Analysis of the Factors Affective on Farmers’ Nonagricultural Activities:
Sample of Western Marmara Region

Nuray Demir
Ataturk University, Faculty of Agriculture,
Department of Agricultural Economics 25240 Erzurum, Turkey

Abstract: This study determines factors affecting farmers who work in livestock sector, but engaged in activities in other sectors. In determining these factors, West Marmara Region of NUTS I region where the yields of meat and milk products is the highest in the country has been chosen as the study area. 301 questionnaires have been conducted in the region and the binary probit model is used to analyze the data. In the study, we found that farmers in livestock with having additional jobs and young, have a high level of education, have social security (retirement fund for public servants, fund for self-employed, fund for workers etc.), have a number of activities in his enterprises, obtain small income from livestock and have a small number of animals of culture species in the enterprises. In conclusion, more training should be provided for the farmers to increase productivity and income, the enterprises should be restructured to be more profitable entities, specialized enterprises in livestock should be established and the number and the effectiveness of the cooperatives in marketing should be increased. These measures will be important for the farmers to be fully engaged in livestock sector.

Key words: Livestock · West Marmara Region · Probit Model

INTRODUCTION

The share of the agricultural sector in the total employments in Turkey was 36.0% according to the latest 2000 consensus data. However, the rate gradually declines over years with nearly to 23.6% in 2013 [1]. In the processes of economic development and growth, the increased agricultural machines have led to unemployment on a large scale, especially in agricultural sector. Although the unemployment is excluded from the process of production, they do not cause any reduction in the whole production, so called “hidden unemployment” in the literature of economics. Although the hidden unemployment is generally perceived as the unpaid family members in agricultural sector in the production process, they do not provide any value added. The hidden and unskilled unemployment in which dominates agricultural sector is being marginalized from the production process because of the increased productivity in the economic development and growth. Thus, most hidden unemployment with a presence of unpaid family workers in agricultural sector [2]. Although livestock is an important sector in terms of both preventing the hidden unemployment [3] and contributing 30% value added to the agricultural production [4], the recent data shows shift for those who working in the livestock sector to non-agricultural sectors and thus results in increased withdrawal from the agricultural activities. The predominant reasons for withdrawal from the sector is perhaps not enough earnings for participants, which ultimately results in the increasing migration flows from rural areas to the urban regions [5]. The study is aimed to determine what factors are responsible for farmers’ non-agricultural activities. A wide variety of model groups were studied and the statistically most meaningful model was chosen. Of course, many independent variables can be included in the model, however, regressors that ought to have greatest impacts on the dependent variable were chosen to be included in the model. The western Marmara region is chosen

Corresponding Author: Nuray Demir, Ataturk University, Faculty of Agriculture, Department of Agricultural Economics 25240 Erzurum, Turkey. Tel: +90-442-231-2591.
because it provides the highest productivity in both milk and meat productions along with better performance in livestock with high technologies used.

**MATERIALS AND METHODS**

The western Marmara region which is one of the twelve regions according to level 1 statistical classification (NUTS I) of the country was chosen as the study area. The data were collected using questionnaire instruments conducted on livestock farm entrepreneurs in the region in 2009. Secondary data was obtained from the relevant studies on the subject.

There are five cities in the region, including Balıkesir, Çanakkale, Edirne, Kırklareli and Tekirdağ. The cities, Balıkesir, Çanakkale and Tekirdağ, having higher numbers of livestock enterprises were included in the study to represent the region. Number of the enterprises was calculated according to the simple random sampling method with the formula presented below. As the variability of the numbers of animals in the enterprises in the study area was different, the number of the surveys conducted in each city was therefore separately determined. For missing information and the possibility of returning surveys with blank the numbers of the surveys was increased by 5%. The study was carried out within 5% sampling error and 95% confidence limits to determine the number of enterprises [6].

\[
    n = \frac{N \cdot \sigma^2}{(N-1) \cdot D^2 + \sigma^2}
\]

In the formula;

- \( n \) = Sampling number,
- \( N \) = The total numbers of entrepreneurs,
- \( \sigma^2 \) = Variance of the population
- \( D \) = \( d/z \) value
- \( d \) = Acceptable error (\( z \), 0.05)
- \( z \) = Shows the value of the \( z \) from the standard normal distribution table.

