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Effect of Credit Accessibility of Farmers on Agricultural Investment and Investigation of Policy Options in Khorasan-Razavi Province

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Abstract: The aim of this study is investigating the effect of credit accessibility of farmers on agricultural investment and policy options in Khorasan Razavi Province of Iran. This study was done on 133 farmers of credit used group from totally 177 farmers of study that received loan from agricultural bank by Logit model. Results of estimated Logit model showed that the number of installments has the most importance in investment of received credit by farmers and then farm land and previous investment have more importance. In addition, effect of policy changes on investment indicated that applying three options of number of installment, cultivated land area and previous investment, simultaneously have the most effect on investment probability. According to results, attention to policy variables in investment for increasing productivity and decreasing of poverty in agricultural sector suggested.

Key words: Agriculture, marginal effect, logit, elasticity, financial, Iran

INTRODUCTION

Agricultural credit plays an important role in agricultural development. Agricultural household models suggest that farm credit is not only necessitated by the limitations of self-finance, but also by uncertainty pertaining to the level of output and the time lag between inputs and output (De Janvry and Sadoulet, 1995). Recent studies show the growth rate of investment in agriculture is less than other economic sector. Agricultural financing is one of the most important factors to develop rural areas in developing countries. Payment of bank credit is a way of financing. In fact, facilitation of access to credit can raise amount of productive investment. Credit has a crucial role for elimination of farmer's financial constraints to invest in farm activities, increasing productivity and improving technologies. Generally, credit accessibility is important for improvement of quality and quantity of farm products so, that it can increase farmer's income and avoid from rural migration. On the other hand, some policy makers believe that payment of credit with low interest rate to farmers can support them against some results of development policies that threat their welfare (Ghorbani, 2005). Therefore, with limited access to credit, the budget balance becomes a constraint, where expenditures have to remain less or equal to the sum of revenues during the period, accumulated savings and credit availability. Hence, credit constraint limits the optimum production or consumption choices (De Janvry and Sadoulet, 1995). In other words, if a producer faces an infinite supply of liquidity at a given price, the production decisions will be independent of consumption decisions. When credit is rationed, some borrowers cannot obtain the amount of credit they desire at the prevailing interest rate, nor can they secure more credit by offering to pay a higher interest rate. In such circumstances, liquidity can become a binding constraint on many farmers' operations. Facing such a situation, households have to choose how to invest and what inputs to buy, depending on the level of credit they receive.

One of the financial institutes has an important role in financing agriculture sector is agricultural bank. This bank can direct agricultural credit flow such that helps general economic policies of government. So, duty of agricultural bank is financing of farmers and related industries and participation in activities that private sector can't invest in it. In fact, access to credit for farmers is accompanied with some problems (Ghorbani, 2005).

Recent theoretical and empirical study in economics has established that credit markets in developing countries work inefficiently due to a number of market imperfections. The literature cites a number of market imperfections which lead some potential borrowers to be rationed out of the credit market. These imperfections include:

- Interest rate ceilings usually imposed by the government
- Monopoly power in credit markets often exercised by informal lenders (Bell *et al*., 1997)

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- Large transaction costs incurred by borrowers in applying for loans
- Moral hazard problems (Carter, 1988)

In many cases a number of these imperfections combine to ration farmers out of the loan market. Zeller *et al*. (2001) found that in Bangladesh credit access had a significant and strong effect on both income and food consumption. In contrast, Diagne and Zeller (2001) found that lower profit levels can come from a number of sources including lower investment levels and a misallocation of variable inputs. The literature suggests that credit rationing can cause a misallocation of resources in farm production. This misallocation of inputs can then cause the credit rationed farmer to have lower profit levels than his unconstrained neighbor (Carter, 1989; Feder *et al*., 1990). Petrick (2004) indicated that access to subsidized credit has a statistically significant role in determining investment behavior of farmers. In various specifications of the credit-investment relationship, the average marginal effect of credit on investment was smaller than one, which implies that credit is partly used for purposes other than productive investment. Ghorbani (1997) believes that because of high transaction costs and interest rate, efficiency of formal credit payment to farmers in Mazandaran Province of Iran is low. Chizari and Zare (2000) showed the effect of credit on agricultural production is positive and significant.

Regards to results of rural credit literature, farmers with credit access problems will invest less in capital assets and their land. Credit rationed farmers will not be able to smooth their expenses over time implying that they will not make long-term investments, especially those which entail sunk costs. A main strategy of governments in developing countries like Iran is help to develop the rural areas and increase agricultural production through investment in the sector, so farmer's access to credit and conduct of it to productive investment projects seems to be required. Although in Khorasan-Razavi Province of Iran, 64% of total credit demand of farmers is covered in 2006 but it hasn't investigated how received credit is used. Thus in this study, the role of credit access on agricultural investment in Khorasan-Razavi Province has been identified and effect of different policy options on investment probability is compared.

