Factors Influencing Agricultural Credits Repayment Performance among Farmers in East Azarbaijan Province of Iran

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ABSTRACT

One of the main challenges facing the Agriculture Bank of Iran regarding lending loans is the high probability of default by farmers. Several factors could be involved in this issue and should be considered in order to control and reduce the risk in the failure of repayment. This study aimed to examine the factors affecting the repayment performance of agricultural loans in the city of Maragheh in East Azarbaijan Province of Iran. Required data were obtained from a sample of 779 individual farmers who had previously received loans from Agricultural Bank during the period 2004-2008. Nested Logit Model (NLM) was applied for analyzing the data and, for this purpose, STATA software was used in the study. Results revealed that having an activity besides farming, extension of the repayment period of the loan, and large volume of received loans are the factors that had significant negative impacts on loan repayment. On the other hand, factors including high interest rates of loans, having collateral of guarantor, services received from the banks, and long term maturity period for the loans increase the probability of timely loan repayment significantly.

Keywords: Agricultural bank, Agricultural credits, Nested Logit Model, Probability of repayment failure, Repayment performance.

INTRODUCTION

Credit is an important policy instrument that can facilitate the application of modern technologies and increase in production, especially in developing countries (Hosseini *et al.*, 2012). Credit is also a key to poverty reduction, livelihood diversification, and increasing the business skills of small farmers (Poliquit, 2006). Agricultural banks, for more than seven decades of experience, are specialized institutions that provide the majority of credits for development of agricultural sector in Iran. These banks aim to enhance agricultural production and fair distribution of income by granting loans to the farmers. Meanwhile, agricultural banks allocate more than 70 percent of their funds to the applicants in this sector (Irannejad, 1996).

Asymmetric information and adverse selection in granting facilities to the risk-taker people have increased the number of delayed, overdue repayments, and suspected to refund credits. On the other hand, failure to repay the received facility increases credit risk and causes disruption in bank planning. Hence, one of the important issues concerning the facility granting by banking system is the high probability of failure in credit reimbursement. Several factors could be involved in this issue which should be identified and controlled for reducing disbursement risk of credits and proper

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solutions should be offered to improve the circumstances.

Default in repayment of bank credits is not a new debate but has been a main concern, recently. The followings are examples of the studies in Iran and other countries. Jaberi (1993) argued that agricultural crop insurance can positively affect improving the repayment of credits in rural Iran. Shaditalab (1993) identified poor management in banking system, inefficient production, marketing problems, high price of production factors, and drought as the major reasons for failure to repay debts to banks. Matin (1997) applied Logit Model for investigating repayment performance of Grameen bank borrowers in Bangladesh and concluded that educational level, duration of membership in the bank, area under cultivation, and diversification of farm income were important factors towards repayment of loans. Lekshemi *et al.* (1998) reported that producer surplus, planting date of crops, lack of access to credit resources, delay in granting loans, and financial gap are the most important causes of default in repayment of credits in Kerala state of India. The study of Bagheri and Najafi (2004) in Fars Province of Iran about recovery of agricultural loans indicated that incidence of natural disasters, ratio of farm income to total, amount of farm income, crop insurance, savings amount, expected time for receiving loan, supervision of banks on loan, length of repayment period, loan application activity, off-farm income, area cultivated, level of education, and city of the applicants are the main factors to discriminate defaulters from non-defaulters of loans. Arabmazar and Rouyintan (2006) examined the qualitative and financial information of companies receiving loans from the agricultural bank in Tehran Province of Iran during 1999-2004. They used a logit model and concluded that factors such as type of activity, working experience with banks, and lending rates were significantly effective on credit risk of borrowers and these factors overlapped with factors affecting credit risk in other banks.

Olagunju and Adeyemo (2007) studied the factors influencing repayment decision among smallholder farmers in southwestern Nigeria and reported that farmers' experience, farming region, transaction cost of borrowers, number of visits to the financial institutions, and proper education of the farmer were the main factors affecting reimbursement. Oladeebo and Oladeebo (2008) investigated factors affecting loan repayment among smallholder farmers in Nigeria. Their results showed that age and education of farmer, farming experience, size and type of activity could be considered as factors influencing the repayment of loans. Sharifi *et al.* (2011) studied the factors affecting reimbursement of agricultural facilities in Isfahan Province of Iran by employing logit and probit models during the period 2007-2009. They concluded that youth of borrower, lending to the agricultural sector and related industries, low amount of loan, type of mortgages, high contribution of borrower in the project were the factors increasing the likelihood of loan repayment. Hence, the main objective of this study was to identify factors influencing repayment of agricultural loans in Iran and also to suggest appropriate solutions for improvement of repayment to reduce the number of loan defaulters.

