

## DETERMINANTS OF DEMAND FOR GOVERNMENT AGRICULTURAL LOANS USING THE LOGIT MODEL

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### ABSTRACT

The research aims to enhance farmers' access to agricultural credit by identifying the most important economic and social characteristics affecting the demand for agricultural loans. Farmers need agricultural credit as a source of financing due to their weak financial capabilities, and that farmers' lack of access to credit may negatively affect the achievement of the level of production that maximizes profit or allow farmers to apply and use modern technologies or develop existing agricultural projects. Cross-sectional data were collected for a random sample of (275) farmers in Baghdad governorate. The Logit model was used to determine the most important factors affecting agricultural loans, which include gender, age, educational level, farm size, experience, and type of tenure, in addition to statistical description and correlation analysis, using The statistical program (EViews10), The results showed that years of experience, farm size, gender, and age have a positive and significant effect, while the educational level has a negative and significant impact, as the higher the educational level of farmers, the greater their ability to obtain employment outside the agricultural sector, such as business in government jobs, or trade and others, while the impact of the type of tenure was weak, and thus the research recommends the need to develop a credit policy that takes into account the studied characteristics of farmers and enhance their capabilities through guidance and training in addition to supporting women farmers .

**Key words :** qualitative response model ,economic and social characteristics ,credit ,bivariate

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تحليل اقتصادي لمحددات الطلب على القروض الزراعية الحكومية باستعمال نموذج (Logit)  
(محافظة بغداد حالة دراسية)

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المستخلص

يهدف البحث الى تعزيز وصول المزارعين الى الائتمان الزراعي العام من خلال تحديد اهم خصائص الاقتصادية والاجتماعية المؤثرة في الطلب على القروض الزراعية. يحتاج المزارعين الى الائتمان الزراعي كمصدر للتمويل وذلك لضعف امكاناتهم المادية ، وان عدم وصول المزارعين الى الائتمان قد يؤثر سلباً في تحقيق مستوى الإنتاج الذي يعظم الربح او يسمح للمزارعين بتطبيق واستخدام التقنيات الحديثة او تطوير المشاريع الزراعية القائمة. وتم جمع البيانات المقطعية لعينة عشوائية بلغ حجمها (275) مزارعاً في محافظة بغداد وقد استخدم نموذج لوجت (Logit) لتحديد اهم العوامل المؤثرة في القروض الزراعية والتي تشمل الجنس والعمر والمستوى التعليمي وحجم المزرعة الخبرة ونوع الحياة فضلاً عن الوصف الاحصائي وتحليل الارتباط. وذلك باستخدام البرنامج الاحصائي (EViews10) ، وقد بينت النتائج ان سنوات الخبرة وحجم المزرعة والجنس والعمر لها تأثير ايجابي ومعنوي بينما المستوى التعليمي فقد كان تأثيره سالباً ومعنوياً اذ كلما ارتفع المستوى التعليمي للمزارعين زاد من قدرته في الحصول على عمل خارج القطاع الزراعي مثل الاعمال في الوظائف الحكومية او التجارة وغيرها ، بينما كان تأثير نوع الحياة ضعيفاً، وبهذا يوصي البحث بضرورة وضع سياسة ائتمانية تأخذ بنظر الاعتبار الخصائص المدروسة للمزارعين وتعزيز قدراتهم من خلال الارشاد والتدريب فضلاً عن دعم المزارعات .

الكلمات المفتاحية: نماذج الاستجابة النوعية، حجم المزرعة، الائتمان، التوسع الزراعي .

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## INTRODUCTION

Agricultural credit is one of the important sources of agricultural financing, which works to help farmers in providing the necessary financing for the implementation of economic activities, and it is one of the effective ways to increase agricultural development (1, 3, 4). On the other hand, agricultural loans are important in raising the level of production and improving it, which is reflected in improving income. there is a positive relationship between agricultural credit and output growth and raising the level of farm income (17,5). and This depends on the experience and skill of the workers(13). The demand for agricultural loans is represented in the extent to which investors or owners of agricultural projects of all kinds and sizes need capital as one of the important production elements, to express the adequacy of self-financing for these projects .The demand for loans is a measure of the extent to which agricultural investors need capital. As it is known that we consider to loans after other sources of financing are in short supply. Farmers and investors in the agricultural sector in Iraq face many problems, including the lack of capital offered for lending and not all farmers are able to access loans. As there are economic and social characteristics that affect the demand for loans(2,14). there is a positive and strong relationship between farm size, experience, gender, age, interest rates as independent variables, and access to loans. The lack of farmers' access to loans has a negative impact on the growth of agricultural output (7 11, 12, 18).The study aimed to determine the impact of these variables on the demand for agricultural loans,in order to establish credit policies capable of achieving the desired goals in developing the agricultural sector and helping farmers to access credit. The research assumes an increase in the opportunity to apply for and obtain a loan whenever the educational level of the borrower is higher, and the age of the borrower is younger with a higher chance for males than for females, and the opportunity to obtain a loan increases with the increase in the size of the farm or the activity, as well as the experience has a positive impact on the demand for agricultural loans.