MATERIALS AND METHODS

Data: In this study stratified random sampling is used. Data collected by interview with farmers in 4 cities of Khorasan-Razavi Province of Iran in 2007. According to sampling method, total sample size is 177 and using proportional allocation, 133 observations for credit used group and 44 observations for non credit used group is determined.

Theoretical framework: The subsequent empirical analysis is based on a potentially non-linear, reduced-form investment equation of the following type (Petrick, 2004):

$$I = I(K, Z, \rho)+\varepsilon \quad (1)$$

where, I denotes the investment volume, K is the amount of long-term credit, Z denotes the existing capital stock or, more generally the initial farm size, ρ is a vector of dummies capturing regional and farmer specific effects and ε is a random error term. There are two important peculiarities compared with conventional neo-classical investment equations (Elhorst, 1993). First, the equation contains a financial variable, K. Second, there are neither user costs of capital nor prices included in the equation. The first peculiarity is due to the assumed relevance of the financial constraint (Petrick, 2004). The second is due to the fact that the investment equation is estimated on a cross-sectional data set, so that prices are assumed to be equal for all farms and hence excluded (Feder *et al*., 1992). The relation between credit access and investment is unambiguously positive. The effect of Z on I depends on the size of the desired capital stock or farm size. A negative sign implies that farm sizes converge over time, whereas a positive sign implies diverging farm sizes. ρ includes a dummy indicating some farmer's characteristics.

Logit model: Logit is a model to assess choosing behavior of person who faced with events have just two options and one of them should be selected. In this study for investigating the effects of access to credit on agricultural investment, logit model on the basis of Eq. 1 is used. In order to test the effects of credit access on farm investments, the dependent variable is defined as purchases of capital equipment, new technologies. Capital equipment includes investments in tractors and machinery, irrigation pumps and green houses. The new technology is drip irrigation, resource saving and production increasing technology. So, If farmer uses loan to invest in agriculture, value of dependent variable will be one and otherwise zero.

Independent variables include: Received loan (X_1), age (X_2), level of education (X_3), family size (X_4), none farm income (X_5), farm land (X_6), farm income (X_7), No. of installments (X_8), amount of saving (X_9) and previous investment (X_{10}).

Relation between independent variables and investment is showed as follow:

$$I_i^* = \beta' X_i + \varepsilon_i \quad (2)$$

where, I_i is latent (unobservable) variable, so dummy variable of investment is used which get 0 and 1 values:

$$I_i = 0 \quad \text{if} \quad I_i^* \le 0$$
$$I_i = 1 \quad \text{if} \quad I_i^* > 0$$

Probability of $I_i = 1$ will be p_i that is shown in relation 3:

$$P_i = \Pr(I_i = 1) = \Pr(I_i^* \ge 0) = \Pr(\beta' X_i + \varepsilon_i \ge 0) \quad (3)$$

Logit model limits probabilities between 0 and 1.

Marginal effect (ME) of independent variables indicate probability variation of being in group $I_i = 1$ if X_i changes one unit.

$$ME = \frac{\partial P_i}{\partial X_i} = \frac{e^{\beta' X_i}}{(1+e^{\beta' X_i})^2}\beta_i \quad (4)$$

Elasticity of dependent variables is calculated as follow:

$$E_{x_i} = \frac{\partial \Lambda(\beta' X_i)}{\partial X_i}\frac{X_i}{\Lambda(\beta' X_i)} = \frac{e^{\beta' X_i}}{(1+e^{\beta' X_i})^2}\frac{X_i}{\Lambda(\beta' X_i)} \quad (5)$$

where, E_{xi} shows elasticity of ith variable and $\Lambda(.)$ represents logistic cumulative distribution function. Also, in order to evaluation of applying policy options, following relation is used (Maddala, 1983):

$$P_i = \frac{1}{1+e^{\alpha+\beta x_i}} \quad (6)$$

RESULTS AND DISCUSSION

Effect of credit access on investment: Results in Table 1 shows that farm land, No. of installments and previous investment by farmer are significant at 5% level but other variables like credit volume are not significant. Signs of variables are as expected such that sign of credit volume is positive that shows increasing of credit amount led to agricultural investment and small loans mostly is used for current consumption expenditures of farmer family. Positive sign of age variable confirms the effect of farmer's experience on usage of received loan. Family size and education level has negative relation with dependent variable. In fact, with higher level of education, farmer can earn from non farm sources so, he does not tend to invest in agriculture. Increasing of farm income causes to increment of probability of investment while sign of none farm income shows reverse relation with variable of investment. Saving variable indicates a direct relation with dependent variable, although it is not significant at 5% level.

