USING PROBABILITY REGRESSION MODELS TO MEASURING MANAGEMENT EFFICIENCY FOR BROILER PROJECTS

E. H. Ali
Assist. Prof.
Coll. of Agri. Univ. of Baghdad
E-mail:Eskanderhali81@gmail.com

M. F. Faeq
Researcher
Ministry of Agriculture
E-mail:marwaaougi@yahoo.com

ABSTRACT

The efficiency of management is determining factor for the success or failure of agricultural projects generally and Livestock particularly achieving its objectives. Therefore, this research came to diagnose the most important variables that determine the efficiency of management using the probability regression models to measure the probability of management efficient of broilers production projects using random sample included (60) broilers projects represented 11.6% of Baghdad province (research community) in 2016. After estimating the relationship between the management efficiency (descriptive dependent variable) and the independent variables affecting it (age, educational level, production index (PI), experience). The results showed that the parameters of these variables were positive according the economic logic, except for the parameter of the experience variable, which was negative contrary to economic logic. The results showed that the independent variables were significant at 1% and 5% levels in logit and probit models, except the PI variable, which was insignificant in the Tobit model. By comparing the results of the three models and the tests performed, the probit model showed its preference. The age and educational level were most important independent variables affecting the efficiency of management, the suggested recommendations of the research indicated to increase the efficiency of the administration through training courses to train workers and teach them to follow the modern methods in poultry production and raise the scientific methods because of its impact in increasing productivity.

Key words: logit, production index, tobit.
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استخدام نماذج الانحدار الاحتمالية في قياس كفاءة إدارة مشاريع فروج اللحم

مروة فاروق فائق
باحثة
وزارة الزراعة

اسكندر حسين علي
استاذ مساعد
كلية الزراعة/جامعة بغداد

المستخلص

تُعد كفاءة الادارة مُحدداً فعالاً لنجاح او فشل المشاريع الزراعية بصفة عامة والحيوانية بصفة خاصة في تحقيق اهدافها لذلك جاء هذا البحث ليلقي الضوء على اهم المتغيرات التي تتحدد بها كفاءة الادارة مُستخدماً نماذج الانحدار الاحتمالية لقياس احتمالية كفاءة ادارة مشاريع انتاج فروج اللحم في ضوء عينة عشوائية اشتملت على (60) مشروع مثلت 11.6% من محافظة بغداد (مجتمع البحث) لعام 2016، وعند تقدير العلاقة بين كفاءة الادارة (المتغير التابع الوصفي) والمتغيرات المستقلة المؤثرة فيه (العمر، المستوى التعليمي، معيار الدليل الانتاجي PI، سنوات الخبرة) أظهرت النتائج ان اشارة مَعلمات تلك المتغيرات موجبة مطابقة للمنطق الاقتصادي ما عدا مَعلمة متغير الخبرة ظهرت اشارتها سالبة مخالفة للمنطق الاقتصادي، كذلك بينت النتائج معنوية المتغيرات المستقلة عند مستوى 1% و5% ولانموذجي Logit وProbit ما عدا متغير PI فقد اظهر عدم معنويته في انموذج Tobit، وبمقارنة نتائج تقدير النماذج الثلاثة والاختبارات التي اجريت عليها اظهر انموذج Probit أفضليته وتبين ان متغيري العمر والمستوى التعليمي هما اكثر واهم المتغيرات المستقلة تأثيراً في كفاءة الإدارة، وأوصى البحث بالعمل على رفع كفاءة الادارة من خلال الدورات التدريبية لتدريبهم عملياً على الطرق السليمة في تربية الدواجن ورفع المستوى العلمي لما له من أثر في زيادة الانتاجية.

