit. First, we include access to training or extension services variable to account for farm management skills. Secondly, the variable distance is included to be a proxy for transaction costs associated with the loan application. It gives the travel time in public transportation to the nearest formal bank office. We apply the direct elicitation method to distinguish between constrained and unconstrained non- borrowers. The application of this approach requires that the qualitative information collected through interviews indeed differentiate between non-applicants that are rationed versus those unconstrained.

4. RESULTS

4.1 Description of characteristics of sampled households

This section consists of two parts. The first section of this chapter presents the summary of the sample distribution of households and the concise idea on the data with respect to cost of borrowing and loan use. Descriptive statistics such as mean and standard deviation were performed to compare households participating from non-participating in formal credit markets. The second section presents the first evidence on the differences in socio-economic characteristics that are assumed to determine farm household' access to formal credit. To facilitate this, a t-test is performed to explain the significance of mean difference between famer borrower and non- borrowers. Table 2, provide the descriptive characteristics of the 115 farmers, pooled sample.

Table 2 Sample statistics (n = 115, pooled sample)

variables	Definition	Mean	Standard deviation
Cluster	Amount of relationships that the farmer has with farming cooperatives or other groups involved in the value chain	2.48	1.02
Length	Length of farm–bank relationship (years)	4.09	3.27
Land size	The amount of land owned in (hectares)	0,68	0,32
Distance	Distance from bank office	8.03	3.67
Access to training	Dummy equal to 1 if the farmer has received training/or extension services and 0 otherwise	0.70	0.46

Source: computed from own surveyed data, 2012

In Table 2, we provide the descriptive characteristics of the 115 farmers, pooled sample. The mean farm size is 0.6757 hectare (ha), similar to the average size for all individual farms in Rwanda see (Table 1). The average farmer–bank relationship was relatively not long at 4 years and the average of the longest distance from the bank office is 8 km. We present the distribution of sampled households and their loan use in table 3.

The results from table 3 show that, out of a total of 85 respondents who borrowed from the formal lending institutions, 60% of loan received were used for production purposes, only 4.7% were used for consumption purposes, 17.6% were used for both consumption and production purposes and 17.6% was used for other purposes. These results show that, only 7.4% of loans borrowed from the informal lending institutions are used for production purposes, 55.6% is used

for smoothing consumption, 27.8% is used for both consumption & production purposes and 9.3% is used for other purposes or other use[4] .

It seems that, most of the loans received from the formal lenders were used for production purposes while those received from informal lenders were mostly used for consumption purposes.

The big difference between the usage in terms of production and consumption purposes can be attributed to the fact that formal lending institutions would lend only to those who can pay back their money. Therefore, formal lenders are likely to finance production projects rather than financing consumption. Besides this, there are the rules, regulations and lending conditions that guide formal financial institutions and that create the gap between borrowers. In contrast, the loans received from the informal lenders are heavily used for consumption purposes. The reason is that informal lenders have a comparative advantage in terms of lower transaction costs in reaching small and poor borrowers who want to smooth their consumptions (Ghate, 1992).

Another point is that there is a large proportion of loans provided for other purposes or other uses (health insurance & educational expenses) from both informal and formal lenders. The reason is that, at the beginning of the year farm households need to pay school fees and buy school materials for their children together with health insurances for their families. These costs appear to be relatively high compared to their farm income. The health insurance is paid annually at the rate of 3000 Rwandan Francs (RWF) per person equivalent to five US dollars (5 US$)[5]. As it can observed in table 4, the family size is relatively large with almost 6 people per household which could be a reason why a large proportion of loan from both formal and informal lender (17.6% and 9.3% respectively) were used to cover the educational and health costs . Table 3 presents the distribution of sampled households and their loan usage.

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[4] Other use is defined as loan used to pay health insurance commonly known as mutuelle de santé and educational expenses(school fees and school materials)
[5] 1$= 600 RWF

Table 3 Distribution of sampled households and credit use

Lending institution	Produ- ction	Consu- mption	Production & consumption	Other use	Total borrower	Non- borrower	Total
Formal	51	4	15	15	85	30	115
Percentages (%)	60	4.7	17.6	17.6	73.9	26.1	100.0
Informal	4	30	15	5	54	61	115
Percentages (%)	7.4	55.6	27.8	9.3	47.0	53.0	100.0

Source: computed from own surveyed data, 2012

We present the first evidence on the differences in socio-economic characteristics that are assumed to determine farm household's access to credit in table 4. These results show that, the variable access to training has a significant mean difference between borrower and non-borrowers at 1% critical level. As anticipated, the high-quality entrepreneurs should be more likely to repay a loan and can better convince potential lenders that they are creditworthy (Barry and Robison, 2001). We also find a significant mean difference between borrowers and non-borrowers at 1% critical level for the variable length of the farm-bank relationship. As expected, the longer the farmer-bank relationship, the higher the chance of the bank to increase the precision of the information about the creditworthiness of the farmer and reduce the associated monitoring costs (Degryse and Ongena, 2005; Baas and Schrooten, 2006). As far as the land size variable is concerned, the results show a significant mean difference between borrowers and non-borrowers at 5% critical level. It is not surprising since the amount of land available can signal the quality of borrower (Bester, 1985 and Duarte, 2011) and the availability of collateral may decrease moral hazard problem (Hoff and Stiglitz, 1990; Boucher, Guirkinger et al., 2009). Most formal lenders in developed and developing countries require physical collateral such as land. In this regard, most formal lenders are more likely to provide a loan if the borrower can pay back the loan by pledging collateral. Similarly these results show that, the variable cluster has a significant mean difference between borrowers and non-borrowers at 5% critical level. The variables age of respondent, farming experience and livestock value have a significance mean difference between borrowers and non-borrowers at 10% critical level. In terms of distance from the main road, the mean difference is significant at 10% critical level while the distance from the bank office is insignificant. The variable that relate to growing maize as a major crop, and gaining off-farm income are statistically significant at 1% and 5% critical level respectively. However, the variables related to yield in kilograms per season, sex, farmer's participation in

Roscas, growing sweet potatoes as a major crop and family size are statically insignificant. In general it seems that formal borrowers are relatively younger with a smaller family size and higher assets in terms of the amount of land owned and livestock values. The small family size seems to be an indication of lower costs in terms of feeding family members and paying health insurance and educational expenses. Thus, these lower costs can be advantageous for acquisition of new assets such as land and livestock (see Table 4).

