Szent István University
The Management and Business Administration PhD School

Doctoral (PhD) theses

FARM STRUCTURE AND EFFICIENCY IN THE HUNGARIAN AGRICULTURE

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Gödöllő
2015

Doctoral School of Management and Business Administration

Scientific field: Management and Business Administration

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1. INTRODUCTION

The study of farm structure and efficiency

Major economic and social changes have been taken place in Hungarian agricultural economy in last seven decades. The development of agricultural economy has experienced sometimes radical and opposite effects of economic and social policy decisions. About these changes can be stated that the acting government has been strongly influencing the normal economic processes without allowing enough time for impact assessment analysis. Moreover the professional advice often disturbed their political preconceptions, thus the changes have been ignored rationality in many cases.

The consecutive decisions have mostly transformed in opposite directions the ownership of farming activities, the holding structure and the organizational forms. The development and operation of a different farming structure has been generated many tension, economic and social losses, which have been manifested in deteriorating of capital endowment, critically low profitability and the reduction of technological level in agriculture, as well as increasing living problems of the (mostly) rural population whose subsistence depends from agriculture.

The farm structure has undoubtedly become more diverse and more flexible in the decades following the regime change but there are many unfavourable factors (fragmented holding structure, dual farm structure, and low level of employment, livelihood, technical and technological development), which are permanently present in the sector.

The transformation process in the transition period is examined in a vast literature, but the effects of the structural changes on efficiency, profitability, and competitiveness of the Hungarian agricultural economy has been neglected.

The most important argument supporting the relevance of this topic is that had been accumulating many experiences in the last two decades of the transition enabling us the examination of the main features of the changed farm structure. The actuality of the topic is also supported by the fact that Hungary joined to the EU during this period and the adverse consequences of the world economic crises experienced in the recent years.

It is important to investigate what farming groups were formed based on the size of the agricultural land, the legal form, the type of farming, the economic performance and what rearrangements and changes can be seen in their management during the past two decades.

To answer this questions it is inevitable to define the content of efficiency, carrying capacity and viability based on literature sources and to examine that the certain categories of farm structure which level of economic performance are able to reach?

Research problem

The Hungarian farm structure was transformed without a well-founded and rational target system in the past few decades. The different farm types characterised by size, activity and profitability can be separated and their ratios, and operations can be harmonised and integrated.

The farming structure fundamentally determines the operation and the utilization of resources (inputs) on one hand and on the other hand, it has a significant influence on profitability, efficiency and competitiveness of farming. The comprehensive knowledge of the farm structure has always been an actual task, which become more important after major economic changes.

The farm structure can be investigated on the one side based on the use of resources, and on the other side based on efficiency and profitability of farming. To evaluate the Hungarian farm structure, an international comparison (EU-28, EU-27 and EU-16) could provide useful information.

By examination of the above mentioned research tasks, the dissertation can give answer to the drivers of efficiency, carrying capacity, viability and competitiveness in different farms size categories, production structure and legal forms. It is also important to find answers how theses farms can improve the performance of the whole agricultural sector and the carrying capacity of the rural areas.

The objectives of the dissertation

At the beginning of my research, the following objectives were identified in relation to the analysis of farm structure and efficiency.

a. Aims based on literature findings:

1st objective: To give insights into the agricultural history focusing on the land reform implemented in 1945 to show the development directions of the Hungarian farm structure.

2nd objective: The presentation of the Hungarian farm structure development in the transition and after joining to the European Union (focusing the direction of changes)

3rd objective: The examination of the chosen historical events (the so-called reform points and periods) what level and direction of changes caused in the Hungarian agriculture.

4th objective: The investigation whether the Hungarian agriculture can be integrated into the EU agricultural- and food structure and if so, to what extent?

b. Objectives based on the primary research:

1st objective: The examination of the Hungarian individual and corporate farms' technical efficiency between 2001 and 2013.

2nd objective: The presentation of efficiency results based on different farm sizes between 2001 and 2013.

3rd objective: The presentation of differences in technical efficiency of the main sectors of the Hungarian agriculture between 2001 and 2013.

The hypotheses of the dissertation

Relying on the literature sources and my personal knowledge, I have set up the following hypotheses in connection to the research theme.

H1: Peaceful agro-political relationships usually result performance improvement but violent, politically motivated actions disrupt the balancing growth and inhibit progress.

H2: The present structure of the Hungarian agriculture is less competitive comparative to the old Member States of the European Union.

H3: The increasing farm size can conduct to improving technical efficiency.

H4: Technical efficiency of corporate farms is higher than the individual farms. (The value of technical efficiency depends on the legal form as well.)

H5: Technical efficiency in crop production is lower compared to the animal husbandry or the fruit production.

2. DATA AND METHOD

The investigations of this dissertation are based on secondary data obtained from the Hungarian Central Statistical Office (KSH), the Hungarian FADN database operated by the Research Institute of Agricultural Economics (AKI), and the EUROSTAT.

The primary goal of the dissertation is to show a detailed investigation on the changes of the Hungarian farm structure. It was an additional objective of the dissertation to examine the evolution of the technical efficiency according to different farm sizes, legal forms, and farming directions.

The used databases and methods used for the examination of research hypotheses are summarized in Table 1.

Table 1: The databases and methods used to answer the research hypotheses

No. of the hypotheses	Database and method
H1	HCSO (GAS, FSS); comparative statistics, SPI index
H2	HCSO, EUROSTAT, FADN; comparative statistics, Gini coefficient and Lorenz curve
H3	FADN; DEA method
H4	FADN; DEA method, multivariate linear regression, Pratt indicator
H5	FADN; DEA method

Source: own edition, 2015.

