THE EXTENT OF FARM CREDIT IN THE LIBYAN AGRICULTURAL SECTOR

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Abstract

Rural households in Libya are credit constrained. In terms of access and amount of credits received, formal banks are the main players in credit market. Despite 44 branches of agricultural banks, distributed in the whole country, these branches offer a limited number of credits for different purposes every year, the shares of these branches in rural credit market are quite small, agricultural banks provide only 24% of loans and the other 76% of loans are provided by other banks, mainly commercial banks. However, agricultural credits provided by agricultural banks offer most favorable terms for those households that have a positive demand on agricultural credits. Households that have no access to agricultural credits on the other hand will face a higher interest rate when applying for credits from non-agricultural banks. This study is going to investigate on how important and large credits in Libyan rural-areas, and who is the main player in the rural-credit market. Therefore in this study factors affecting of access to and applications for credit are determined in three different locations. In addition the affect of households and land, regional socio-economic characteristics is being analyzed, using econometric analysis based on primary data collected during field research in years the 2006 and 2007. Empirical results using recent data collected from three different regions in Libya, confirm that more than the half of rural households have no access to credits, and around 42% of rural households do not want to participate or take loans from any financial institution charging interest rates due to the religious consideration prohibit interest rates charged by banks. The results clearly indicate that more 51.85% of the loans taken by households are used to build houses, 33.3% of the loans are used in production inputs, and 9.8%, 4.9% of loans are used for family needs and social events respectively. Findings indicate that socio-economic characteristics' of head of households are important factors increasing the probability of access to credit. Households headed by married men have a higher probability of access to credit compared to households headed by females or solidarity persons. Head of household with some years in schooling and a permanent monthly income from off-farm activity have a higher probability of access to credits than other households without income or education. Different forms of credit constraints are also discussed and comparisons between selected samples down in order to classify constrained and unconstrained households.

JEL Classification: C51, D12, G21

1. INTRODUCTION

The central tenet of institutional economics is that a modern economy is a complex, evolving system whose effectiveness shows in meeting diverse and changing human purposes. Observers of economic growth in less develop countries (LDCs) excluded important and essential dimensions of the problem of economic development, in particular institutional development to achieve freedom, economic prosperity and security. One of the most important government institutions financial institutions of and their role in rural credit market is central for economic development.

How sufficient are these institutions in rural areas?

About 75% of the world's poor live in rural areas, according to Food and Agriculture Organization of United the Nations (FAO). The majority of people in LCDs are farmers or depend on agriculture related activities for their incomes, yet their incomes do not meet the daily basic need. The achievement of agricultural development programs depend on the efficiency of farmers. In order to enable farmers to increase production and to adequately use modern agricultural inputs, it is necessary to provide credit on easy terms.

This paper focuses on the interaction between rural households and financial institutions in three different locations. Such studies became very important in recent years mainly focusing on characteristics of head of households as borrowers, such as age, gender, income, family size and collateral characteristics of households such as size of the land owned, machinery used, type of houses owned….etc. Household characteristics are important for demand and supply in credit markets. Therefore this study is investigates on size and importance of rural credit market in rural areas, on the main factors affecting, on the main players in credit market. Its also focuses on the affects of household's socio-economic as well as on land and regional characteristics on the access to credit and credit applications in three different locations, representing the whole country, using different econometric models. In particular, an important question is the ability of Libyan microfinance lenders to balance the trade-off between the need to the payoff of the micro-credit lending program and the desire to serve the maximum number of rural households.

The first model investigates whether households in rural areas have access to credits or not. This model is going to investigate the main household characteristics that might have a significant impact on access such as age, education, family size, income, number of employees in family and types of agricultural activities, etc. The second model is a choice model determining the factors, which might have an impact on credit applications. The third model is going to determine the amount of credits received, in order to detect the impact of socio-economic, land and institutional factors on the amount of credits received among applicants. The fourth and final model, is going to test whether households face credit constraints or not and which are the main factors that might lead to such constraints.

The empirical analysis of the models illustrated above is based on: first, the probability of borrowers from formal financial institutions (banks), second, the hypothesis that the probability of applying to the agricultural bank is very high, as this bank offers loans at the cheapest interest rate, third, based on the previous hypothesis households have positive demand for offers by agricultural banks and plays a major rule in the local credit market- particularly in the rural, as there are more than 44 branches of agricultural banks distributed in the whole country.

In the last two decades, several studies focused on understanding the working of financial institutions in developing countries. These studies revealed, that world's poorest such as farmers, shopkeepers, weavers, small commodity producers, micro-entrepreneurs and traders require access to simple instruments to obtain working, capital, maintain assets, or expand business. Such instruments have an impact on income and poverty alleviation and their standard of living. An important feature of rural credit market is that access is easier for some groups compared to other. Therefore providing financial services has become a major issue, particularly in rural-areas.

Access to rural credit market in LDCs is one of the most important indicators affecting the household's welfare outcomes. Rural households lacking adequate access to credits are believed to have negative consequences in technology adoption, agricultural productivity, food security, nutrition, health, education and overall welfare of households. (Alio Diagne, Manfred Zeller and Manohar Sharma. July 2002). Credit is an important instrument for providing the welfare of rural household's directly by reducing their vulnerability of short-term income shocks- (Binswanger and Khandker 1995, Jaffee and Stiglitz 1990 and Leathers 1990). The majority of LCDs has set up different credit programs and tries to improve the access to rural credit market and establish agricultural banks that provide credit programs at subsidized interest rates. The majority of financial institutions, particularly so called agricultural banks or rural banks established to support framers and rural households and provide credit at subsided interest rates. These banks have failed to serve the rural poor and be a sustainable credit institution (Adams, Graham and von Pischke 1984; Guasch 1986 and Adams and Vogel 1985). Credit policies in some developing countries focused on making access easier rather than providing credit with subsided interest rates, which might lead to less participation in credit programs even for those who have access to credit.

