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Financial Planning of Soil Conservation Based on Potential Demand of Credit (Case Study of Khorasan Razavi Province)

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Abstract: This study was carried out to study factors influencing on potential demand of credit for soil conservation using a cross sectional data of 350 wheat producers of Khorasan Razavi Province in 2008 and applying linear regression model. Results showed that offer interest rate of needed credit, age and income of farmers and short run conservation practices diversity have negative effect on potential demand of credit and investment in soil conservation and awareness index of farmers have positive effect on it. Also, potential of needed credit for using of soil conservation practices in rain-fed wheat lands of Khorasan Razavi Province is 14 million rial ha^{-1}. Average offer interest rate of farmers for receiving of soil conservation credit is 4.7%. Regard to results, considering to local experiences of farmers in soil conservation, potential demand of needed credit for soil conservation and low-priced interest rate, increasing the income and financial ability of farmers in indigenous development planning of investment in soil suggested.

Key words: Conservation credit, soil, linear regression, subsidy

INTRODUCTION

Soil is one of the important factors of agriculture production that prepares the ground for other factors and it has a vital rule in prevention of some undesirable social phenomena such as immigration. Soil erosion is frequently mentioned as a major economic and environmental problem especially in developing countries (Hosseini and Ghorbani, 2001, 2004; Hosseini *et al*., 2003, 2009; Wu *et al*., 2003; Ghorbani and Hosseini, 2004b; Jun and Kevin, 2004; Demeke and Coxhead, 2006). More than annually 100 million m^2 sediment behind dams shows that the severity of soil degradation in uplands of Iran (Iran is ranked as one of the countries which have a very high average of soil erosion, about 33 t ha^{-1} $year^{-1}$ (Hosseini *et al*., 2003)).

Soil erosion is either due to rapid and uncontrolled deforestation of slopping uplands and their conversion to agriculture or soil-degrading and erosive agricultural practices in uplands. While the former had been more noteworthy, the latter is frequently mentioned as a serious problem in developing countries (Hosseini *et al*., 2003; Ghorbani and Hosseini, 2004a; Senahoun *et al*., 2001).

Soil conservation as major alternative for preventing and/or decreasing of cropping lands erosive can affect on conserving the potential of soil production and increasing the potential of soil, i.e., yield of crops. Soil conservation is a process that positive effect of it don't reveal in short run and to revealing of positive effects, it need to passing the time (Hosseini *et al*., 2003; Ghorbani and Hosseini, 2004a, b).

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Farmers that consider solely short run benefit of soil conservation, they avoid using the soil conservation practices, whereas they can have high rial benefit in long run. On the other hands, soil conservation is a costly process that need to high investment regard to selective soil conservation type by farmers (Ghorbani *et al*., 2008). Regard to farmers' crops profile and revenue of it, this revenue don't permit indigenous investment in soil conservation from direct revenues of agricultural sector. Therefore, it must form investment process in soil conservation from financing alternative (Hosseini and Ghorbani, 2004). Based on information of potential adoption rates of soil conservation practices, it exist a potential willingness to invest in soil conservation. In reality, because of constraint in agricultural sector incomes (surplus incomes), they have always potential demand to receive of soil conservation credit that policy makers must consider it to programming in financial-credit supports in soil conservation field.

Knowledge to potential demand of credit for using soil conservation practices provide this possibility to soil conservation sector policy makers for estimating the needed credit of this sector. Rather, regard to combination and profile of farmers' soil conservation practices, can estimate needed credit of each conservation practices. Another point about potential demand of soil conservation credit is determining of factors influencing on credit demand. This information can help to optimal allocation of credit regard to farmers and farms characteristics, conservation practices and credit function. This approach can tend to optimal use of credit to applying soil conservation practices and effectiveness and efficiency of soil conservation credit.

Lichtenberg (2003) showed that cost allocation to soil conservation practices would have a special effect on adoption of these practices. Griswold (1987) showed that farmers selected low-cost, management-oriented conservation practices to become eligible for program participation. Program implementation costs for administration and technical assistance were lower than expected. Pattanayak and Mercer (2003) showed that benefit of agro-forest effect on encouraging of farmers to agro-forest activities of soil conservation and increasing of social welfare. Pandy (2001) showed that adoption of soil conservation technologies depend on capital. Tchale (2004) showed that low price of agricultural products, increasing of inputs price, lack of powerful and suitable money market for small farmers have to use instability agricultural practices. Ultimate result of it would be decline in soil fertility. In fact, lack of capital for purchasing of inputs and other investment forms in lands, inefficient ownership systems and unsuitable technologies will tend to nonbeing use of soil conservation practices. Gebremedhin (2004) showed that the use of indirect economic incentives such as credit supply, extension services, taxes, input and output price support and market development has been limited. Also, there is a need to use both direct and indirect incentives combined with real participation of beneficiaries if effective and sustained soil conservation effort is to take place. Ureta *et al*. (2006) showed that output diversification, soil conservation practices and structures and the adoption of forestry systems have a positive and statistically significant association with farm income. The results indicate that when investing in natural resource management projects, governments and multilateral development agencies should pay close attention to output diversification, land tenure and human capital formation as effective instruments in increasing farm income. This study tried to (1) estimate the potential demand of farmers for soil conservation credit and (2) determine the social, economical, physical and attitudes variables influencing on potential demand of credit for soil conservation by estimating the potential demand of credit for soil conservation. Results of this study can use to planning in financing of soil conservation practices in agricultural sector.