الكلمات المفتاحية: لوجت، معيار الدليل الإنتاجي، توبت.
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INTRODUCTION

The management efficiency of the projects depends on a number of determinants, including the economic efficiency of the projects and ability to make the right decisions by the management in addition to the personal features of the manager such as age, educational level, years of experience and other determinants, the management efficiency of projects vary from project manager to another according to his skills. The projects management interesting at achieving effective performance as the most important indicator that reflects the status of the project in its various aspects as it is the most important in achieving the main objectives of the project of survival and continuity. The project may have good financial resources and advanced technology, but may not be able to use them efficiently and effectively without the existence of human resources with unique capabilities of directing and exploiting them in a manner which is in agreement with the objectives of this project. In this study, discussed the broilers projects as a study case; the poultry industry is one of the major pillars of the economy of many countries of the world because of for the short cycle of capital invested in it (20). The Iraqi production of meat broiler for the period (1997-2016) reached about (1282720) tons, and The percentage of Baghdad province reached 18% from it, also meat broilers production is one of the main sources of food to build the human body because it contains a high amount of protein, where one kilogram contains 190 grams of protein and 1490 calories (5). Meat broilers are feature by high food conversion efficiency compared to the other animals, as the bird consume 2 kg of feed for production 1 kg of meat. While the sheep, 13.4 kg of feed is consumed to give 1 kg of meat, while 10.7 kg of feed is consumed in cows to give 1 kg of meat (11). Broilers meat is particularly important for consumption by all social groups because of its low price compared to the prices of other sources of animal protein (14). Also the poultry industry are easily manageable and have low invested capital while generating rapid returns (18). broilers projects also accommodate too many of unemployed people, cause it's small and widespread in most of the country's governorates (10). This study started from the problem that many of the broilers production projects suffer from many problems, such as administrative and technical problems which resulted in decrease of efficiency of these projects because of poor management and the lack of implementation of the required duties and lack of attention to the concepts of modern management that enable them to achieve their goals efficiently and effectively, so the objective of the research to measure the management efficiency of projects assuming that there are several factors and determinants effect of the management efficiency, which cannot be measured quantitatively, Particularly with regard to the management efficiency factor itself

MATERIALS AND METHODS

Three probabilistic response models (Logit, Probit, Tobit) were used to achieve the research objectives as one of the most important tools of the analysis to determine the most important independent variables affecting the qualitative dependent variable (management efficiency) and using the maximum likelihood estimation method by using Eviews 6. data were obtained using a questionnaire prepared for this purpose, which was randomly collected from a sample of (60) broiler production projects, which represented 11.6% of the projects of the Baghdad province (research community) which reached (516) projects in 2016.

RESULTS AND DISCUSSION

Regression analysis was concerned with describing the relationship between the dependent variable and the explanatory variables if the dependent variable is qualitative binary although the existence of such types of dependent variables is common, especially when studying human, social and economic phenomena (12) (16). Therefore, the need to discover alternative statistical methods to deal with such variables and specialized in the interpretation of phenomena which have binary feature because it have property of predicting the probability of happened or not-happened of the values of dependent variables so that the regression models are unable to describe and explain the relationship between explanatory variables and the dependent qualitative variable, The normal regression

model estimated in the ordinary least squares OLS method cannot perform well if the dependent variables are (dummy) with intermittent values such as zero and one, it will not be able to estimate the parameters of the regression model efficiently, which will not be useful in predicting the results or in the analysis or forecasting, as well as, this type of regression and because of the nature of the dependent variable, the result will have problem of heterosedasticity and problem of auto correlation between residuals and independent variables. Thus, the expected value of the dependent variable will not is within the logical and actual range of that variable. Meaning that it will not be between zero and one, and this problem remains exists regardless of the form of the estimated relationship in linear and nonlinear models (9). Thus, there is a need to develop new statistical methods that have the quality of regression to arrive at better equations, and at the same time resolve the problem of applying normal linear regression models (12). These models are the qualitative response models that can give a clear idea of the effect of the explanatory variable in the binary dependent variable. In addition to the above, we should not restrict the dependent variable (the respondent) or force it to be only a binary variable; it may be tri-chotomous or Poly chotomous. It is possible that the dependent variable has multiple levels or layers and therefore the binary variable must be studied before estimating the main model (8). Before using the qualitative response models (Logit, Probit, Tobit) in this research to estimate the relationship between the efficiency of the management (dependent qualitative variable) and the independent variables affecting it. We will refer to how the descriptive dependent variable is calculated according to a questionnaire prepared for this purpose, which designed according to the fourth Likert scale and analyzed according to this scale using the SPSS 23 program. Based on its results, the projects were classified in terms of management efficiency (low, medium, high) The results showed that the efficiency mean (38.35) and a standard deviation reached (7.11) at the level of the research sample according to the level of efficiency of the degrees ranged between (24-53) and the number of paragraphs reached (60) paragraph (project) as shown in Table 1.