Table 4 Table First evidence on the differences in socio-economic characteristics assumed to determine a household's access to formal credit.

Borrowing from formal banks	characteristics	Borrower N=85		Non-borrower N=30		T-Values
		Mean	Sd	Mean	Sd	
	Cluster	2.67	0.85	1.93	1.25	-3.57**
	Length	5.20	2.92	0.93	1,80	-7.98***
	Land size	0.73	0.29	0.51	0.34	-3.41**
	Access to training	0.81	0.493	0.37	0.490	-4.99***
	Yield in KGs/Season	1402.7	2804.3	753.3	867.11	-1.31
	Sex	0.37	0.49	0.40	0.50	0.22
	Age	45.38	11.69	50.90	12.69	2.14*
	Family size	5.52	1.65	6.03	2.47	1.26
	Distance from the main road	6.37	2.43	7.63	2.63	1.83*
	Bank office's distance	7.78	3.59	8.77	3.86	1.27
	Off-farm income	0.54	0.50	0.23	0.43	2.99**
	Farm-experience	12.77	6.91	9.73	4.49	-2.25*
	Growing maize	0.37	0.45	0.73	0.49	-3.73***
	Growing suit-potatoes	0.33	0.47	0.47	0.50	1.34
	Value of livestock	186505.88	188899.42	9666.67	11669	-2.44*
	Participation in Roscas	0.75	0.43	0.70	.46	-0.56

Source: computed from own surveyed data, 2012

*** Significant at 1%, ** significant at 5% and * significant at 10% critical level. The last column reports the value of t statistics

In order to classify borrowers and non-borrowers as constrained or unconstrained, the direct elicitation approach relies on several qualitative questions. Depending on the response of these questions, we classified farmers into five categories as identified by Boucher et al.(2009). Table 5 comprises common responses and their corresponding rationing category.

Table 5 Common response to qualitative questions

Responses	Constraints status
I received the desired loan from formal lenders in the past 12months	Unconstrained borrowers
I do not need a loan, interest rate was too high or farming does not give enough profit to pay back the loan.	Unconstrained non-borrowers
I received a loan from bank in the past 12 months, but not the requested amount.	Constrained (quantity rationed)
I applied for a loan in the past 12 months years but my application was rejected	
I did not apply for a loan because I thought the formal lender would reject my application.	
I did not want to risk my land, I was afraid to put in risky my land,	Constrained (Risk rationed)
Bank office was too far away, Bank requires too much paperwork	Constrained (Transaction cost rationed)

Table 6 summarizes the results of interviews that classified the farmers as credit constrained or unconstrained (Boucher and Guirkinger, 2008; Boucher et al., 2009 and Duarte, 2011). A remarkable outcome is that most farmers considered themselves as credit unconstrained. The percentage of unconstrained farmers is 73.9% from which 64.3% are unconstrained borrowers and 9.6% unconstrained non-borrower farmers. The percentage of farmers constrained due to risk rationing also is 8.7% against a very low percentage of 1.7% of farmers constrained by transaction costs. The percentage of quantity-constrained farmers is 15.7%.

From these results, we cannot unambiguously determine why perceived credit constraints might be relatively low in Rwanda compared with other developing countries.

However, it seems as if these results can be attributed to the Rwandan financial sector policies such as deregulation, which in turn has raised the level of competitiveness in the financial sector, an adequate regulatory framework, and the widespread presence of savings and credit cooperatives at each sector (county) level of Rwanda across the country. This allows unbanked but bankable households to have access to financial services at low transaction costs (NBR, 2008a). With our data set, we cannot conclude why the degree of credit rationing would be relatively low at this level. Instead, we can suggest a further study of the reasons for differences

in credit status within Rwanda. Table 6 presents the classification of farmers with respect to their credit constraint status.

Table 6 Classification of farmers by credit constraint status

Credit constraint status	Number of farmers	Percentages(%)
Unconstrained		
Borrower	74	64.3
Non-borrower	11	9.6
Total credit unconstrained farmers	85	73.9
Constrained		
Quantity rationed	18	15.7
Transaction cost constrained	2	1.7
Risk rationed	10	8.7
Total credit constrained farmers	30	26.1
Total number of farmer	115	100

Source: computed from own surveyed data, 2012

With respect to the rest of this chapter, section 4.2 describes the main variables that may influence the credit constraints in the formal credit market while section 4.3 presents the results of marginal effect of multinomial logit model.

4.2 Variables explaining credit constraints

The credit market is characterized by asymmetric information, with problems such as adverse selection and moral hazard influencing formal banks to ration credit (Freixas and Rochet, 1997). Some variables may decrease credit rationing. Table 2 compares the means of five variables that are assumed to influence credit rationing categories among households. Our analysis focuses on two variables, collateral or tenure security and social capital that are often cited in bank literature as important in explaining credit constraints in developing economies.

Table 7 Expected results of marginal effects for multinomial logit model

Variables	Price-rationed borrower (unconstrained)	Price-rationed non-borrower (unconstrained)	Quantity rationed (constrained)	Transaction cost and risk rationed (constrained)
LAND SIZE	+	+	-	-
LENGETH	+		-	-
CLUSTER	+	-	-	-
ACCESSTO TRAINING			-	+
DISTANCE			-	+

a) Collateral

Collateral can signal the quality of borrower (Bester, 1985 and Duarte, 2011) and the availability of collateral may decrease moral hazard problem (Hoff and Stiglitz, 1990; Boucher, Guirkinger et al., 2009). As indicated by Duarte (2011), an increase landholdings should reduce the probability of being a rationed borrower. Diana (2008) stated that households with large landholdings are expected to have high returns and show higher demand for credit. They are also likely to have better access to credit, as they may appear to lenders as less risky borrowers. We use total land owned by the farmer as a proxy for collateral. The variable land size is measured as the amount of land in hectares owned by the farm household. Land is the most common form of collateral used by formal lenders in majority of developing countries in general and in Rwanda in particular. We expect that the probability of becoming a price rationed borrower (unconstrained) increases if the amount of collateral increases, because banks are more likely to provide a loan if a borrower can pay back his loan by pledging a collateral. For price rationed non-borrowers (unconstrained), we predict that the probability increases if the amount of collateral increases, because better-off, unconstrained farmers have more wealth to self-finance.