MATERIALS AND METHODS

Data

This study was conducted based on a sampling survey on the rain-fed wheat producers in 2008. In fact, the data used in this study come from a primary survey. Number of sample (farmers) selected by using the simple random sampling. The survey covered 3 cities and 30 villages. From the selected villages a list of farm households was prepared and 10% of these households were selected at random. The survey thus covered 350 rain-fed wheat producers from 3 cities and 30 villages. Detailed information pertaining to soil conservation, potential demand of credit for soil conservation and other environmental data such as socio-economic and behavioral variables of the farmers were collected. The data were collected in Khorasan Razavi Province of Iran using interview technique and filling of questionnaires by researchers.

Linear Regression Model

Regard to estimating the different models, this study used linear model as the best model for estimating the potential demand of credit for soil conservation in rain-fed wheat lands of Khorasan Razavi Province.

$$Pcredit_i = \alpha + \sum_{i=1}^{9} \beta_i X_i + \sum_{i=1}^{2} \gamma_i D_i + \varepsilon_i$$

where, pcredit is potential demand of needed credit for using of soil conservation practices in farms, X_i's are 11 quantities variables, D_i's are 2 dummy variables (Table 1), ε_i is residual

Table 1: Variables of potential demand of credit for using soil conservation practices

Variables	Descriptive	Measurement unit
Demographic-social factors		
Age	Age of households' head	Year
Education	Education of households head	Class
Physical factors		
Land situation	Sloped lands situation	Land fragmentation = 1 Land consolidation = 0
Land ownership	Wheat cultivated farm ownership	Personal ownership = 1 Otherwise = 0
Short run conservation practices diversity	Short run soil conservation practices diversity conclude animal fertilizer, crop residue and mulching	Number
Long run conservation practices diversity	Long run soil conservation practices diversity conclude tree Planting, vertical plow on slope, waterways, riprap, terrace	Number
Attitudes factor		
Farmers' awareness index	Farmer awareness index of soil conservation effects in farm (A compound index of improvement in soil color, texture, moisture, surface layer, fertility and wheat production)	Number
Economical factors		
Farmers' income	Total income of farmers' household from inside and outside different sources	Rial $month^{-1}$
Offer interest rate	Offer interest rate of farmers to needed credit for soil conservation	Percent
Investment ability	Potential ability of farmers to investing in soil conservation	Rial
Investment	Investment in soil conservation	Rial
Dependent variable		
Potential needed credit	Needed potential to credit for using and investing in soil conservation practices	Rial ha^{-1}

term, α, β_i (i = 1, 2, …, 9) and γ_i (i = 1, 2) are parameters of model to be estimated. Model (1) is estimated by Ordinary Least Square (OLS) method (Gujarati, 2003).

This study used following equations for computing elasticity of variables:

$$E_{x_i} = \beta_i \frac{X_i}{Pcredit}$$

$$E_{D_i} = \gamma_i \frac{D_i}{Pcredit}$$

where, E_{X_i} and E_{D_i} is the elasticity of ith variables of potential demand of needed credit for using of soil conservation.

RESULTS AND DISCUSSION

Sample Descriptive

Table 2 shows mean characteristics of variables of potential demand of credit function for soil conservation in Khorasan Razavi Province. Information of this table shows that average of farmers' age and education are 55.63 year and 5.72 classes, respectively. The 1.7% of sloped agricultural lands are fragment and ownership of 65.4% of lands is personal. Farmers' household income is 1202400 rial month^{-1}. Average investment ability of farmers and investment in soil conservation are 2577143 and 1731429 rial. Also, potential of needed credit for using of soil conservation practices in rain-fed wheat lands of Khorasan Razavi Province is 14 million rial ha^{-1}. Average offer interest rate of farmers for receiving of soil conservation credit is 4.7%.

