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# Determining the factors affecting the profitability of industrial beef livestock units in Khuzestan province

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**Abstract:** The basic objective of this study was to evaluate the profitability of industrial livestock- meat units and identify factors that affect the profitability in Khuzestan Province. The research method was surveying- functional and in terms of time, it is a cross-sectional study. The population consisted of fattening beef production units in Khuzestan Province that a total of 80 samples were obtained in the production period of 2011-2012. The questionnaire was the main tool for data collection. The research results show: the Logit binary models, Madala and Mac Fowden statistics to study the factors that affect the likelihood of success and failure in beef animal husbandry farms show that in the first model, variables of area, the ratio of the current livestock to the potential, the feed conversion ratio, the performance of each head of cattle, education and certification type; have a positive impact and having a side job and the farm location (inside the village) have a negative effect on this probability. In the second model that the cost - benefit ratio is used, the experience and side job variables are insignificant as well.

**Key words:** Livestock units of Khuzestan Province; Profitability index; Interest rate; Cost-benefit ratio index; Logit Binary models; success and failure

## 1. Introduction

The prediction of Malthus can be mentioned as the first concern of scholars about the ability to provide food for continuing of human life. He argued that the production of food increases with the mathematical growth and population growth increases with geometric growth thus, in future, the human will not be able to meet his food requirements. Although this theory of Malthus due to the lack of consideration of many factors of technological progress, is criticized by many intellectuals, but the current growth in world population and emergence of food crises cause that many experts be faced with problem in providing food for this growing population (Rahmani and Torkamani, 2010).

At present, the world population is 7 billion people which in 2080, this number will increase to more than 10 billion (Tim, 2001). This increase in the world population occurs when due to promotion of the quality of life, especially in developing countries, the per capita food consumption is also rising. The per capita food consumption in the world, on average by about 20 percent increase, from 2,360 in 1960 already has reached to about 2790 kcal and it is predicted that per capita food consumption in 2050 will increase to approximately 3130 kcal (Yazdanpanahi and Najafi, 2005). The problem is so serious that phrases such as population, food, malnutrition, food security and poverty are of the most words that attracted the discussions of scientific, political and social community to themselves.

In addition to the food supply, food scientists believe that the inclusion of a moderate ratio of animal products in the diet of humans is essential (Motaghi Talab and Golchin, 2012). Meanwhile, developing countries have more nutritional problems and higher population growth rates, the growth of livestock production should be about 483 percent that the people of this country can daily have access to 2450 calories and 21 grams of animal protein (FAO, 2011).

Animal husbandry since ancient times was an important agriculture branch and an economic activity. In Iran, the subdivision of livestock and poultry farming after aquiculture was the most important agriculture subsection (Sheikh Zeinoddin and Bakhshoodeh, 2008). This subsection has been a growing trend in added value in agricultural sector, so that this share in different years has constantly been between 30 to 35%. In the Forth Development Plan, the increase in the production of livestock and fish protein to reform the nutrition structure is considered, so that the contribution of the animal protein per capita increases to 29 gram. Given that red meat forms about 15 to 20 percent of protein, therefore, this product will be of particular importance.

## 2. Theoretical literature and research background

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### 2.1. Characteristics of the profit function

These features of the profit function are obtained merely due to the assumption of profits maximization. None of the assumptions of convexity, smoothness, and other types of regularity assumptions are not necessary.

1. The profit function is non -reducing to output prices and is non-increasing to the inputs prices. If for all output values $p_i^* > p_i$ and for all input values $p_j^* > p_j$ then $\pi(P_j^* \geq \pi(P_j)$.
2. The profit function with respect to the homogeneous p is of degree one. Namely for all t-values greater than zero: $\pi(tp) = t\pi(p)$
3. The profit function is convex with respect to p. namely if $p'' = tp + (1-t)p'$ with respect to all $0 \leq t \leq 1$, then $\pi(p'') = t\pi(p) + (1-t)\pi(p')$
4. The profit function is continuous with respect to p. the function $\pi(p)$ is continuous, at least when $\pi(p)$ is well-reacting and well-behaved and for $i = 1, \ldots, n, p_i > 0$, ( Varian , 2011).

