

PHD THESIS

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PRODUCTIVITY OF PRODUCTION FACTORS IN HUNGARIAN DAIRY FARMING

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KAPOSVÁR
2004.

1. PRELIMINARIES AND OBJECTIVES OF THE STUDY

The reason of choosing the issue “Partial analysis of land, labour and capital productivity in Hungarian dairy farming” within the main doctoral program of “Economics of production, development and consumption of animal origin products” was the coming EU accession. After the accession, Hungary became a member of the community of 25 countries and has to meet the unified and common requirements of the EU.

The changes in the economic conditions have accelerated due to the enlargement. The conditions and regulations of the production and marketing have changed. In this situation, the role of international analyses is getting greater because the actors of the market can estimate their future role and opportunities only this way. The network of the EDF gives opportunity for this, where dairy farms of 19 countries are compared with using economic indices.

Using production factors is expense in the production. The quota system and the decrease in milk price forecast that in order to maintain and improve the profitability the costs should be decreased. A high share of the costs origins from the use of the production factors, therefore the structure of the factors should be defined in the dairy farms. One of its methods is the partial productivity of land, labour and capital.

The definition of productivity, as an economic parameter is not been clearly agreed on by even experts. Productivity indices were set up on the basis of the EDF method, which is acknowledged by the farmers and researchers of 19 countries. Consequently from the above mentioned, the **objective** of the dissertation is to define the parameters relating to the use of the factors of Hungarian dairy farms (advantages, disadvantages) by defining

and comparing the productivity. In order to achieve the objective the following tasks had to be done:

- Definition of partial productivity of production factors in dairy farming based on the database of the European Dairy Farmers (EDF).
- Comparison of the average land, labour and capital productivities of Hungarian, Eastern German and EDF farms.
- Estimation for the role of productivity as an economic index in the milk production.
- Definition and international analysis of quantitative factors influencing productivity on the basis of the EDF database.
- In the analysis of land, labour and capital productivity, definition of factor use influencing the profitability of dairy farming with additional complementary indices.
- Based on the results obtained in the analysis, definition of advantages and disadvantages of the Hungarian dairy farms.

It was not the objective of the dissertation to define an optimal structure of the production factors, because this would have needed a complex investigation carried out in cooperation with other disciplines and could be adopted only for individual farms.

2. MATERIALS AND METHOD

The structure and the form of the dissertation are based on the prescriptions made in the PhD doctoral regulation (2002). The method of the research was partly based on Tomcsányi “General research methods (Általános Kutatásmódszertan)”.

Data was collected from primary and secondary sources. Primary information was collected on the basis of the EDF method in case of the Hungarian dairy farms. After filling the questionnaires, the figures were discussed with the owner or manager of the farms, when the cause and effects were also revealed, which are needed for the analysis. Secondary sources were the data of the EDF, KSH, AKII, and the ÁT. Kft.

During the analysis, the indices were created from the figures of Hungarian, East German and EDF dairy farms; then weighted averages were calculated. Consequently, the average of four years was weighted with the number of the farms. The difference was tested by T test and significance analysis. Statistical calculation was made with SPSS for Windows.

Considering the Hungarian approach, the study includes farms with more than 100 cows. The level of production and productivity of the Hungarian farms were compared to the EDF and East German (former DDR) farms.

Productivity was expressed in natural measures (yield per factor unit use). At first, the produced yields were defined. Due to the international comparison, milk yield are expressed in (4%) fat corrected milk equivalent.

In the case of labour productivity as partial index, the ratio of milk yield expressed in FCM and labour input was used (kg FCM per hour per year). In order to get detailed information, the cost of labour (Euro per 100 kg FCM) was also calculated.

Land productivity was calculated as the produced FCM milk per unit of forage producing area. (tons FCM per ha/year)

If land production is analysed in case of dairy farms, the production level of the forage and feeding have to be also considered. In the analysis of land productivity, two figures were calculated additionally: feeding costs and land costs (both in euro per 100 kg FCM).