In literature survey, different approaches are used to measure credit constraints. Households are classified as fully credit constraint if they applied and their applications were rejected or if they did not apply because of insufficient collateral, high transaction cost of loans or because fear of losing wealth, (Barham, 1992). Households that have at least one of their members (member older than 17) facing a binding credit limit are classified as credit constrained, (Diagne, Zeller and Sharma 2000). The borrowers that indicated a desire for more credit at the going interest rates or that did not borrow because they could not obtain credit were classified as credit constrained. Households are credit constrained if they have turned down by a lender or have not been able to get as much credit as they applied for in the past few years, (Jappelli, 1990). Poor people are facing limits on overall amount they can borrow from any given source of credit, if they are willing to put up to back the loan and depend on the interest rate they are willing to pay. Considering all factors mentioned above leads to creation of lack of effective contract-enforcement mechanisms. Lenders have the incentive to further restrict the supply of credit, even though they have enough to meet the given demand even though the borrower is willing to pay a higher interest rate, (Avery 1981, Stiglitz and Weiss 1981). In the literature there are two main approaches to measure credit constraints. The first approach is an indirect method: detecting credit constrains through violation of the permanent income hypothesis. The second method is a direct method: directly questioning of household. This is the method is used in this study.

2. DATA AND METHODS

This section provides descriptive information of methods used in this study as well as data collection and locations. Furthermore a detailed description of sample design is being given.

The primary-data used in the analysis is based on rural-household surveys. The data covered are socio-economic land and regional characteristics of households living in the rural-areas. Rural household survey is used to collect the data during field research in the years 2006 and 2007, the survey was applied in three different regions altogether 330 households were interviewed. Region 1 is representing MUSRATA, region 2 is representing SURT and region 3 is representing HUN & WADAN. The survey was designed to collect information on rural-households and translated to the Arabic Language. To get more information on rural-households and to avoid problems during the survey, a pilot survey in each region was conducted.

The data was selected from several villages in the mentioned three regions, located in different geographical areas. In the north of the country, where the most important agricultural activities are located and around 85% of the total population is settled, two regions were selected (MUSRATA and SURT), the third region was selected from the south part of the country (HUN & WADAN)[1] . In all different geographical regions farmers depend on ground water as the climate is very dry and average annual rainfall almost zero. In addition to cultivation people are also engaged with livestock husbandry, mainly sheep and goat husbandry. Agricultural bank are exited in all three regions.

Stratified random sample was used in each region. Each region is containing several villages, each rural-household was interviewed similar interview, and the data collected in each region was used as primary data in this study.

Data was also collected from the Libyan Ministry of Agriculture, the Libyan Ministry of Planning, the Libyan Ministry of Economy, the Agricultural Center Bank, the Libyan Center Bank and local authorities in each region.

The optimal sample size in each region is computed as following: First, the information in each region was collected by the pilot survey that provided an overview of the households' socio-economic, land and institutional characteristics and helped to avoid any problem that might face the interviewers in term of questions used in the survey.

After collecting the information using a pilot survey in the three regions, the highest variations in household assets [2] was founded. Households' assets variable was used to determine the optimal sample size. Moreover, household assets found in several papers as important factor determines access and applying for credit among individuals. To estimate the mean value $(\mu)$of households' assets of rural-population in the three regions with 95% confidence; the sample estimate $\bar{x}$ or in other form:

$$P\left(\left|\hat{X} - \mu\right| \leq \varepsilon\right)95\%$$

The total population size[3] of the three regions is 30000 households and the estimated average and estimated standard deviation of household assets in all regions respectively is 11349, 10600

[1] Hun and Wadan are selected as one region, because these regions are close to each other, particularly in rural areas , these two region are quite small, the total rural-population is around 6000 households
[2] Variation means that the standard deviation of households' assets is quite high.
[3] Population: means statistically the total rural -households living in the three regions

Libyan Dinars (LYD). With respect to the given data and by the excel program, the optimal sample size in this study should be 330 households in three regions. But each household has different population size, so the next step is to draw a stratified sample of each region with a proportional allocation which is as follows: given the information on the total population of each region known, which is as:

- The total rural-households living in region 1 is 13000
- The total rural-households living in region 2 is 11000
- The total rural-households living in region 3 is 6000

The following calculation is to get the optimal sample size in each region, since we know the optimal sample size in the whole regions:

- ✓ Region 1; (330*13000/30000) = [143]
- ✓ Region 2; (330*11000/30000) = [121]
- ✓ Region 3; (330*6000/30000) = [66]

Using the stratified-random sample with respect to the total-rural households in each region, in region 1 the sample of households interviewed is 143 households, that includes at least 5 villages and agricultural banks existed in all three regions, in region 2 the sample is 121 households interviewed, and finally in region three 66 households were interviewed using same method.

3. DETERMINANTS OF ACCESS TO CREDIT

In the economy, there are many setting of outcomes considered as a discrete choice among a set of alternatives, rather than continued outcome, which measure some activities. For example, modeling labor force participation[4], the outcome of whether make a major purchase or not, have access to credit or not, participate in rural credit market or not, etc, where in these examples are called discrete regression model, this means that the dependent variables assume discrete values. A probability of an event will occur; this can be written as a liner probability model:

$$y = x_i\beta_i + u_i \quad (3.1)$$

This section deals with discrete limited dependent variables, where binary choice model is used to determine access to credit in rural area, the response variable coded as 1 or 0, 1 if individual household has access to credit and 0 if not, a behavioral model of each of these outcomes, including several explanatory factors, that call x . For a given set of x values there are only two possible values for the disturbance, $(-x_i\beta)$ and $(1-x_i\beta)$; the disturbance follows a binominal distribution. Given the properties of the binomial distribution, the variance of the disturbance process, continued on x, is $\mathrm{Var}(u|x) = x\beta(1 - x\beta$, therefore; we cannot use the regression with a binary-response variable that cannot ensure that quantity will be positive for arbitrary x values, so another formulation of the model from an economic point of view will be discussed next.