For constrained, quantity-rationed farmers, we hypothesize that the sign for the collateral variable is negative, which indicates that an increase in the amount of land available decreases the probability of being classified as a quantity-rationed borrower. This is due to the fact that farmers with more land have collateral to show banks and therefore should get the loans they

request. We expect the same trend to hold for the probability of becoming a risk- and/or transaction cost-rationed household because better-off households have more wealth, higher returns and can show the bank that they are less risky by pledging a collateral. As such, less paperwork will be required to them because they can pay back the loan by pledging a collateral.

b) Social capital

In line with Duarte (2011), we include two variables to account for social capital .This study focuses on how social capital is related to farm-bank relationships but we will not cover the entire spectrum of bank-farmer relationships. Rather will focus on two variables, cluster(the number of relationships that the farmer has with farmer cooperatives /or other actors involved in the value chain) and the length of the farmer bank relationship to explain access to credit for farm households in the formal credit market of Rwanda.

A cluster is widely defined as a group of supply chain players — input suppliers, traders, processors, farmer cooperatives, extension agencies, and banks — who interact frequently (Duarte, 2011). Being a member of a cluster defines different aspects of social capital which is normally understood as the quantity and quality of interpersonal relationships. Clusters may allow better access to organizational capability at the grassroots level, information on markets, technologies, product quality, and finance. We therefore predict that, an increase in the number of relationships that a farmer has with farmer cooperatives and/or other groups involved in the value chain has two effects. First, the probability of becoming a quantity-rationed borrower decreases if the interconnected relationships, such as a business cluster or belonging to more cluster signals that the farmer is creditworthy. Secondly, the probability of becoming a transaction cost- and risk-rationed borrower decreases since the relationships with more clusters suggest that the farmer is creditworthy. Thus, the need for the bank to screen the farmer decreases as well. For our analysis, the cluster effect on credit is especially important. We expect that financial access is positively related to social capital.

We also consider that, a longer farmer-bank relationship improves the accuracy of the bank's information about the creditworthiness of the farmer and reduces monitoring costs (Degryse and Ongena, 2005; Baas and Schrooten, 2006). It is likely that a bank would be willing to extend a loan if its relationship with the farmer were longer. In addition, the transaction costs related to applying for a loan decreases because the borrower can probably provide less information to the bank or possibly because the borrower is more familiar with filling out the bank form or loan

application. Degryse and Ongena (2005) suggest that to obtain a loan, a new borrower may have to visit the bank office between two and three times, whereas a regular customer is not requested to do so. Therefore, we hypothesize that the probability of being a quantity rationed farmer decreases if the length of farm- bank relationship increases because the lender increases the accuracy of information about the creditworthiness of the farmer and increases funds available to that farmer. We expect the same tendency to hold for the probability of being a risk/ or transaction cost rationed farmer. However, the effect of this variable on the probability of becoming an unconstrained non-borrower is unclear.

c) Control variables

We use a variable that represents farm characteristics and which may correlate with farmer management skills (Barslund and Tarp, 2008). We include the access to training or extension services variable to account for farm management skills (Petrick, 2004b). Farmer management skills may decrease credit constraints (Barry and Robison, 2001). Farmers who received training seem to be good quality entrepreneurs and they can easily convince potentials lenders that they are creditworthy (Patrick, 2004b). We hypothesize that the probability of becoming a quantity-constrained farmer relates negatively to management skills, which implies that an increase in the quality of entrepreneur decreases the probability of being classified as quantity-rationed. This is because farmers who have received training may appear as less credit risky to lender and thus should receive the loans they request. For transaction cost/or risk rationed, we expect the relationship to be negative because good quality entrepreneurs can prove that they are creditworthy. The next variable is a proxy of transaction cost associated with the loan application. It gives the travel time in public transportation to the nearest formal bank and is likely to be positively correlated with transaction costs (Boucher et al., 2009). We expect the variable distance from the bank office to be positively correlated with transaction cost rationed. Table 8 reports the marginal effects of each regressor on probability of the household being observed in each rationing category.

Table 8 Marginal effects of Regressors on Probability of Rationing Regimes

Variables	Price-rationed borrower unconstrained)	Price-rationed non-borrower (unconstrained)	Quantity rationed (constrained)	Transaction costs & Risk rationed (constrained)
LAND SIZE	4.14***	0.35	-0.44*	-2.15*
	(0.144)	(0.107)	(0.252)	(0.243)
LENGTH	6.5***	6.3***	-2.09*	-3.38**
	(0.006)	(0.005)	(0.008)	(0.007)
CLUSTER	0.32	3.11**	-2.93**	-2.17*
	(0.014)	(0.009)	(0.032)	(0.027)
ACCES TO TRAINING	2.01*	-0.97	-1.62	-0.52
	(0.055)	(0.053)	(0.052)	(0.049)
DISTANCE	1 .15	-0.42	-0.42	0.63
	(0.001)	(0.004)	(0.006)	(0.005)
TESTS				
VIF= 1.42				
Wald test (15) Pseudo R^2	56.60*** 0.7369			

Marginal effects are estimated at sample of regressors.
Standard errors are reported in parentheses.
***Indicates the marginal effect is significant at the 1% level.
**Indicates the marginal effect is significant at the 5% level.
*Indicates the marginal effect is significant at the 10% level; Wald test is for test of joint significance of all regressors; Common rule of thumb is that VIFs of 10 or higher value may indicate problem of multicollinearity. There is no multicollinearity between regressors since the VIF test   indicates the mean VIF value of 1.42. The model fit is rich with pseudo R2 of 0.7369 .It measures the ratio of explained sum of square to total sum of squares, with 0 and 1 as lower and upper respectively.

4.3 Results of marginal effects of multinomial logit

Table 8 presents the marginal effects of each regressor on the probability of the household being observed in each rationing category. As discussed above, our main concern is to identify the main determinants of farm households' credit constraints and to distinguish between non-borrowing households that are credit constrained versus unconstrained.

