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# Key Factors Affecting the Profitability of Farms in the Czech Republic

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## Anotace

Příspěvek se zabývá hodnocením ekonomické situace českých zemědělských podniků a jejím vývojem v delší časové řadě. Analýza byla provedena na základě vlastní databáze výběrového souboru zemědělských podniků tříděných podle regionů LFA, výrobního zaměření a velikosti podniku. Růst produkce je způsoben především růstem výnosů z rostlinné výroby, podíl výnosů z živočišné výroby a nezemědělské výroby klesá. Výrazným trendem ve sledovaném období je růst produktivity práce, který je ovlivněn především snižováním počtu pracovníků. Vzhledem k vysoké závislosti výsledku hospodaření v zemědělství na vnějších podmínkách je vývoj tohoto ukazatele charakteristický výraznými výkyvy. Závislost výsledku hospodaření na dotacích je největší v horských LFA. Podniky zaměřené na rostlinnou výrobu jsou nejméně závislé na dotacích, ale jejich výsledky hospodaření jsou nejvíce ovlivněny ostatními vnějšími podmínkami hospodaření, především klimatickými podmínkami a cenovým vývojem.

## Klíčová slova

Výsledek hospodaření, rentabilita, produktivita práce, dotace, LFA.

## Abstract

The paper deals with assessment of the economic situation of Czech farms and its development in a long time-line. The analysis is based on our own database of farms in a sample of farms classified by LFA, production type and size. An increase of production is mainly caused by an increase in crop production revenues, animal and non-agricultural production revenues are decreasing. An increase of labour productivity is an important tendency in the period influenced mainly by decreasing the number of workers. Due to the high dependency of profit or loss in agriculture on environmental conditions, the development of indicators is characterized by significant fluctuations. The dependence of profit on subsidies is greatest in the mountain LFA. Enterprises focused on crop production are the least dependent on subsidies, but their profit is the most affected by other external economic conditions, particularly by climatic conditions and price developments.

## Key words

Profit/loss, profitability, labour productivity, subsidies, LFA.

## Introduction

Compared to other sectors of the economy agriculture is known for its specific features. First of all, production processes in agriculture are complemented by a factor of influence of natural conditions, the weather, length of production processes and the associated length of current assets turnover. For obvious reasons, the position of the agricultural sector becomes a subject of political discussions because of the high proportion of utilization of public money. Generally, agriculture can be included in the primary sector, as there is a direct contact with nature and manufacturers gaining products in conjunction with natural influences. It is an economic activity that characterizes the production of products and related services. The traditional role of agriculture as a primary sector and food producers is accompanied by the production of non-food and non-production features that is becoming larger size.

In 2012, the agricultural sector contributed to the total gross value added of 1.32%, representing a decrease of 0.09 percentage points Developments in agricultural producer prices in 2012 showed an annual increase of 4.1%, which, however, lagged behind the growth in producer prices in 2011,

which amounted to 19.1%. According to the Czech Statistical Office (CSO) data, the share of employees in agriculture decreased by 0.02 percentage points Agriculture continues to be characterized by a lagging wage disparity in the level of average wages for the average of the Czech Republic. In 2012, this gap was reduced to 78%. The growth of nominal wages of workers in agriculture was 5.0%; which was higher than the rate of inflation, so the real wage grew by 1.7% (MZe, 2013).

In 2012, a high economic standard with the beginning in 2011 was maintained (after a decline in 2009 and a modest recovery in 2010) with 16.1 billion CZK as the overall economic performance of the sector which is the second highest profit achieved after 1990. The value of production of the agricultural sector in 2012 compared to 2011 showed only a slight increase of 2.5%. This trend was involved in crop production increase of 1.9% and livestock production by 3.7%. The increase in production value in 2012 was not as in 2011 due to growth in the volume of production, but only a rise in the price of agricultural production, which compensated the volume decline of most commodities (MZe, 2013).

According to the CSO data on final harvests, the crop production declined for almost all major commodities. The decrease in the volume of production occurred in cereals, legumes, potatoes, sugar beet, sunflower, poppy, hops, grapes and vegetables. A significant increase in the volume of output was recorded on the contrary, for rape by 6.0%, which corresponds to the trend of recent years, and fruits. The price increases of up to 15 % were recorded for all crop production market commodities (with the exception of potatoes). In livestock production, according to the CSO data on the results of livestock production the growth was recorded for milk and poultry meat, beef with stagnation, decline in pork and eggs. Prices of animal products increased (with the exception of cow's milk – a decline of about 6%). Record price growth was recorded for eggs (55.8%) after failure of imports from Poland. Overall, positive aggregate economic results of agriculture sector in 2012 were accompanied with high share of intermediate consumption of more than 70% in comparison with the top EU countries at around 50% (MZe, 2013).

The aim of the paper is to assess the economic situation of Czech farms and its development in a long time-line. This aim includes partial tasks: to evaluate the structure of production of agricultural companies and its changes up to 2000, to judge the financial indicators, the effectiveness of factors of production, to evaluate the results of synthetic models of financial health, to judge the dependence of profit on subsidies. Within the solution of partial aims the results among groups of companies divided according to LFA, type of production and economic size, will be compared.

## Materials and methods

The data necessary to the research were based on original sample prepared at the University of South Bohemia in České Budějovice since 1996. The sample consists of about 100 farms all over the Czech Republic. The crucial data are collected from financial and production statements – Balance sheet, Profit loss statement, Annual statement on harvest and Statement on sowing areas. The data are completed by an original questionnaire with additional information on economy and production. The results are calculated as an average per farm or hectare of land or one worker. The paper used sorting of enterprises into groups according to the share of agricultural land in the LFA to the total utilized agricultural area (UAA), as well as the type of production and by the size.