Using a latent variable is a useful to such econometric model:

$$y^* = x_i\beta_i + u_i \quad (3.2)$$

[4] For more information, see William. H Greene ; Econometric Analysis , Fifth Edition 2003 –P,664

Where y^* is an unobservable magnitude that can be considered the net benefit to individual i of taking an action (e.g., having access to, or applying for credit), in this case it is not possible to observe that net benefit, but we can possible observe the outcome. In fact, in this study, using rural household survey, I observe the outcome of head of households if he/she is able to take credit from any financial institution or not:

$$y_i = 0 \text{ if } y^* < 0$$
$$y_i = 1 \text{ if } y^* \geq 0 \quad (3.3)$$

That is, I observe that the individual did $(y = 1)$ or did not $(y = 0)$, have access or did not have access to credit respectively, considering y^* as a latent variable, linearly related to a set of factors x and a disturbance u. The probability of an individual making each choice using the previous equation as in the following:

$$\begin{aligned} P_r(y^* > 0|x) &= \\ P_r(u > -x\beta|x) &= \\ P_r(u < x\beta|x) &= \\ P_r(y = 1|x) &= \boldsymbol{\psi}(y_i^*) \end{aligned} \quad (3.4)$$

Where $\boldsymbol{\psi}(.)$ is a cumulative distribution function (CDF).
Using maximum likelihood technique to estimate the parameters of binary choice model, for each observation, the probability of observing y conditional on x may be written as:

$$P_r(y|x) = \{\boldsymbol{\psi}(x_i\beta)\}^{yi} \{1\text{-}\boldsymbol{\psi}(x_i\beta)\}^{1-yi}, \qquad y_i = 0, 1 \quad (3.5)$$

The log likelihood for observation i may be written as

$$\ell_i(\beta) = y_i \log\{\boldsymbol{\psi}(x_i\beta)\} + (1 - y_i)\log\{1 - \boldsymbol{\psi}(x_i\beta)\} \quad (3.6)$$

In addition, the log likelihood of the sample is $L(\beta) = \Sigma_{i=1}^{N} l_i(\beta)$, to be numerically maximized with respect to the k elements of β. In this study, I used the common estimator of the binary-choice mode binominal probit. For the probit-model $\boldsymbol{\psi}(.)$ is the CDF of the normal distribution function. Using probit-model to verify whether individual households have access to credit or not, which depends on individual and family household characteristics, such as socio-economic, region, land and other factors, which denoted vector x_i. On other words, the probability that individual households are able to access to credit or not, will depend on for instance head of household, gender, education, farm size, irrigation system, household assets, region, etc. Data contains information on 330 households; 167 out of 330 have access to credit which is around 51%. I fit a probit model of access to credit on the household socio-economic, land, and regional characteristic etc. The following results are found in table (3-1)

Table (3-1) Factors determining access to credit in the Libyan rural areas

Variables	Coef.	Std.Err	z	P>IzI	95%Conf.	Interval
Head of Household (HH)	0.9019	0.2836	3.18	0.001	0.3460	1.457
HH-gender	1.6349	0.6941	2.36	0.019	0.2744	2.995
HH-marital status	0.8436	0.4599	1.83	0.067	0.0579	1.745
HH-formal education	0.0614	0.0231	2.66	0.008	0.0161	0.106
HH-monthly income	0.0015	0.0009	1.67	0.095	0.0002	0.003
Farm Productivity	0.3013	0.1179	2.56	0.011	0.0702	0.532
Water-source	0.4549	0.1125	4.04	0.000	0.2343	0.675
Soil-type	0.3515	0.0930	3.78	0.000	0.1691	0.534
Livestock-holding	0.6067	0.2627	2.31	0.021	0.0917	1.121
Household assets	0.0784	0.0171	4.57	0.000	0.0447	0.111
_cons	-6.7518	1.3251	-5.10	0.000	-9.349	-4.15

HH monthly income means; monthly income from off-farm activities

The results shown in table (3-1) indicate that access to credit in Libyan rural areas is determined by socio-economic characteristics of the households, such as head of household, gender, martial status, level of education, monthly-income, and other factors such as farm-productivity, water availability, type of soil, livestock-holding and household's assets. As apart of their signs, the coefficients in the binary choice models are not easy to interpret directly. One way to interpret the parameters and to ease comparison across different models is to consider the partial derivative of the probability and take further steps of analysis of the marginal effects of individual household characteristics of having access to credit, i.e. y =1 with respect to explanatory variables. The effect of a change in explanatory variables on the value of dependent variable, for a discrete explanatory variable, for example dummy, the effect can be determined from computing the implied probability for two different outcomes, fixing the values of all other explanatory variables. This will be discussed in the next section, to determine the change of the significant variables that found in the model above on access to credit.

One of the major challenges in working with limited dependent variables models is the complexity of explanatory factors' marginal effects on the result of interest, which arises from the nonlinearity of the relationship. In (3.4), the latent measure is translated by $\boldsymbol{\psi}(y_i^*)$ to a probability that $y_i = 1$. Although in (3.2) is a linear relationship in the β parameters, (3.4) is not. Therefore, although x_j has a linear effect on y_i^*, it will not have a linear effect on the resulting probability that $y = 1$.

$$\frac{\partial \Pr(y=1|x)}{\partial x_i} = \frac{\partial \Pr(y=1|x)}{\partial x\beta} \cdot \frac{\partial x\beta}{\partial x_i} = \psi'(x\beta).\beta_j = \psi(x\beta).\beta_j \qquad (3.7)$$

In a binary-outcome model, a change in factor x_j does not induce a constant change in the $\Pr(y = 1|x)$, because $\boldsymbol{\psi}(\,)$ is a nonlinear function of x. One of the reasons of using $\boldsymbol{\psi}(\,)$in the binary-outcome model is to keep the predicted probabilities inside the interval [0, 1]. This bound property of $\boldsymbol{\psi}(\,)$ implies that the marginal effects must go to zero as the absolute value of x_j gets large. Choosing smooth distribution functions, like the normal and logistic, implies that the marginal effects vary continuously with each x_j. Via the chain rule, the effect of an increase in x_j on the probability is the product of two factors; the effect of x_j on the latent variable and

derivative of the CDF evaluated at y_i^*. The term of $\psi(.)$ is the probability density function of the distribution. After, the using log-likelihood of probit-model, using the stata-program , I used the stata-command to compute the marginal effects at the multivariate point of means, to see, what is the probability of access to credit if x_j variable has increased by one unite (in case of x_j is a continues variable), what is to the probability of access to credit if x_j has changed form 0 to 1 (in case of x_j is a dummy variable) and what is the probability if x_j is equal to a certain value. In the next table (3-2), for computing the marginal effect, one can evaluate the expressions at the sample means of each x variable in case of continues variables and for dummy variables, or at a certain value of x_j. Results indicated that socio–economic characteristics play an important role of determining access to credits in the Libyan rural areas. The results show that households headed by females have less probability of access to credits as well as single headed households. The model reports that level of education and monthly income from off-farm activities have a positive effect on the probability of access to credit. In addition, farm characteristics such as type of soil and availability of water have a significant effect on the probability of access to credit in rural areas. Other factors such as household assets are also found to be important factors effecting probability of access to credit in rural areas.