MATERIALS AND METHODS

Data Collection

Data were collected from investigating the records of 779 farmers who had received loans from Agriculture Bank of Iran (Bank Keshavarzi Iran) during the period 2004-2008. The required data were gathered through Proportionate Stratified Random Sampling. This is a method of sampling that involves the division of a population into smaller groups known as strata. In stratified random sampling, the strata are formed based on members' shared attributes or characteristics. A random sample from each stratum is taken in a number proportional to

the stratum's size when compared to the population. In this study, data were drawn from the following four categories:

1. Suspected to recovery
2. Overdue
3. Delayed
4. Due date repaid credits

In fact, data are from two groups. Due date and not due date repaid credits. The categories one, two, and three can be considered a nested branch from the second group. Therefore, the Nested Logit Model (NLM) would be an appropriate candidate for analysis.

Nested Logit Model

Many discrete choice contexts are characterized by alternatives, which represent a combination of two or more underlying choice dimensions. The model structure used to analyze multi-dimensional choice depends, to a large extent, on the assumptions made regarding shared unobserved attributes. The Multinomial Logit (MNL) structure assumes the absence of any common unobserved attributes among the utilities of the joint choice alternatives. This assumption results in the Independence of Irrelevant Alternatives (IIA) property, which is untenable in most multidimensional choice contexts or, at least, should be empirically tested. This model assumes that the odds for any pair of outcomes are determined without reference to the other outcomes that might be available. This is known as the Independence of Irrelevant Alternatives (IIA) property.

The Independence of Irrelevant Alternatives (IIA) property is a major limitation of both multinomial and conditional logit models as it implies equal competition between all pairs of alternatives, an inappropriate assumption in many choice situations.

The Multinomial Probit (MNP) structure allows a flexible structure for the covariance among the unobserved attributes of the

alternatives. Consequently, it allows a flexible substitution pattern among the joint choice alternatives. Unfortunately, in most choice contexts, the increase in flexibility of the MNP structure comes at the expense of evaluating very high dimensional multivariate normal integrals for the choice probabilities. In these types of choice situations, the Multinomial and Conditional Logit models will yield incorrect predictions of diversions from existing modes. In other words, these illustrate that the IIA property is difficult to justify in situations where some alternatives compete more closely with each other than they do with other alternatives. This limitation of the multinomial and conditional logit models results from the assumption of the independence of error terms in the utility of the alternatives. Different models can be derived through the use of different assumptions concerning the structure of the error distributions of alternative utilities. One of them is the Nested Logit Model (NLM) developed by McFadden (1984), which generalizes the MNL model. It has a closed-form mathematical structure and is relatively easy to estimate, and relaxes the IIA assumption by allowing the unobserved factors to be correlated.

In this research, at first, the IIA assumption was examined by Hausman and McFadden (1984) test, then, by the test developed by Small and Hsiao (1985). To perform the Small and Hsiao's test, the sample was divided into two random subsamples of approximately equal size. Both tests confirmed each other and implied that the IIA was not valid. Beside the aforementioned tests, the Wald and Lagrange Multiplier tests were used for examining whether the dependent categories can be combined. Both tests provided very similar results implying that no category can be collapsed.

To derive the mathematical form of the Nested Logit Model (NLM), it is better to begin with the unconditional probability as below:

$$prob[twing_j, branch_l] = p_{jl} = \frac{\exp(\beta X_{j|l} + \gamma Z_l)}{\sum_{l=1}^{L}\sum_{j=1}^{J_l}\exp(\beta X_{j|l} + \gamma Z_l)}$$

This probability can be written as:

$$p_{jl} = \frac{p_{j|l}}{p_l} = \left(\frac{e^{\beta X_{j|l}}}{\sum_{j=1}^{J_l} e^{\beta X_{j|l}}}\right)\left(\frac{e^{\gamma Z_l}}{\sum_{l=1}^{L} e^{\gamma Z_l}}\right)\frac{\left(\sum_{j=1}^{J_l} e^{\beta X_{j|l}}\right)\left(\sum_{l=1}^{L} e^{\gamma Z_l}\right)}{\left(\sum_{l=1}^{L}\sum_{j=1}^{J_l} e^{\beta X_{j|l} + \gamma Z_l}\right)} \tag{1}$$

Where P_{jl} is the probability that individual j chooses alternative l, x refers to attributes of alternatives, z refers to characteristics of individuals and J is the number of unordered alternatives.