Table 1. Degree of Management Efficiency for Broiler Projects in 2016

Efficiency Degree	Projects Classes	Projects Number	Percentages %	Mean	Std. Deviation
Low	24-33	17	28.33	29.71	3.46
Medium	34-43	28	46.67	38.86	3.00
High	44-53	15	25.00	47.20	2.62

Source: depended on the data of questionnaire

Table 1 shows that the highest percentage of the studied projects was within the intermediate level (46.67) with mean reached (38.86). This means that more than half of these projects are described regarding their level of efficiency in management of broiler projects in the medium to high level. this is due to the good management of these projects through the optimal use of production resources and mixing them as recommended scientifically and this reflected on the efficiency of management. this has been demonstrated by the evaluation of the productive qualities by measuring the criteria that included the feed efficiency conversion, rate of the weight increase, bird body weight, the average of consumed feed and the percentage of mortality. the criteria for evaluating the efficiency of the productive and economic management of broilers have been applied, including the PI, and before estimating using the qualitative response models, it should be applied of their hypotheses, including correlations between explanatory variables (age, experience, educational level, production index) as well as the correlation between them and the random variable using Eviews 9 program, The results showed that there is no correlation between the explanatory variables and the random variable, knowing that all other hypotheses showed their compatibility with use of these models, and the practical application to estimate the qualitative response models as following:

First: Logit model

This model is one of the most important statistical methods used in classification and prediction when the dependent variable is binary value (in a digital codes 0 and 1 (7). This model is less sensitive to the natural

deviation trend (Normal Distribution) of the study variables than other statistical methods (1). Such as discriminant analysis and linear regression. Thus, it can exceed a number of OLS hypotheses, making it the best analysis if the variable is binary (6) (19). This model is depend on the Cumulative distribution function (CDF), the relationship between probability and explanatory variable is a nonlinear relationship (2). The Logit model is more flexible than traditional regression models, it can be assumed relationship between the dependent variable and other explanatory variables, through which the probability of an event can be estimated (3). In the estimation of this model after determining the management efficiency (binary dependent variable), the efficient manager (event occurrence) takes the value of 1 while the inefficient manager (non-event) takes the value of 0 and determination the independent variables affecting it (age, education level, experience, PI) Using the maximum likelihood method and Eviews 9 program, the results of the estimate were obtained in Table 2.

Table 2. Logit Model

Dependent Variable: MANAGEMENT_EFFICIENCY
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 05/25/18 Time: 11:34
Sample: 1 60
Included observations: 60
Convergence achieved after 9 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AGE	0.647979	0.254642	2.544662	0.0109
EDUCATION	1.790436	0.827098	2.164719	0.0304
EXPERIENCE	-0.403409	0.185595	-2.173600	0.0297
PI_EF	0.036746	0.017940	2.048284	0.0405
C	-33.22446	13.51757	-2.457872	0.0140

McFadden R-squared	0.790271	Mean dependent var	0.716667
S.D. dependent var	0.454420	S.E. of regression	0.214277
Akaike info criterion	0.416695	Sum squared resid	2.525297
Schwarz criterion	0.591224	Log likelihood	-7.500849
Hannan-Quinn criter.	0.484963	Deviance	15.00170
Restr. deviance	71.52888	Restr. log likelihood	-35.76444
LR statistic	56.52719	Avg. log likelihood	-0.125014
Prob(LR statistic)	0.000000		

