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Determinants of Farmers' Access to Credit in the Lao People's Democratic Republic

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Abstract

Access to credit for farmers remains a huge challenge in the Lao PDR. This study aims to identify the determinants of farmers' access to credit. To achieve this goal, this research uses a data set from a country-wide household survey conducted in 2019. The survey took place in six provinces – Attapue, Champasack, Khammouane, Savannakhet, Vientiane, and Xiengkhuang. The current study applies a Logit model to analyze what factors significantly determine farmers' access to credit. The result shows that the age of the household head is concavely related to credit access. Household size is negatively correlated with access to credit. Household income is found to have an insignificant impact on demand for credit while household saving does have a significant impact. The area of agricultural land does matter for access to credit because it is commonly used as collateral. The incidence of natural disasters in the last three years significantly determines households' access to credit.

Keywords: access to credit, natural disaster, collateral, logit model

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JEL Classification: O13, Q14, R51

1. Introduction

Access to credit for farmers remains a huge challenge in the Lao PDR. Despite government efforts and development partners' support to finance farmers, financial institutions and banks still fail to offer reliable and affordable banking products and services to farmers. Moreover, farmers' lack of financial management skills such as trading and production records, credit history, collateral, and small turnover means that financial institutions believe them as too risky and too costly to serve as customers.

In rural areas, small-scale credit and financial support are mainly provided to farmers through development projects and local government agencies. Financial institutions are underrepresented in rural areas, but credit access procedures are also too complex for the farmers and loans are ill-adapted to the farmers' needs and constraints. Alternatively, farmers who are not able to borrow from formal financial institute needs to borrow from the informal source of finance which is relatively high-interest rate.

It is very significant to find what factor determines access to credit, which will help policymakers and financial institutes find a solution to help farmers. Some previous studies find the access to factors determining access to credit include gender, age, farming experience, education, farm size, and income and expenditure. Their primary methodology to analyze factors that determine access to credit was logit regression (Ullah et al., 2009; Owusu, 2017; Chitungo & Munongo, 2013; Ibrahim & Aliero, 2012; Kacem & Zouari, 2012).

This study focused on rice farmers as it is the main crop of Lao PDR. The rice production area accounts for 55.2% of the total agricultural area. In 2019, the production of lowland rice was 2.9 million tons, and the production of dry season paddy rice was 0.45 million. The markets with the greatest potential for Lao PDR's exports of rice are Viet Nam, China, and Thailand.

Financial support and access to credit could empower farmers to increase their wealth and ability to feed the population. The rising demand for rice in domestic and foreign markets requires an increase in production, which means investing in capital, land, and labor. In addition, the risk of natural disasters, including climate change, seems to increase the need for investments to improve the resilience of agriculture. Thus, this research aims to identify the factor determining

farmers' access to credit in Lao PDR and to analyze the impact of natural disasters on access to credit.

2. Methods and data

This study aims to identify the determinants of household access to credit. To achieve this goal, in 2019 a country-wide household survey. The survey took place in six target provinces – Attapue, Champasack, Khammouane, Savannakhet, Vientiane, and Xiengkhuang province. The target population for the study was farmers whose main income mainly comes from rice production. The questionnaire was developed before the survey and administered with the help of research assistants who helped the respondents whenever they needed assistance. The distribution of the individual household surveys is presented below.

Table 1: Distribution of farmers by province

Province	Frequency	Percent
Attapue	36	5.51
Champasack	103	15.77
Khammouane	135	20.67
Savannakhet	258	39.51
Vientiane	90	13.78
Xiengkhuang	31	4.75
Total	653	100

Source: Survey in 2019

This study aims to investigate what factors influence farmers' decisions in access to credit. The current paper applies an economic model to address this research question. As already noted, the dependent variable in this analysis is a qualitative response to whether a household can get access to credit. This study solely relies on household samples with access to formal credit sources, including village saving group, microfinance institutes and banks. Several methods can be applied to estimate the equation with a binary dependent variable. The Linear Probability Model (LPM), estimated by the Least Square Method, is a technique easily implemented to deal with the binary dependent variable. However, the linear estimation does not satisfy a critical assumption

that the estimated outcomes strictly lie between zero and one (Wooldridge, 2015). Logit and Probit Models are widely applied in the literature to overcome the shortcoming of linear estimation. These models are non-linear equations that are estimated by applying the Maximum Likelihood. Due to its computational simplicity, this study is solely reliant on the Logit Model which is widely applied to analyze determinants of access to credit in the previous literature (Ullah et al., 2009; Owusu, 2017; Chitungo & Munongo, 2013; Ibrahim & Aliero, 2012; Kacem & Zouari, 2012). The structure of this model is specified as follows:

$$P_i=F(Z)=F(\alpha+\sum \beta_i X_i)=\frac{1}{1+e^{-z}} \quad (1)$$

where P_i is the probability that a farmer gets access to credit, X_i denotes the vector of independent variables which are described in Table 2. α is the constant term. β_i is the vector parameters of independent variables to be estimated in this study.