First, we consider collateral which is measured as amount of land owned by the farmer. As expected we find a strong positive significant effect for possession of land on the probability of

being a price-rationed borrower (Unconstrained). According to prior literature, collateral can signal the quality of borrower Bester (1985) and Duarte (2011) and the availability of collateral may decrease moral hazard problem (Hoff and Stiglitz, 1990; Boucher, Guirkinger et al., 2009). Most of the time, banks are more likely to provide a loan if the borrower can pay back the loan by pledging a collateral. Boucher et al.(2009) suggest that, land ownership may also affect the farmer's participation in credit markets through two main mechanisms. First, land can be used as collateral which enables formal lending institutions to overcome adverse selection and moral hazard problems. Secondly, the farmer who has the land ownership and who was previously discouraged from borrowing due to risk or transaction costs may search for a loan.

We find a negative significant effect for possession of land on the probability of being quantity rationed because quantity rationing may arise from the household's inability to post the collateral required by the lender to overcome the information problems within credit transactions. This is anticipated as formal lenders in Rwanda are progressively requiring borrowers to pledge unquestionable collateral. These results support the argument that farmers with less amount of land are more likely to be quantity constrained by formal lending institutions. As anticipated we also find a negative significant effect for the ownership of land on the probability of being transaction cost and risk rationed because better-off households have more wealth, higher returns which incite them to show higher demand for credit. They may appear as less risky borrowers, and therefore formal lenders can require less paperwork for them given that they can pay back the loan by pledging a collateral.

Secondly, we consider the length of the bank-farmer relationship variable. It has a positive significant effect on the probability of farmers being either price-rationed borrowers (unconstrained) or price- rationed non –borrowers (unconstrained) and a negative significant effect on probability of being a quantity rationed or transaction cost- and risk-rationed farmers. As anticipated we find a negative significant effect for the length of farm-bank relationship on the probability of being quantity rationed because a longer farmer-bank relationship may improve the accuracy of the bank's information about the creditworthiness of the farmer and reduce monitoring costs associated with the loan contract (Degryse and Ongena, 2005; Baas and Schrooten, 2006). We also find a negative significant effect for the length of famer-bank relationships on probability of being a transaction cost- and risk-rationed borrower which implies that a long-term relationship between farmers and banks can reduce transaction costs and risks associated with the loan contract. This could be due to the borrower being more

familiar with filling out loan application forms and the bank requiring less paperwork from these recognized customers.

Thirdly, we consider the variable cluster or number of relationships that a farmer belongs to. We find a positive significant effect of the number of clusters that a farmer belongs to on the probability of being a price-rationed non-borrower (unconstrained). The possible explanation of these results is that, unconstrained or price-rationed households are unaffected by asymmetric information in credit markets due to their endowments and opportunities. Although, asymmetric information may suggest that lenders impose a credit limit, this limit is not binding for unconstrained households (Boucher et al., 2009). As expected, a higher fraction of cluster that the farmer belong to decreases the probability of being quantity constrained as it is likely to decrease the probability being transaction costs and risk rationed. The reason for this outcome can be explained in two mechanisms. First, the interconnected relationships such as a business cluster or belonging to more cluster signals that the farmer is creditworthy such that the probability of being quantity constrained declines with the number of relationships that the farmer belong to. Secondly, farmers that belong to more clusters face lower transaction costs and risk associated with loan contracts probably due to their shared experience and information with other groups involved in the value chain.

Control variables

As expected, we find a positive significant effect of access to training on the probability of farmers being a price-rationed borrower(unconstrained) .It is not surprising since farmers who have management skills as proxied by access to training seem to be good quality entrepreneurs and they can easily convince potentials lenders that they are creditworthy (Patrick, 2004b). However, we find a statistically insignificant effect on the probability of being quantity constrained. It seems that an increase in the quality of entrepreneurs reduces the probability of being classified as quantity-rationed.

Finally, we consider variable related to distance from the bank office. As expected, the probability of being transaction cost /or risk constrained increases with the distance, although the impact of the variable is not significantly different from zero.

5. DISCUSSION AND CONCLUSION

Major results are summarized and discussed with reference to each of the three specific question(s) raised in Chapter 1. We have tried to determine whether farm households in Rwanda are credit constrained as well as identify the main factors that influence formal credit provision for farm households. In line with Boucher et al.(2009), we define a farmer as credit constrained if the farmer's effective demand for credit exceeds supply. We consider quantity rationing from the supply side as well as transaction or/and risk rationing from the demand side. Therefore, we can examine the level from which credit constraints frequently arise from demand- or supply-side factors. Furthermore, by distinguishing many categories of constrained and unconstrained borrowers we later provide a more detailed analysis in order to show which variables are important in explaining the probability of belonging to a particular group of borrowers or non-borrowers.

Recall that, the main objective of this study was to determine whether farm households in Rwanda are credit constrained as well as identify the main factors that influence formal credit provision for farm households in Rwanda. To determine the main factors that influence the probability of belonging to a particular group of borrowers or non-borrowers, we estimate a multinomial logit model. We mainly focus on the effect of two variables namely, collateral and social capital that are often cited in bank literature. The important outcome is that farmers with more social capital are less risk and/or transaction cost constrained. Moreover, these findings revealed that, the non-consideration of constraints deriving from quantity rationing would result in a significant increasing of both occurrence and impacts of credit constraints in rural credit market of Rwanda. These results also suggest that among the group of credit-constrained farmers, quantity rationing seems much more predominant than risk and/or transaction cost rationing (see Table 6).

Are farm households in Rwanda credit constrained? This question was addressed in chapter 4 where an important outcome of our findings show that, most farmers consider themselves credit unconstrained regardless of the type of credit constraints they face. The results show that 26.1% of the sample felt credit constrained with most farmers,15.5% of the sample being quantity rationed. A much lower share of farmers,1.7% is constrained by transaction costs. We hypothesize that this perception results from the fact that being more connected or belonging to more clusters provides more alternatives for the funding of their investment projects and enables them to face lower transaction costs and risk associated with loan contracts.

To what extent does social capital influence farmer access to credit? This question was addressed in chapter 4 as well. We find that a long-term relationship between farmers and banks has a strong impact on the probability of being a risk and/or transaction cost rationing farmer because probably famers could have more experience in filling out credit application forms or the bank might require less paperwork from these recognised customers. The negative relationship between the probability of being transaction cost and/or risk rationed and the length of the relationship between farmers and banks can be explained by the fact that a farmer that has been borrowing several times is less risk-rationed. In addition to this, a higher fraction of cluster that the farmer belong to decreases the probability of being quantity constrained as it is likely to decrease the probability being transaction costs and risk rationed.