If we define the inclusive value for the l^{st} branch as:

$$I_l = \ln \sum_{j=1}^{J_l} e^{\beta X_{j|l}} \tag{2}$$

Then, after canceling the term and using this result, we find:

$$p_{j|l} = \frac{e^{\beta X_{j|l}}}{\sum_{j=1}^{J_l} e^{\beta X_{j|l}}} \tag{3}$$

and

$$p_l = \frac{e^{\beta X_{j|l} + \gamma Z_l}}{\sum_{l=1}^{L} e^{\beta X_{j|l} + \gamma Z_l}} \tag{4}$$

Where, the new parameter τ_1 must equal 1 to produce the original model. Therefore, we use the restriction $\tau_1 = 1$ to recover conditional logit model and the preceding equation just shows this model in another form. The Nested Logit Model arises if this restriction is relaxed. The inclusive value coefficients, unrestricted in this fashion, allow the model to incorporate some degree of heteroscedasticity. Within each branch, the IIA restriction continues to hold (Greene, 2010).

There are two ways to estimate the parameters of the Nested Logit Model: Limited Information Maximum Likelihood (LIML) and Full Information Maximum Likelihood (FIML) estimation (Greene,

2010). The limited information that is a two-step maximum likelihood approach can be performed as follows:

Estimate β by treating the choice within branches as a simple conditional logit model.

2- Compute the inclusive values for all the branches in the model. Estimate γ and the τ parameters by treating the choice among the branches as a conditional logit model with attributes Z_{ib} and I_{ib}.

Since this approach is a two-step estimator, the estimates of the asymptotic covariance matrix of the estimate at the second step must be corrected (McFadden, 1984).

For Full Information Maximum Likelihood (FIML) estimation of the model, the log-likelihood is

$$\ln L = \sum_{i=1}^{n} \ln[prob(twig \mid branch_i) * prob(branch)_i] \tag{5}$$

The information matrix is not block diagonal in β and (γ, τ), so FIML estimation will be more efficient than two-step estimation (Greene, 2010).

Based on the Nested Logit Model, we used type of repayment as the dependent variable and interest rate of loans, maturity period, type of guarantor, extension of loans, received services and having off-farm activities were used as independent variables. The estimated Nested Logit Model is as shown below:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \varepsilon \tag{6}$$

Where,
y= Type of repayment
x_1= Interest rate
x_2= Maturity periods
x_3= Type of guarantor
x_4= Loans extension
x_5= Received services
x_6= Off-farm activities
ε= Error term and $\beta_0, ..., \beta_6$ are the coefficients that should be estimated.

RESULTS AND DISCUSSION

Descriptive statistics of the variables used in the study are listed in Table 1 which shows that the average loans granted to farmers is 44.5 million Rials, while its maximum and minimum are 230 and 3.32 million Rials, respectively. The average interest rate of the credits is 13.8 percent, while the highest and lowest are 25 and 4 percent, respectively.

Maturity periods for repayment is almost 10 months, while the most and the least are 12 and 1 months, respectively. The mean age of borrowers is 52 years, in which the oldest is 90 and the youngest 27 years old. This implies that most of the borrowers are middle-aged. The average number of installments for repayment is almost 19.5.

Meanwhile, the maximum is 180 and the minimum is 1. Almost 85 percent of borrowers have other people as guarantor and the rest were lent by collateral. According to Table 1, 39% of the borrowers extended their loans, and almost half of them have horticultural activities, too. In addition, 18 percent of them have benefited from agricultural services, 30% have other sources of income besides farming, and 90 percent have received loans for capital accounts and the rest for current accounts.