Obs with Dep=0	17	Total obs	60
Obs with Dep=1	43		

Source: depended on the data of questionnaire using eviews 9

Results of Table 2. Indicate that the parameter of each variables (age, educational level, PI) is positive according economic logic. Increase of any factor of each (age, educational level, PI) by one unit led to increase of probability of project management efficiency (0.647, 1.790, 0.036) respectively, while the other variables in the model remaining constant. This explains the importance of educational level in project management, as project managers with the highest level of education are more efficient than the less educated. The positive effect for PI factor is a clear indicator of the good performance of the herd, contrary to the mistaken belief that the weight average of bird during marketing is the indicator of the meat broilers quality, but the good performance achieves the highest body weight and the lowest mortality percent and the shortest breeding period and efficiency of feed conversion. This is a sign of the good economic returns of the project. International companies are currently competing to produce high value breeds for the management standards of broilers production projects, including PI criteria (13). While the results of the statistical analysis indicate that, the parameter of the experience variable was negative against economic logic, which had the opposite effect on the management efficiency. The increase of experience by one unit will reduce the probability of management efficiency by 0.403. The reason may be due to the lack of experience among the owners of broilers production projects or perhaps because some of them have not acquired the long experience of modern techniques of production, so they are less efficient to

manage. and some of these projects in the Baghdad province were within the agricultural initiative projects that started in 2008, either by establishing new projects or rehabilitation of the old or expand the production capacity to accommodate more birds, also the results showed according to Z statistical test that independent variables were significant, according to the test of statistic Mc Fadden R^2, the studied variables were able to explain 79% of the fluctuations in the binary dependent variable (probability of management efficiency). The remaining percent which reached 21% is due to other factors not included in the model. Results of the LR test which reached (56.527) according to the distribution of x^2 which is greater than the value of table x^2 in df 4. thus rejecting the null hypothesis H_0 which states "inefficient management of broilers production projects" also the Hosmer & Lemeshow test was conducted which its value reached (0.314) at the degree of freedom 8 for the level of statistical significance of 1.000 which is greater than 0.05 which means that it is not statistically significant, that is, the model is appropriate and represents the data well.

Second: Probit model

This model is similar and certain to the Logit model in terms of the nature of the binary dependent variable that takes two values (1, 0) and depends on the probability density function PDF and the cumulative distribution function CDF (2). In estimating the relationship between management efficiency (binary dependent variable) and the independent variables affecting it (age, educational level, experience, PI) using Eviews 9 program, the results of the estimation were obtained in Table 3.

Table 3. Probit Model

Dependent Variable: MANAGEMENT_EFFICIENCY
Method: ML - Binary Probit (Newton-Raphson / Marquardt steps)
Date: 05/25/18 Time: 11:35
Sample: 1 60
Included observations: 60
Convergence achieved after 8 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AGE	0.377937	0.147032	2.570438	0.0102
EDUCATION	1.045544	0.466680	2.240389	0.0251
EXPERIENCE	-0.234723	0.105134	-2.232603	0.0256
PI_EF	0.021405	0.010295	2.079197	0.0376
C	-19.36673	7.737659	-2.502918	0.0123

McFadden R-squared	0.794429	Mean dependent var	0.716667
S.D. dependent var	0.454420	S.E. of regression	0.213567
Akaike info criterion	0.411738	Sum squared resid	2.508598
Schwarz criterion	0.586266	Log likelihood	-7.352133
Hannan-Quinn criter.	0.480006	Deviance	14.70427
Restr. deviance	71.52888	Restr. log likelihood	-35.76444
LR statistic	56.82462	Avg. log likelihood	-0.122536
Prob(LR statistic)	0.000000		

Obs with Dep=0	17	Total obs	60
Obs with Dep=1	43		

Source: depended on the data of questionnaire using eviews 9

Results of Table 3 indicate to positive relationship between the variables of each (age, educational level, production index PI) and the binary dependent variable. The increase of factor (age, educational level, PI) by one unit increases the probability of project management efficiency by (0.377, 1.045, 0.021) respectively, with stability of other variables included in the model, while the model showed the inverse relationship between the variable of experience and the efficiency of management. The increase of experience by one unit led to decrease of management efficiency probability by 0.234. The results of Z statistic test showed the significance of the independent variables in the effect on the binary dependent variable. According to the Mc Fadden R^2 statistic test, which explained 79% of the changes in the binary dependent variable caused by the

independent variables, also LR test, which reached (56.824) which is greater than the value of table x^2 at df 4 that means acceptance of the alternative hypothesis (H_1). Which means the efficiency of the management of the broilers production projects. Also, the Hosmer and Lemeshow test (0.224) was conducted at a level of freedom degree of 8 at a statistical significance level of 1.000 which is greater than 0.05 which means that it is not significant and thus the capabilities of the model fit the data well.