## MATERIALS AND METHODS

Logistic regression model was adopted to analyze the economic and social factors of farmers, which include gender, age, educational level, farm size, experience, and type of tenure. The impact of these factors on the demand for agricultural credit. This method is used if the dependent variable is a qualitative (descriptive) variable, that is, it takes only two values (0,1) and the explanatory (independent) variables are quantitative or qualitative. This model deals with the variance of the dependent variable that changes with the change of the independent variable (6,8). The regression analysis using the Ordinary Least Squares (OLS) method gives inefficient estimates of the model parameters and is not useful in the analysis or in predicting the results. This is because this type of regression will lead to the emergence of the problem of Heteroskedasticity, as well as the problem of linear correlation between explanatory variables. This is due to the fact that the dependent variable is a qualitative variable, so the variance of the random error is not normally distributed, but follows a Bernoulli distribution. This model depends on the cumulative distribution function (CDF) and the relationship between the probability (the binary dependent variable) and the independent variable is considered nonlinear.. Here, it should be noted, in contrast to the linear models estimated by the (OLS) method, that the parameter values using the qualitative response models method cannot be explained by economic interpretation directly, but only mean the positive or negative influence on the probability (Pi). Logistic regression is a type of statistical model dependent on linear regression models, which enables the modeling of a binomial variable in terms of a set of expected random variables, whether they are numerical or qualitative (categorical) variables. It can be used to predict the probability of a particular event occurring with additional knowledge of the values of variables that can be explained or related to that event (10), and it has several types of which Binomial logistic regression: It is also called binary logistic regression and it is one of the most famous types of logistic

regression, as it is used to explain the effect of independent variables (explained) on binary responses. The binomial logistic regression equation is as follows:

$$Y = b_0 + b_1X_1 + b_2X_2 + \dots + b_n X_n$$

Where:

Y = represents the dependent variable (binary).

b<sub>0</sub>= The constant term in the binomial logistic regression equation.

b<sub>n</sub>X<sub>n</sub> = the value of the object relative to the independent variables

One of the conditions for applying logistic regression is that the dependent variable be a binary variable with regard to binomial logistic regression (9). Some hypotheses must be applied before estimating the model for using these models, including hypotheses, include the complete absence of a correlation between the explanatory variables with each other. The variables that show a complete correlation between them must be deleted. In addition to the hypothesis that there is no correlation between random error and the six explanatory variables included in the qualitative response model, using the Eviews10. And to determine the suitability of model variables after estimation. Including the analysis of sediments and differences and is used for the purpose of comparing the observation values and the

expected values of the model that does not include the independent variables. And the test of correlation between the independent variables with each other, and the Wald Statistic test, which is used to determine the significance of the parameters of the explanatory variables of the Logit model as a whole, that is, the significance of the model (16). As for the Mc Fadden R-squared statistic, which is replaced by the coefficient of determination ( $R^2$ ), whose value is doubtful and misleading, and its value is usually between (0.2 - 0.6) and in the most cases it reaches (0.8). This occurs when the true spread is very close around the points, in which case the predicted values of the dependent variable are close either to one or to zero. For this reason, it was adopted to (Mc Fadden R)(15). To estimate the model, data were collected for a sample of (275) farmers in Baghdad governorate.

**RESULTS AND DISCUSSION**

Table (1) shows that there is no correlation between the explanatory variables and each other. Table (2) shows that there is no correlation between the explanatory variables and the random error.