How does collateral influence farm households credit constraints in the formal credit market? Again this question was addressed in chapter 4. The results revealed that having ownership of land is associated with a significant lower probability of transaction cost rationing. The explanation for these results is that qualification for a land ownership in Rwanda requires that individuals provide a number of documents provided by the local authority such as the national identity card, receipts for payment of taxes related to land registration , an act of notoriety and a certificate testifying that the plot has not been pledged to any lending institutions . Many of these documents are also requested by formal lending institutions such that the farmers who did not meet the required documents for land ownership are likely to complain that they did not apply for credit because providing documents would be too costly. Finally the results show that, the possession of land has a negative significant effect on the probability of being quantity rationed because quantity rationing may arise from the household's inability to post the required collateral to overcome the information problems within credit transactions. This is not surprising since in Rwanda banks are progressively requiring borrowers to pledge unquestionable collateral.

In line with the ideas of Boucher et al.(2009), in Rwanda we need policies that would put more attention on the legal process of land registration, strengthening institutions related to the enforcement of loan contracts and establishing strategies that would provide insurance for farm output, its price and health. We also outlined the direct elicitation methodology to determine whether or not farm household is credit constrained and, if so, to identify the rationing mechanism at play. The direct elicitation method we applied relies on qualitative questions that elicit different types of information. For more details (see appendix 2).

6. POLICY IMPLICATION

When trying to generalize the results of this study, it is important to consider the particular conditions of the Rwandan context. To facilitate this, four policy implications can be derived from this study. First, this study indicates that although to some extent a credit constraint was found, it is not generally predominant in the Rwandan rural financial market. This possibly can be attributed to Rwandan financial sector policies including deregulation, which has raised the level of competitiveness in the financial sector, an adequate regulatory framework and the widespread presence of saving and credit cooperatives across the country .

Secondly, in Rwanda to get the benefit of liberalization policies, it is important to develop some degree of coordination in the market through cluster formation for example. Thus, long-term relationships between banks and farmers and the formation of clusters enables more and better information sharing between banks and farmers and consequently more trust. In the situation of Rwanda, cluster formation and long-term relationships were organized by private actors themselves who saw some economic benefit in cluster formation. This policy may help in cluster formation by facilitating the interaction between cluster coordination and farmers themselves or their representatives. For example, government agencies may establish programs that foster business connections between small-scale farmers and agro-processing or input supplier companies. This needs closer attention from research and policy on how such clusters can play their roles effectively and on the extent to which they can substitute direct interventions by government organizations and NGOs in credit rationing mitigation in Rwanda.

Thirdly, investments is needed in policies that put more attention on the legal process of land registration, strengthening institutions that related to the enforcement of loan contracts and establishing strategies that would provide insurance for farm output, its price and health care.

 Fourthly, in order to improve access to credit and improve farmer livelihoods under such situations, further and careful development approaches are essential in order to modernise current credit market systems such as creation of credit bureaus or other institutions that facilitate information sharing between banks on borrowers' credit history. However, further investigation beyond this study would be appropriate.

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APPEDIX 1

QUESTIONNAIRE

Identification	Answers
Name of the farmer/respondent	
Date	
Address (Region, cell and village)	
Phone number	

SECTION 1: HOUSEHOLD CHARACTERISTICS   CODE

1.1	Age				|_____| Years
1.2	Gender	1 = Male, 0 = Female			|_____|
1.3	Marital status	1 = Single	3 = Widowed	5 = Cohabitation	|_____|
		2 = Married	4 = Divorced		
1.4	What is your level of education ?(if the respondent is the head of household go to question1.5) yes= 1, No= 0				|_____|
		1 = No education	3 = Secondary education		|_____|
		2 = Primary education	4 = Higher education(university)		
		5 = Post graduate education 6 = Informal education (literacy, etc)			
1.5	What is the level of education of the household head?				|_____|
		1 = No formal education	3 =secondary education		|_____|
		2 =Primary education	4 = High education (University)		
		5 = graduate education			
		6 = Informal education			
1.6	How many people live in your household? (including respondent)				|_____| members
1.7	How many people under 15 years old live in your household?				|_____| members
1.8	How many people above 15 years old, who cannot work due to old age, sickness and disability, live in your household?				|_____| members
1.9	How many people who have an income live in your household?				|_____| members

SECTION 2: HOUSEHOLD SOCIO-ECONOMICS   CODE

| 2.1 | The house where you live in is: | 1 = Owned but you are still paying it | | 3 = Rented (for money) | 5 = Other (specify) | |_____| |
| | | 2 = Owned and already paid | | 4 = Borrowed (for free) | | |

2.2	What materials is your house made of?				
	1 = Mud/soil	4 = Wood	7 = Block Cement		Wall: |_____|
	2 = Bamboo	5 = Tin(container)	8 = Concrete (mixture of brick, cement and iron)		
			9 = Other (specify), 10= sheets, 11= grasses,		
	3 = Straw/leaves etc	6 = Brick	12=sheeting , 13= amategura		Roof: |_____|

2.3	What is the main source of drinking water in the household?			
	1 = Tap inside the house	4 = Neighbour's house	7 = Public well	|_____|
	2 = Hand pump in house	5 = Public tap	8 = Rivers/stream/canal/pond	
	3 = Own well	6 = Public hand pump	9 = Other (specify)	

| 2.4 | What is the type of latrine in the household? | | | | |_____| |
| | 1 = Toilet at home | 2 = Toilet at neighbour's home | | 3 = Public toilet | 4 = In the open access | |

| 2.5 | What is the primary fuel used for cooking? | | 1 = charcoal | 2 = Firewood | |_____| |
| | 3 = Kerosene | 4 = Electricity | 5 = No cooking arrangement | 6 = Other (specify) | |

| 2.6 | Do you own land | | 1 = Yes, 0 = No | |_____| |

| 2.7.1 | If yes, How big is your land? | |_____| ha |

| 2.7.2 | Do you rent land? | 1=Yes, 0=No | |_____| |

| 2.7.3 | *If yes how big is the rented land?* | /_____/ha |

| 2.8 | *Please indicate how many cattle, livestock, or poultry do you own:* | |

41

1 = Cows	/_____/	*3 = Pigs*	/_____/	*5 = Chicken*	/_____/
2 = Goat	/_____/	*4 =Sheep*	/_____/	*6 = Other (specify)*	/_____/

2.9	Please could tell us if do you have an off-farm income in your household? Yes=1, No= 0	|_____|			
2.10	Please indicate what type off- income source do have in your household				
	1. Work in your own activity and you are own boss (Self-employment)	|_____|	4 = Pension, social allowances	|_____|
	3 = Receive money from migrant family members (remittances)	|_____|	5 = others specify	|_____|
	7 = Other (specify)	|_____|		

3. What are three main crops grown in your farm?

1 =

2 =

3 =

4. What was the average yield of each crop per season?

Name of crops	Average yield/crop season (in kg)	Amount earned /crop season (Approx)	Remarks
1.			
2.			
3.			