I also used the SPI index (Standardized Precipitation Index) to answer to the first hypotheses which is one of the most commonly used tool in researches of drought. The SPI is a tool which was developed primarily to define and monitor drought. It is based on statistical methods which are able to quantify the ratio of moisture and drought on various timescales.

It allows an analyst to determine the rarity of a drought at a given time scale (temporal resolution) of interest for any rainfall station with historic data. It can also be used to determine periods of anomalously wet events. The SPI is not a drought prediction tool.

Generally, 1, 3, 6, 12 and sometimes (even) 24 monthly precipitation amount are taken into account to the similar climatic norms.

SPI index is calculated for a given point which well illustrates the status of a drought landmark in the present and past periods. The long-term time series (1950-2012) are obtained from the Hungarian Meteorological Service (OMSZ). I examined what weather was characteristic at the time of the defined reform points and periods in Hungary, and how these influenced (or could influence) the development of the agricultural output.

Gini coefficient and Lorenz curve were applied investigating the second hypotheses. The Gini coefficient is a measure of inequality distribution and can takes values between 0 and 1. A value of 0 corresponds perfect inequality, while the value 1 represents total inequality. In economics, the Lorenz curve is a graphical representation of the cumulative distribution function of the empirical probability distribution of wealth or income. Its advantage is that it gives an exact picture about the degree of concentration and the curve makes it very vividly: it allows the comparison of a wide variety of concentrations.

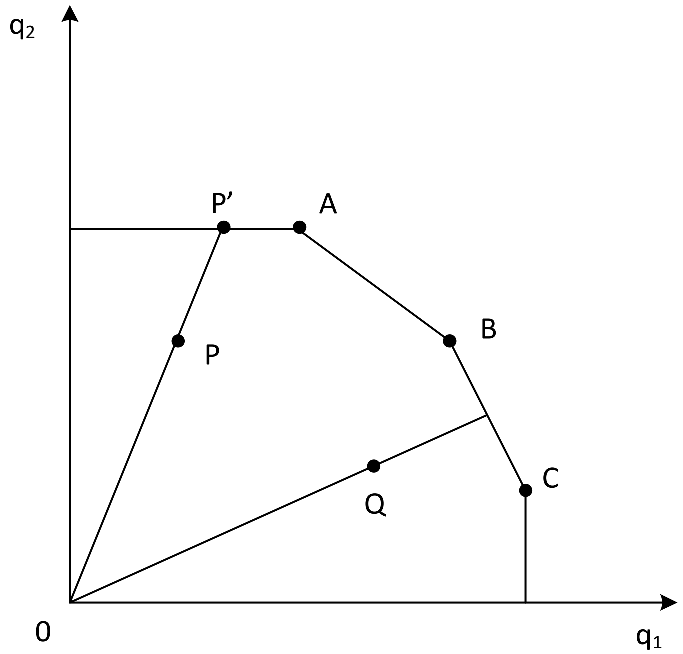
Based on literature sources we can state those farms are considered to be efficient of which production reaches the limit of production possibilities (opportunities) that is the level of production which is available at the current time using the current technology is not possible to produce more.

The investigation of the following hypothesis is based on efficiency analyses, which is carried out with output-oriented efficiency calculations using DEA method (H3, H4, and H5).

DEA (Data Envelopment Analysis), developed by Charnes, Cooper and Rhodes (1978), is a non-parametric technique for evaluating the technical efficiencies of a collection of "Decision Making Units (DMUs)" which consume common inputs to generate common outputs.

Based on the definition of efficiency, DEA is a mathematical optimization technique which determines the efficiency of each DMU by maximising the ratio of a weighed sum of its outputs to a weighed sum of its inputs while ensuring that the efficiencies of other units do not exceed 100%. The DEA method is based on a model of linear programming in order to define the technical efficiency levels, in cases of constant or variable returns to scale.

The observations (farms) are located in the area under the curve in the output-oriented DEA model (with two inputs and one output). The curve shows the combinations of the various outputs. Points A, B, C and P' indicate an efficient production along to boundary line, while the efficiency represented by points P and Q can improve along the respective lines.



Source: own edition, 2015.

Figure 1: The schematic representation of the output-oriented DEA model

Multivariate linear regression was calculated in relation to the fourth hypothesis. I started out the equation of the linear regression, than it was used the Pratt's relative importance index (PRF) which is able to separate the determination coefficient (R^2).

By the explaining meaning or effect we should understand as the fact of the PRF ratio how is involved in the production process and how it influences it.

3. RESULTS

3.1. The violent reforms hindering the consolidated development of the Hungarian agriculture

The Hungarian agriculture had suffered a radical transformation in the last 60-70 years which had a significant influence by the sector's share in the national economy, employment and investment; and it has also had important changes in the farm structure.

I got data from the Hungarian Central Statistical Office and the Hungarian Meteorological Service and I used the SPI index. The chapter examined the characteristics of the cyclic reforms which disrupted the balance of development and inhibited the progression.

I defined five reform points and periods in the time series based on literature sources as emphasized events:

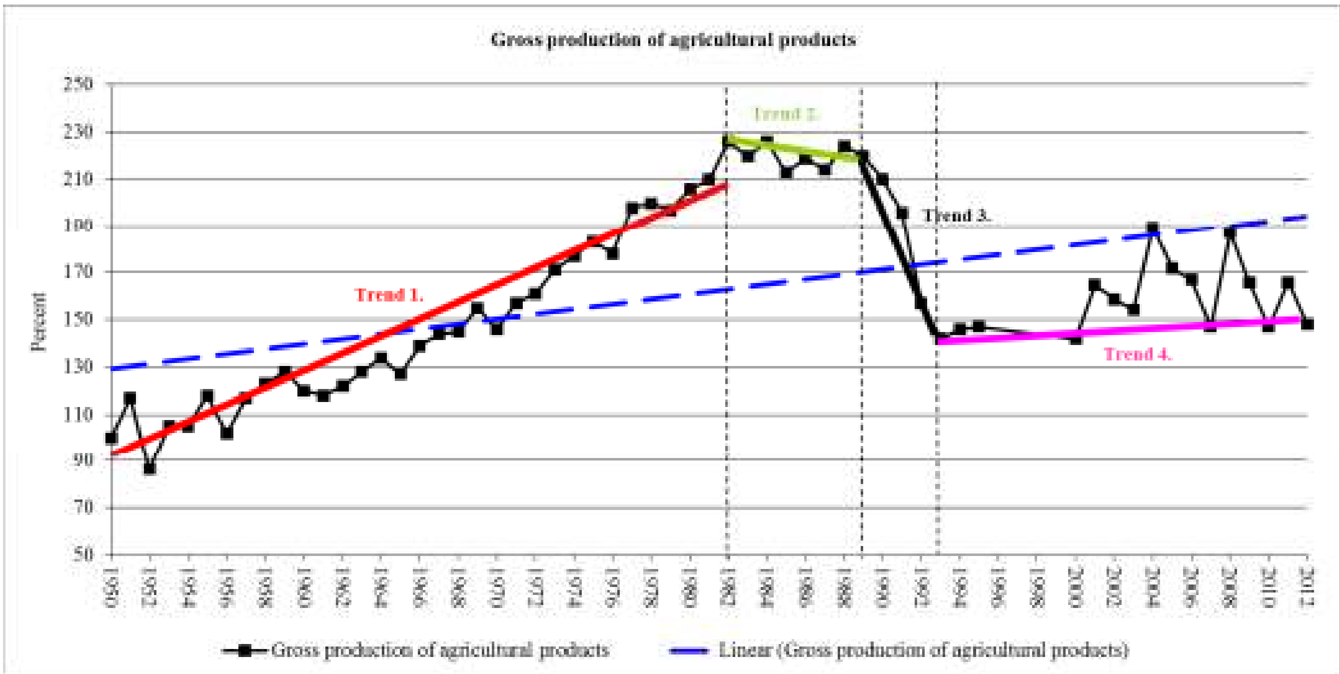
- 1948: the first period of collectivisation of agriculture,
- 1958-1961: the first phase of the true collectivisation,
- 1966-1968: period of the new economic mechanism,
- 1989-1990: transition, compensation and privatization,
- 2004: Hungary's joining to the EU.

Agriculture had suffered the largest decline in 1952 (Figure 2), then it has begun a steady progress more or less. The value of SPI was 1.2515 in 1952 which shows a moderately wet weather, so the weather conditions were favourable for agricultural production in this year, the probability of drought was 9.2 percent.

The sector's whole output (performance) had dropped significantly in 1952, why – based on the above mentioned facts – we cannot blame the weather but rather the agricultural policy decisions ignored rationality. Although a new agricultural policy "revolution" (collectivism) has taken place between 1958 and 1961, data had not shown fluctuations in those years.

The second period based on the figure had been between 1982 and 1989. The value of SPI was -0.4099 in 1982 which shows a moderately dry weather. The cumulative probability of drought was 34.1 percent then. The 1980s were mostly characterized by modest dry weather, so the weather conditions were not favourable for agricultural production, but the decline of the sector's performance is not only a consequence of this only factor.

A new economic policy revolution had been going since 1978. Its primary purpose was especially to stop the increasing of debt cutting back the growth and investment. The debt and the budget deficit had increased by the mid-1980s; the standard of living had reduced, the terms of trade deteriorated and the inflation was present by the unemployment.



Source: own edition based on HCSO 1996. and 2013.

Figure 2: Gross production of agricultural products (1950 = 100%)

The post-transition years made the third period between 1990 and 1994. Hungarian agriculture was a prosperous sector of the national economy before the transition. The political, economic and social transition resulted in a rapid and radical workforce loss in the whole economy: 1.7 million workplaces were lost in the early 1990s, mainly in the productive sectors.

The rearrangement of the farm and property structure, the reduction in the technical and technological standards, the privatisation of land and the loss of its important markets made it vulnerable.

The number of agricultural corporate farms had risen sharply. The majority of the large farms before the transition had been broken. The value of SPI was -0.7891 (slightly dry) in 1990 and this weather was typical the significant part of this decade.

The sector's performance had showed a rapidly changeable picture after 1995-1996. Following the EU accession in 2004, the gross value of agricultural production was in decreasing way. After a small-scale growth, the sector's performance was affected in an unfavourably way by the global economic crises.

In my opinion, the unreasonable agricultural and economic policy decisions are responsible for the rapidly changing agricultural output. The continuous and opposite-signed agricultural policy decisions had not helped with the development of the agriculture, they had been resulted in its erosion.

3.2. Comparative analyses of agricultural output between Hungary and other selected EU member states

I compared the agricultural performance between Hungary and some EU Member States with the following indicators:

- agricultural output at basic price,
- gross value added of agriculture at basic price,
- the proportion of agricultural land of the total area,
- the average agricultural area per farm,
- comparison in the concentration of land use,
- gross income per one hectare of agricultural land,
- the gross value added per agricultural employed person,
- total assets and own capital per one hectare of agricultural land,
- cost efficiency,
- net income of farms per hectare, and
- the fixed assets per hectare.

Hungary still have a significant disadvantage compared to the EU Member States who had joined to the community earlier, but most of the indicators are still better than the average of the EU-27 countries and it managed to have reduce a lot from our disadvantages since 2004: the catching up is though slow but steady. The global financial and economic crises took back a little the picking up, but the last period is a cause for optimism.

Less than half (42.9 percent) of the total agricultural output in the EU-28[1] were produced by three countries in 2014: France, Germany and Italy. Their agricultural output has shown a nearly 1.2-fold increase over the past 10 years as well as in Hungary.