Hoshide and colleagues in 2011 in a research investigated the profitability of dairy livestock farms in the United States. In this study, the high cost of production raised as the main problem of organic milk production units in America. The study results showed a significant effect of farm size on the profitability of the production units. Severe and ZoBell in 2011 investigated the factors affecting the profitability of beef cattle units. In this study which was conducted in Oklahoma, 48 livestock units have been selected. The units in this research are fed in two groups, one group feeds from dry forage and another group is fed from wet forage.

The results show that in both groups, the initial weight of livestock and livestock daily weight gain are two important factors affecting the profitability of livestock units. Also, the results show the more profitability of livestock which were fed with wet forage. Rahmani and Torkamani in 2010 assessed the status of beef and chicken production in Fars Province. In this study, the impact of price risk and production factors on the production of these products has been investigated. In this study, the Muawiya Al-Qalis Method was used. The results of the study show that with increase in price and production risks, the amount of beef production in all the studied period decreased based on the coefficient-oriented model but in the additive model, this affair in some months decreased and increased in some months.

For beef based on both models, with increase in price, the production increases as well. However, in this study different results have been obtained for chicken. Alijani and Sabouhi in a study in 2009 considered the measurement of market power and production and the distribution cost efficiency of veal beef. In this research, the simultaneous equations method was used with the New Empirical Industrial Organization approach. This study data is related to the time series of 1971-2006 and the Herfindahl index has been used as a variable in the marketing margin equation. The results show that during the period under review, the market power and effect of cost efficiency in production and distribution of meat was respectively 0.114 and -0.523, inside the country. This indicates that producers do not have market power and can't affect prices. Manufacturing firms are also cost-effective and can make a profit as well.

### 2.2. Methodology

Since the main objective of the present paper is to identify factors affecting the profitability of the industrial beef production units in Khuzestan Province, this is a functional research in terms of research type that the results of studying it can be effective for achieving development goals in the livestock sector of the country. In terms of time, also given that this research is conducted during the cross-sectional period of June 2011 to August 2010 and annual information of industrial fattening units in Khuzestan Province was collected through questionnaire, the study is a survey.

### 2.3. Research variables

Dependent variable: the two indices of the cost-benefit ratio and the income per head are considered as profitability indicators and the dependent variable in this study.

Independent variables: the following variables have been considered as factors affecting the profitability of livestock meat production units in Khuzestan Province: the area of the production unit, production per cattle, and the proportion of the current capacity to the potential capacity, the Conversion factor, the animal husbandry location, and the features of farm manager.

## 3. Empirical results of regression models of the factors affecting the profitability

In this section, using the regression analysis, the factors affecting the profitability of meat production units in Khuzestan Province have been investigated. In regression analysis, also two indices of interest rate and income rate to cost as the indicators of the profitability of the units under study as the dependent variable are investigated in order to identify these two factors.

In order to specify the desired pattern using previous studies and existent theories, the independent variables were identified and imported into the models. Also for suitable specifying the pattern, the various forms which were used in previous studies were applied in order to estimate the profit function. In the present study, linear, quadratic and inverse forms are taken into consideration. Finally, according to the model selection criteria such as F-test, the linear form have been selected as the optimal form.

In the present study, two models were estimated to investigate the effect of variables on the profitability index. In the first model, the profitability index of increments and in the second model, the profitability index to the cost-benefit proportion is considered. The results of these two models are shown in Tables 1 and 2.

**Table1:**Results of the estimation of the regression model of the factors affecting the profitability ind**ex**

| Variable name | Explanation | Coefficient | t-statistic | SD | Elasticity |
|---|---|---|---|---|---|
| Area | Farm area | 950.38 | 2.24 | 423.9 | 0.29 |
| cow | The proportion of current capacity and potential capacity | 5778000 | 3.56 | 1623000 | 0.48 |
| cowf | Conversion factor | 8314800 | 2.83 | 293700 | 0.42 |
| cowef | The performance of each head of cattle | 9092600 | 2.08* | 4370000 | 0.57 |
| village | Farm location | -3197400 | *-3.78 | 826200 | -0.22 |
| ojob | Having second job | -1417100 | ***-1.70 | 829900 | -0.05 |
| exp | Experience | -1184100 | **-1.8 | 64510 | -0.12 |
| madrtak | Certification kind | 2627000 | *2.82 | 930100 | 0.12 |
| ecu | Education | 1426300 | *2.73 | 521300 | 0.35 |
| constant | Constant | - 8166900 | *-2.40 | 339200 | 0.85 |
| 1.89 DW= JB-Test=4.12 | | | =0.82**0**$R^2$ $\overline{R}^2$ =0.79 | | |