5. Farmer's management skills (years of farming experience and participated in training or workshop organized by extension services)
a. Years of farming experiences in your own farm
         Number of year's   _____

b. Have you participated in training or in workshop organized by extension agencies?
1= Yes
0=No

6 .Do you hire casual labourers?
1=Yes (if yes , skip to question 6)
0= No

7. How much do you pay per season? ....Rwf
8. How far is the bank office from your firm(number of Km).....................Km
9 . How far is your farm from the main road? (number of Km)....................Km
10. Do you sell any crop product to the market?
         1=Yes(If Yes, skip to question 10)
         0= No
11. Could you tell us the farm get price and market price of each crop by filling in the table below?

Name of crop marketed	Unit price (Rwf/kg) farm gate price	Unit price(Rwf/kg) market price
1.		
2.		
3.		

12. Have you had any problem in selling your crop?

     1=Yes(if yes, skip to question 12)
 0=No
12. which problem do you face when selling your crop?
1= Unclear price information
2= Unclear price charged for the service
3= Delayed payments
4= Technical assistance
5= Others specify
13. Please indicate the types of assets do you own and its present value (Allowed for multiple answers)

Category	Number	Present value
1= Cow 2 =Goat 3= Pig 4= sheep 5= chicken		
6=House/building		
7=Land in ha		
8=Vehicles		

9=Motorcycle		
10=Bicycle		
11=Radio		
13=Television		
14=Others (please specify)		

SECTION3: SAVING BEHAVIOR

3.1	In the last 12 months have you participated in informal lending institution?	1 = Yes, 0 = No	|_____|
	1. if so , which institution did you participate in?		
	1 = ROSCA		
	2= credit union		
	3= other specify		
3.2	Do you participate in Rosca? 1= Yes, 0 =No	|_____|	
3.3	If so, how many?	|_____|	
3.4	Does anybody in your household has participated in informal lending institution 1 = Yes, No= 0	|_____|	
3.5	If so, in which institution does he participate in ?		

	1 = ROSCA			
	2= credit union			
	3= other specify			
3.6	Do you have an account in formal banking institution Yes=1, N0=0		|_____|	
	1= commercial bank	5= Mobile money		
	2= post bank	6= others		
	3= credit cooperatives			
	4= MFI			
	7= SACCO			

SECTION 4: CREDIT

CR 1 What the main source of financing do you use in your activities? :(Multiple answers is allowed)

       1= Formal banks

       2 = Traders

       3= Input suppliers

       4 = Friends

       5 = Relatives

       6= wholesalers

       7= Own capital

       8= Others specify ----------------------------

CR2 Do you work with formal lending institutions ?

      1 = Yes

      0 = No (if No , skip to the question CR3)

CR3 For how many years had you worked with formal lender?

CR 4 Did you receive any loans from formal lending institutions in the last 12months?

　　　　0=No, (if no, please skip to next question CR5)

　　　　1=Yes (if yes, please fill out the next table)

The Name of the formal financial institution (bank, MFI, SACCO, etc)	What was the value of the loan?	What was the interest rate ?	Did you want a larger loan at the same Interest rate? Yes= 1 No= 0	How much did you pay back in each monthly instalment	When did you receive this loan	When will you finish paying it off?	What was the loan used for?	How many years did you work with this institution?	Are you still working with this formal financial institution? 1=Yes, 0=No	If No, why? (code) 1.lack of collateral 2.bad credit history 3.high interest rate 4.payment system 5. formal inst are strict

CR 5 Did you receive any loans from informal lending institutions in the last 12months?

      1= Yes, (if yes, please fill out the next table)

      0= No, (If No, Please skip to the question CR6)

The name of the Lender	What was the value of the loan?	What was the interest rate	Did you want a larger loan at this same interest rate? Yes= 1 No =0	How much did you pay in each monthly instalment	When did you receive this loan?	When will you finish paying it off?	What was the loan used for?	How many years did you work with this institution?

CR 6 In the past 12 months have you applied for bank loan and been rejected?

    1= Yes (if Yes, please fill in the next table)

    0 **= No (** if No, skip to the question CR7)

CR7. Which formal lender rejected your application?	CR8. In which year?	CR9. Why your application has been rejected?

CR 10 Would a formal lending institution lend you if you applied?

    1 = Yes(If yes, skip to question CR11)

    0 =No (if No, skip to the question CR12)

CR 11 Why did you not apply for a loan? (Multiple answers)

1	The loan was not needed
2	The interest rate was too high
3	Farming does not give enough profit to repay back the debt
4	The farmer did not want to risk (risk-aversion)
5	Worry and/or fear./ Afraid bank will seize collateral
6	Formal lenders are too strict; they are not as flexible as informal ones
7	Formal lenders do not offer refinancing
8	The bank branch was too far away
9	Banks require too much paper work associated with the application

CR 12 If you were certain that formal lender would approve your application , would you apply?

        1 = Yes(skip to the next section)

        0 = No(skip to the question CR10)

CR 13 Why would you not apply for loan if you have been certain that formal bank would approve your application?

1	The loan was not needed
2	The interest rate was too high
3	Farming does not give enough profit to repay back the debt
4	The farmer did not want to risk (risk-aversion)
5	Worry and/or fear./ Afraid bank will seize collateral
6	Formal lenders are too strict; they are not as flexible as informal ones
7	Formal lenders do not offer refinancing
8	The bank branch was too far away
9	Banks require too much paper work associated with the application

CR 14 What are the challenges   you face   when applying for loan from formal credit institutions?