The gross value added of agriculture was low in the whole European Union (EU-28) between 2004 and 2013 however this indicator was significantly higher in Romania, Poland and Hungary than the EU average.

According to the concentration of land use Hungary is characterized by that many small farms use a small percentage of agricultural land. 90 percent of farms cultivate about 10 percent of the land area. The value of the Gini coefficient was 91.9 percent in Hungary in 2010 which shows the most bipolar farm structure among the EU Member States examined. The indicator's value is also high in Romania (74.6 percent), but not nearly as much as the Hungarian value.

One of the major problems of the Hungarian agriculture is the specifically low gross farming income. The gross farming income in Hungary per hectare is less than one-fifth of the value of the Netherlands, and less than half of the value of Italy.

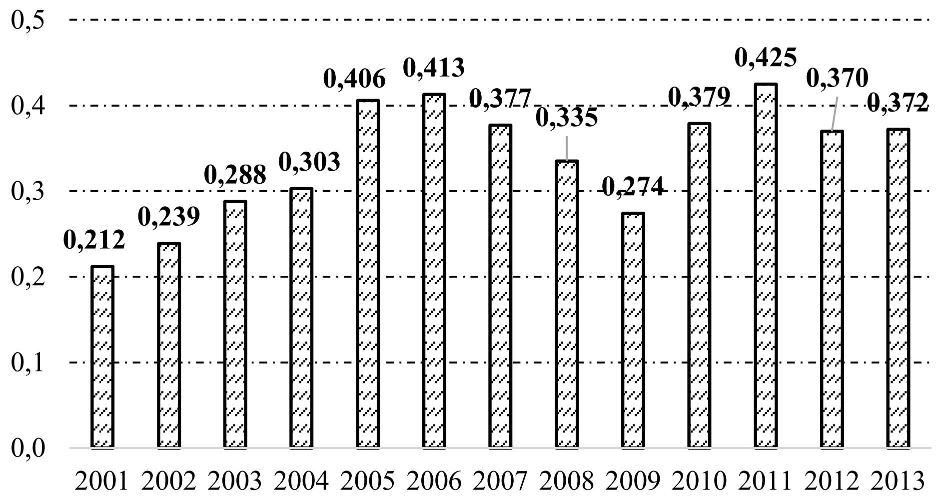
The picture is very complicated because we cannot compare the Hungarian agriculture one-to-one with the German, the French or the Dutch agriculture. There are different traditions in production, different farm structure, different environmental conditions and various agricultural policy however Hungarian agriculture is well positioned within the EU based on the selected indicators.

[1] EUROSTAT data means EU-28, and FADN data means EU-27.

3.3. The results of the Hungarian farm efficiency analysis

Efficiency was calculated based on DEA method in the following output and input data:

- output: gross value of production minus the value of subsidies,
- input 1: agricultural area (ha),
- input 2: agricultural employment (AWU),
- input 3: material costs (HUF),
- input 4: depreciation of fixed assets (HUF),
- input 5: livestock (LU).



Source: own edition based on FADN data, 2015.

Figure 3: The technical efficiency in the total sample (2001-2013)

(N = 1850)

In terms of the changes of technical efficiency it can be stated that the technical efficiency of the farms have continuously improved year to year until 2006 and then a decline had occurred for 3 years (Figure 3).

A modest improvement has happened in 2010 and 2011 and later, between 2011 and 2012, a slight decline it occurred in terms of the technical efficiency. A minor technical efficiency improvement can be demonstrated from 2012 to 2013. It is important to emphasize that the figure is based on the full FADN sample. I did not distinguish between legal form, size or the type of farming. The dissertation will present the main results differentiated by legal form, size and sector groups (arable farming, pig farming, dairy farming, and fruit production) in the following.

The global financial crisis followed by the economic crisis has seriously affected not only Hungary but also the agricultural sector. The impact of the economic downturn has also manifested in by the decreasing in employment, the declining in investment, and the hectic exchange rate alteration.

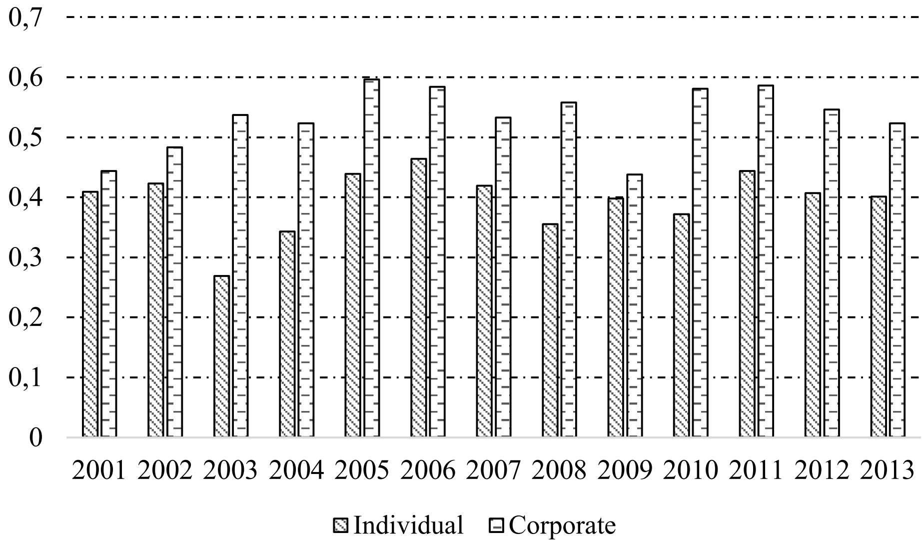
The technical efficiency was significantly reduced by 7 percentage points in 2009 compared to 2008 due to the crisis. The unexpected and sudden events had shocked the whole Hungarian economy.