Finally, it was determined that the numbers of questionnaires were 115, 97, 89 for Balıkesir, Çanakkale and Tekirdağ cities, respectively and the total numbers of questionnaires were to be 301.

The data obtained from the survey was then loaded onto the EXCEL with certain codes. We used a binary probit model in the LIMDEP software program to analyze factors affecting farmers’ non-agricultural activities. The dependent variable which is the binary choice reflecting whether the farmer has a constant job out of agricultural sector with an indication of 1 (Yes) / 0 (No). Various binary choice approaches such as linear probability, logit and probit models can then be used to determine factors affecting the farmer choice of job selection: in or out agriculture.

The model was estimated using the probit model. The probit model is developed as an alternative to the logistic regression. Both analyses are similar to each other and the underpinning difference lies on their distribution. While the log odds are used in the logistic regression, the cumulative normal distribution is used in probit analysis. The hypothesis lying under the probit analysis is in the form of response function \( Y_i = \alpha + \beta X_i + u_i \). Here, \( X \) is observable, but \( Y \) is unobservable variant. In practice, we do not observe \( Y \) instead we observe \( Y \) when \( Y > 0 \).

The conditional expectation for \( Y \) is \( \alpha + \beta X_i + u_i \geq 0 \) and \( \alpha + \beta X_i + u_i < 0 \) \( Y_i \) is \( = 0 \). If the \( (\Phi(z)) \) is defined as normal cumulative distribution function for normal standard variable \( z \), then if, it is \( \Phi(z) = Pr(Y_i = 1) \), it is expressed as

\[
    Pr(Y_i=1) = Pr(u_i > -\alpha - \beta X_i) = 1 - \Phi((-\alpha - \beta X_i)/\sigma) = \Phi((\alpha + \beta X_i)/\sigma) [7]
\]

\[
    Pr(Y_i=0) = Pr(u_i \leq -\alpha - \beta X_i) = \Phi((-\alpha - \beta X_i)/\sigma) [7]
\]

where \( \sigma \) is the standard deviation of the model and is usually set to one in the binary choice model. The value \( R^2 \) which measures the variability contribution of the exogenous variables to the dependent variable has less importance when the binary choice model is used. We rather rely on t-statistic and their corresponding p-values for individual significance of regressors [8].

We here presented alphabetical illustration of the model as:

**STA**: \( f \) (AG, GEN, EDC, GUAR, TYP, DIST, SHA, FOR, CULT)

**STA** : Farmers’ having non-agricultural activities (yes:1, no:0)
**AG** : Age of the farmer
**GEN** : Gender of the farmer (man:1, women:0)
**EDC** : Educational status
**GUAR** : Farmer’s social security (yes:1, no:0)
**TYP** : Type of enterprise (sheep raising:1, cattle breeding:2, both:3)
**DIST** : Distance of the enterprise to the city center
**SHA** : The share of income from the livestock sector in the total income of the enterprise
For : Production of forage crops in the enterprise
(yes: 1, no: 0)
Cult : The share of the culture breeds of animals in the enterprise

RESULTS AND DISCUSSION

Before proceeding estimation of the model, we have checked multicollinearities among exogenous variables used to determine the variability in the dependent variable. Results are presented in Table 1.

We found that correlations among exogenous variables were modest with a negative highest correlation (-0.369) between the share of the livestock and presence of social security, while the highest positive correlation between the share of livestock and presence of the forage crop production was 0.28.