Since the probability that a farmer can get access to credit is P_i, the probability that a farmer cannot get access to credit can be expressed as below:

$$1-P_i=1-F(Z)=1-F(\alpha+\sum \beta_i X_i)=\frac{1}{1+e^{z}} \quad (2)$$

Dividing (1) by (2) gives the odd ratio which is the proportion of the probability that a farmer gets access to credit to the probability that a farmer does not get access to credit.

$$\frac{P_i}{1-P_i}=\frac{1+e^{z}}{1+e^{-z}}=e^{z} \quad (3)$$

Taking the natural logarithm into both sides of equation (3) and adding the disturbance, u_i, into the equation, we can have a Logit Model as follows:

$$L_i=ln\left[\frac{P_i}{1-P_i}\right]=\alpha+\sum \beta_i X_i+u_i \quad (4)$$

where L_i is the logarithm of odds ratio which is potentially determined by the vector of independent variables X_i. These include household heads' characteristics (gender, age, marital status, occupation, education), and household characteristics (household size, household income, saving, residential land, agricultural land, irrigation, and natural disaster).

Small farmers' access to the credit market depends on a wide range of factors, including household heads and household characteristics. The detailed descriptions of dependent and independent variables included in the current study are shown in the following table.

Table 2: The definition of variables

Variables	Descriptions
Access to credit	Equal 1 if a household gets access to credit and 0 otherwise
Male	Equal 1 if the household head is male and 0 otherwise
Age	Household head's age in years
Age square	Squared age of household head
Married status	Equal 1 if a household head is married and 0 otherwise
Education	Years of schooling
Farmer	Equal 1 if a household head occupation is farmer and 0 otherwise
Household size	The total number of household members
Saving	Equal 1 if the household has a saving and 0 otherwise
Income	Total income per year in million Lao Kip
Irrigation	Equal 1 if agricultural land is connected to irrigation and 0 otherwise
Residential land	The total area of residential land in squared meters
Agricultural land	The total area of agricultural land in squared meters
Disaster	Equal 1 if there is a disaster in the last three years and 0 otherwise
Attapue Province	Equal 1 if households are in Attapue province and 0 otherwise
Champasack Province	Equal 1 if households are in Champasack province and 0 otherwise
Savannakhet Province	Equal 1 if households are in Savannakhet province and 0 otherwise
Vientiane Province	Equal 1 if households are in Vientiane province and 0 otherwise
Xiengkhuang Province	Equal 1 if households are in Xiengkhuang province and 0 otherwise

Before conducting empirical analysis, this study eliminates missing data. The study relies on 652 farm households. The descriptive statistics of all variables included in the econometric model are shown in Table 3.

Table 3: The summary statistics of variables

	Observations	Mean	SD	Min	Max
Access to credit	652	0.331	0.471	0	1
Male	652	0.446	0.497	0	1

Age	652	49.02	11.57	18	87
Married	652	0.929	0.256	0	1
Education	652	5.526	2.694	0	16
Farmer	652	0.917	0.276	0	1
Household size	652	5.675	2.086	1	14
Household income (LAK million)	652	23.70	22.40	1	210
Saving	652	0.577	0.494	0	1
Irrigation	652	0.578	0.494	0	1
Residential land (squared meter)	652	930.3	1411.3	14	16000
Agricultural land (squared meter)	652	17657.5	16922.1	0	150000
Disaster	652	0.920	0.271	0	1
Attapue Province	652	0.055	0.229	0	1
Champasack Province	652	0.158	0.365	0	1
Savannakhet Province	652	0.394	0.406	0	1
Vientiane Province	652	0.138	0.345	0	1
Xiengkhuang Province	652	0.048	0.213	0	1