Table: (3-2) Marginal effects of factors that have effects on the probability of access to credit.

Variables	dy/dx	Std. Err.	z	P>|z	95%	C.I.	x
Head of Household @husband	0.3587	0.112	3.20	0.001	0.1390	0.5785	1
HH-gender*	0.5443	0.136	4.00	0.000	0.2776	0.8110	0.963
HH-marital status @married	0.3331	0.181	1.83	0.007	-0. 229	0.6891	1
HH-formal education	0.0243	0.009	2.66	0.008	0.0063	0.0422	7.1
HH monthly income	0.0006	0.000	1.67	0.095	0.0001	0.0013	228.2
Farm productivity@ Increased	0.1310	0. 045	2.90	0.004	0.0423	0.0423	1
Water -source @ Ground water	0.1800	0.044	4.05	0.000	0.0928	0.2671	2
Soil-type@ Clay	0.1391	0.036	3.78	0.000	0.0670	0.2111	2.545
Livestock holdings*	0.2381	0.099	2.4	0.016	0.0436	0.4327	0.781
Household-assets[5]	0. 0310	0.067	4.62	0.000	0.1783	0. 4417	11.390

(*) dy/dx is for discrete change of dummy variable from 0 to 1
(@) [6] is representing the marginal effect at a specific value of x

Notes HH means; head of household and HH monthly income means; income from off-farm activities

Rural-households with a male headed household have 54% higher probability than those whose head of household is female holding other factors constant. Rural households whose head of the household is husband have a 35% higher probability of access to credit. This may reflect the stability of income of the family more members inside the family might have a job therefore more income. Such families might have a better economic situation or better collateral security and engage in more business activities compared with other families.

Education level and monthly income of the head of the household are important factors determining access to credit in the Libyan rural area. Head of households who have better

[5] Household assets measured in thousand Libyan Dinars
[6] (@) is representing the marginal effect at a specific value of x_j

education, a permanent job, a monthly income from off-farm activity have better chances of access to credit than other who have less education, no job or temporary contracts and irregular income.

Land productivity, soil type, and water availability in the farm have a significant impact on access to credit among households, this results might reflect the reality, if we take in our consideration the dry climate in Libya, where the average rainfall is quite small in the north part of the country around 200-350 mm per year and no rainfall in middle and south part. So owning land even large areas, without permanent water sources and good quality of soil will be not profitable to invest in any agricultural activity and therefore not encourage for any borrow activities. Farmers who have permanent water sources in their farm, for example ground water has 18% higher probability than other farmers who depends on rain water.

The results also shows that households that hold livestock have 23% higher probability to have access to credit, which has been expected, as households that hold livestock and therefore have more assets, they might used as collateral when taking loans. It might be even more encouraging of engaging for more activities for income diversifications.

Rural families who own assets have higher probability than those families, who own fewer assets, if we suppose that a total household asset is increased by 10 units the probability of access will be increased to 31%, holding other factors constant.

4. DETERMINANTS OF APPLYING FOR CREDIT

In the previous model almost half of the households have access to the credit market and I discussed the main households' socio-economic, farm and other characteristics affecting the probability of access to credits. In this part I will go a step further by investigating whether individual households that have access to credits, did apply for credit or not, taking into consideration that applying for credits among households also depends on the farm and households' socio-economic characteristics. In this model, I am going to observe those households that have access and applied for credit, using the bivariate probit model. The model has two independent variables including factors that might have impacts on the probability of access and application for credit. Using such a model is to determinate whether there are different impacts of these factors on each concepts or not. Factors such as age, gender, education, income, marital status, family size and other socio-economic characteristics would be relevant in explaining whether individual household applied for credits or not. Examining such variables of what has been known as Qualitative Response (QR) Model.[7] The Formal Structure Model is an other example of a limited dependent variable framework, in which a correlation of equations' disturbance plays an important role. In its simplest form, the model may be written as

[7] Model for Qualitative dependent variables can be found in most discipline in economics. A frequent use in labor economics and in the analysis of micro -level data sets.

$$y_1^* = x_1\beta_1 + u_1$$

$$y_2^* = x_2\beta_2 + u_2$$

$$\begin{pmatrix} u_1 \\ u_2 \end{pmatrix} \sim N\left\{\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{bmatrix} 1 & p \\ p & 1 \end{bmatrix}\right\} \quad 4.1$$

The bivariate brobit Model is similar to the selection model. Considering a two stages process in which the second equation is observed conditional on the outcome of the first. In this study, individual-households that have access to credit are identified as $y_1 = 1$. In second equation $y_2 = 1$, is a variable available only for those household that have already applied for credit, which means that all households that have applied for credit, already have access to credits. In this context, the reliance of the second equation on the first is an issue of partial observability. With partial option, Poirier (1981) used the specification of such a model that using the partial observability. Most commonly, the parameters on binary choice models or limited dependent variable models in general are estimated by maximum likelihood. The likelihood contribution of observations i with y_i=1 is given by $P(y_i = 1|x_i)$ function of unknown parameter vector β and similarly $y_i = 0$, the log-likelihood for this model is as following:

$$\text{In } L = \sum_{y=1} \ln \Phi\left[\hat{\beta_1}' X_i, \hat{\beta_2}', n\tilde{}\right] + \sum_{y=0}(1 - \Phi\left[\hat{\beta_1}' X_1, \hat{\beta_2}' X_2, n\tilde{}\right]) \quad 4.2$$

Where, Φ is the bivariate cumulative normal distribution function, the model given above would be estimated using a complete sample on,$[y_1, y_2, x_i, x_2]$. Using a piviarte probit model with partial observability in which, instead of observing both y_1 and y_2, I observe the product of $(y_1 * y_2)$.The factors determining the access to and application for credit might have an impact on applying for credit, factors include head of households' socio-economic characteristics such as level of income, age, education, gender, family size, number of members of households who have a job, type of agricultural activities and land characteristics, etc. The different attributes between agricultural banks and non-agricultural banks, might affect some individuals when applying for credits, such as interest rate, distance from nearest banks and other regional characteristics always comparing the three regions. In case of the Bivariate Probit Model Analysis, I have two binary response variables are mutually determined. In this model, I would like to estimate access and application for credits simultaneously, and estimate the coefficients needed to account for the joint distribution. See table (4-1)

Table 4-1: Determinants of access for credit, only for individuals who have applied