Potential Demand Model of Credit

Estimated potential demand function of credit for soil conservation showed in Table 3. This table shows that explanatory power of the model (R^2) is good i.e., 52.8% of variation of potential demand of credit for soil conservation explained by 6 variables such as offer interest rate of needed credit, age of farmers, farmers' income, short run soil conservation practices diversity, farmers' awareness index and investment in soil conservation. F statistic shows that model is significant at 1% level.

Table 2: Descriptive characteristics of potential demand of credit for soil conservation

Variables	Mean
Demographic-social factors	
Age (year)	55.63
Education (class)	5.72
Physical factors	
Land situation	0.617
Land ownership	0.954
Short run conservation practices	1.13
Long run conservation practices	1.13
Attitudes factor	
Farmers' awareness index	0.9
Economical factors	
Farmers' income (rial month^{-1})	1202400
Offer interest rate (%)	4.7
Investment ability (rial[4])	2577143
Investment (rial)	1731429
Dependent variable	
Potential needed credit (rial ha^{-1})	1.4×10^7

[4]- 9960 rial = 1$

Table 3: Potential demand function of credit for soil conservation practices

Variables	Parameters	t-statistic	Elasticity at mean
Constant (α)	0.37×10^{8}	4.494*	-
Offer interest rate	-0.147×10^{7}	-1.701***	-0.485
Age	-298980	-2.994*	-1.123
Education	-231770	-1.366ns	-0.092
Farmers' income	-1.583	-2.140**	-0.119
Land situation	-0.25×10^{7}	-1.136ns	-0.108
Land ownership	0.127×10^{7}	0.298ns	0.085
Short run conservation practices	-0.557×10^{7}	-3.561*	-0.444
Long run conservation practices	-672250-	-0.652ns	-0.053
Farmers' awareness index	0.101×10^{8}	2.729*	0.640
Investment ability	-0.040	-0.238ns	-0.007
Investment	0.775	4.787*	0.094
R^2	0.528		
F	34.3*		

*Significant at 1% level, **Significant at 5% level, ***Significant at 10% level, ns: No significant

Potential demand function of credit for soil conservation in rain-fed wheat lands (Table 3) shows that offer interest rate for needed credit of soil conservation has a negative and significant relationship with potential demand of credit for soil conservation at 10% level.

In the other words, by decreasing the interest rate, potential demand of credit for soil conservation and then demand for adopting and using of soil conservation practices at farm level will increase. Elasticity of this variable shows that by increasing 1% in interest rate of soil conservation credit, potential demand of farmers for credit will decrease 0.484% (i.e., 67760 rial). This elasticity shows that affecting degree of this variable on demand of credit for soil conservation practices is very high. Therefore, decreasing the interest rate of soil conservation credit (payment low-priced credit or green subsidy) can consider as a factor of encouraging of farmer to using of soil conservation practices by agricultural policy makers and planners. In reality, this variable indicates that low-priced or low interest rate credit payment in rural regions can help to improvement of agricultural lands in short and long run soil conservation practices pattern. Final result of this process would be conservation the potential soil production and increasing the yield of wheat. Age of farmers is a significant variable at 1% level that has negative effect on potential demand of needed credit for using soil conservation practices. Estimated elasticity of farmers' age shows that by increasing one percent of it, potential demand of credit for soil conservation will decrease 1.123%. In fact, this elasticity indicate that increasing in age has a significant effect on decreasing of demand for credit and younger farmers have higher potential demand to credit for conservation of rain-fed wheat lands. This affect is due to different factors that are linked to farmers' personality and behavioral characteristics. First, because of increasing farmers risk aversion degree by increasing the age of their and then willingness and as a result demand of credit for soil conservation will decrease. Second, older farmers have probably used soil conservation method in farm level duration last years. Therefore, their demand for soil conservation credit would be lower.

Farmers' income is a key variable of credit demand function for soil conservation that expect has dual effect on demand of credit. First, because of farmers' ability to repayment of credit will have positive effect on demand of credit and second because of using farms' income in soil conservation would have negative effect on it. In this study, this variable has negative effect on potential demand of credit for soil conservation. In fact, by increasing of farmers' income, their demand for receiving of agricultural credit will decrease and major investment in soil conservation would be as indigenous and from agricultural incomes. Elasticity of farmers' income indicates that by increasing one percent in farmers' income (i.e., 12024 rial), potential demand of farmers for soil conservation credit will increase 0.119% (i.e., 16660 rial).