As seen in Table 3, around 33 percent of farmers report that they have access to credit. Around 45 percent of the total samples are male. Respondents' age is around 49 years, and more than 90 percent of the samples are married. The average number of respondents' schooling years is 5.5 years. The highest year of schooling is 16 years while the lowest is zero. Around 91.7 percent of respondents reported mainly working in the farming sector. The average size of household samples is 5.6 persons. The income of household samples is around LAK 23.7 million per year. The highest household income is LAK 210 million, while the lowest is only LAK 1 million per year. There is around 58 percent of the total samples reported that they have savings. More than half of household samples reporting that the agricultural land is irrigated. The average area of residential and agricultural lands is around 930 and 17,657 square meters, respectively. 92 percent of respondents revealed that they experienced a natural disaster during the last three years prior to the survey.

3. Results

This section firstly presents results and discussions on differences in characteristics of households with and without access to credit. Then, the preliminary results of the Logit Model and its marginal effects are reported in Table 5. According to the summary statistics of variables shown in Tables 3 and 4, there is no significant outlier in the data. The result of the correlation matrix shows that correlation coefficients among independent variables are lower than 0.5, suggesting that multicollinearity does not exist in this study.

Table 4 reports the mean values of variables by farmers with and without access to credit. T-tests are carried out to illustrate whether the individual and household characteristics of farmers with access to credit are statistically significant from those without access to credit. The result shows no statistical difference in the proportion of household heads' gender. Household heads from households with access to the credit market are on average 47 years old, while those without access to credit are slightly older. The age difference is statistically significant at the 1 percent level. The average years of household heads' schooling are larger in households with access to credit. The size of households borrowing money from the credit market is smaller than that of households not borrowing money. The mean income of households with access to credit is larger than those without access to credit. Wealthier households, observed from residential and agricultural land sizes, have better access to the credit market. This result is consistent with the fact that households holding more extensive land can easily borrow money because the land is essential collateral. Households with better access to the credit markets have a higher average income, while they are less likely to have savings. Farm households that experienced disaster over the last three years are found to have more demand for credit. Considering access to credit by provinces, it is found that households in Attapue and Champasack have a higher proportion of household samples with access to credit than those without access to credit. On the contrary, this proportion is lower in Savannakhet, Vientiane, and Xiengkhuang provinces. The differences in the proportion of household samples with and without access to credit are significant at the 1 percent level in Attapue, Savannkhet and Vientiane provinces while they are not statistically different in Champasack and Xiengkhuang.

Table 4: The summary statistics of variables

	with access to credit (216 samples)	without access to credit (436 samples)	T-test of equality means
Male	0.431	0.455	-0.025

Age	47.33	49.82	-2.495***
Married	0.935	0.927	0.008
Education	5.833	5.373	0.460**
Farmer	0.940	0.906	0.034*
Household size	5.454	5.783	-0.329**
Household income (Logarithmic form)	16.73	16.55	0.176***
Saving	0.481	0.624	-0.142***
Irrigation	0.708	0.513	0.196***
Residential land (Logarithmic form)	6.130	5.902	0.228**
Area of rice land (Logarithmic form)	9.581	9.386	0.195***
Disaster	0.968	0.897	0.071***
Attapue Province	0.102	0.032	0.069***
Champasack Province	0.167	0.154	0.013
Savannakhet Province	0.282	0.450	-0.168***
Vientiane Province	0.079	0.167	-0.088***
Xiengkhuang Province	0.037	0.053	-0.047

Note: *** denotes significant at the 1 % level, ** significant at the 5 % level, and * significant at the 10 % level.

This study applies the maximum likelihood method to estimate the Logit Model. The results are shown in Table 5 below. The first two columns are the results of the Logit Model, whose dependent variable is whether a household has access to formal credit regardless of the sources of the credit. To simplify the interpretation of empirical results, this study computes the marginal effects of the Logit Model, which are presented in the last two columns in Table 5. This research estimates the heteroskedasticity-consistent standard error to deal with the inconstant distribution of disturbances.