Calculation of capital productivity (kg FCM per 1000 Euro per year) is based on the EDF method of the ratio given by the milk yield and the capital allocated in dairy in long term. Capital allocated was considered at a net value in the analysis.

Allocated capital in production is highly influenced by the interest rates. Therefore, capital cost was calculated as additional figure. Although, it is not related to the analysis of fixed capital, the production cost influences the results and competitiveness of dairy farming. Therefore, a detailed cost analysis was carried out as the following structure of elements shows

3. RESULTS

The only main product of specialised dairy farms is milk; both its quantity and quality influence the results of the farm. During the analysis of EDF data, the average milk yield of Hungarian, East German and EDF farms were compared.

The milk yields of the Hungarian farms were lower than those of the EDF and East German farms in all years considered ($p < 0,05$ in both cases). According to the figures of these four years, the milk yield of the Hungarian farms are 6 to 15 percent less than those of the EDF and is 9 to 19 percent lower than the East German averages. The EDF figures increase from 1999 and in 2002 it is 7510 kg per cow. The degree of increase is higher than 1 to 1.5 percent that is the general average in Europe. The increase of the Hungarian milk yields was not continuous (according to the data of AKII, KSH, and ÁT Kft); in 2001 it decreased by 1.3 percent compared to year 2000. The milk yields of the Hungarian farms involved were higher than that given by the Central Statistical Office (5516 kg); because the KSH data is the average of all the farms of the country, which contains the specialised dairy farms and double-purpose cows as well. The average yield obtained in the analysis is close to the figure of the ÁT Kft, which is the average yield of the recorded farms (6773 kg in 2000).

The results obtained in the international comparison show that productivity may increase with improving the specific yields, although it is a complex task and the required investments cost extra money, therefore the economic results of the development are questionable.

3.1 LABOUR PRODUCTIVITY

The Hungarian figures are only 36 to 42 percent of the EDF. With the exception of year 2002, the difference is similarly high between the Hungarian and the East German farms. The difference is significant ($p < 0,05$): The results of the four years can be considered as homogeneous. The extent of the variability is 16 percent in case of the Hungarian, 4 percent in case of the EDF and less than 17 percent in case of the East German farms. Considering that milk yields differ only in a small extent, the results of labour productivity reflect on the high use of labour in Hungarian farms. In Hungary, typically a higher number of workers are employed in the production and the yield per hour of labour input is much lower than in the EDF farms.

Farms normally use those factors that produce higher income with least costs. Therefore, it is important to know the price of labour and the additional costs of labour use.

According to the analysis, in Hungary, labour cost (wages paid and opportunity cost of own labour) per cow is lower than those of the EDF and East German farms. The reason of the difference between average labour costs is that in Hungary lower wages are paid than in the western farms. Due to the lower labour costs, Hungarian farms employ more workers. Besides of the previous, the higher interest rates also encouraged the farmers to use labour instead of capital.

Labour productivity is influenced by quality elements also that need further investigations.

With increasing labour productivity, labour costs can decrease; however, not only the calculable figures (costs) but the quality elements of labour have to be improved.

3.2 LAND PRODUCTIVITY

Analysis of land use is quite a difficult task in the agriculture. It is influenced by much more factors (e.g. feeding, crop production) in animal production than in crop production.

It was found that the EDF average was higher than that of the Hungarian farms. The difference was the greatest in 2002, when the Hungarian average was only 44 percent of EDF level. The Hungarian average was even lower than that of the East German farms. This difference increased continuously from 1999, as productivity increased in East German and decreased in the Hungarian farms. The difference in land productivity of the three groups is proven by T test ($p < 0,05$).

The reason for the low land productivities of the Hungarian farms was that the forage fed was produced on larger land than in the EDF farms. The reason for it is that the yields of forage feed production, the level of feed production and the quality of the forage are low, in Hungary. The investigated Hungarian farms replaced forage with concentrate, which induced increase in the costs. Land productivity is influenced by the land costs also. Comparing the land costs (land rent and opportunity costs) of the three groups it was found that those of the Hungarian farms were the lowest.