According to the relation to the less favoured areas, the enterprises are classified according to the methodology of FADN (2012):

- Mountain areas (LFA M) – more than 50% of UAA in mountain LFA;
- Other LFA (LFA O) – more than 50% of UAA in LFA and LFA M less than 50%;
- NON LFA – more than 50% of UAA outside the LFA.

Classification by type of farming was based on the prevailing share of revenues from crop and animal production, with the fact that businesses with sales of crop production or livestock production higher than 2/3 were belonging to the group and the other belongs to a group of mixed agricultural production.

To sort the size of the company was using the rules of the European Union (Annex I of Commission Regulation (EC) No 800/2008). Given that there were only 0-5 micro-enterprises and large enterprises in the sample for each year, only the group of small and medium-sized enterprises was assessed.

Within the analysis of the structure of production the analysis of the indicators of the volume of aggregate production in monetary units, the volumes of production of major commodities of vegetable and animal production, natural yields and the efficiency of production are carried out.

For the analysis of profitability, capital structure and liquidity basic indicators of financial analysis (Giroux, 2003; Peterson and Fabozzi, 2006) will be used and assessment of the interaction between these indicators in the period 2000 to 2012.

The effectiveness of the factors of production is evaluated by means of the indicators of production intensity, labour productivity and activity. The relationship of revenues to the area of agricultural land is characterized by the intensity of production, the relationship towards the average number of employees is characterized by the labour productivity and the relationship between revenues and assets is characterized by the activity (turnover). The dynamics of labour productivity is decomposed into causal impacts of dynamics of revenues and number of workers:

$$\Delta LP = \Delta LP_R + \Delta LP_E$$

$$\Delta LP_R = \ln I_R / \ln I_{LP} \,.\, \Delta LP$$

$$\Delta LP_E = - \ln I_E / \ln I_{LP} \,.\, \Delta LP$$

where:

$R$ – revenues

$E$ – number of employees

$LP$ – labour productivity, $R / E$

$\Delta LP$ – absolute change of labour productivity between periods

$\Delta LP_R$ – absolute change of labour productivity due to revenues

$\Delta LP_E$ – absolute change of labour productivity due to number of employees

For the aggregate evaluation of financial health of companies the most widely used prediction and diagnostic models were used. Among the worldwide most frequent models we can rank Altman's models, which exist in several modifications. In our case it was the modification of Z-score from 1983 (Altman, 2002) regarded the unknowingness of market values of equity of companies. From the Czech models the IN05 index was used (Neumaier and Neumaierová, 2005). The IN95 model is specified also for the branch of agriculture, but the parameters of model IN05 were estimated on newer data. For this reason also the Slovak model G-index (Gurčík, 2002) suitable for evaluation of the Czech agricultural companies (Kopta, 2009; Zdeněk, 2012) was included into the evaluation of companies, Altman's model in the form Altman (2002):

$$Z = 0.717x_1 + 0.847x_2 + 3.107x_3 + 0.120x_4 + 0.998x_5$$

where:

$x_1$ – working capital / assets,

$x_2$ – retained profits / assets

$x_3$ – profit before interest and tax / assets

$x_4$ – equity / debt

$x_5$ – revenues / assets

Index IN05 in the form of Neumaier and Neumaierová (2005):

$$IN05 = 0.13x_1 + 0.04x_2 + 3.97x_3 + 0.21x_4 + 0.09x_5$$

where:

$x_1$ – assets / debt,

$x_2$ – profit before interest and tax / interest cost (max. 9)

$x_3$ – profit before interest and tax /assets

$x_4$ – revenues / assets

$x_5$ – current assets / short-term liabilities

G-index in the form of Gurčík (2002):

$$G = 3{,}142x_1 + 2{,}226x_2 + 3{,}277x_3 + 3{,}149x_4 + 2{,}063x_5$$

where:

$x_1$ – retained profits / assets,

$x_2$ – profit before tax / assets

$x_3$ – profit before tax / revenues

$x_4$ – cash flow / assets

$x_5$ – inventories / revenues

For the evaluation of the development of subsidies the so called index of dependence on subsidies, which represents the cost rate adjusted for subsidies, where the value over 100% express what share of company costs is needed to be covered by subsidies. The dependence between the volume of subsidies and profit in time is described by linear regression and correlation analysis.

The farms in the EU countries are distinguishable by three main factors: the structural characteristics, for their financial characteristics and their productive orientation and the importance of subsidies on the farms. The four clusters of farms obtained show that the farms in the EU broadly fall