Table 5: The determinants of small farmers' access to credit

	Logit		Marginal Effects	
	Coefficient	SE	Coefficient	SE
Constant	-8.025***	2.286	_	_
Male	0.1390	0.197	0.0291	0.041
Age	0.1456**	0.058	0.0304**	0.012
Age squared	-0.0016***	0.001	-0.0004***	0.000
Married	-0.0056	0.367	-0.0012	0.077
Education	0.0505	0.038	0.0105	0.008

Farmer	0.5563	0.351	0.1042*	0.058
Household size	-0.1259***	0.046	-0.0262***	0.010
Household income (Logarithmic form)	0.0700	0.118	0.0146	0.025
Saving	-0.5542***	0.196	-0.1171***	0.042
Irrigation	0.5113**	0.245	0.1045**	0.049
Residential land (Logarithmic form)	0.0468	0.073	0.0097	0.015
Agricultural land (Logarithmic form)	0.2003*	0.114	0.0417*	0.024
Disaster	1.3114***	0.504	0.2066***	0.054
Attapue Province	0.8371*	0.432	0.1947*	0.107
Champasack Province	-0.3014	0.382	-0.0600	0.073
Savannakhet Province	-1.1547***	0.264	-0.2259***	0.048
Vientiane Province	-1.4048***	0.360	-0.2267***	0.042
Xiengkhuang Province	-0.3310	0.570	-0.0646	0.103
Pseudo R-square				0.1449
Chi-square				102.36***
Observations				652

Note: *** denotes significant at the 1 % level, ** significant at the 5 % level, and * significant at the 10 % level.

4. Discussion

In this analysis, a dummy variable is created to control if a household is headed by a male. The results in table 5 show no evidence of gender bias as prior expectation. This result is consistent with the studies of Muhongayire et al. (2013) and Sebatta et al. (2014) in the contexts of rural Rwanda and Zambia, respectively. This study's result contradicts the finding of Baiyegunhi and Fraser (2014), which finds a positive correlation between male-headed households and access to credit in South Africa. Similarly, Zeller et al. (1994) show that males are more likely than females to obtain informal credit.

Household heads' age is commonly included as a predictor of access to credit. Several studies in the literature (Baiyegunhi & Fraser, 2014; Lemessa & Gemechu, 2016) find no linear correlation between the head of household age and access to credit. The age of the household head may be non-linearly related to credit access. This concern is taken into consideration by including the squared age of household heads in the equation in addition to their age. As expected, household heads' age and their square are significant factors influencing a household's demand for credit. While household heads' age is positively correlated with the probability of getting access to credit, the squared age of household heads is negatively correlated with the probability of

access to credit. The optimal age of household heads at the turning point can be derived from the quadratic form of correlation between household heads' age and the probability of access to credit. The estimate suggests that the likelihood of access to credit firstly increases with the age of the household head, but after a certain age (approximately 43 years old), a further increase in the age of the household head reduces the likelihood of access to credit. To some extent, the concave shape of the correlation supports the view that younger farmers with insufficient wealth are likely to rely more on credit markets to adopt modern technologies (Nguyen, 2003). Because of risk aversion and a higher probability of default, the demand for credit from older household heads could be lower.

This study tries to capture if demand for credit is significantly different across the marital statuses of household heads. A dummy variable is generated; it equals one if household heads are married and otherwise is 0. In line with other studies, we find no statistical relationship between household heads' marital status and credit access. This study also includes a dummy to test whether farmers have more demand for credit. It seems that household heads who mainly engage in the farming sector are more likely to get access to credit. This relationship appears to be statistically significant at the 10 percent level. The result illustrates that the probability of access to credit among farmers is on average 10 percent higher than those with other main occupations.

Education plays a crucial role in the access to credit throughout on-farm efficiency. Musebe et al. (1993) assert that higher educational attainment enables household heads to have better money management skills, which may secure access to credit. Additionally, Ibrahim and Bauer (2013) point to the possibility that education enables households to improve agricultural production through the application of new agricultural methods and risk management. To capture this, this study includes the highest years of household heads' school as a predictor. The estimated result shows that household heads' education attainment positively impacts the probability of getting access to credit, although this correlation is not significant. The finding of this study is not compatible with other studies in the case of Pakistan (Shah et al., 2008), Uganda (Kiiza & Pederson, 2001), and Nigeria (Nwaru et al., 2011) that find a significant impact of education attainments on the likelihood of getting access to credit.

According to the literature, labor endowment may affect the household's participation in the credit market. There is no consensus about the sign of correlation between household size and access to credit. Schereiner and Nagarajan (1997) argue that more labor allows a household to

have a better ability to manage credit risk, they may have a better access to credit. Nevertheless, Lemmesa and Gemmechu (2016) assert that smaller households are likely to utilize more capital, thus raising the demand for credit. The finding of this study shows that household size is significantly and negatively correlated with access to credit. This result is comparable with the finding of Lemmesa and Gemmechu (2016) in Ethiopia, whereas it is contrary to the study of Muhongayire et al. (2013). Based on the estimated results in table 5, the probability of getting access to credit is declined by on average 2.6 percent for an additional member of the household.