Land productivity indirectly is affected by capital price (interest) as well. If land productivity depended on the capital price only, it could be improved by increasing the capital allocated per hectare after the EU accession. However, forage production is dependent on several factors (e.g. weather). Therefore, more intensive production (e.g. higher use of fertilisers) will not certainly result in higher yields. It is the decision of the farmers whether to produce forage on larger or smaller land. What certain is that land productivity has to improve in order to increase the competitiveness of the Hungarian dairy farms.

3.3 CAPITAL PRODUCTIVITY

Analysis of the productivity of capital as production factor is the most difficult. Primarily the definition and its heterogeneous forms are the main challenges. One way of the analysis is partial productivity, the method used here is acknowledged by the EDF members.

Capital productivity of Hungarian farms is 40 percent higher than the EDF and 45 percent higher than the East German farms. In case of the three groups, the differences are significant at $p < 0,05$. This result reflects on that the Hungarian dairy farmers use much less real capital to produce one unit of milk than the competitors and produce greater yields with lower capital allocated. On the EDF farms, high capital allocation is typical. Considering only the capital productivity, it would be said that the Hungarian farms produce more profitably, because similar yields are produced with less capital fixed. Because a lower amount of fixed capital has lower opportunity cost, the Hungarian farms save costs in using capital. Of course, similarly to the other productivity figures (land, labour) neither this is so simple.

The use of producing factors is highly influenced by the price of the factors. Therefore, the question of how much the capital costs arise in the Hungarian and the EDF farms. It was necessary to analyse the capital cost as well, which contains the paid real interest (6% after loans) and opportunity cost (3% after own capital).

The analysis of capital cost shows the amount of capital used on the farms at same interest and opportunity rate. Knowing the yields, Hungarian farms use much less capital for milk production than the EDF and East German farms. The reason of low capital fixed is that capital necessary to the investments is available at only a higher interest rate (2 to 3 percent higher interest rate than in the EU) for Hungarian farmers (*Radó, 2003*).

The results of the production and the amount of used production factors are highly influenced by the production costs. The results of the cost analysis show that factor costs represent a higher share within the total costs in case of the EDF and the East German farms than in Hungary. Among the direct costs, feed costs have the greatest role. Feed costs of the Hungarian farms are higher than the EDF average. The reason for the difference is in the different feeding technology (ratio of forage and grain crops) and in the lower forage quality. On the Hungarian farms, milking concentrate is fed in higher ratio, which is more expensive than forage. With decreasing the amount of concentrate fed the feeding costs can be decreased, however in order to avoid physiologic problems it can be solved only by the harmonisation of the feed and the farm management methods.

Out of the special factor costs the greatest advantage of the Hungarian farms is in case of the labour costs. This has a great relevance because low labour cost accompanies high labour use and low labour productivity. With improving productivity, labour input decrease (at same level of milk yield), which leads to lower labour costs. Therefore, after the EU accession, the likely increase of labour price will not result in great increase in labour costs. From entrepreneurs' side this fact is a comparative advantage.

If Hungarian farms want to produce at a competitive cost level with the EDF and the East German farms, the use and allocation of the production factors have to be chosen by considering the results of a continuous comparison and analysis.

4. CONCLUSIONS

According to the results of the analysis, the milk yields of the Hungarian farms were lower than the average of the EDF and East German farms. By improving the milk yields, the partial productivity can be increased, however, it has extra costs. It may increase productivity but can decrease incomes parallelly. Therefore, it is more reasonable to improve productivity by reducing the use of the production factors because the Hungarian dairy farming uses higher amount of factors.

In case of labour productivity, the Hungarian average is behind those of the EDF and East Germany. This high differentiate could be interpreted as the level of human resource management is low. Labour cost – as a complementary figure – reveals, though, that the price of the Hungarian labour is much lower than on the EDF and East German farms. From the cost analysis of the farms it was found that the share of the labour cost is lower in the total production cost.