Source: research's findings

* Significant at 0.01 ** Significant at 0.05 *** Significant at 0. 10

**Table 2:** Results of the estimation of the regression model of the factors affecting the cost-benefit index

| Variable name | Explanation | Coefficient | t-statistic | SD | Elasticity |
|---|---|---|---|---|---|
| Area | Farm area | 0.002 | *2.95 | 0.00068 | 0.25 |
| cow | The proportion of current capacity and potential capacity | 1.37 | *4.43 | 0.3 | 0.46 |
| cowf | Conversion factor | 0.11 | *2.31 | 0.5 | 0.26 |
| cowef | The performance of each head of cattle | 1.2 | *2.33 | 0.76 | 0.24 |
| village | Farm location | -0.31 | *-2.13 | 014 | -0.09 |
| ojob | Having second job | -0.15 | -1.18 | 0.14 | -0.02 |
| exp | Experience | -0.011 | -1.08 | 0.01 | -0.04 |
| madrtak | Certification kind | 0.34 | *2.38 | 0.14 | 0.06 |
| ecu | Education | 0.31 | *4.05 | 0.07 | 0.3 |
| constant | Constant | 1.05 | ***-1.79 | 0.58 | -0.44 |
| 2.11 DW= JB-Test=3.38 | | | =0.86**0**$R^2$ $\overline{R}^2$ =0.83 | | |

Source: research's findings

* Significant at 0.01 ** Significant at 0.05 *** Significant at 0. 10

As can be seen in the above tables, the two regression models show almost the same results. In both models, all variables except for the two variables of experience and the second job, approximately all variables imported in the model are statistically significant at the level of 1%. In both models, the variables of the area of the farm, the proportion of current capacity and the potential capacity, the conversion factor of feed to meat, the performance of each head of cattle, certification type, and level of education have a positive effect on the parameters of the profit and cost -benefit ratio and variables of farm location (village), level of experience, having a second job; show a negative impact on the dependent variable. Although the effect of two variables of the levels of experience and second job are not statistically significant at the significance level of 1%.

To validate the obtained results, some problems may exist in econometric models which have been studied in both models using available statistics. Given the cross-sectional nature of the used data, the first problem which was investigated was the variance anisotropy among the disturbing components. Using the White test, the existence of anisotropy in the two models is confirmed. Thus, in order to solve this problem in both models, the consistent covariance matrix has been used.

The perfect multicollinearity relationship between the independent variables imported in the model was evaluated through the main components which after investigating this issue, a strong multicollinearity relationship was diagnosed between age and experience. That's why due to no

solving of this problem, using common methods, inevitably, one of the variables namely the age has been removed from the models. It is worthy to explain that variables such as experience can greatly explain the role of variables such as age in the model. Due to the cross-sectional nature of the data, the autocorrelation problem in the models do not have much importance, but this problem in both models was tested regarding the y-intercept in models and the lack of interruption of the dependent variable in the model using Durbin-Watson statistics. As the value of this statistic indicates in models, the lack of positive and negative autocorrelation between the disturbing components of models is confirmed. Also the assumption of the normal distribution of disturbing components was tested through Jarque Bera Test that due to the lack of rejection of the null hypothesis, the normal distribution of these disturbing components in both models was confirmed.

## 4. The results of the estimation of Logit models

The next phase of research, the factors influencing the likelihood of success and failure in beef livestock farms in Khuzestan Province has been investigated. To meet the target, the binary Logit models are used. For this purpose, using the cluster analysis, the firms based on the amount of profit per cattle were divided to the two categories of successful and less successful firms. Due to the similarity of the results obtained from the two indices of profit and the benefit-cost ratio, the Logit Model has been estimated only for the first index. To estimate the mentioned Logit function, the maximum likelihood method is used. The results of model estimation are reported in Tables 3.