**Table1. Correlation test between explanatory variables**

	Age	Gander	Education	Experience	Farm-Size	Tenure
Age	1.000000	-0.094803	-0.262860	0.480182	0.018567	0.085435
Gander	-0.094803	1.000000	0.112352	-0.047775	0.015913	-0.152754
Education	-0.262860	0.112352	1.000000	-0.020810	-0.057871	-0.191812
Experience	0.480182	-0.047775	-0.020810	1.000000	-0.038435	0.048732
Farm-Size	0.018567	0.015913	-0.057871	-0.038435	1.000000	0.045755
Tenure	0.085435	-0.152754	-0.191812	0.048732	0.045755	1.000000

\*Completed by the researcher using Eviews10 program

**Table2. Correlation between the random variable and explanatory variables**

	Age	Gander	Education	Experience	Farm-Size	Tenure	Resid
Age	1.000000	-0.094803	-0.262860	0.480182	0.018567	0.085435	5.31E-13
Gander	-0.094803	1.000000	0.112352	-0.047775	0.015913	-0.152754	-3.93E-13
Education	-0.262860	0.112352	1.000000	-0.020810	-0.057871	-0.191812	-8.24E-13
Experience	0.480182	-0.047775	-0.020810	1.000000	-0.038435	0.048732	-2.72E-13
Farm-Size	0.018567	0.015913	-0.057871	-0.038435	1.000000	0.045755	2.54E-14
Tenure	0.085435	-0.152754	-0.191812	0.048732	0.045755	1.000000	2.43E-13
Resid	5.31E-13	-3.93E-13	-8.24E-13	-2.72E-13	2.54E-14	2.43E-13	1.000000

\*Completed by the researcher using Eviews10 program

Table (3) shows the characteristics of the sample

**Table 3. The economic and social characteristics of the sample**

Variables	Category	Number	Percent (%)
<b>Gender</b>	<b>Mail</b>	<b>233</b>	<b>84.73</b>
	<b>Female</b>	<b>42</b>	<b>15.11</b>
<b>Age (years)</b>	<b>&lt; - 30</b>	<b>15</b>	<b>5.40</b>
	<b>31-40</b>	<b>55</b>	<b>19.78</b>
	<b>41-50</b>	<b>90</b>	<b>32.73</b>
	<b>51-60</b>	<b>65</b>	<b>23.63</b>
	<b>61 to above</b>	<b>50</b>	<b>17.99</b>
<b>Education level</b>	<b>illiterate</b>	<b>62</b>	<b>22.54</b>
	<b>Primary</b>	<b>88</b>	<b>32</b>
	<b>middle school</b>	<b>30</b>	<b>10.79</b>
	<b>high school</b>	<b>45</b>	<b>16.19</b>
	<b>University</b>	<b>40</b>	<b>14.39</b>
	<b>other</b>	<b>10</b>	<b>3.60</b>
<b>Experience (years)</b>	<b>&lt; 10</b>	<b>80</b>	<b>28.78</b>
	<b>11-20</b>	<b>97</b>	<b>35.27</b>
	<b>21-30</b>	<b>50</b>	<b>17.99</b>
	<b>31-40</b>	<b>33</b>	<b>11.87</b>
	<b>41 and more</b>	<b>15</b>	<b>5.40</b>
<b>Farm size (dunum)</b>	<b>&lt; 10</b>	<b>197</b>	<b>71.63</b>
	<b>11-20</b>	<b>30</b>	<b>10.79</b>
	<b>21-30</b>	<b>20</b>	<b>7.19</b>
	<b>31-40</b>	<b>11</b>	<b>3.96</b>
	<b>41-50</b>	<b>8</b>	<b>2.88</b>
	<b>51- to more</b>	<b>9</b>	<b>3.24</b>
<b>Type of land holding</b>	<b>land owner</b>	<b>183</b>	<b>66.54</b>
	<b>Rent</b>	<b>80</b>	<b>28.78</b>
	<b>agricultural contract</b>	<b>12</b>	<b>4.32</b>
<b>Total</b>	<b>not receiving loans</b>	<b>170</b>	<b>61.81</b>
	<b>beneficiaries of loans</b>	<b>105</b>	<b>37.77</b>

\*Prepared by the researcher based on the questionnaire

Table 3 shows that the percentage of women in the sample is lower than that of men, since most women are in the family, few women have the decision to borrow, and most of the farmers questioned fall within the middle age group. The sample was also characterized by a high rate of illiteracy and primary education, ranging between less than 10 and older than 41 years, which constituted the lowest percentage among farmers, and that most of the farmers in the sample are owners of small farms with an area of 10 dunums or less, as their percentage constituted (71.63%). As for large farms, their

percentage was lower, and most farmers owned The land accounted for (66.54%) of them, while the rest of the farmers were tenants of the land. sample are owners of small farms with an area of 10 dunums or less, as their percentage constituted (71.63%). As for large farms, their percentage was lower, and most farmers owned The land accounted for (66.54%) of them, while the rest of the farmers were tenants of the land. The model parameters were estimated using the greatest possibility method and using the 10Eviews program, as shown in Table (4).