in the North and Central Europe, the Mediterranean and the East (Dos Santos 2013). Different methods of classification of farms are used in studies evaluating the economic efficiency of farms such as by type of farming according to the FADN classification, which is based on the economic categories of standard gross margin (Divila and Sokol, 1999), or by agricultural production areas, or by legal form of enterprise (Grznár and Szabo, 2002). Tavernier and Tolomeo (2004) studied the relationship between farm size and sustainable agriculture for different classes of farms. Different authors suggested various methodologies to establish farm types. Duvernoy (2000) successfully used land cover as a criterion to identify farm types. Adamišin and Kotulič (2013) evaluated the economic performance of farms in Slovenia sorted by legal forms of enterprise and demonstrated a higher economic return for the companies compared to the cooperatives. According to them, better economic performance of the company may be caused not only by different management approaches, but also a better starting situation. Bojnec and Latruffe (2013) find that small farms are less technically efficient. The decline in the number of medium-size farms which has been observed since the accession to the EU may be explained by the fact that medium farms cumulate all disadvantages in terms of performance: they are too small to be economically efficient, but they are too large to be profitable. Size has a positive effect on technical efficiency, by contrast, it has a negative effect on allocative efficiency, but the effect on the overall economic efficiency is positive. As for profitability, farm size has a negative link with it. Regarding subsidies, they have a negative influence on technical efficiency, by contrast, they have a positive influence on allocative efficiency, but the influence on the overall economic efficiency is negative. As for profitability, subsidies have a positive relationship with it. Brožová and Vaněk (2013) strive to analyze as well the viability of organic farms and their contribution to sustainable agriculture and environment. The research showed that the share of profitable organic farms was much higher than in conventional agriculture. However, this result was conditioned by including subsidies in the total revenues. Szabo and Grznár (2013) say that position of Slovak farms in the LFA conditions is far from flattering: they hardly achieve the average performance of the LFA farms in the EU-25; neither do they receive the amount of supports received by these farms in the Union. The legal persons and business companies achieve better results almost in all the indicators than agricultural cooperatives.

Adamišin and Kotulič (2013) say that slow structural change and high subsidization of agriculture calls for studies on whether such conditions could explain the low performance of the agricultural sector, and, if so, what is the effect of the implementation of the high subsidizing CAP on farms' behaviour and survival possibilities. As summarised by Gorton and Davidova (2004), the question of farms' productivity and efficiency in post-socialist countries is crucial to understand whether the countries could compete within the enlarged EU after their accession and how farm structures in these countries would evolve. In particular, farms' survival is an important issue, as it is decisive for land use and sustainable rural development, the presence of farms avoiding land abandonment and providing employment and green amenities in rural areas. Land abandonment has been relatively high in post-socialist countries after the transition, due to political and economic changes. Kuemmerle et al. (2009) cite declining returns from farming, tenure insecurity and demographic developments as main causes of such phenomenon. These problems are dealt with outside the EU too, for example by Singh (2013) at small farmers without any income from non-agricultural activities have very little chance to absorb losses caused by even one year of crop failure. That agriculture is becoming less attractive as a business and people are moving to urban centers, more and more land is coming to a forced lease.

The ongoing political discussions on the future of the CAP indicate a further strengthening and enhancement of the environmental objectives of EU agricultural policy. Alongside policy changes, important structural developments have taken place in the global markets, such as the energy price rise and the expansion of bioenergy production, greater commodity price volatility, shift in consumption patterns in developing countries and climatic changes. These external drivers put new pressures on the agricultural sector but there is also a reaction from the policy side leading to an adjustment in policy objectives and changes of policy instruments (Paloma at al., 2013). According to Petrick and Zier (2012), the amount of direct payments has become increasingly difficult to be defensible to the public and the results of their study suggest that a moderate reduction of these payments will have a negative impact on employment in agriculture. On the other hand Latruffe at al. (2013) say, that the removal of the CAP could

induce a substantial share of farmers to exit farming that the change in strategies following this policy change would vary across farm, and that economic opportunities outside agriculture would be essential. All these findings reveal that a dramatic break in support policy, such as the one implemented in New Zealand, may need to be accompanied by a specific transitional programme, such as the Exit Grant scheme in New Zealand (Rae et al., 2003), and a strong policy for the development of off-farm opportunities. Acs at al. (2010) proved, that loss of Single Farm Payment will have a serious effect on the long-term viability of hill farms in the Peaks. The loss of Single Farm Payment does not have effect on the intensity of livestock production, since due to the Agro-environmental Scheme the intensity of production is already relatively low.

Vavřina at al. (2012) analyses the current situation of measurement and management of economic performance of agricultural enterprises within the Visegrad group and further delineate the possibilities of efficient management of economic performance of those entities, especially in the context of scenario proposals of agricultural development beyond 2013. The CAP should reflect the current requirements, according to the Rome Treaty from 1955: primarily should improve the productivity, stabilize the markets, ensure the food base and maintain the reasonable prices for consumers. Direct payments are therefore significant instruments for agricultural producers how to ensure these requirements. Any further research on aiming to answer the question: How to efficiently distribute these payments according to maintain the social welfare and meet the strategic objectives needs to be conducted. Štolbová and Míčová (2012) analyse the economic results of the small and large farms in the LFA within the CR, and evaluates the impacts of the current LFA measures, where the payment distribution is based only on the grassland area, regardless of the farm size in the CR. Based on these analyses, it was suggested to distribute the LFA payments in the CR per 1 ha of UAA of farm. Also, it was showed that it would be suitable to introduce a graded decrease of the LFA payments rates according to the farm size. The analysis proves that the economic survival of the large farms, measured as the farm net value added per one annual work unit, will not be endangered. It is possible to conclude that there is a space for introducing the degressivity of the LFA payments depending on the farm size in the CR.