3.1.1. The results of efficiency analysis by legal forms

The technical efficiency of the individual and corporate farms did not show much difference in the early 2000s, it was close to the same level (Figure 4). The technical efficiency of the corporate farms has increased compared to previous years in 2003, while the private farms have suffered significant setback.

The improvement of the TE indicator can be seen by both legal forms after Hungary's joining to the EU. The technical efficiency of the individual farms has improved at the time of the economic crisis (in 2008 and 2009) while the TE indicator has declined by the corporate farms.

The technical efficiency has stagnated or a modest decline is observed for both individual (0.42) and corporate farms (0.56) at the end of the examined period (2010-2013), although the indicator is higher in the latter group.



Source: own edition based on FADN data, 2015.

Figure 4: Improvement of technical efficiency broken down by legal forms (2001-2013)

The dissertation used multivariate linear regression to examine the influence of the output and input data (independent variables) used by the DEA method on the technical efficiency (dependent variable).

I would like to make a methodological comment: I only calculated efficiency with input 5 (the livestock) in relation to pig farms and dairy farms. The program called DEAP is only calculating efficiency if there are no zero data in the sample. There is no livestock by the crop or fruit production in most cases. In this case the value of the livestock would be zero. Therefore they would have dropped out of the sample which would thoroughly be reduced the sample size.

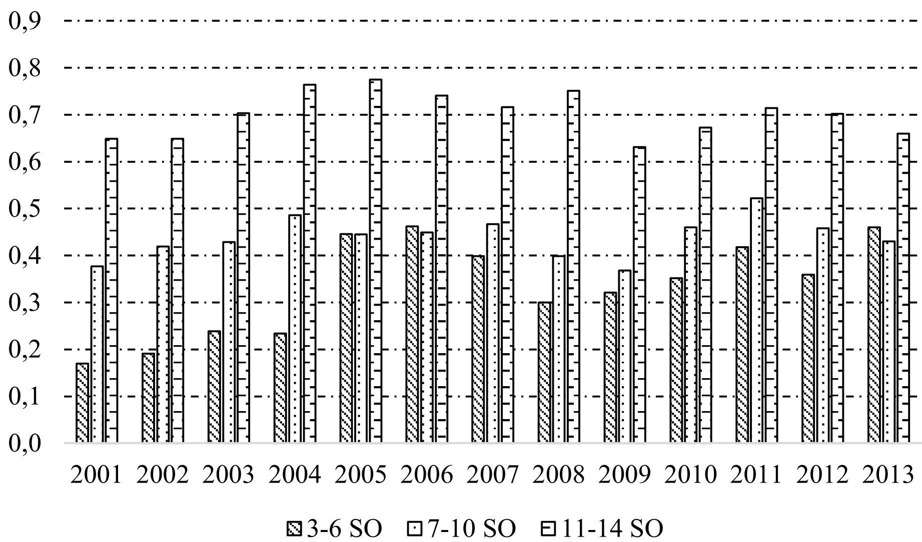
The Pratt indicator, which is characteristics of the individual and corporate farms too, has shown that "the gross value of production minus the subsidies" indicator had the greatest influence by the changes of technical efficiency, however, the strength of influence was different from year to year. The other selected indicators had a negative impact on technical efficiency in most cases.

Behind the high percentage of the unexplained resistance, it can be explored the so-called efficiency reserves. Here – among other things – the cost, the natural, the expense and the managerial efficiency, the used production technology and the damaging effects of extreme weather conditions can play a role.

3.1.2. The results of efficiency analysis by size categories

Since 2010 onwards the typology has been based on the Standard Output[2] (SO). Holdings have been classified into 14 size categories according to the European Commission regulation. I created three groups based on the 14 SO size classes and efficiency calculations were separately made for these groups. The first group included farms belonging to the size category of 3-6 SO, the second group contained farms belonging to the size category of 7-10 SO, and the third group included farms belonging to the size category of 11-14 SO (Figure 5).

A methodological feature of data processing is the usage of Standard Output from 2010 to express the economic size of farms according to EU rules. From 2010 the SGM (Standard Gross Margin) is replaced by the SO. Standard output is a standardised production value related to a unit of agricultural production (one hectare of land or one livestock unit generated in usual weather and production conditions). SGM[3] reflects the income generating capacity of the enterprises. SO reflects the output of the enterprises.



Source: own edition based on FADN data, 2015.

Figure 5: Improvement of technical efficiency broken down by size categories (2001-2013)

Those farms belongs to the first group (3-6 SO) which had a standard production value between 4 000 and 50 000 EUR. During the examined period 883 holdings have represented this observation, which is 46.5 percent of the total sample.

[2] SO = Total production – Direct subsidies.
[3] SGM = Total production – Direct variable costs.

Technical efficiency of farms belonging to the first group was relatively low in the early 2000s. Then the indicator almost doubled after the EU accession, which is attributed to the increase of the volume of subsidies. A large amount of financial resources were suddenly available for the farmers which was spent for development, investment, and the modernization of the amortized machinery and equipment.

Technical efficiency had begun to decline from 2006, but it was still higher than the observed value at the beginning of the 2000s. The time series data from 2005, 2006, 2011 and 2013 were relatively high. They had reached or even exceeded the value of the technical efficiency in the whole sample (0.43).

The global economic crisis also had a big impact on these holdings. Figure 5 shows that the technical efficiency was 8-10 percentage points lower in 2008 and 2009 than a year ago.

Those farms belongs to the second group (7-10 SO) which had a standard production value between 50 000 and 750 000 EUR. During the examined period 864 holdings have represented this observation, which is 45.5 percent of the total sample.