**Table 3:** The Logit Model estimation results for the benefit index for successful and less successful groups

| Variable name | Explanation | Coefficient | t-statistic | SD | Elasticity |
|---|---|---|---|---|---|
| Area | Farm area | 0.0006 | 1.94 | 0.029 | ----- |
| cow | The proportion of current capacity and potential capacity | 4.32 | 2.22 | 0.054 | ----- |
| cowf | Conversion factor | 0.75 | 2.44 | 0.056 | ----- |
| cowef | The performance of each head of cattle | 7.5 | 2.07 | 0.07 | ----- |
| village | Farm location | -0.75 | -1.97 | -0.005 | -0.12 |
| ojob | Having second job | -2.008 | -2.29 | -0.013 | -0.1 |
| exp | Experience | -0.047 | -0.82 | -0.007 | ----- |
| madrtak | Certification kind | 3.05 | 2.11 | 0.021 | 0.18 |
| ecu | Education | 0.98 | 2.2 | 0.036 | ----- |
| constant | Constant | -11.3 | -3.15 | -0.17 | ----- |
| LOG-LIKELIHOOD FUNCTION=26.22<br>LRT=*105.59* | | 46**0=**/Madala $R^2$<br>66**=0/** $\overline{R}^2$ Macfadden | | | |

Source: research's findings
* Significant at 0.01 ** Significant at 0.05 *** Significant at 0. 10

**Table 4:** The Logit Model estimation results for the benefit-cost index for successful and less successful groups

| Variable name | Explanation | Coefficient | t-statistic | SD | Elasticity |
|---|---|---|---|---|---|
| Area | Farm area | 0.00036 | 1.6 | 0.14 | ----- |
| cow | The proportion of current capacity and potential capacity | 2.2 | 2.67 | 0.35 | ----- |
| cowf | Conversion factor | 0.42 | 2.14 | 0.27 | ----- |
| cowef | The performance of each head of cattle | 4.1 | 1.98 | 0.03 | ----- |
| village | Farm location | -0.5 | -1.98 | -0.03 | -0.07 |
| ojob | Having second job | -0.88 | -1.7 | -0.05 | -0.14 |
| exp | Experience | -0.006 | -0.17 | -0.009 | ----- |
| madrtak | Certification kind | 1.26 | 2.07 | 0.07 | 0.09 |
| ecu | Education | 0.25 | 2.01 | 0.08 | ----- |
| constant | Constant | -6.93 | -2.1 | -0.95 | ----- |
| LOG-LIKELIHOOD FUNCTION=-55.25<br>LRT=72.07 | | Madala $R^2$=0.34<br>$\overline{R}^2$ Macfadden=0.39 | | | |

Source: research's findings
* Significant at 0.01 ** Significant at 0.05 *** Significant at 0. 10

In the binary models, using the R2 statistic is not suitable, therefore, other criteria such as R2 Madala and Mac Fowden are considered. As can be seen in the above tables, these criteria in the estimation models are in a relevant range and this indicates the appropriate explanatory power of these models. The LRT test also shows the significance of the entire model in the patterns, shows that in the level of 1%, both models are statistically significant. Thus, the significance of all these models is confirmed.

As in the tables 4 and can be seen, these results are very close and similar. In the first model, the variables of area, the proportion of the current livestock and the potential livestock, forage conversion factor, the performance of each head of cattle, farm location, having side job, education and certification; have had a significant effect on the probability of success or failure of beef animal husbandry farms in the province. In this mode, the variable of experience is not statistically significant. That meanwhile, variables of the area, the proportion of the current livestock and potential livestock, forage conversion factor, the performance of each head of cattle, education and certificate; show a positive impact and having a side job and farm location (inside the village) show a negative effect on this probability.

In the second model, also the benefit-cost ratio was used to determine the success or failure of firms, in addition to the lack of significance of the experience variable, the coefficient of having a side job is not statistically significant in presented levels.