1. Collateral requirements
2. The lending terms
3. Payment system
4. Paperwork
5. Other_____

SECTION 5: SOCIAL CAPITAL

I'd like to ask you about the groups or organizations, networks, associations, both formal and informal. These could be groups such as input suppliers, other farmers, processors, traders, extension agencies, and banks or just groups of people who get together regularly to do any activity.

SCP 1 .Dou you belong to any of these groups listed above?

    1 = Yes(If yes, skip to the question SCP2)

    0 = No

SOCP2. How many groups   does your firm collaborate with? or do you belong to? (please indicate the number)

SCP 3 . Please indicate the type of group do you collaborate with

(multiple answers is allowed)

1= Farming cooperatives
2= Input supply company
3= Saving and credit cooperatives
4= Banks
5= Extension agencies
6= Processing company
7= Others specify

SOCP 4.To what extent do you trust the group that you belong to?

To a very small extent	1
To a small extent	2
Neither small or large extent	3
To a large extent	4
To a very large extent	5

SOCP 5.To what extent do you rate the quality of these networks/relationship among these group?

Bad quality	1
Good quality	2
Very good quality	3
Excellent quality	4

4= Banks

Appendix 2
Direct elicitation method

From credit section 4, we summarise in figure 3 the Direct Elicitation Method and we started with question 4. Did you receive any loan from a formal lender in the past 12 months?

- ☐ Yes   Answer the question and continue with question in figure 3
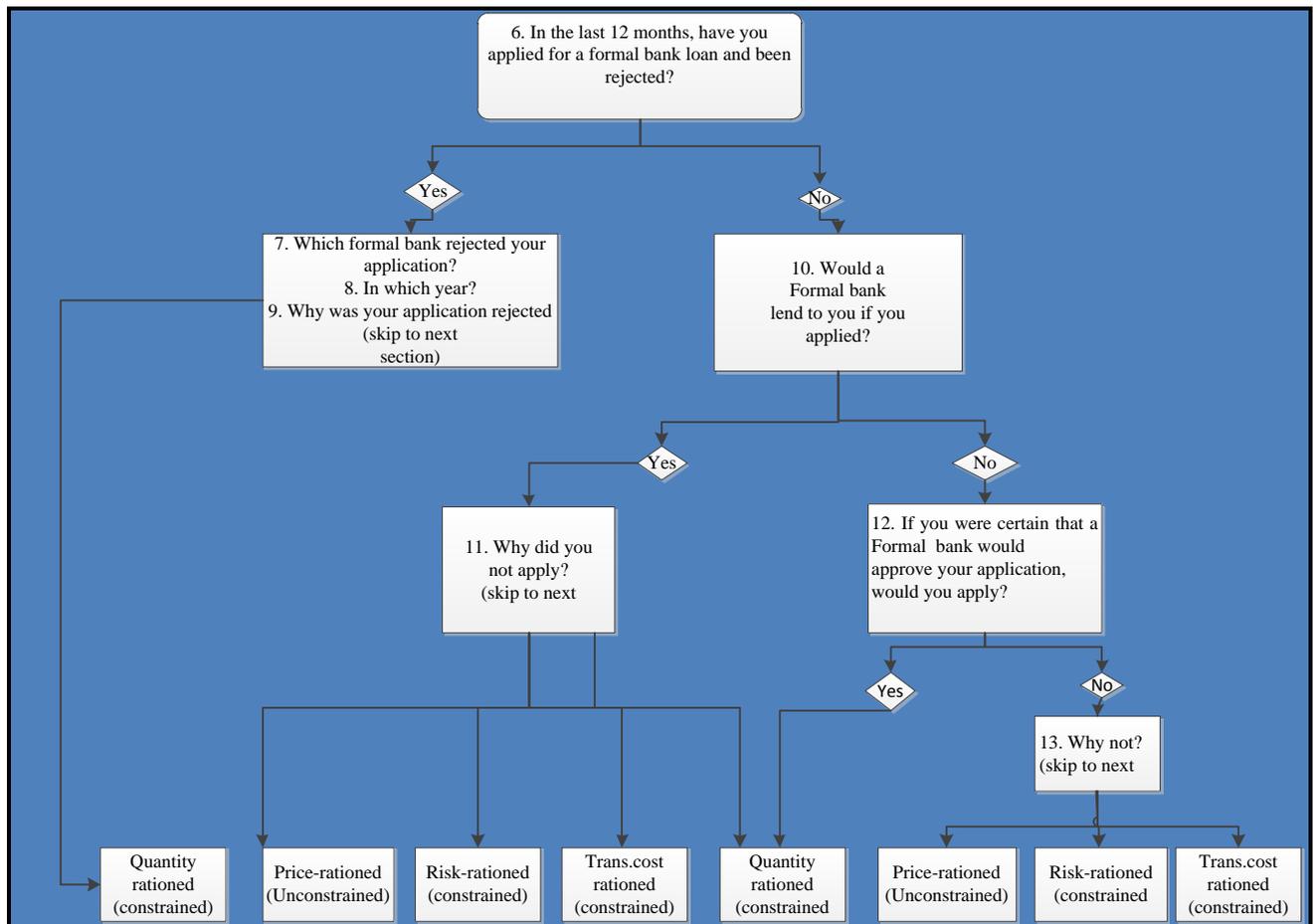- ☐ No   skip to the next question (CR5)

Figure 3 Illustration of farmers' perception on formal lending institution

In figure *3*, we summarise how we apply direct elicitation method to determine whether or not a farmer is credit constrained and, if so, to identify the role played by collateral and social capital variables in determining credit constraints. The first phase, we collected information related to the respondent's socio-economic characteristics and effects of these characteristics. Further, we include additional questions to understand the reasons why some respondents did not seek for loan and the actions they would take in counter-factual situations as well. In order to classify borrowers and non-borrowers as constrained or unconstrained, the direct elicitation approach relies on several qualitative questions.

Question 4

Did you receive a loan in the past the past 12 months from a formal credit institution?

If so, we asked several questions with respect to the loan contract characteristics, such as the loan amount, the interest rate, the use of loan, and the loan period. In order to identify quantity rationing, we also asked whether the farmer had received the desired amount. If the answer to question 4 was no, we continued with question 6

Question 6

Have you applied for a bank loan in the last 12 months?