Short run soil conservation diversity at farm level has negative and significant effect on potential demand of credit for soil conservation because need for credit to using of short run soil conservation practices is low and credit demand for supplying of it as economical and needed time for receiving of credit-these practices must use at short run-don't benefit of necessary justification. In reality, farmers use agricultural incomes to expending in short run soil conservation practices. Elasticity of this component shows that by increasing one percent in short run soil conservation practices, potential demand of credit for soil conservation practices will decrease 0.444%. Coefficient of farmers' awareness index of soil conservation shows that it has positive effect on potential demand of credit for soil conservation. On the other hands, by increasing of farmers' awareness to soil conservation, their demand for credit will increase. Elasticity of this variable indicates that by increasing one percent of this index, potential demand of farmers for receiving of soil conservation credit will increase 0.64%. This elasticity retells high affect degree of awareness index on demand of credit and consequently demand for using of soil conservation practices at farm level. Therefore, this index signals that can encourage farmers to receiving of soil conservation credit through promotion of farmers' knowledge and awareness to soil conservation. This study can guarantee the success of soil conservation supportive programs like green subsidy payment.

Investment in soil conservation is a factor of potential demand of credit for soil conservation that has positive and significant effect on it (i.e., soil conservation credit directly is function of investment in soil conservation practices). In fact, by increasing of investment in soil conservation practices, potential demand of credit for soil conservation will increase. This sign is according to expectation. Elasticity of investment in soil conservation shows that by increasing 1% this component, potential demand of credit for soil conservation will increase 0.094%. Elasticity comparison of quantitative variables show that Farmers' awareness index has the highest positive elasticity on potential demand of credit for soil conservation and age and offer interest rate have the highest negative elasticity on it.

Regarding no significant variables must indicate several points: First, the sign of no significant variables are statistically according to expectation. For example, by increasing of classic education of farmers because of establishment other income opportunities to spending in cropping practices and/or action to using of conservation practices in last years, potential demand of credit for soil conservation will decrease. Land fragmentation is a variable with negative effect on potential demand of credit for soil conservation practices because it decreases production scale. This process confronts action of using soil conservation practices with difficulty. On the other hands, needed credit for using of conservation practices will decrease. Result of these reasons will have decreasing of demand of soil conservation credit. Land ownership has a sign according to expectation on potential demand of credit for soil conservation because conservation practices especially long run practices will use in lands with personal ownership. In fact, these farmers have potentially needed incentive for receiving of soil conservation credit. Long run conservation practices diversity has sign according to expectation. In reality, by increasing of long run soil conservation practices diversity, needed level to investment and consequently demand for receiving of credit increase but due to repayment ability problems, demand will decrease. On the other hands, it's possibly that soil conservation practices are done at farms in last years. Then, increasing the diversity of long run soil conservation practices, potential demand of credit for soil conservation will decrease. Also, the time of get results will decrease demand of using the soil conservation practices and consequently demand of credit. Investment ability has the same effect of farmers' income. In the other words, by increasing of farmers'

financial ability to investing in soil conservation, potential demand of farmers to soil conservation credit will decrease. Second, to apply the results of no significant variables in policy making and planning of financial supportive for soil conservation must be cautious.

Literature review on credit demand of soil conservation show that don't exist any experimental study in this scope. In fact, this study has been conducted with a new structure for determining potential demand of credit for soil conservation and factors influencing on it in Khorasan Razavi Province. Therefore, results of this study can't compare with other studies because nature and objectives of this study is different by other researches. The results of other studies shown that credit and other economic incentives have key role in adoption and investment of soil conservation (Lichtenberg, 2003; Griswold, 1987; Hosseini and Ghorbani, 2001; Pattanayak and Mercer, 2003; Pandy, 2003; Tchale, 2003; Gebremedhin, 2004; Ureta *et al*., 2006). Therefore, results of this study confirm these findings but other results can't compare with these studies.

This study tries to estimate the potential demand of credit of soil conservation. Result of this study s howed that potential demand of credit of soil conservation is estimated 14 million rial ha^{-1}.Also, offer interest rate of needed credit, age and income of farmers and short run conservation practices diversity have negative effect on potential demand of credit and investment in soil conservation and awareness index of farmers have positive effect on it. Therefore, the second objective is surveyed.

CONCLUSION

This study was carried out to study determinants of potential demand of soil conservation credit using a cross sectional data of 350 wheat producer of Khorasan Razavi Province in 2008 and linear regression model. Results showed that offer interest rate of needed credit, age and income of farmers and short run conservation practices diversity have negative effect on potential demand of credit and investment in soil conservation and awareness index of farmers have positive effect on it. Also, potential of needed credit for using of soil conservation practices in rain-fed wheat lands of Khorasan Razavi Province is 14 million rial ha^{-1}. Average offer interest rate of farmers for receiving of soil conservation credit is 4.7%. Regard to results, considering to local experiences of farmers in soil conservation, potential demand of needed credit for soil conservation and low-priced interest rate, increasing the income and financial ability of farmers in indigenous development planning of investment in soil conservation suggested. In fact, potential demand of credit for soil conservation is a key tool for financial planning in soil conservation scope that can use by financial institutes.

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