Comparing the results of the both models by MLE method and the results of estimation of the OLS model, shows that the results of these models are quite similar. This similarity in significance levels, significance ratio of imported variables in the model and the significance direction of variables are clearly visible.

## 5. The final effect of the explanatory variables in the Logit models

As mentioned in the methodology, in the Logit models, the variables coefficients are not important very much and it is necessary for these variables, in dual models, the final impact be separately calculated. It is also necessary to calculate these effects that a basic status be considered for the variables. In this study, the basic status is considered as follows.

It is assumed that the farm is located at the village, the unit manager has a side job and the director's academic degree is not related to animal husbandry. Also for the continuous quantitative variables, it is assumed that all variables are at their means levels. Therefore, the ultimate effects of the independent variables of village location, lack of managers' side jobs and the type of certificate are calculated in the last column of the above table.

As can be seen, this ultimate effect for the village location variable equals to 12 and 7 percent. This means that for a farm which operates outside the village district, compared to farms which work inside the village with similar technical specifications, in this model, respectively, 12 % and 7% more likelihood of success are assumed. These results also show about the variable of having side job that the likelihood of success of a manager who is working as a professional in the field of animal husbandry and has devoted all his time to this activity, compared to a manager who has a side job, there are 10 and 14 percent more likelihood in the two models.

The ultimate effect which is calculated for certificate type, also shows that for anyone who is educated in animal husbandry field, if works in this major, compared to graduates of other majors, the likelihood of success based on the results of the two models will be 18 and 9 percent more.

## 6. Conclusions and recommendations

The results for having a side job variable show that a manager who is working as a professional in the field of animal husbandry and has devoted all his time to this activity, compared to a manager who has a side job, there are 10 and 14 percent more likelihood in the two models. The ultimate effect which is calculated for certificate type, also shows that for anyone who is educated in animal husbandry field, if works in this major, compared to graduates of other majors, the likelihood of success based on the results of the two models will be 18 and 9 percent more.

Then based on the results, the following suggestions for improving fattening units in Khuzestan Province are considered.

1. As the obtained data show, the study units in Khuzestan Province, in terms of profitability, enjoy a relevant range. So it seems that Khuzestan Province in terms of having economic and natural advantages in the field of animal husbandry units can transform to the main hub of production in the country. Therefore, presenting the information in this field and building good infrastructure in order to encourage farmers and investors to these types of activities, can be an effective step in the progress and development of this agricultural subsector in Khuzestan Province.
2. Evaluation of profitability of surveyed units indicates that a considerable differences in terms of profitability exists in big and small units in the Province. Thus, at the same time of increasing the number of livestock, the profitability rate increases. This result indicates the increasing in returns to scale for the profitability of these units. Therefore, in this context, it is suggested that firstly by providing financial supports and services from the relevant authorities, the possibility for development and progress of smaller units be created, secondly, due to the large vacant capacity of big units, the appropriate context to use the maximum capacity of these units to be created.
3. Investigating the status of income and expenditure of units implies that the major difference between the profitability of these units is more related to the cost sector than the income sector. In other words, the cost of production of units that have higher profitability is generally lower than comparable units. Therefore, it is suggested that in fattening units of the Province, in order to increase profitability, a greater attention to this part of the production should be paid. In other words, these units by reducing their costs, specifically in the cost

of buying cattle and needed forage, can enhance their profitability.

4. The results indicate higher profitability of units outside the village than units that have been built in the village. In this field, two suggestions can be presented. First, in construction of new fattening units, this difference be considered by authorities and investors. Second, given the differences between features of centers inside and outside the village, the required context should be provided in order to increase the profitability of traditional units inside the village.

5. The education is of the variables which can increase the profitability of fattening units in the province. Therefore, it can be recommended that providing required facilities for graduates of agricultural and animal husbandry majors, can be considered as a step towards increasing the profitability of these types of units.

6. The two variable of the Conversion factor and performance of each cattle are among variables which have significant impact on the profitability. Given that using the student, experts and new technology, they can affect these two factors, thus, it is suggested that applying the tools mentioned above, the needed context be provided to increase the profitability of these units.

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