The estimated results of Nested Logit Model were shown in Table 2 and indicate that the high amount of loan is one of the main factors that enhance the likelihood of loan repayment. This can be justified since mostly large farmers get larger loans and are capable of reimbursement. Significantly

Table 1. Results of descriptive statistics of the variables.

Definition of the variables	Average	Maximum	Minimum
Amount of loans (Million Rials)	44.5	230	3.32
Credit-deposit ratio (%)	0.145	1	0
Interest rate (%)	0.138	0.25	0.04
Maturity periods (Months)	10.27	12	1
Age of borrower (Years)	52.2	90	27
Number of installments	19.47	180	1
Guarantor of loan (People= 1, Collateral= 0)	0.85	1	0
Loans extension (Yes= 1, No= 0)	0.39	1	0
Horticulture activities (Yes= 1, No= 0)	0.51	1	0
Receiving services (Yes= 1, No= 0)	0.18	1	0
Off-farm activities (Yes= 1, No= 0)	0.30	1	0
Type of loans (Capital= 1, Current= 0)	0.90	1	0

Source: Agriculture Bank of Iran.

Table 2. Estimated results of Nested Logit Model.

Definition of the variables	Estimated coefficient	Z-statistics	Significance level
Interest rate	8.563	2.10	0.035
Maturity periods	0.153	3.11	0.002
Type of guarantor	0.616	2.57	0.010
Loans extension	-0.774	-4.71	0.000
Received services	1.230	2.49	0.013
Off-farm activities	-0.476	-2.77	0.006

Source: Research findings.

positive coefficients for maturity period for repaying the loans implies that the higher time to repayment, the higher odds for reimbursement. Positive coefficient of guarantor indicated that loans with a person as a guarantor instead of collateral are more likely to be repaid. There is a negative relationship between extension of the loan and its repayment implying that defaulters did not succeed in repayment by extending the due time. Receiving other services from the banks is positively associated with repayment, too. Having off-farm activity and employment is a variable that negatively affects the probability of reimbursement.

CONCLUSIONS

Empirical results of this study highlight the importance of taking into account factors including interest rate, maturity period, type of guarantor, extension of the loan, kind of received services and off-farm activities in financial markets. Therefore, it is recommended to the policy makers and agricultural banks to put in place a comprehensive credit risk management process to monitor and control credit risks for reducing risk of delinquencies and defaults. And also reconsider the extension of loans and lending to the farmers having noticeable off-farm incomes and activities. In addition, it seems necessary to ask the loan applicants to provide appropriate collateral and to enforce loan repayment obligations for effective credit delivery to the agricultural sector.

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عوامل موثر بر عملکرد وصول مطالبات بانک کشاورزی در بین کشاورزان استان آذربایجان شرقی ایران

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چکیده

یکی از چالش‌های اصلی بانک کشاورزی در اعطای تسهیلات بانکی در ایران، بالا بودن احتمال بازپرداخت نشدن از سوی وام‌گیرندگان است. در این زمینه عوامل متعددی می‌توانند دخیل باشند که لازم است به منظور کنترل و کاهش ریسک در احتمال بازپرداخت مورد توجه قرار گیرند. تحقیق حاضر با هدف بررسی عوامل موثر بر بهبود وصول مطالبات بانک کشاورزی در شهرستان مراغه استان آذربایجان شرقی انجام شده است. داده‌های مورد نیاز از طریق بررسی پرونده ۷۷۹ نفر از کشاورزان وام‌گیرنده طی سال‌های ۱۳۸۳ تا ۱۳۸۷ جمع‌آوری شده است. برای تجزیه و تحلیل داده‌ها از الگوی لاجیت متداخل و برای برآورد مدل از نرم‌افزار STATA بهره‌گیری شد. نتایج نشان داد که داشتن فعالیتی به غیر از کشاورزی، تمدید مدت بازپرداخت وام و بالا بودن مبلغ وام دریافتی عواملی هستند که بر بازپرداخت وام تأثیر منفی گذاشته‌اند. در حالی که عواملی همچون بالا بودن نرخ بهره وام دریافتی، داشتن وثیقه برای تضمین، دریافت خدمات از بانک و طولانی بودن فاصله پرداخت اقساط جزو عواملی هستند که احتمال بازپرداخت وام را افزایش می‌دهند.