I defined new concepts called crisis-bearing ability or crisis-tolerance in connection to the efficiency examination. The following statement was formulated based on the results of the dissertation: larger holdings (7-10 SO) had a higher crisis-bearing ability. The technical efficiency had only declined with 3 percentage points in their case in 2008 as a result of the crisis. The technical efficiency had decreased of 8-10 percentage points in the smaller farms.

The time series is showing a balanced picture in which the year 2009 is considered as a major downturn (global financial crisis) however, the decrease is not significant. The absolute value of the technical efficiency is higher in these farms compared to the group of farms belonging to the first size category (3-6 SO).

Those farms belongs to the third group (11-14 SO) which had a standard production value between 750 000 – 3 million EUR. During the examined period only 174 holdings have represented this observation, which is 6-10 percent of the total sample.

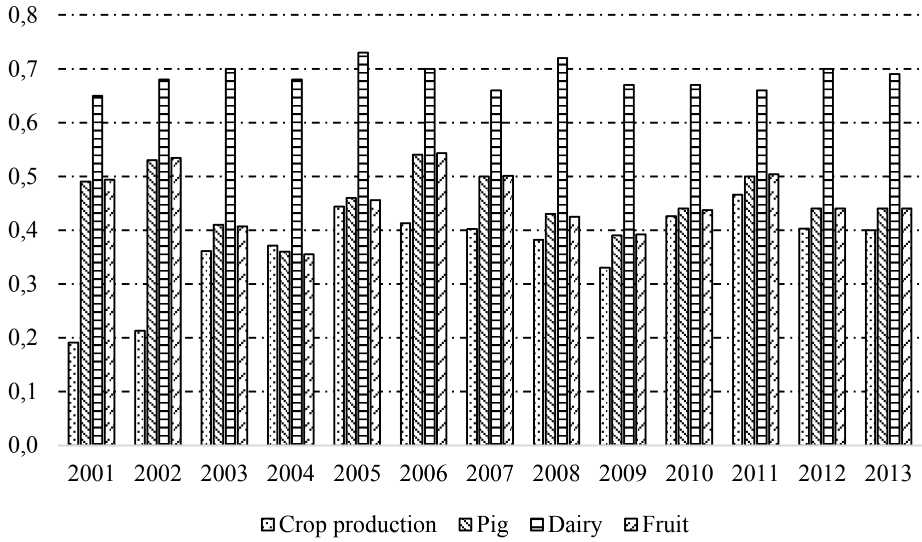
The technical efficiency is the highest between these farms belonging to this group. The value of the TE indicator was 0.7 in average which is three tenths higher as the value of TE in farms belonging to the second sized group (7-10 SO) and it is four tenths higher as the value of TE in farms belonging to the first group (3-6 SO).

The technical efficiency by the biggest farm size (11-14 SO) are playing a dominant role because their technical efficiency is the highest in the sample however, their crisis-bearing ability is the lowest: their technical efficiency declined 12 percentage points in 2009 compared to 2008.

I could partially confirmed my previous statement which said that the crisis-bearing ability in the bigger farms are higher compared to the smaller farms. The crisis-bearing ability in farms belonging to the second sized group (7-10 SO) is higher than the crisis-bearing ability in holdings belonging to the smallest size group (3-6 SO). I stated that the crisis-bearing ability is the highest in farms belonging to the biggest size group (11-14 SO). This assumption was incorrect.

3.1.3. The results of the efficiency analysis according to type of farming

I made efficiency analysis by the type of farming between 2001 and 2013: arable crop production, pig breeding, dairy farming, and fruit production.



Source: own edition based on FADN data, 2015.

Figure 6: Improvement of technical efficiency broken down by type of farming (2001-2013)

Almost half of the holdings in the FADN deal with arable crop production correlated to the ratio of crop and livestock production (65:35). It is necessary to make a clarification because the mixed farms also use agricultural land which greatly affects the high proportion of cropping.

3-4 percent of the FADN sample consists of the pig farming, while the proportion of dairy farms is nearly 7-10 percent in the sample. The fruit-growing farms represent 7-8 percent of the total sample, which means 160-170 farms.

The technical efficiency of arable crop production was very low at the beginning of the 2000s, but it had increased later. As a result of the EU accession in 2004 a large amount of subsidies had arrived in the sector. The technical efficiency of farms had risen by seven percentage points by 2005 due to the increase of subsidies. The improvement was followed in a decline, which had the lowest point in 2009.

In my point of view, the impact of the global economic crisis can be seen in 2008 and 2009, which resulted in a 5 percentage point's decline of the technical efficiency. Farmers had to face with the occurrence of extreme weather conditions in recent years. The production had declined due to the drought in 2007 and 2012. A very large amount of rainfall resulted in the decrease of production in 2010. (The value of SPI was 3.1612 in 2010, which means extremely wet weather. The indicators value was -0.9767 in 2012, which shows dry weather. The value of SPI was 0.3934 in 2007, which means a slightly wet weather.)

The technical efficiency by pig farms was already high in the early 2000s as well compared to the value of technical efficiency by arable crop production. It was 2.5 times higher and it showed a relatively balanced picture. A modest decrease had occurred in 2008 and 2009 but this period was followed by a fast improvement. The average technical efficiency figure by pig farms were 0.44 in 2013.

The technical efficiency by dairy farming was the highest in 2001 compared to the other types of farming and it still had this position under the period examined. The technical efficiency by pig farms has approached it, while arable crop production stayed largely below that level.

The average technical efficiency of dairy farms was a valued at about 0.7, but higher values had occurred in only two years. The technical efficiency was lower all the rest of the years, however, they are also concluded that the technical efficiency was stable over the period between 2001 and 2013.

The technical efficiency of fruit production had showed a strongly fluctuated picture between 2001 and 2013. The value of TE was the lowest (0.355) in the year of the EU accession (2004) and it was followed by a significant improvement. It had reached the lowest point (0.392) in 2009 and since then, it has been growing and stagnating in turn. The crisis-bearing capacity by the fruit production is low, because it had occurred a 4 percentage point decrease in terms of the technical efficiency due to the financial and economic world crisis, which can be stated significant.