Variables	Coef.	Std.Err	z	P>IzI	95% Conf.	Interval
HH-marital status	0.837	0.444	1.88	0.001	-0.0335	1.708
HH-formal education	0.179	0.069	2.45	0.014	0.0336	0.304
HH-main occupation	0.112	0.056	1.99	0.017	0.0014	0.222
Farm Productivity	0.265	0.114	2.31	0.021	0.0407	0.491
Water –source	0.421	0.108	3.87	0.000	0.2079	0.634
Soil-type	0.327	0.092	3.53	0.000	0.1453	0.508
Livestock-holding	0.513	0.266	1.93	0.024	-0.0087	1.034
Household assets	0.082	0.018	4.51	0.000	0.0465	0. 118
_cons	-6.266	1.233	-5.08	0.000	-8.6838	-3.849

Table 4-2: Determinants of applying for credit

Variables	Coef.	Std.Err	z	P>Izl	95% Conf.	Interval
HH-marital status	1.282	0.4920	2.61	0.009	0.3183	2.247
Family size	0.100	0.0377	2.67	0.008	0.0268	0.174
HH-formal education	0.858	0.5043	1.70	0.089	-0.1305	1.846
HH-main occupation	0.289	0.0818	3.54	0.000	0.1288	0.449
HH-monthly income	0.009	0.0026	3.69	0.000	0.0045	0.014
Farm Productivity	0.523	0.1403	3.73	0.000	0.2488	0.798
Water-source	0.252	0.1133	2.23	0.026	0.03045	0.474
Soil-type	0.043	0.0997	0.44	0.036	-0.1515	0.239
Using machinery	0.698	.29837	2.34	0.019	.11416	1.283
Livestock-holding	2.275	0.4162	5.47	0.000	1.4598	3.091
Household assets	0. 101	0.0223	4.56	0.000	0.0581	0. 146
_con	-5.864	1.4549	-4.03	0.000	-8.71652	-3.013

After fitting the model, the model outcome is illustrated in two tables, table (4-1 and 4-2) are show the main factors determining access to credit for those who have access and applied for credit. These factors are the same factors discussed in pervious section. Male headed households with a married head of household generally have some years of schooling, access to permanent water sources and an increasing productivity of farm and holding livestock and possess assets. Those households have a higher probability to benefit from rural-credit programs offered by formal banks. The results in these tables, confirm that the same factors that had an affected on the access to credits, also have an impact on credit application probability. The effects have different degrees, which are shown in the coefficients, however still the characteristics of households and land characteristics are the major factors determining credit applications. Two new factors that have no impact on access but have significant impact on applying for credit, are family size and using machinery. The impacts of all these factors will be discussed after determining the marginal effects in the next section. Calculating the marginal effect of each factor will show the exact impact on credit applications when a factor is increased by one unit. See table 4-3

Table 4-3: Marginal effects after the Bivariate Probit Model

Variables	dy/dx	Std.Err	z	P>IzI	95% Conf.	Interval	X
HH-marital status @married	0.374	0.14264	2.62	0.009	0.094	0.654	1
Family size	0.029	0.01027	2.86	0.004	0.009	0.049	7.94
HH-formal education	0.021	0.00596	3.55	0.000	0.009	0.033	7.1
HH-main occupation	0.084	0.02133	3.95	0.000	0.042	0.126	4.27
HH-monthly income	0.003	0.00064	4.45	0.000	0.002	0.004	228.9
Farm Productivity@ increased	0.153	0.04238	3.6	0.000	0.069	0.235	2
Water-source @ Ground water	0.174	0.03154	2.35	0.006	0.012	0.136	2
Using machinery*	0.221	0.10371	2.12	0.034	0. 016	0.423	0.39
Livestock-holding *	0.376	0.05037	7.46	0.000	0.277	0.474	0.78
Household assets	0.039	0.01	3.64	0.000	0.014	0.046	11390

(* dy/dx is for discrete change of dummy variable from 0 to 1),
(@ dy/dx is the probability change of y when x equals a certain value)
(HH-monthly income of head of household from off-farm activity)

In table (4-3), there are some changes of factors that have had impacts on credit applications, compared with factors discussed in the previous section. The new factors family size (number of persons in a family) is an important factor determining credit applications. The second a new factor determining credit application is using machinery. These two factors are not significant when I determining access to credit. Rural families with a married head of household have a significant impact on access and application for credit. Compared to with Families whose head of household is single they have a 37% higher probability of applying for credits holding other variables constant. Rural families who owned machinery have a 22% probability of applying for credits, holding other factors constant. Livestock holding has a significant impact on applying for credits. Rural families holding livestock have a 37% higher probability of applying for credits compared with families who do not hold livestock. Household assets are important factors determining credit applications, if assets of rural families increased by one unit[8] will increases the probability of applying for credits by almost 039%. If we suppose that household assets increases by 10 units it will lead to increase of credit applications 39%, holding other factors constant.

5. DETERMINATION OF AMOUNT OF CREDITS RECEIVED

In the previous sections, I have investigated whether households' have access to credits or not and whether they apply for credits or not, focusing on the main factors that have an impact on access and application for credits. The specific objective of this section is to complete the analysis for those households that have received credit by determining the amount of credits received and to investigate the affect of households' socio-economic, regional, land and institutional factors on the amount of credits received.

In this part, I employ unique data including only those households that have received credit. This data covered households and institutional characteristics that might have an effect on determining the amount of credits received. Household characteristics as discussed in the previous sections that including households socio- economic, land and regional characteristics and other characteristics related to banks, including interest rate, type of loan, repayment period and type of lender, etc, are used as explanatory variables that might have an impact on the amount of credits received, using the Multiple Regression Model.

Multiple Regression Model allows us to test how well we can predict a dependent variable on the basis of multiple independent variables. In this part, I would like to know the main factors causing changes on the amount of credits received; in this analysis only 87 out of 103 households have received credits. Households received a certain amount of credit or type, which was dependent on their socio-economic characteristics, land, and loan characteristics including interest rate different types of loan such as season or short loans, medium and long-term loans and repayment period, etc. The regression model is used to know how changing one or more variables will change the value of other variables. The dependent variable here is the amount of credits received; the multiple regression model used to determine the effect of these variables on amount of credits received.