## Results and discussion

### 1. Production structure

The volume of production in an average farm increased from 60.8 million CZK in 2000 to 96.6 million CZK in 2012. Classified by the LFA, production volume grew fastest in the NON-LFA (64.5%), slightly slower in the LFA O (63%) and significantly slower in mountain areas (15.8%) (table 1). The differences between small and medium-sized enterprises are not as significant, the production increased in small enterprises by 111% from 2000; the growth of production in medium-sized enterprises was not as fast (by 86% in 2012). For enterprises classified by type of farming, the slowest production growth occurred in the enterprises with mixed agricultural production (about 47%) and slightly faster in farms focused on livestock production (48%) the fastest growth occurred in crop production (by 85%).

Sale of cereals was growing in the NON-LFA by 4.8% per year in average; by about 1% per year in other LFA, decreasing slightly in mountain areas (table 2). According to the CSO

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Index 12/00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mountain areas | 45404 | 45280 | 42267 | 38054 | 47867 | 45605 | 47669 | 51300 | 51720 | 44041 | 52939 | 52162 | 52564 | 1.158 |
| Other LFA | 58593 | 67141 | 64656 | 60298 | 68843 | 73989 | 72637 | 81608 | 83837 | 68662 | 71869 | 82062 | 95615 | 1.632 |
| NON LFA | 75671 | 83210 | 82207 | 92016 | 100243 | 108673 | 103876 | 126576 | 133187 | 104444 | 107042 | 115305 | 124450 | 1.645 |
| Small farm | 24092 | 26989 | 27442 | 25241 | 29592 | 32322 | 32764 | 41289 | 42857 | 36871 | 44036 | 51048 | 50843 | 2.110 |
| Middle farm | 84471 | 92910 | 92493 | 94339 | 105857 | 112306 | 109455 | 130474 | 138177 | 114141 | 130765 | 139106 | 157192 | 1.861 |
| Crop production | 64780 | 69366 | 80331 | 67001 | 75486 | 89870 | 98966 | 108141 | 120084 | 102767 | 86530 | 118431 | 119639 | 1.847 |
| Mixed p. | 67696 | 74648 | 70251 | 75302 | 82155 | 82386 | 86136 | 104717 | 98846 | 79963 | 97074 | 82008 | 99485 | 1.470 |
| Livestock p. | 52537 | 61784 | 59453 | 60710 | 71151 | 78497 | 69090 | 73677 | 81399 | 64404 | 61624 | 72728 | 77780 | 1.480 |
| Total | 60894 | 68246 | 65262 | 67442 | 76108 | 80837 | 78054 | 91698 | 93804 | 75506 | 79436 | 86852 | 96584 | 1.586 |

Source: Own survey of the sample farms

Table 1: Production in an average farm (thous. CZK).

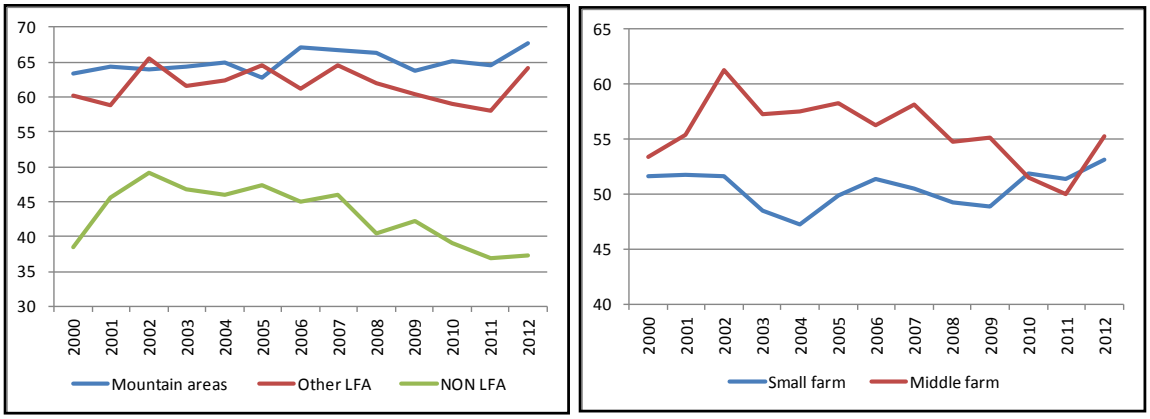
(2014) the production of cereals in the CR increased from 2000 by 2.2% (the average growth rate 0.2% annually), concurrently the sowing areas of cereals decrease (approximately by 1.1% annually), but the growth of natural yields is faster being 1.3% annually. Sales of legumes had an overall decreasing trend with a growth in the NON-LFA only by 3% a year. In the nationwide comparison the decrease of the production of legumes is at 46% of the situation in 2000 (CSO, 2014 ). Sale of potatoes shows an overall decline by 5% per year in average, only it remained at approximately the same level in mountain areas. This corresponds with the CSO data on production, according to which the average decrease of the production of potatoes in the monitored period makes 6% annually. In contrast, the sales of rape in all areas except the mountain were growing at an average rate of 3% per year, in the nationwide comparison the average growth rate from 2000 is 2.3%. Classified by type of production, farms reported an increase of cereals sales in crop production at an average rate of 8% per year, farms with livestock production reported decreasing sales of cereals at an average rate of 1.3 % per year and farms with mixed production did not report any changes in sales of cereals. For small and medium-sized enterprises selling cereals was growing at approximately the same rate. For sales of legumes, a significant increase occurred in farms with crop production, farms with mixed and livestock production reported a decline up to the quarter of 2000. Sales of potatoes were declining in all types. Rapeseed sales were growing in farms with crop production by an annual average of 9.5 %; by 2 % per year in farms with mixed production and decreasing slightly in farms with livestock production. Sales of legumes in small farms grew by an average of 5 % per year; it declined slightly in medium-sized enterprises. Sales of potatoes grew by 0.5% per year in small farms; it decreased by 3 % per year in the medium-sized enterprises. Sales of rapeseed grew at an average in medium-sized enterprises by 4.5 % per year. Small farms reported the growth by 0.1 % per year.