**Table4. Results of Logit model**

Variable	Coefficient	Z - Statistics	Prb.
Gander	2.225234	2.219397	0.0265
Age	0.136350	6.357217	0.0000
Education	-0.996270	-5.842705	0.0000
Farm – Size	0.029472	2.065605	0.0389
Experience	0.201756	7.659205	0.0000
Tenure	0.435042	1.468668	0.1419
C	1.356238	0.933684	0.3505
McFadden R-squared	0.572808	Akaike info criterion	0.619029
LR statistic	209.4879	Schwarz criterion	0.711093
Prob(LR statistic)	0.000000	Hannan- Quinn criter.	0.655977
Log likelihood		Avg. Log likelihood	-0.284060
		Obs with Dep=0	170
		Obs with Dep=1	105

\*Completed by the researcher using Eviews10 program

The results of Table (4) show that the effect of the gender factor was positive at the level of 5%, which means that male farmers are more likely to obtain loans compared to female farmers. The odds ratio (2.225) is greater than one, which indicates that the change in the sex of the farmer (from female to male) increases the probability of obtaining loans by (2.225). This is generally because the men own the capital, and even if the women owns the land, they are not entitled to act without men, according to the social norms prevailing in the Iraqi rural areas. Male farmers also have greater opportunities for external contact and to move easily and out of their areas to the location of the lender. As for the effect of age, the parameter of this variable appeared significant at the level (1%) and its positive sign indicates that young farmers are less willing to obtain loans compared to the category of older farmers. As the parameter of this variable amounted to (0.136) less than one, which means that the increase in the age of one year for the farmer increases the probability of obtaining loans by (0.136). This is because most of the farms are run by the head of the family or the head of the family, who owns the land and the capital, which qualifies him to request loans, unlike the young men. This may refer to the deprivation of young people from obtaining their own loans or choosing projects. Or because of the youth's unwillingness to work in the agricultural sector and their continuous search

for other activities and businesses that may be outside the agricultural sector. While the Education level indicated that there is a negative relationship between this variable and the possibility of obtaining loans, this contradicts the results of many studies that confirm the existence of a positive relationship. However, the high level of education may be a reason for increasing the farmers' ability to work in other non-agricultural activities. These may be jobs in the public sector, with an income level that suffices them from that which they get from the interest in agriculture and its development. Therefore, few applicants for loans with a high level of education. While the parameter of farm size was positive at the 5% significance level. This indicates that as the size of the farm increases by one unit, the probability of obtaining the loan will increase by (0.029). This is consistent with the logic of economic theory, as by increasing the size of the farm, this will lead to an increase in the need to cover the increased costs of production. But the effect of the area is weak on the demand for loans, as the value of the loan application increased without increasing the cultivated area through the use of modern and new technologies in the same area. There are productive projects that do not need a large area, but may require large capital. Especially when the project is done on a small area, for example, the area of orchards is fixed, but needs renewal and maintenance. The parameter "Experience" also appeared, with a

positive sign, which corresponds to the economic logic, where the greater the experience by one unit, the greater the possibility of expanding projects and adopting new and modern methods to confront climate changes or unfavorable conditions. It is considered one of the conditions for obtaining loans, thus increasing the chance of demand for loans by (0.201) when the other variables included in the model remain stable. As for the Tenure type: the sign of this variable is positive, meaning that the more the type of possession is owned by the owner, the greater the demand for loans, and the more the type of possession tends towards the second type

(rent), the less likely it is to access loans. This is because farmers who own land are more secure and able to expand projects, especially investment, to ensure that they remain on the land. On the other hand, land ownership increases the borrower's ability to bear risk, unlike farmers who do not own the land, who are subject to the terms of the lease or contract (with the government or with the private sector). As well as the possibility of providing the required real estate guarantees, which are usually requested in large investment projects. According to Table (4), the value of the Mc Fadden R-squared statistic was (0.57).