Although the income earned through the livestock sector was better in the region than the other regions, it seems that the farmers are engaged in several other non-agricultural type occupations to earn more income. Reported in Table 2 are results from the binary probabilistic model, probit, that determines factors responsible for an engagement in the out of farm jobs. Contributions from the exogenous variables to the variation for the dependent variable was statistically significant with $\chi^2(9) = 58.904$, showing that the variations in the regressors play key roles in determining the probability of having a job of non-agriculture for a farmer.

Table 1: Correlation coefficients among variables in the model

<table>
<thead>
<tr>
<th></th>
<th>YAS</th>
<th>CINS</th>
<th>EGT</th>
<th>GUV</th>
<th>ICE</th>
<th>ILU</th>
<th>PAY</th>
<th>YEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>YAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CINS</td>
<td>0.143*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGT</td>
<td>-0.343**</td>
<td>0.022</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GUV</td>
<td>-0.131</td>
<td>-0.146*</td>
<td>0.226**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICE</td>
<td>-0.033</td>
<td>-0.027</td>
<td>0.093</td>
<td>-0.114</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ILU</td>
<td>-0.055</td>
<td>0.028</td>
<td>0.127</td>
<td>0.159*</td>
<td>-0.047</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAY</td>
<td>-0.018</td>
<td>-0.150*</td>
<td>-0.041</td>
<td>-0.369**</td>
<td>-0.038</td>
<td>-0.110</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEM</td>
<td>0.056</td>
<td>-0.003</td>
<td>0.015</td>
<td>0.010</td>
<td>-0.044</td>
<td>-0.129</td>
<td>0.281**</td>
<td></td>
</tr>
<tr>
<td>KUL</td>
<td>-0.030</td>
<td>0.017</td>
<td>0.071</td>
<td>-0.016</td>
<td>0.084</td>
<td>-0.084</td>
<td>0.175**</td>
<td>0.211**</td>
</tr>
</tbody>
</table>

* : P<0.01, ** : P<0.05, N: 301

Table 2: The results estimate of binomial probit model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Std.Error</th>
<th>P value</th>
<th>Marginal Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant term</td>
<td>0.035</td>
<td>0.012</td>
<td>0.001*</td>
<td>0.015</td>
</tr>
<tr>
<td>Age of the farmers</td>
<td>-0.029</td>
<td>0.009</td>
<td>0.003*</td>
<td>-0.009</td>
</tr>
<tr>
<td>Gender of the farmers</td>
<td>-0.413</td>
<td>0.062</td>
<td>0.509</td>
<td>-0.132</td>
</tr>
<tr>
<td>Education status</td>
<td>0.137</td>
<td>0.273</td>
<td>0.004*</td>
<td>0.045</td>
</tr>
<tr>
<td>Farmers' state guarantee</td>
<td>0.438</td>
<td>0.162</td>
<td>0.006*</td>
<td>0.139</td>
</tr>
<tr>
<td>Type of the enterprise</td>
<td>0.528</td>
<td>0.198</td>
<td>0.007*</td>
<td>0.168</td>
</tr>
<tr>
<td>Distance of the enterprise to the town center</td>
<td>0.002</td>
<td>0.003</td>
<td>0.343</td>
<td>0.001</td>
</tr>
<tr>
<td>The share of the livestock sector in the income of the enterprise</td>
<td>-0.014</td>
<td>0.004</td>
<td>0.002*</td>
<td>-0.004</td>
</tr>
<tr>
<td>Production of forage crops in the enterprise</td>
<td>-0.015</td>
<td>0.012</td>
<td>0.220</td>
<td>-0.004</td>
</tr>
<tr>
<td>The share of the culture breeds of animals in the enterprise</td>
<td>-0.005</td>
<td>0.002</td>
<td>0.011*</td>
<td>-0.001</td>
</tr>
</tbody>
</table>