In 2012, the density of livestock was 54.5 animals per 100 ha. It increased by 2.9 % in the sample since 2000. This value does not correspond with the nationwide average, since according to the CSO (2014) the development in the Czech Republic indicates the average drop rate of the density of livestock by 1.1% annually. This discrepancy can be explained by narrowing the sample by long-term non-profitable subjects, where the unwillingness to take part in the further survey can be seen and thus the prevailingly developing subjects showing the increase of production are included in the sample. Also the aggregate volume of production in the sample shows significantly higher increase (by 58%) than the nationwide average (according to the CSO 2013), the production in current prices increased by 21%. Density of livestock increased by 6.5 % in other LFA areas and by 6.9 % in the mountain areas. The livestock density in NON-LFA decreased by 3.2 % compared to 2000. Classified by production type, the fastest growth of density was reported in mixed production, the average company focused on crop production reported decreased livestock density. Small and medium-sized farms reported the same level of livestock density (Fig. 1) in recent years. The growth performance was greatest in the NON-LFA. Small businesses were growing faster than the medium-sized. According to the analysis by Kopeček et al (2009), all model

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Index 12/00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mountain areas | 1149 | 975 | 1119 | 953 | 1031 | 925 | 740 | 899 | 922 | 826 | 841 | 842 | 959 | 0.835 |
| Other LFA | 1688 | 1939 | 2070 | 1488 | 2042 | 2209 | 1947 | 2199 | 2226 | 2433 | 2065 | 2180 | 1898 | 1.124 |
| NON LFA | 2827 | 2681 | 3793 | 3320 | 3483 | 4963 | 4680 | 4636 | 5377 | 4797 | 4429 | 4667 | 4973 | 1.759 |
| Small farm | 824 | 921 | 1273 | 916 | 1252 | 1371 | 1253 | 1201 | 1482 | 1703 | 1595 | 1587 | 1352 | 1.641 |
| Middle farm | 2637 | 2646 | 3265 | 2792 | 3076 | 4016 | 3621 | 4076 | 4390 | 4077 | 4021 | 4436 | 4506 | 1.708 |
| Crop production | 2198 | 1652 | 3094 | 2142 | 3987 | 4998 | 6369 | 6041 | 5298 | 5772 | 5022 | 5753 | 5694 | 2.590 |
| Mixed p. | 2536 | 2886 | 3535 | 3025 | 3014 | 4066 | 3437 | 3145 | 3976 | 3766 | 3126 | 2544 | 2524 | 0.995 |
| Livestock p. | 1202 | 1219 | 1521 | 1217 | 1489 | 1870 | 1467 | 1486 | 1520 | 1446 | 1232 | 1065 | 1032 | 0.858 |
| Total | 1929 | 2000 | 2471 | 2062 | 2364 | 2975 | 2651 | 2826 | 3036 | 2890 | 2585 | 2745 | 2708 | 1.404 |

Source: Own survey of the sample farms

Table 2: Sale of cereals (t).




Source: Own survey of the sample farms

Figure 1: Development of the density of livestock units per 100 ha of agricultural land.

results with the actual intensity of fattening cattle show a negative profitability of the industry. A prerequisite for achieving positive results in this sector would be necessary to increase the intensity of fattening level of at least 0.9 kg per day. In our group of farms such performance was reported by an average farm in the NON-LFA only and in farms with mixed production, but in some years only.

Average annual milk yield compared to 2000 increased from 5056 l per cow to 7211 l per cow in 2012 (by 43%), which in comparison with the national average (by 41%) means a slightly lower milk yield, but a higher growth rate. According to Řezbová and Tomšík (2012) increasing milk yield as one of the intensification factor compensates continuously declining number of dairy cows in the Czech Republic and ensures sufficient milk production needed to supply domestic demand. The sale of milk in an average company increased by 45% from 2000, at the same time the state of dairy cows decreased to 91% of the state in 2000.With the largest increase in the NON-LFA (56%), it increased by 35% in the LFA M and by 37% in the LFA O compared to 2000. The yield of dairy cows classified by the farm size was higher for medium-sized farms than for small; the average growth rate was the same 3% in both categories. According to the type of production, the yield of dairy cows was higher in an average farm focused on crop production.