Consequently, the Hungarian farms use higher amount of labour because both in absolute and relative means the labour cost is lower than in case of the EDF farms. Because of the high interest rates, physical capital (machinery, equipment) is replaced with labour. Due to the great difference between the labour costs, it is likely that the labour cost per unit of milk will increase, and the labour costs of the three groups will converge. Therefore, in order to maintain the total labour cost, the labour productivity should be improved. The rationalisation of labour use can be realised only at farm level, which requires further surveys with special regard to the quality of labour.

The land productivity of the Hungarian farms was lower than the average of the EDF and East German farms. One of its reasons is that much larger land is used for forage production than on the other farms. Based on the results obtained, the lowest land costs belong to the Hungarian farms. From the detailed analysis of the specific feeding costs it was found that the Hungarian farms produce less amount of forage. In Hungary, the farms allocate lower amount of capital per hectare of land during the forage production, due to the high interest rates. Thus, the yields of the forage production are lower, and larger land is needed to produce the necessary amount of feed. The increase of the land rents cautions that the Hungarian farmers have to decide whether to produce more intensively with higher yields and reduce their land or to produce the needed amount of forage in extensive way on relatively larger land.

The capital productivity of Hungarian farms is significantly higher than the EDF average. The Hungarian farms use little capital, because the interest rates are high and dairy farming is not regarded as good investment due to the high risk and low profitability. Thus, as little capital is used as possible and capital is replaced with other (e.g. labour) production factors (within a certain interval).

The interest rates will likely decrease, because these are the highest in Hungary within the EU. As a consequence of the reducing interest rates, capital is available at a higher price for the farmers. This fact can significantly increase the amount of allocated capital in the future, which leads to the decrease of capital productivity.

There was a high correlation found between capital productivity and total production cost. The most important cost component is feeding cost, which is significantly higher on the Hungarian farms than the EDF average. The reason for it is that the Hungarian farmers feed cows with a higher amount of

concentrate because of the poorer quality of forage. The price of the concentrate is higher than that of the forage. By reducing the concentrate use, the feeding costs can decrease significantly.

The special costs of the use of production factors represent a high share of the total production cost. On Hungarian farms, the share of the factor costs is lower within the total cost than on the EDF farms. In the EDF states, the cost of capital is lower, while the costs of labour and land are higher than in Hungary. Therefore, due to the changing circumstances after the EU accession, the differences will likely reduce: the labour and land costs increase and the capital price (interest) decreases.

5. NEW SCIENTIFIC FINDING RESULTS

1. Based on the methods and database of the EDF, I have first analysed and compared the productivity of land, labour and capital in dairy farming in Hungary.
2. The results of my analyses have shown that the specific milk yields and productivity of labour and land are lower than the averages of the EDF and East German farms. Capital productivity is higher on Hungarian than on the EDF and East German farms.
3. I have defined those cost elements that significantly influence the partial (land, labour and capital) productivity of the Hungarian dairy farms. The value and role of the cost elements will change, therefore in order to improve the productivity, the farms have to optimise their cost and factor structures.
4. I have made a recommendation on that in order to improve the productivity of the Hungarian dairy farms, the size of used land and amount of labour input have to be reduced. In order to maintain the competitiveness of capital productivity, allocation of capital should be done by the “principle of least cost”.
5. In case of dairy farming, productivity figures can be compared at international level, although in order to draw more exact conclusions, also collection and analysis of qualitative information of the individual farms are needed, beside of quantitative figures.

6. RECOMMENDATIONS

- In order to improve the productivity figures, the factor structure and cost elements should be optimised on the farms.
- Due to the changing prices of the production factors, it would be necessary to analyse the use of the factors periodically (even several times annually).
- A complex feed scientific and breeding technological analysis are needed to increase the productivity figures by improving the specific milk yields.
- Due to the complexity of the improvement of productivity figures, a well-structured questionnaire has to be created for deep interviews, which is acknowledged by all the EDF members.
- The Hungarian farms have to improve their labour productivity, which requires the qualitative analysis of the labour as well as the quantitative surveys.
- Because of the low level of land productivity, the Hungarian farms have to improve the yields of their forage production, the quality of the forage and the forage : concentrate ratio of the feed.
- The feeding costs have to be reduced, which requires the analysis of the nutritional values of the feeds.

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