Summary findings are as follows: the technical efficiency has improved after Hungary's joining the EU for each of the four groups (arable crop production, pig production, dairy production, and fruit production). The technical efficiency has declined after the world crisis in both of the groups.

3.4. New and novel scientific results

I have found the following new and novel scientific results:

R1: The research and the approach itself was new (novel) because no one has previously examined this topic using such methods like DEA and SPI.

R2: My first suggestion has partly confirmed my statement because the used method called SPI has shown that weather anomalies cannot be responsible for the hectic change of the agricultural performance for the second half of the 1990s. The uncontrolled agricultural policy decisions had disturbed the balance of development.

R3: The second hypothesis was justified using statistical data and simple comparative methods: the Hungarian agriculture could not yet reach the full integration into the EU's food and agricultural structure although the majority of the indicators are improving.

R4: I calculated efficiency analysis with DEA method separated by legal form, size and type of farming using FADN data between 2001 and 2013. The examination carried out to show the following results:

- The increasing farm size can work towards the improving technical efficiency;
- The technical efficiency was the highest by the corporate farms and by those farms who are dealing with animal husbandry, it is closer to the one. The technical efficiency was very low by arable crop production and by the individual farms.
- The technical efficiency has stagnated by both legal forms over the last three years. The gap between the individual and corporate farms had increased after the economic crisis in terms of the technical efficiency.
- The average technical efficiency is about 0.4 by arable crop production, which is much lower compared to the animal husbandry.
- The average technical efficiency is about 0.5 by fruit production which is also lower compared to the animal husbandry.

R5: It has been introduced the concept of crisis-bearing ability and crisis-tolerance which was defined in relation to the technical efficiency change and the economic crisis. By those farms, where the technical efficiency had not changed (or even increased) due to the global financial and economic crisis, their crisis-bearing ability is higher. Those farms, where the technical efficiency had decreased due to the global economic crisis, have a low crisis-tolerance.

R6: The investigations have identified the potential factors affecting the technical efficiency change, which are as follows:

- legal form,
- farm size,
- type of farming,
- annual work unit,
- agricultural policy tools,
- level of subsidization.

4. CONCLUSIONS, RECOMMENDATIONS

4.1. Accepted or rejected hypothesis

Three hypothesis were confirmed and two hypothesis were partly confirmed after the statistical and economic examination (Table 2).

Table 2: Accepted or rejected hypothesis

Number of the hypothesis	The content of the hypothesis	Confirmation or rejection
H1	Peaceful agro-political relationships usually result performance improvement but violent, politically motivated actions disrupt the balancing growth and inhibit progress.	partly confirmed
H2	The present structure of the Hungarian agriculture is less competitive comparative to the old Member States of the European Union.	partly confirmed
H3	The increasing farm size can conduct to improving technical efficiency.	confirmed
H4	Technical efficiency of corporate farms is higher than the individual farms. (The value of technical efficiency depends on the legal form as well.)	confirmed
H5	Technical efficiency in crop production is lower compared to the animal husbandry or the fruit production.	confirmed

Source: own edition, 2015.

The first hypothesis (H1) was partly confirmed in the light of the available data and the methods used. Weather anomaly could not cause such decline in the agricultural output during the examined period (between 1950 and 2012). However, the rapidly changing agricultural policy decisions had greatly contributed to the volatile movement of the sector's performance.

The second hypothesis (H2) was partly confirmed. Most of the selected indicators are below the EU average (EU-27) in Hungary, however, a developing trend had emerged after the EU accession, which is a reason to be optimistic.

The hypothesis which are in connection to the technical efficiency (H3, H4, and H5) are confirmed using the DEA method.

As for the results differentiated by farm sizes is spectacular that the technical efficiency is the lowest in the smallest farms and it is increasing as the farm size increases. The average farm size is the highest by the biggest farms (11-14 SO), its value is nearly 0.7.

The efficiency analysis according to legal forms (H4) has shown the leading role of corporate farms, although the technical efficiency was at the same level by both of the legal forms in the early 2000s.

I made efficiency analysis according to the types of farming. The results had showed that the technical efficiency is the lowest by the arable crop production and the fruit production, its value is about 0.3-0.4 typically.

The average technical efficiency by the pig farming is 0.5. The dairy farming has the highest value of technical efficiency: its average value is about 0.7.

5. PUBLICATIONS IN RELATION TO THE TOPIC OF THE DISSERTATION

Scientific papers in Hungarian language

1. **Tóth Orsolya** (2014): A magyar és egyes uniós tagállamok mezőgazdaságának összehasonlító elemzése. Acta Carolus Robertus 4 (2) Gyöngyös p. 119-134. ISSN 2062-8269
2. Garay Róbert – **Tóth Orsolya** (2012)**:** Élelmiszergazdaság, mint stratégiai ágazat? (vitaösszefoglaló) Gazdálkodás LVI. (2.) p. 146-161. ISSN 0046-5518

Scientific papers in foreign language

3. **Tóth Orsolya** (2013): Farm structure and competitiveness in the Hungarian agriculture. Agroeconomica Croatica III. 1. 2013. július p. 26-32. ISSN 1333-2422
4. **Tóth Orsolya** (2012): Connection between the agricultural employment and the social land programmes in Hungary. Bialystok, XIX. SERiA Congress (The Polish Association of Agricultural and Agribusiness Economists), Annals p. 276-280. ISSN 1508-3535
5. **Tóth Orsolya** (2013): Atypical forms of employment in the Hungarian agriculture. Rzeszów, XX. SERiA Congress (The Polish Association of Agricultural and Agribusiness Economists), Annals p. 324-329. ISSN 1508-3535