It is widely documented that access to credit is highly dependent on household income to some extent reflecting the payback capability of the household. This study includes the logarithmic form of household income in the equation to smoothen a large deviation. The estimate shows that household income is positively associated with the probability of credit access though it is not significant at the conventional levels. This finding is partially consistent with the study of Mohamed and Temu (2009) that income does not alter the probability of females' access to formal credit while it does matter for the variation in the probability of access to credit among males. However, a direct comparison is cautioned because estimating regression separately by gender may result in different results. This study finds the significant impact of saving on households' access to credit. The result suggests that the probability of credit access tends to be around 12 percent lower in households with saving than in those without saving.

According to the literature, credit provision is highly dependent on household wealth and collateral. This analysis's credit demand equation contains residential and agricultural land as a proxy of household richness. These covariates are in the logarithmic form. The estimate indicates that residential land is not a significant predictor of credit access. In line with other studies in the literature, agricultural land in logarithmic form is statistically significant at the 10 percent level. Ceteris paribus, a 1 percent increase in agricultural land is positively associated with around 4 percent increase in the probability of credit access. This result is not unexpected because agricultural land is the most important collateral for formal credit market. Farmers with larger farm sizes tend to exploit more capital in their production and seek more credit (Binswanger & Rosenzweig, 1986).

The occurrence of natural disasters is anticipated to be related to smallholder farmers' credit access decisions. When a natural disaster takes place, it may potentially damage agricultural production and property. The adverse effects of disaster may push farm households' demand for

credit to recover their production property. Based on the estimated result, the association between the likelihood of credit access and natural disaster is statistically significant at the 1 percent level. The estimate illustrates that the probability that households have access to the credit market tends to increase by more than 20 percent when a natural disaster occurred in the community in the last three years prior to the survey.

Credit demand may be significantly different across regions and provinces. By taking this concern into consideration, this research creates five dummy variables to control household samples living in Attapue, Champasack, Savannakhet, Vientiane, and Xiengkhuang. Households living in Khammouane province are used as the reference group. The estimate shows that the demand for credit among households in Attapue, Savannakhet, and Vientiane provinces are significantly different from those in Khammouane province. Holding other factors unchanged, households living in Attapue seem to demand more credit than those in the reference province by around 19.5 percent. On the contrary, the likelihood of households' access to credit in Savannakhet and Vientiane provinces is lower by on average 23 percent compared to the reference group.

In sum, the impacts of household heads' characteristics on the likelihood of access to credit are mixed. There is no difference in access to the credit market between male-headed and female-headed households. Thus, gender discrimination in the credit market is not the case in Lao PDR. The result exhibits a concave association between the probability of credit access and household heads' age. Household heads' marital status and education do not matter for households' access to credit. Household heads who mainly engage in the farming sector are likely to demand more credit. Access to the credit market appears to decline in the size of households. Household income and the area of residential land do not significantly determine credit access while saving does. This result confirms that agricultural land remains one of the most critical collaterals to get access to the credit market of Lao PDR. The incidence of disaster increases the demand for credit among farm households.

5. Conclusions

Access to credit has played a vital role in improving the livelihood of farm households. The primary objective of this study is to investigate a wide range of factors influencing farmers' access to credit. This study relies on a dataset from a household survey conducted during 2019 in six provinces – Attapue, Champasack, Khammouane, Savannakhet, Vientiane, and Xiengkhuang

provinces. A Logit Model is applied to examine whether farmers' access to credit can be significantly explained by farm households' characteristics. This study does not find noteworthy evidence of gender discrimination in the credit market. The probability of farmers' access to credit is not statistically associated with household heads' marital status, education, and main occupation. The result shows a concave shape correlation between household heads' age and farmers' access to credit. The probability of credit access is found to increase in household size. While household income does not matter for the likelihood of credit access, household saving appears to have a negative impact on farmers' access to credit. This finding illustrates that irrigation can significantly explain the variation in the probability of credit access. Since agricultural land is one of the most critical collaterals in the credit market, the area of agricultural land is significantly and positively related to the likelihood of credit access. The incidence of natural disasters increases farmers' demand for credit to recover their production and property.

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