[8] One unit is equal 1000 LYDs

In the multivariate case, when there is more than one independent variable, the regression line cannot be visualized in the two-dimensional space, but can be computed just as easily. The way is to construct a linear equation containing all those variables. I have a cross-sectional sample from the rural household; the linear regression model of each observation in the sample has the form;

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_{i.1} + \hat{\beta}_2 x_{i,2} + \hat{\beta}_3 x_{i,3} + u_i \qquad 5.1$$

Where, $x_{i,1}$, $x_{i,2}$, and $x_{i,3}$ are sets of variables including household, Land, and financial institutions characteristics, β_1, β_2, and β_3 are parameters to be estimated and u_i is a stochastic disturbance, representing the net effect of all other unobservable factors that might influence y, where y here is the amount of credits received. After estimating the equation (5.1) using STATA, the result indicated that the amount of credits received is determined only by financial-intuition factors, other sets of variables were not significant. Therefore, I drop all other factors, which have no effect on the amount received, and I include only the institutional factors, which included the interest rate and repayment period that really have a significant impact on the amount of credits received among households. The new regression equation therefore is including only those two factors.

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \hat{\beta}_2 x_2 + u_i \qquad 5.2$$

Where,$\hat{y}$ is the amount of credits received, $\hat{\beta}_0$ is the intercept, $\hat{\beta}_1$ measures the changes in y with respect to x_1, holding other factors fixed, and $\hat{\beta}_2$ measures the changes in y with respect to x_2, holding other factors fixed, x_1, x_2 both are institutional factors, representing interest rate and repayment period respectively. The variance of its distribution, σ_u^2, is an unknown population parameter to be estimated along with β parameters. I assume that N > k: to conduct statistical inference, there must be more observations in the sample than parameters to be estimated, N must be larger than k. The results of this model are represented in the following table (5-1)

Table (5.1) Results of Multiple Regression Model: Determining amount of credit received

Number of Obs = 87

					Prob > F	= 0.0000
					R-squared	= 0.7198
					Adj R-squared	= 0.7132
Amount of credits received	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Interest rate	-446.9534	200.811	-2.23	0.028	-844.8365	-49.07022
Repayment period	587.5384	42.40397	13.68	0.000	503.2134	671.8633
_cons	7950.213	1806.056	4.40	0.000	4358.672	11541.57

$$\hat{y} = 7950.213 - (446.95)x_1 + (589.53)x_2 + u_i \qquad 5.3$$

n= 87 R^2 =0.71

First, the model in general is statistically significant; the F-test reporting the result. Moreover, R-squared of the model is quite high (0.71). The R-square; is the proportion of variance in the dependent variable, which can be predicted from the independent variables. The model shows that approximately 71% of the variance of amount of credit received, is accounted by the two independent variables in the model or more precisely, is that the interest rate and the repayment period of credit are representing 71% of the variance of amount of credit received. Adjusted R-square; as predictors are added to the model, each predictor will explain some of the variance in the dependent variable. The adjusted R-square attempts to yield a more honest value to estimate the R-squared for the population. The P-value associated with F-value is very small (0.000), these values are used to answer the equation (Do the independent variables reliably predict the dependent variables?), the P-value is compared to alpha level (typically 0.5). The P-value of is smaller than (0.5) in each independent variables, therefore I can answer the question above (Yes), the independent variables reliability predict the dependent variable. In the equation (6.2), the value of β measures the cause effects of a one unit increase of x on the value of y . β is also referred to as regression coefficient for x and it is the average amount the dependent variables increase when the independent variable increase by 1 unit. In the equation (6.2) β_1 is coefficient represents interest rate effects. The coefficient of interest rate has a negative sign see table (5.1), the interpretation of β_1 refer that; if interest rate is increase by 1%, this will lead to decrease on the amount of credit received by 446 LYD, holding other variables constant. The second factor, which is determining the amount of credit received, is the repayment period. The coefficient of β_2 is referring of the impact of repayment period on the amount of credit received; the interpretation of coefficient of β_2 shows that if 1 unit increasing in period of repayment which measured here in (years) that will lead to increases the amount of credit received by (587) LYD, or in other words every additional year increased of repayment back of credit, leads to increases the amount of credit by (587) LYD, holding other variables constant. In term of banks that provide credit, 24% of credits are received from agricultural banks and 69% of credits are received from non-agricultural banks and only 6% of credits are form both banks, around 51.8% of loans are used for rural-housing, 33.3% are used in production inputs, 9.8%, and 4.9% are used for family needs and social events respectively, see figure (5-1) and (5-2)

Figure: 5-1 Distributions of credit among formal lenders

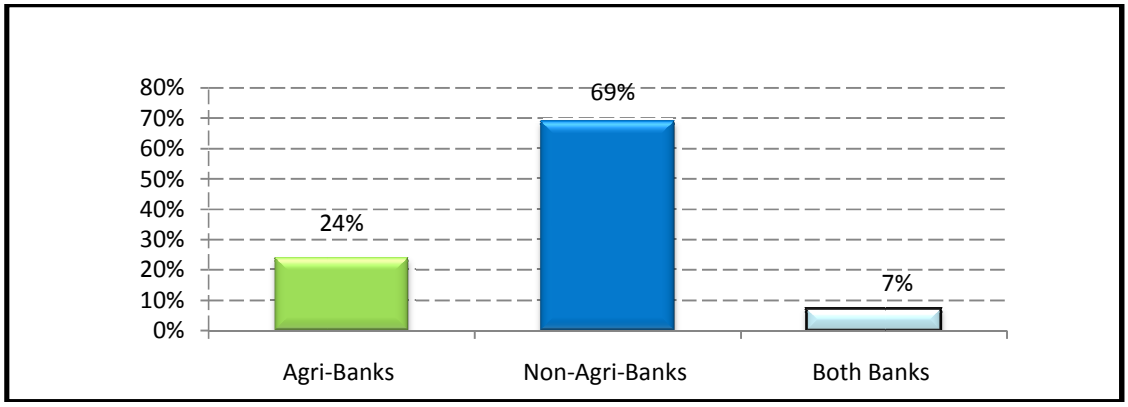
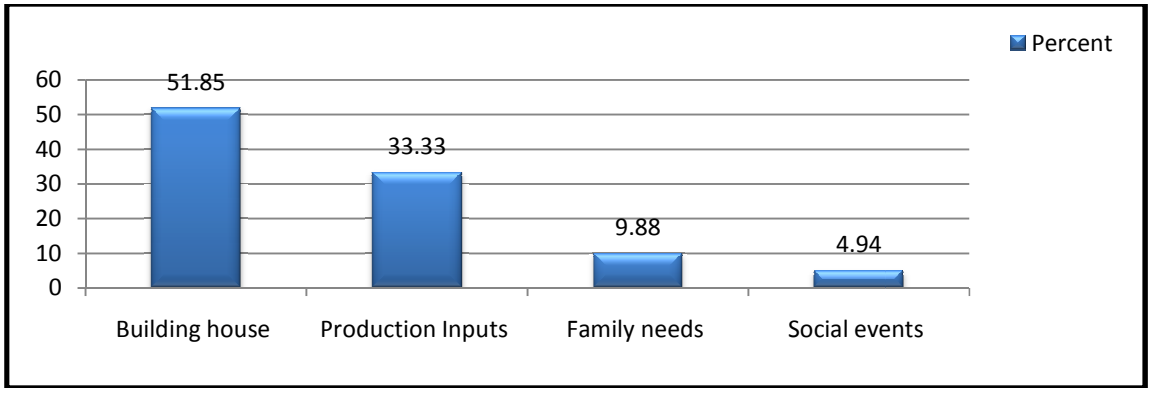