Papers published in scientific conferences in Hungarian

6. Kemény Gábor – Fogarasi József – Tóth Kristóf – **Tóth Orsolya** (2012): The impacts of climatic factors on the yields of crop production. XIII. Nemzetközi Tudományos Napok, Károly Róbert Főiskola, 2012. március 29-30., Gyöngyös, p. 45-52. ISBN 978-963-9941-54-0.
7. **Tóth Orsolya** (2014)**:** A földreformok hatása a magyar mezőgazdaság teljesítményére. XIV. Nemzetközi Tudományos Napok, Károly Róbert Főiskola, 2014. márc. 27-28., Gyöngyös, p. 347-351. ISBN 978-963-87831-1-0

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8. **Tóth Orsolya** (2012): The possibilities of increasing employment in agricultural economy – the experiences of Hungarian social land programme. Nagyvárad p. 305-317. In: Bélyácz, I. – Fogarasi, J. – Szabó, K. – Szász, E. (eds.): Knowledge and sustainable economic development. ISBN 978-606-8156-30-9
9. Kemény Gábor – Fogarasi József – Tóth Kristóf – **Tóth Orsolya** – Varga Tibor (2012): International wheat price volatility and the increasing export of Russia. Kazakhstan and Ukraine. In: 123rd EAAE Seminar – Price volatility and farm income stabilisation; Modelling outcomes and assessing market and policy based responses. Dublin 2012. 02. 23 – 2012. 02. 24. p. 1-9.
10. **Tóth Orsolya** (2012): Farm structure and competitiveness in agriculture. Skopje 132nd EAAE Seminar (Is transition really over? – New dimensions and challenges of transition and post-transition processes in agriculture and food sectors in the European Union and EU acceding and neighbouring countries. 2012. 10. 25 – 2012. 10. 27. p. 1-13.
11. Kemény Gábor – Fogarasi József – Tóth Kristóf – **Tóth Orsolya** – Varga Tibor (2012): Problemkreis und Schadenkalkulation einer Mehrgefahrenversicherung im ungarischen

Ackerbau. In: Ökosystemdienstleistungen und Landwirtschaft. Wien 2012. 09. 20 – 2012. 09. 21. BOKU, 2012.

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12. Kemény Gábor (szerk.) – Felkai Beáta Olga – Fogarasi József – Kovács Gábor – Merkel Krisztina – Tanító Dezső – Tóth Kristóf – **Tóth Orsolya** (2010): A hazai mezőgazdasági válság finanszírozási csatornái és a pénzügyi válság ezekre gyakorolt hatása. Agrárgazdasági Könyvek, Agrárgazdasági Kutató Intézet, Budapest, 2010, p. 149, ISSN 2061-8204, ISBN 978-9-634915-51-5
13. Tanító Dezső (szerk.) – Felkai Beáta Olga – Fogarasi József – Kemény Gábor – Molnár András – Papp Gergely – Popp József – Potori Norbert – Tóth Kristóf – **Tóth Orsolya** – Varga Tibor (2010): Tények és szempontok a 2014-2020 közötti KAP reformjához. Agrárgazdasági Tanulmányok, Agrárgazdasági Kutató Intézet, Budapest, 2010, p. 118, ISSN 1418-2130, ISBN 978-963-491-555-3
14. Kemény Gábor (szerk.) – Varga Tibor (szerk.) – Fogarasi József – Kovács Gábor – **Tóth Orsolya** (2011): A hazai mezőgazdasági biztosítási rendszer problémái és továbbfejlesztésének lehetőségei. Agrárgazdasági Könyvek, Agrárgazdasági Kutató Intézet, Budapest, 2011, p. 124, ISSN 2061-8204, ISBN 978-9-634915-65-2
15. **Tóth Orsolya** (2011): Foglalkoztatás és munkaerő-lekötés. Magyar Mezőgazdaság OMÉK 2011. különszám p. 8-14.
16. Biró Szabolcs (szerk.) – Hamza Eszter – Molnár András – Rácz Katalin – Székely Erika (szerk.) – Tóth Kristóf – **Tóth Orsolya** – Varga Eszter (2012): A mezőgazdasági foglalkoztatás bővítésének lehetőségei vidéki térségeinkben. Agrárgazdasági Könyvek, Agrárgazdasági Kutató Intézet, Budapest, 2012, p. 121, ISSN 1418-2122, ISBN 978-9-634915-75-1
17. **Tóth Orsolya** (2013): Beszámoló a Gazdálkodás Baráti Köre és Szerkesztőbizottsága tanácskozásáról (krónika). Gazdálkodás LVII. (1.) p. 5 ISSN 0046-5518
18. **Tóth Orsolya** (2013): A lengyel agrárközgazdászok (SERiA) XX. jubileumi találkozója és konferenciája. Gazdálkodás LVII. (5.) p. 500-503. ISSN 0046-5518
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20. Biró Szabolcs – Adam Wasilewski – **Tóth Orsolya** (2014): Land tenure. p. 33-54. In: Potori Norbert – Pavel Chmielinski – Andrew Fieldsend (2014): Structural changes in Polish and Hungarian agriculture since EU accession: lessons learned and implications for the design of future agricultural policies. Agrárgazdasági Könyvek 2014. p. 291. ISBN 978-963-491-588-1
21. Kemény Gábor – Klimkowski Cezary – Fogarasi József – **Tóth Orsolya** – Varga Tibor (2014): Agricultural insurance support schemes. p. 117-137. In: Potori Norbert – Pavel Chmielinski – Andrew Fieldsend (2014): Structural changes in Polish and Hungarian agriculture since EU accession: lessons learned and implications for the design of future agricultural policies. Agrárgazdasági Könyvek 2014. p. 291. ISBN 978-963-491-588-1