Third: Tobit model

This model is an extension of the Probit model and is known as the limited or restricted regression model, which deals with the distribution characters of the efficiency levels (15). This model is used if the dependent variable contains zero and continuous observations. This method is called Tobit Censored Truncated Regression (17). Tobit model is estimated using the ML method and Eviews 9 program as shown in Table 4.

Table 4. Tobit Model

Dependent Variable: MANAGEMENT_EFFICIENCY_TO
Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)
Date: 05/25/18 Time: 11:36
Sample: 1 60
Included observations: 60
Left censoring (value) at zero
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AGE	0.019029	0.002447	7.776770	0.0000
EDUCATION	0.053681	0.016306	3.292170	0.0010
EXPERIENCE	-0.014426	0.002776	-5.195978	0.0000
PI_EF	0.000401	0.000266	1.506967	0.1318
C	-0.577533	0.159056	-3.631013	0.0003
Error Distribution				
SCALE:C(6)	0.149235	0.017204	8.674473	0.0000

Mean dependent var	0.299333	S.D. dependent var	0.194299
S.E. of regression	0.129759	Akaike info criterion	-0.107929
Sum squared resid	0.909224	Schwarz criterion	0.101505
Log likelihood	9.237880	Hannan-Quinn criter.	-0.026008
Avg. log likelihood	0.153965		
Left censored obs	17	Right censored obs	0
Uncensored obs	43	Total obs	60

Source: depended on the data of questionnaire using eviews 9

Results of Table 4 indicate to positive relationship among the variable of each (age, educational level) and the management efficiency variable (the dependent variable). The increase of the factor (age, educational level) by one unit, this increases the probability of project management efficiency by (0.019, 1.053) respectively, while the model showed the inverse relationship between the variable of experience and the efficiency of management so the increase of experience by one unit, the probability of management efficiency will decrease by 0.014. The results of the Z statistical test showed the significance of the independent variables in the effect on the dependent variable except the PI variable which appeared insignificant in this model. It should be noted that according to this model, the Mc Fadden R^2 test, the LR test, and the H & L test could not be conducted for the reasons which may be attributed to this model cannot be evaluating using the Eviews 9 program so it replaced by other tests such as the Wald test Which follows the distribution of x^2 in df 4. The all parameters of the regression of the Tobit model were significant and showed that the explanatory variables (age, experience, educational level, production index) included in the model have a significant effect to predict the value of the qualitative dependent variable (management efficiency) thus rejecting the null hypothesis (H_0) that assumed the parameters of the explanatory variables (b's) of the Tobit model are zero and accept the alternative hypothesis H_1. also other statistical indicators are shown in Table 4 such

as (Akaike info criterion, Schwarz criterion, Hannan-Quinn criter.) gave lower values than in other models. This confirms the goodness of the Tobit model, and when comparing the qualitative response models used in its estimation and tests, we conclude that Logit and Probit that their results were somewhat similar and this is consistent with the theoretical basis for them. The difference is that the Logit model has tails and extensions in the distribution (4). Although both models have an expectation equal zero, but the Logit model based the standard distribution while the Probit model is based on the normal standard distribution. Also the probability value of the Logit model is near zero and one at a slower rate than Probit. The value of Mc Fadden R^2 in the Probit model was slightly higher than the Logit model as shown in Tables 2 and 3, while this value did not appear in the Tobit model, The LR test was higher in the Probit model and reached (56.824) than the Logit model which was (56.527), while the LR statistic in the Tobit model (9.237) was lower than the Logit and Probit models. Thus the Probit model showed its superiority among the three models according to the results of the evaluation and tests and the most important factors (explanatory variables) have an impact on the probability of management efficiency are the factors of age and educational level, so the research recommended working to raise the efficiency of management through training courses to train them in practice on the optimum methods in the management of poultry and raise the scientific level which have directly impact on productivity increase, as well as to encourage investment in broiler projects because of these economic efficiency and excellence in the short cycle of capital and the exploitation of maximum capacity to increase the proportion of projects operation with optimal use, also attention to qualitative factors that cannot be measured quantitatively and the need to expand the use of qualitative response models as an effective method that gives an idea of the effect of the independent variable in the qualitative dependent variable.

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