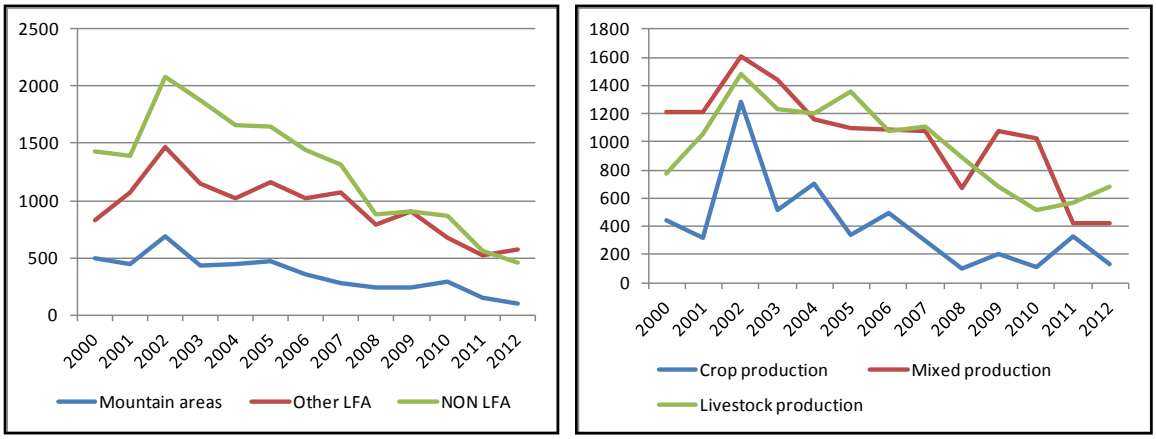
A significant long-term trend is to reduce the number of pigs. Foltýn and Zedníčková (2010) reported that the number of pigs decreased in all categories by an average of 40%. Reasons for that are primarily in reduced interest in breeding pigs that are not supported categories of animals in the EU. However, since the demand for pork has stagnated, lower domestic production has been compensated by increasing yield and increased imports of cheaper pork from abroad. The number of pigs in the average farm declined from 944 pieces to 445, i.e. by 53% since 2000. This is a more noticeable decrease than the national state of pigs, which dropped by 43% (CSO, 2014) in the monitored period.

The most significant decrease occurred in the mountain LFA (from 499 to 99 units, i.e. by 80%), followed by the NON-LFA (from 1432 to 456 animals – by 68%). The slowest decline in pig numbers occurred in the LFA O (by 30%). Classified by production type, the fastest decline in pigs occurred in farms specializing in crop production (Figure 2).

## 2. Development of profit and profitability

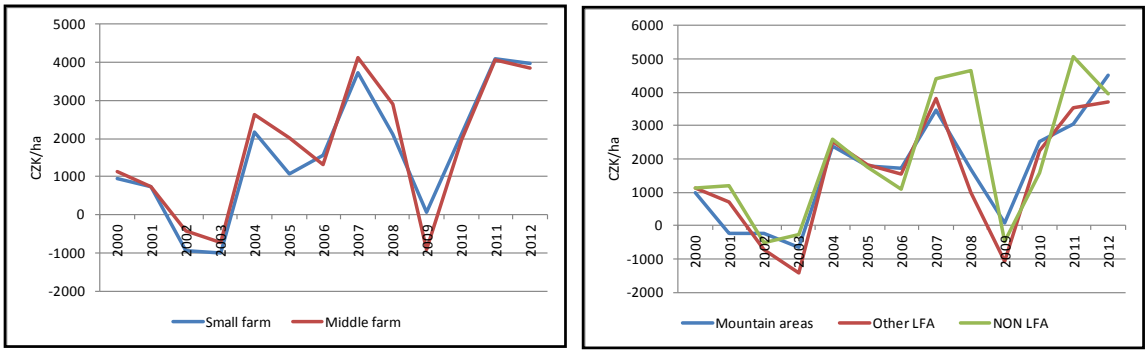
The overall indicator of management of each enterprise is the net profit/loss for the period. For the purpose of the analysis and to maintain the comparability of data, the profit before tax was monitored, adjusted per hectare of agricultural land. Profit in this form is an expression of both the efficiency and economics of the manufacturing process (Střeleček et al. 2011).

The development of the profit reported large fluctuations in different years. The highest profit per hectare of agricultural land for the entire period was achieved in the average farm in 2011 (4070 CZK/ha) and in 2007 (4034 CZK/ha), the loss occurred in 2002, 2003 and 2009. Prior to joining the EU, the largest profit was achieved outside




Source: Own survey of the sample farms

Figure 2: Development of pigs per farm in pieces.




Source: Own survey of the sample farms

Figure 3: Development of profit before tax.

the LFA area and the smallest was in the mountain LFA. After 2004, the higher profit was achieved by the LFA, except for the years 2007 and 2011 in which the greatest profit occurred out of the LFA. In these years, the economic results were significantly affected by exceptionally good external conditions of farming. The loss was always highest in the other LFA. Classified by farm size, the profit per hectare was generally higher in medium-sized enterprises, but in the last three years, the profit was higher in small farms. The loss in 2002 and 2003 was higher in small farms, but in the crisis year of 2009, the average small farm reported loss (Fig. 3). According to the type of production, the highest profit was achieved in farms with crop production achieved and the lowest in mixed production since 2004. Losses before 2004 were greatest for farms focused on crop production in the crisis year 2009; the loss was significantly higher in companies with mixed production.