**Table5. Quality of conformity test (Hosmer & Lemeshow) according to Logit model**

	Quantile of Risk		Dep=0		Dep=1		Total Obs	H-L Value
	Low	High	Actual	Expect	Actual	Expect		
1	7E-06	0.0021	27	26.9731	0	0.02689	27	0.02692
2	0.0028	0.0146	27	27.7830	1	0.21696	28	2.84827
3	0.0148	0.0449	27	26.2784	0	0.72161	27	0.74142
4	0.0465	0.0879	28	26.1248	0	1.87523	28	2.00983
5	0.0907	0.2046	22	22.8986	5	4.10138	27	0.23216
6	0.2083	0.3741	20	20.0602	8	7.93980	28	0.00064
7	0.3783	0.6809	11	12.6354	16	14.3646	27	0.93786
8	0.6809	0.8859	5	5.37800	23	22.6220	28	0.03288
9	0.8905	0.9740	2	1.65883	25	25.3412	27	0.07476
10	0.9751	0.9999	1	0.20964	27	27.7904	28	3.00212
			170	170.000	105	105.000	275	9.36686
	H-L Statistic		9.3669		Prob. Chi-Sq(8)			0.3123
	Andrews Statistic		72.761		Prob. Chi-Sq(10)			0.0000
			7					

\*Completed by the researcher using Eviews10 program

This means that the variables (Sex, Age, Farm Size, Experience, Education, tenure type) explained 57% of the fluctuations in the binary dependent variable (variance in the probability of loan demand). Therefore, they can be considered (the variables) as the most important and most influential factors in the demand for loans. As for the remaining 43%, it is due to other factors that were not included in the model. Whereas, the (LR Statistic) Likelihood LR test was (209.48) (Table 4) which is greater than Tabular value of X. Thus, the null hypothesis HO (no demand for loans) is rejected and the alternative hypothesis H1 (there is demand for loans) is accepted. The quality of conformity test (H &

L) Hosmer and Lemeshow (Table5) was also taken into consideration. The results of the quality-matching test (H & L) of the Logit model, which follows the X distribution, showed that the statistical value of H-L was (9.36) at a degree of freedom (8) for a level of statistical significance that reached (0.31), with a value greater than 0.05, i.e. (>0.313 0.05). That is, it is not significant (not statistically significant). Thus, the null hypothesis HO (the null hypothesis) is accepted, which says that the Logit model is adequate and represents the data well. That is, the expected (estimated) values in the model match or are equal to the observed values of the dependent variable (demand for loans).

**Table 6. Wald Statistic Test for Logit Model Parameters**

Test Statistic	Value	Df	Probability
F-statistic	12.90334	(5, 268)	0.0000
Chi-square	64.51670	5	0.0000
Null Hypothesis: C(1)= C(2)= C(3)= C(4)= C(5)= C(6)=0, Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(1)		-2.660275	1.030305
C(2)		-0.298692	0.294001
C(3)		-1.431312	0.338848
C(4)		-0.428254	0.295904
C(5)		-0.636798	0.301611

\*Completed by the researcher using Eviews10 program

Most of the results of the analysis agreed with the research hypothesis, except for the educational level variable, which showed a negative relationship with the demand for agricultural loans. The results also showed that young people are less willing to work in agriculture than the elderly, so their demand for credit is less. The more women farmers are, the less likely they are to access credit. Accordingly, the research recommends the In other words, the model capabilities fit the data well. The Wald Statistical Test was conducted, and Table (6) shows the results of Wald's statistic, which follow an X distribution at a degree of freedom (5). The parameters of the regression of the Logit model as a whole showed their significance ( $0.000 > 0.05$ ), which means that the explanatory variables (gender, age, education level, farm size, experience, tenure type) included in the model have a significant effect on the probability of the dependent variable (demand for loans). The alternative hypothesis H1 that the parameters of the explanatory variables (bs) of the Logit model are not equal to zero. need to develop a credit policy that takes into account the studied characteristics of farmers in a way that guarantees their access to credit . In addition to developing special programs for young people to motivate them to work in agricultural activities. Women farmers must also be supported in order to enable them to expand their agricultural activities, raise their contribution to agricultural output and improve the level of farm income.

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