Figure: 5-2 Loan purpose distribution among rural households

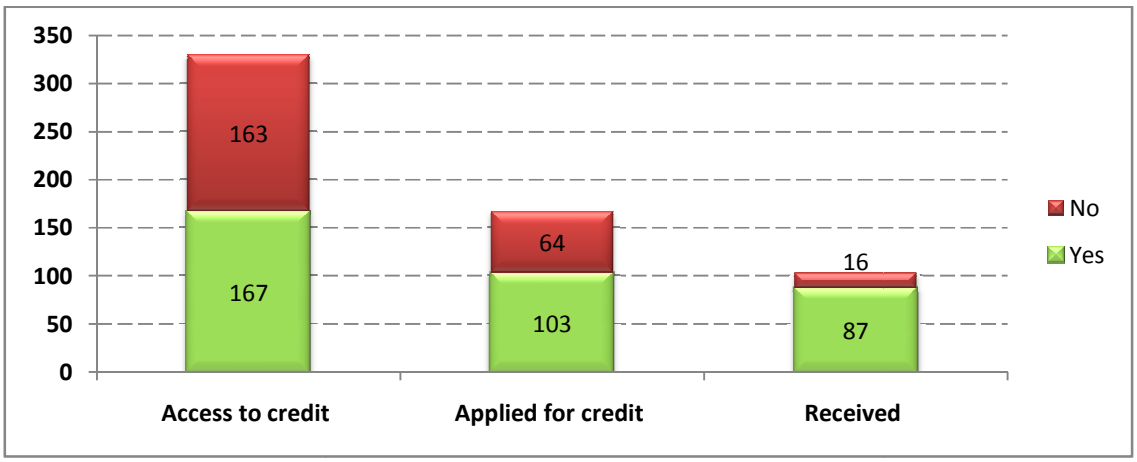


6. DETERMINANTS OF CREDIT CONSTRAINTS

High degree of risk in rural area and the lack of information infrastructure imply that rural credit market in developing countries are likely to suffer from serious imperfection that lead the majority of farmers find themselves facing a binding credit constrained. In spite of general perception that rural financial markets perform poorly, relatively little empirical evidence exists about that factors that leads to such policy and impact of credit constraints on productivity in agriculture. The primary objective of the direct elicitation approach is to respect is to classify households as constrained or unconstrained with respect to the type of institutions and to socio-economic characteristics of rural-households. The analyses will identify whether the constraints derive from quantity or interest rates or other socio-economic variables. The approach that is used here is a combination of observed outcomes and qualitative questions based on primary-data collected during the year 2006 and 2007. First, households are divided into two categories; Households that have received credits and other have not received any credits. Those households whose applied and their applicants rejected are quantity rationed (credit constrained), while those whose applicants were approved are identified as (credit unconstrained). In this case, those households that have applied for credit will include in the sample analysis, which are 103 households out of total sample 330. In this section, I would like to evaluate whether the rural-household that have applied for credit are credit constrained or unconstrained.

In this framework, I will discuss the possibility that credit constraints may take multiple forms. The first form of credit constraints is considering those households who have applied for credit and their applications refused due to lack of collateral requirements or other factors related to contract terms. The sample used in this analysis is composed 103 households which are including only those who have applied for credit, see figure (6-1), detailed information included about head of household's social-economics characteristics', such as gender, education, livestock-holding and assets, all these factors that might lead to credit constraints or amount constraints will included in the analysis.

Figure: 6-1: The distribution of access, applications and received credit among households



In this section, comparisons between two groups of households, those households that have applied for credit and their applicants refused are considered as (credit constraint), where other households that applied for credit and their applicants accepted is considered as (unconstraint). Table (6.1) and (6.2) gives statistical descriptive on two groups:

Table 6-1: illustrated descriptive statistics of refused applicants

Variables	Obs	Mean	Std. Dev.	Min	Max
HH-gender	16	0.94	0.25	0	1
HH-formal education	16	8.9	7.334	0	16
Livestock-holding	16	0.86	0.341	0	1
Assets	16	10225	5226.54	5000	19000

Table 6-2: illustrated descriptive statistics of accepted applicants

Variables	Obs	Mean	Std. Dev.	Min	Max
HH-gender	87	1	0	1	1
HH-formal education	87	7.62	5.415	0	16
Livestock-holding	87	0.931	0.2548	0	1
Assets	87	18253	19397	4000	82000

The results show there different between two groups. The refused applicants are 94% of them males and 6% females, compared with unconstrained households. There are also different in assets and livestock between constrained and unconstrained households. Those households whose considered here credit constraint own less assets and holding less livestock and no

impact on level of education between two groups. Table 6.2 which is illustrated the difference between two groups.