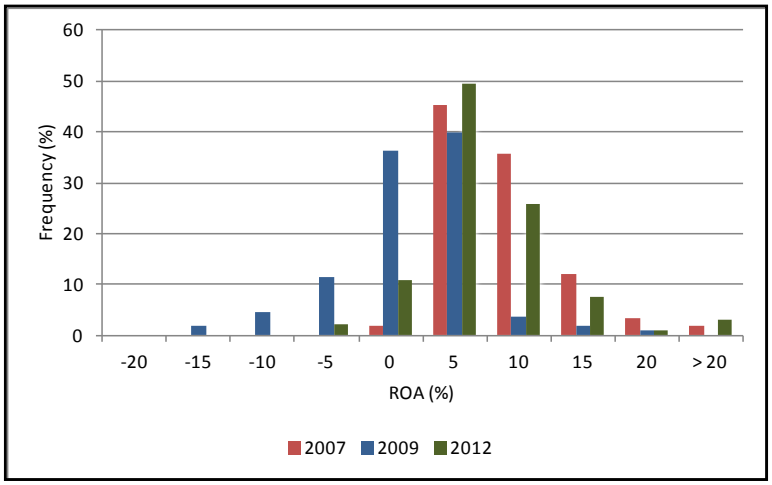
The most commonly used indicator of profitability is the return on assets (ROA). This indicator measures net profit for the period with total assets. In terms of farm development, only positive values are important. A negative rate of profit is always unsatisfactory. One of the important elements of the evaluation is to assess the economic performance of management efficiency, which is to assess the frequency distribution of farms by ROA. If the distribution of enterprises is platykurtic, significant reserves in the management exist within the real economic conditions. On the other hand, the leptokurtic distribution with low variability means that quantitative reserves are depleted in the management and change can only occur due to the qualitative conditions (Lososová and Zdeněk, 2013). If we compare the distribution of farms by size of income, then it is obvious that there were more than 50% of loss-making farms in the years 2002, 2003 and 2009, and only 2 % in 2007. It was 5% in 2011; in 2012 the number

of loss-making enterprises increased to 13% the same as in 2010. Flat shift of enterprises in direction for the worse, or vice versa for better economic outcomes highlights the significant influence of external factors, especially the prices and climatic conditions (Fig. 4).

### 3. The efficiency of production factors

Relation of revenues to area of farmland characterizes the intensity of production, the relation of revenues to average number of employees characterizes the labour productivity and the relation of revenues to assets characterizes the activity indicators. The intensity of production increased in the average enterprise by 4.1% per year, with the slowest growth in mountain areas (3.1%) and is lowest at around 80% of an average company. According to type of farming, the highest production occurred in farms with crop production, however with a slow growth (about 2.8% per year), the fastest growth occurred in the average company focused on livestock production which was still the lowest intensity of production. The average small farm reported the production of lower intensity (about 80% of the average), but it grew in average by 5.2% per year; the medium-sized farms reported production intensity higher by 10% compared to the average. It grew by an average rate of 4.2% per year.

Labour productivity classified by the LFA was the largest in the NON-LFA; decreasing with deteriorating conditions in all areas and increasing in all areas as quickly at an average rate of 7% per year. Classified to the type of production, the labour productivity was greatest in farms with crop production as well as the fastest growth rate (about 9 % per year) and the lowest in livestock production. According to the size, labour productivity increased at the same level




Source: Own survey of the sample farms

Figure 4: Distribution of farms by return on total assets

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Index 12/00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mountain areas | 676 | 705 | 700 | 666 | 820 | 844 | 910 | 1032 | 1107 | 1008 | 1209 | 1275 | 1442 | 2.13 |
| Other LFA | 733 | 842 | 824 | 771 | 1001 | 1052 | 1073 | 1271 | 1315 | 1166 | 1351 | 1566 | 1677 | 2.29 |
| NON LFA | 833 | 867 | 829 | 836 | 937 | 1017 | 1053 | 1244 | 1492 | 1307 | 1405 | 1746 | 1932 | 2.32 |
| Small farm | 785 | 853 | 881 | 814 | 1018 | 1054 | 1056 | 1293 | 1363 | 1203 | 1400 | 1672 | 1743 | 2.22 |
| Middle farm | 754 | 825 | 798 | 785 | 926 | 993 | 1033 | 1203 | 1363 | 1204 | 1326 | 1553 | 1743 | 2.31 |
| Crop production | 779 | 983 | 1001 | 848 | 774 | 1010 | 1057 | 1336 | 1543 | 1251 | 1595 | 1806 | 2125 | 2.73 |
| Mixed p. | 802 | 799 | 802 | 800 | 952 | 989 | 1025 | 1191 | 1369 | 1263 | 1340 | 1516 | 1667 | 2.08 |
| Livestock p. | 699 | 833 | 780 | 762 | 970 | 1012 | 1041 | 1212 | 1290 | 1138 | 1262 | 1515 | 1585 | 2.27 |
| Total | 758 | 829 | 804 | 786 | 939 | 1002 | 1037 | 1220 | 1363 | 1204 | 1349 | 1592 | 1743 | 2.30 |

Source: Own survey of the sample farms

Table 3: Development of labour productivity (thous. CZK/worker).

(of about 7% per year) in small and medium-sized enterprises (table 3). The causes of the increase in labour productivity were different in different areas; their effect on the change in labour productivity can be quantified using methods such as logarithms indices. In mountain areas, labour productivity increased during the period by 619 thousand CZK, due to reducing the number of workers. The impact of production was significantly lower than in other areas ($\Delta LP_R$ = 148 thousand CZK). The labour productivity growth in the LFA O can be explained mainly by increases in production ($\Delta LP_R$ = 559 thousand CZK) and a decrease in workers ($\Delta LP_E$ = 385 thousand CZK). The strongest production growth effect occurred in the NON-LFA, causing an increase in productivity of $\Delta LP_R$ = 650 thousand CZK and a decrease of the number of workers explaining the productivity growth of $\Delta LP_E$ = 450 thousand CZK. The impact on production to labour productivity growth was significantly higher in small farms ($\Delta LP_R$ = 897 thousand CZK). A decrease of the number of workers was the lowest. This could be explained by the increase in labour productivity since 2000 by $\Delta LP_E$ = 60 thousand CZK.