Based on Table 1 three variables include farm land (X_6), of installments (X_8) and previous investment (X_8) are significant at 5 percent level, so these variable are the most important factors influencing on investment behavior of farmers. Logit coefficients shows the ratio of variation the logarithm of investment probability to none investment probability $[Ln(p_i/1-p_i)]$, if independent variables varied one unit. So, increasing of X_6, X_8, X_{10} will increase probability of I. In other word, land indicates farmer's ability for preparing required collateral to access the great loans that are more suitable for agricultural investment. More No. of installments let farmer to use received loan for investment in agricultural production that often has longer pay back period. Positive effect of previous investment on dependent variable is quite expected, because shows experiment of farmer in this field that can facilitate new investment decision.

Table 1: Logit model estimation for investment behavior of farmer

Variables	Variable definition	Coefficient	t-statistic	Aggregated weighted elasticity	Elasticity at mean	Marginal effect
X_1	Credit volume	0.0036	0.006	0.003	0.008	0.0008
X_2	Age	0.0250	1.267	0.459	0.547	0.006
X_3	Level of education	-0.1840	-0.731	-0.063	-0.079	-0.044
X_4	Family size	-0.1350	-1.410	-0.262	-0.331	-0.032
X_5	Non-farm income	0.1010	0.881	0.043	0.051	0.024
X_6	Farm land	0.0800	2.128*	0.182	0.319	0.019
X_7	Farm income	-0.0190	-0.333	-0.029	-0.052	0.004
X_8	No. of installments	0.0530	3.461*	0.249	0.422	0.013
X_9	Saving amount	0.3560	1.031	0.041	0.098	0.086
X_{10}	Previous investment	1.2750	2.180*	0.073	0.096	0.310

LR test = 48.4, Estrella R^2 = 0.344, Maddala R^2 = 0.305, Cragg-Uhler R^2 = 0.416, Mcfadden R^2 = 0.262, Right prediction = 0.74, *Significant at 1% level

Table 2: Effect of policy options on investment probability

Variables	Policy options	Change in investment probability
X_6	Farm land	0.186
X_8	No. of installments	0.227
X_{10}	Previous investment	0.119
X_6+X_8	Farm land+No. of installments	0.385
X_6+X_{10}	Farm land+Previous investment	0.223
X_8+X_{10}	No. of installments+Previous investment	0.270
$X_6+X_8+X_{10}$	Farm land+No. of installments+Previous investment	0.441

To find effect of unit variation of dependent variable on independent probability, marginal effect is used. Also, elasticity of variables is calculated to determine relative importance of them. Two kind of elasticity: elasticity at mean and aggregated weighted elasticity estimated that aggregated weighted is more reliable. So, in this study, values of marginal effect, elasticity at mean and aggregated weighted elasticity are used.

According to results shown in Table 1, elasticity and ME for farm land (X_6) are 0.1825 and 0.019, respectively. It means, if farm land increases on hectare then probability of applying loan for agricultural investment will increment 0.019 units. Also, with 1% growth of farm land, will increase investment probability up to 0.1825%. Elasticity and M.E for X_8 are 0.349 and 0.013 while for X_{10} are 0.073 and 0.31, respectively.

Comparison of significant variables of logit model shows that number of loan installments is the most important factor in investment decision of farmer. Farm land and previous investment are the next factors, respectively. These results should be considered in the field of rural financing to motivate investment in agriculture sector and increase efficiency of credit program.

LR test is used to determine signification of model. Results showed that estimated model is significant at 1% level. Values of McFadden, Maddala, Estrella and Cragg Uhler statistics are 0.26, 0.30, 0.34 and 0.41, respectively. Also, right prediction is 74% that is acceptable.

Policy options and agricultural investment: Effect of different policy options on probability of investment is shown in Table 2. If single policies are used, No. of installments (X_8), farm land (X_6), previous investment (X_{10}) have the most effect on investment probability, respectively.

Increasing farm land and No. of installments simultaneously is the best supplementary policy that increments probability of investment up to 0.385 units. If three variables are used together as a policy then investment probability will be increased up to 0.441 units.

In fact, farm land represents financial situation of farmers and ability of control the repayment risk. Because of seasonally nature of agriculture and long period of pay back for initial investment in some agricultural activities such as horticulture, longer repayment period led to increase the probability of investment. These results should be considered in the process of credit payment in agriculture bank. With attention to results of this study following suggestions are introduced:

- Results showed that longer repayment period and more number of installments led to motivate the desired investment in agriculture. So, bank can investigate the financial situation of farmers and profitability of farm production to set a financial profile and ranking customers to pay the loans with longer repayment period and more of installments that are suitable for agricultural investment
- Increasing of farm land and No. of installments simultaneously have the most effect on probability of investment as a policy option so should be considered in financing strategies
- Results confirmed positive effect of credit on agricultural investment. Thus, the gap between supply and demand of credit should be decreased by efficient credit payment program

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