If so, we asked which formal lending institution rejected your application?, in which year? and why the credit institution decided to reject your application? Question number 7, 8 and 9 respectively . If the answer to the question 6 was no, then we continued with question 10. Identification of supply side constraints focus on question 10 which asks non-applicants if they believe that a bank would lend them if they would apply. The issue of this perception component is that, identification of binding supply constraints relies on the respondent's perception of bank's willingness to offer them loans. This perception may not be true. To proof this we consider the example of two farmers with positive effective demand that are indistinguishable except in their perceptions of bank's supply condition. The first correctly believes that he or she faces positive supply and thus ends up taking a loan and carrying out his or her investment. The second incorrectly believes he or she faces no supply. Thus, he or she does not apply for a loan and give up the project. These two farmers would be classified as credit unconstrained and constrained respectively.

Question 10

Would a formal lending institution lend you if you applied?

If so, we continued with question 11 which asked why did you not apply for a loan? Table A1.1 provides possible answers and the associated rationing category. If the answer to question 10 was no, we continued with question 12. The non- applicants pose a bigger problem because the fact that they did not apply for loan does not mean zero notional demand. To perform this, we ask the following questions: Why the respondent did not or would not apply for a loan. This can be clearly found in question 11 and 12 of figure 3. We consider again question 12 in figure 3, which asks farmers who believe themselves qualified for a loan to explain why they did not apply? If the respondent states that the transaction costs were the main reason for not applying, we classified him/her as transaction costs rationed. Similar question was asked to the

respondent who gave fear of losing their land as reason for not applying, they were classified as risk rationed. But if the answer was no, then they were asked if they would seek a loan if the risk of losing land were abolished. These additional questions would serve us for another purpose especially to know if the respondent would not seek bank loan even if the risk of losing land were abolished. If so, then we concluded that the lack of credit demand was mainly caused by the lack of profitable investment project rather than risk of losing land. This respondent was classified as price rationed (unconstrained) instead of risk rationed.

Question 12

If you were certain that a formal bank would approve your application, would you apply? If the answer was yes, the farmer was classified as quantity-constrained. If the answer was no, we asked why they would not apply for a loan. Table A1.1 shows possible answers and the rationing category associated.

Table A1. 1 Common response to qualitative questions

Response	Associated question	Rationing category
I received loan from formal bank in the past 12 months	Question 4	Price rationed borrower (unconstrained)
I do not need a loan, interest rate was too high	Question11,13	Price rationed non- borrower
Farming does not give enough profit to repay the loan	Question11,13	(unconstrained)
I received loan from bank in the last 12 months but less than requested	Question 4	Quantity rationed
I applied for a loan in the last 12 months but my application was rejected.	Question 6	Quantity rationed (constrained)
I did not apply for a loan because I thought my application would be rejected.	Question 7	Quantity rationed
I did not want to risk my land	Question11,13	Risk rationed
I did not want to be worried	Question11,13	(constrained)
Banks are very strict , they are not flexible as informal lender**.**	Question11,13	Risk rationed
Bank office are too far away	Question11,13	Transaction cost rationed
Banks requires too much paperwork associated with loan application	Question11,13	(constrained)

Appendix 3
The multinomial logit model

Table A1-2: Coefficient of regressors on different categories of credit compared with price-rationed (unconstrained borrowers)

Variable	Price-rationed Non-borrowers (Unconstrained)	Quantity Rationed (Constrained)	Transaction costs & Risk Rationed (Constrained)
LAND SIZE	-0.67	-2.32*	-2.69**
	(2.365)	(21.432)	(21.557)
LENGETH	2.25**	-1.59	-2.87**
	(0.346)	(0.449)	(0.467)
CLUSTER	2.19*	-1.87*	-0.93
	(0.383)	(1.852)	(1.622)
CONTROL VARIABLES			
ACCESS TO TRAINING	-1.23	-2.26*	-1.94*
	(1.502)	(2.408)	(2.220)
DISTANCE	-0.36	0.50	0.72
	(0.128)	(0.395)	(0.360)
TESTS			
VIF= 1.42			
Wald test (15)	56.60***		
Pseudo R^2	0.7369		

Note: ***; **; *; parameter estimate significant at 1%, 5% and 10%, respectively. Standard errors are reported in parentheses. All variables are estimated using robust standards errors ; Wald test is for test of joint significance of all regressors; Common rule of thumb is that VIFs of 10 or higher value may indicate problem of multicollinearity. There is no multicollinearity between regressors since the VIF test indicates the mean VIF value of 1.42. The model fit is rich with pseudo R^2 of 0.7369 .It measures the ratio of explained sum of square to total sum of squares, with 0 and 1 as lower and upper respectively.

Table A1-3: Marginal effects of Regressors on Probability of Rationing Regimes

Variables	Price-rationed borrower unconstrained)	Price-rationed non-borrower (unconstrained)	Quantity rationed (constrained)	Transaction costs & Risk rationed (constrained)
LAND SIZE	4.14***	0.35	-0.44*	-2.15*
	(0.144)	(0.107)	(0.252)	(0.243)
LENGTH	6.5***	6.3***	-2.09*	-3.38**
	(0.006)	(0.005)	(0.008)	(0.007)
CLUSTER	0.32	3.11**	-2.93**	-2.17*
	(0.014)	(0.009)	(0.032)	(0.027)
ACCES TO TRAINING	2.01*	-0.97	-1.62	-0.52
	(0.055)	(0.053)	(0.052)	(0.049)
DISTANCE	1 .15	-0.42	-0.42	0.63
	(0.001)	(0.004)	(0.006)	(0.005)
TESTS				
VIF= 1.42				
Wald test (15) Pseudo R^2	56.60***			
	0.7369			

Marginal effects are estimated at sample of regressors.
Standard errors are reported in parentheses.
***Indicates the marginal effect is significant at the 1% level.
**Indicates the marginal effect is significant at the 5% level.
*Indicates the marginal effect is significant at the 10% level; Wald test is for test of joint significance of all regressors; Common rule of thumb is that VIFs of 10 or higher value may indicate problem of multicollinearity. There is no multicollinearity between regressors since the VIF test   indicates the mean VIF value of 1.42. The model fit is rich with pseudo R2 of 0.7369 .It measures the ration of explained sum of square to total sum of squares, with 0 and 1 as lower and upper respectively.