In this part of the paper I use linear probability model (LPM), the model is used to determine the probability of credit constraints among applicants'-households. Rural households that applied for credit and their applications are refused is considered here as (credit constraints), where other household that applied for credit and their applications are accepted are considered as (unconstraint). In this model $y = 1$ is denoted if household is credit constraints, 0 otherwise and including other-variables that might decrease or increases the probability of constraints among applicants-households, it means to write-down a multiple regression model, such as

$$y = \beta_0 + \beta_1 x_1 + \ldots\ldots\ldots\ldots\ldots \beta_k x_k + u \qquad 6.1$$

Where,

y is a binary dependent variable , that $P(y = 1|x)$

x is independent variables

u is error term,

Then the equation can be as

$$P(y = 1|x) = \beta_0 + \beta_1 x_1 + \ldots\ldots\ldots\ldots\ldots \beta_k x_k + u \qquad 6.2$$

Which, says that the probability among applicants –households to be credit constraints $P(x) = P(y = 1|x)$ is a linear function of x_j.The linear probability model (LPM) measures the change of the probability of been credit constraints among credit-applicants when some variables changes holding other factors fixed:

$$\Delta P(y = 1|x) = \beta_j \, \Delta x_j$$

6.3The multiple regression model can allow us to estimate the effect of various explanatory variables on qualitative events, so the estimated equation can be as:

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x_1 + \ldots\ldots\ldots\ldots\ldots \hat{\beta}_k x_k,$$

Table: 6-3 The LPM estimates of credit constraints among applicants

Number of Obs = 103						
					F(4, 98)	= 3.76
					Prob > F	= 0.0068
					R-squared	= 0.1332
					Adj R-squared	= 0.0978
Credit constraint	Coef.	Std. Err.	t	P>|t|	[95%	Conf. Interval]
HH-gender	-.82561	.3498	-2.36	0.020	-1.519	-.1314
Livestock holding	-.41295	.1688	-2.45	0.016	-.7479	-.0779
HH-formal education	.00162	.0060	0.27	0.790	-.0104	.0136
Assets	-.00701	.0024	-2.83	0.006	-.01193	-.0020
_cons	1.4603	.4076	3.58	0.001	.65144	2.269

HH means head of households'

$$\hat{y} = 1.46 - (.82)\text{HHgender} - (41)\text{Livestockholding} + (.0016)\text{edu}(-.007)\ \text{Assest}$$

$$(.001)\quad (.020)\qquad (.016)\qquad\qquad (.790)\qquad (.006)\qquad\qquad 6.3$$

$$\text{n} = 103,\quad R^2 = .133$$

The LPM estimates credit constraints among credit-applicants in table above, the results reported that the probability of credit constrained among applicants is decreased to 82% if the head of household gender is male holding other factors fixed. This means that those families who head of the house is female facing credit constraints. The second factor that reduces the probability of credit constraints is holding-livestock, applicants who have livestock have reduced the probability to credit constraints to 41% holding other factors fixed. The third factor is household assets; this factor is an important factor that founded in all models that determined access and applied for credit in the previous chapters. In LPM the coefficient is also negative sign, which means that if households' assets increased by one unite (1000) LYD this will reduce the probability of credit constraints by 0.007% holding other factors fixed. In this result if household asset increased to 15 units LYD will reduce the probability of constrained to 10% holding other variables constant. Households socio-economic characteristics' have a significant impacts on credit-constrained, head of households who own less assets, female, and not-holding livestock in their farms are more likely to be credit constraint.

7. CONCLUSION

This study is determining how large and important rural-credit market in Libya, particularly for households who living in rural-areas. The majority of them are depends on public sector for their incomes, 37% of rural-households are main occupation is in government sector, 33% of them are retired, 12% are working in private sector and only 9% of rural households whose main occupations is agriculture. However, agricultural sector is an important sector for rural-households to increase their incomes. The study is estimating access to credit, credit application, determining amount of credit received among successful applicants and determining also whether household facing credit constraints or not, including the factors that have impacts on these concepts. The study can provide knowledge about the relative importance of the various social-economic factors of rural households and formal financial institutions credit policies within or beyond the control of policy that determine whether or not some households will benefit from rural credit programs designed by formal banks. The results demonstrates that using econometric models which are useful framework for investigating the relationship between lenders and borrowers, and describing the role of agricultural and non-agricultural banks in credit rural market, and for measuring the probability of access to and applying for credit among households.

Rural households in Libya are access constraints; around half of rural-population has no access to credit. The results indicated that socio-economic characteristics have significant affect on access to credit, rural-families that head of households is married males, have some years in schooling, earning income from off-farm activity and his farm-productivity is increasing which is including a good quality of soil and have permanent water sources or holding livestock, those families have higher of access to credit, where rural-households that head of the households is female, not holding livestock, no education, their farm productivity is decreasing due the soil

quality or lack to water or owning less assets are more likely to be access constraints, or in other words poor people are facing access constrains or they are probably excluded form credit programs.

In terms of credit applications, 61.7% of those framers that have access are applied for credits, other 38.3% of those who access did not apply for credit. Head of households' socio-economic characteristics have a significant effect of credit application. Households who head of the house is married male, having permanent incomes from off-farm activities, or farmers who have permanent water sources in their farm and using machinery or those farmers who holding livestock on their farms or households who owned assets have higher probably of applying for credit, where other rural-families who head of the households is female, or single or have no water sources in his farm or not holding livestock, or owning less asset have low probability of applying for credit, and therefore they are not benefiting from credit programs that offered by formal banks. The results indicate that formal banks are considering only those households who are really able to pay- back credit, other poor-households have higher probability to be out of credit programs that offered by formal banks.

In term of successful and unsuccessful credit applications, 84% of applicants have received credit and 16% of applicants are refused. Institutional factors mainly interest rates charged and repayment-periods are the main factors that explaining amount of credit received variations among successful applicants, 72% of amount of credit received variation is explained by the institutional factors, the level of interest rate has a significant effect on amount of credit received among borrowers. Rural households are applying for less amount of credits if the interest rate is higher and larger amount of credit of interest rate is lower. Borrowers in rural-areas are tending to borrow more amount of credit if the repayment periods take longer time and less amount of credit if the repayment period takes short time. Interest rate charged by agricultural banks is lower than interest rates charged by non-agricultural banks, despite 44 agricultural bank branches distributed in whole country the shares of these banks in rural credit market is quite low, which is 24%, where the shares of non-agricultural banks is 76% that means the commercial banks plays important roles in rural areas.

Rural families who head of the house is female are facing higher probability of credit constraints, where those families who head of the households is male that reduced the probability of credit constraint to 82%, those families who owning assets or holding livestock have also lower probability of credit constrained. Rural-families that holding livestock have 41% low probability of facing credit constraints. Rural families whose head of the household is female or have fewer assets or not-holding livestock are facing higher probability of credit constraints.

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