Mc Fadden R square: 0.219

$\chi^2(9) = 58.904$

*: P<0.01

Signs of exogenous variables used in the model were in compatible with the economic theory as expected. Results indicate that there was a negative relationship between the probability of having job activities outside of the agriculture and the age of a farmer, showing that as the farmer aged, the probability of finding a job outside the agriculture decreases. This is because of impairments associated with a farmer as he/she ages. The likelihood of engaging job activities outside the agriculture decreases with male farmers, the income share of livestock in the total farm income, presence of growing forage crops in farm and the share of cultural breeds of animals in the enterprise, while there was a positive relationship between the probability of engaging jobs outside the agriculture and farmer’s educational level, presence of having social security, types of the enterprise and distance to a city zone. Livestock is heavily performed in the local enterprises and most of the income is earned through the livestock. The result is consistent that we expect less immigration flow from the agriculture to non-agricultural activities as the farmers earn more farm income. This is perhaps because increasing farming income led to farmers specialize more in the livestock sector than other non-agricultural sectors and set to increase levels of total farm profits in which they operate. With this connection in mind, the numbers and the share of culture-breeds of animals in the enterprises are important means to increase levels of farm income of the livestock. The likelihood of engagement in non-agricultural type occupations lower.
as the culture-breeding share of animals in the enterprise fosters. On the other hand, farmers’ characteristics such as educational attainments, presence of social security and the type of enterprise foster the probability of having job activities in non-agricultural activities. Human endowments gained through education led farmers to understand opportunity cost of educational attainments, showing more enthusiasm toward non-agricultural type occupations.

In probit model, the marginal effect of a variable shows a unitary impact on the probability of engaging in non-agricultural jobs [9]. Reported in Table 2 in the last column are marginal impacts of exogenous variables on the dependent variable. Only statistically significant variables will be discussed. For example, one more year aging of a farmer will likely increase the likelihood of participation in non-agricultural activities by %0.001, while one more year investment in education will led farmers to participate in non-agricultural activities by %0.004. A one unit increase in shares of livestock and culture-breeding animals in the enterprise will likely foster the likelihood of participation in non-agricultural type activities by %0.002 and %0.001, respectively.

CONCLUSION

Since farm income is low in the agricultural sector in the country with higher employment and hidden unemployment rates, these problems subsequently result in greater losses of labors over time and hence less marginal productivity of labor due to losing of qualified labors in agriculture. As a result, those labors in the sector tend to have occupations other than agricultural sector, particularly as is the case with the livestock sector. This is also the case in the western Marmara region where higher income per animal and the livestock are heavily performed.

Results show that the elderly male farmers with higher farm income, presence of forage crops and culture-breeds of animals remain in agriculture sectors, while more educational attainments, presence of social security status, types of enterprise are driving forces behind withdrawal from the agriculture. In a study making interregional comparisons, it was stressed that high income is generated from the enterprises with culture breeds of animals; these enterprises have more specializations in livestock [10].

It is significantly important to take immediate precautions in order to provide a stable agricultural growth in Turkey [11]. Given the results, it is essential that the income from the livestock should be increased to encourage the better educated farmers with social security guaranteed to remain in livestock agricultural sector. It is also significantly important to have established all marketing means to facilitate domestic trades for milk and meat productions in the region. One study reported that the sectors with no benefit knowledge of the organization and a traditional type of production have failed to preserve their maintainability and overcome the difficulties [12,13]. Furthermore, the study revealed that farms which located far away from the town center have difficulties in welfare of the animals, veterinary services and marketing animal products and thus leave the livestock sector soon after. Another study on the subject reported that one of the most important obstacles is the scattered, small scale enterprises which fail to specialize in production with lower low productivity [14]. Results suggest that farmers should have easy access to the services of the experts; a specialized livestock sector producing for the market instead of subsistence farming should be established; the training offered should be extended to provide the awareness; and the sustainability should also be provided. All these suggestions are believed to reduce the nonagricultural activities and to help establish a profitable specialized livestock sector.

REFERENCES