The ratio of asset turnover for the average enterprise stagnated, with a slight decline in this indicator in the mountain LFA. The highest value was reported in the NON-LFA (0.747) decreasing towards worse areas (0.569 in the mountain LFA). A similar development is seen in farms classified by the type of farming, the fastest turnover of assets in farms with crop production and the slowest in livestock production. For small farms, the rate of turnover assets increased until 2009 and slower in subsequent years compared to medium-sized farms.

## 4. Indebtedness and liquidity

Indebtedness of the average farm in all areas was decreasing (table 4), the average annual change in mountain LFA was −0.7 percentage point; 1.9 pp in LFA O, −3 percentage points in the NON-LFA. The difference in the level of indebtedness among areas were insignificant, the value of total debt was 34% in the NON-LFA, 37.9% in the other LFA and 41.2% in the mountain LFA in 2012. The highest value of debt classified by the type of farming was reported in farms with mixed production and the lowest in farms with crop production. The biggest average annual change was reported for farms focused on livestock production (−3.4 pp). The debt was higher in small farms, decreasing faster by 4 percentage points in the average and by 2 percentage points a year in medium-sized enterprises.

The value of current ratio for the average farm in the NON-LFA was 5.37 in 2012, 3.56 in LFA O and 4 in the mountain LFA. The values of current liquidity oscillated and any relation between LFA areas cannot be observed in all the years in all areas, however, it exceeds the recommended interval (table 5). For the quick ratio, acceptable values range from 1 to 1.5. Quick ratio values in 2005 ranged in the interval (nearly its lower limit in 2003), in the following years, the liquidity improved with minor oscillations. Farms with crop production were significant for fluctuations of the quick ratio; in 2003 it fell below the recommended limit, and since 2007 it significantly exceeded the upper limit. The quick ratio of farms classified by size ranged at the upper end, only small farms were below the lower limit in the period 2002 – 2004.

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Index 12/00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mountain areas | 45 | 45 | 42 | 43 | 42 | 39 | 41 | 40 | 39 | 39 | 41 | 36 | 41 | 2.13 |
| Other LFA | 48 | 43 | 42 | 39 | 37 | 37 | 39 | 39 | 40 | 40 | 36 | 36 | 38 | 2.29 |
| NON LFA | 49 | 45 | 43 | 39 | 39 | 40 | 38 | 36 | 37 | 39 | 36 | 33 | 34 | 2.32 |
| Small farm | 67 | 61 | 56 | 53 | 55 | 48 | 46 | 46 | 45 | 41 | 41 | 39 | 41 | 2.22 |
| Middle farm | 44 | 41 | 39 | 37 | 36 | 37 | 37 | 36 | 37 | 39 | 35 | 33 | 35 | 2.31 |
| Crop production | 34 | 35 | 28 | 43 | 30 | 25 | 29 | 30 | 37 | 38 | 36 | 31 | 30 | 2.73 |
| Mixed p. | 47 | 41 | 44 | 38 | 41 | 40 | 41 | 39 | 36 | 37 | 37 | 37 | 42 | 2.08 |
| Livestock p. | 52 | 49 | 43 | 40 | 40 | 39 | 39 | 38 | 42 | 42 | 38 | 35 | 34 | 2.27 |
| Total | 48 | 44 | 42 | 40 | 39 | 39 | 39 | 38 | 39 | 39 | 37 | 35 | 37 | 2.30 |

Source: Own survey of the sample farms

Table 4: Development of indebtedness (%).

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Index 12/00 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mountain areas | 3.68 | 3.70 | 3.41 | 2.73 | 3.25 | 4.14 | 3.87 | 4.43 | 4.04 | 3.98 | 4.30 | 4.51 | 4.00 | 1.09 |
| Other LFA | 4.54 | 4.15 | 3.64 | 3.23 | 3.26 | 3.77 | 4.08 | 3.67 | 3.19 | 3.43 | 3.49 | 3.57 | 3.56 | 0.78 |
| NON LFA | 2.86 | 3.49 | 3.38 | 3.03 | 3.01 | 3.31 | 3.57 | 4.07 | 4.13 | 3.76 | 3.54 | 4.78 | 5.37 | 1.88 |
| Small farm | 2.68 | 3.04 | 2.49 | 1.85 | 2.23 | 3.61 | 3.61 | 3.91 | 3.56 | 3.81 | 3.43 | 3.84 | 3.74 | 1.40 |
| Middle farm | 3.81 | 3.93 | 3.82 | 3.44 | 3.37 | 3.55 | 3.83 | 3.98 | 3.74 | 3.61 | 3.75 | 4.43 | 4.46 | 1.17 |
| Crop production | 2.76 | 2.98 | 2.86 | 2.44 | 3.16 | 3.59 | 3.78 | 4.63 | 4.05 | 4.29 | 3.99 | 5.14 | 6.25 | 2.26 |
| Mixed p. | 4.02 | 4.08 | 3.54 | 3.23 | 3.00 | 3.40 | 3.77 | 3.71 | 4.12 | 3.53 | 3.29 | 3.64 | 3.44 | 0.85 |
| Livestock p. | 3.30 | 3.62 | 3.57 | 3.00 | 3.24 | 3.69 | 3.81 | 4.06 | 3.23 | 3.55 | 4.00 | 4.38 | 4.41 | 1.34 |
| Total | 3.58 | 3.77 | 3.49 | 3.06 | 3.13 | 3.56 | 3.79 | 3.97 | 3.70 | 3.66 | 3.63 | 4.20 | 4.22 | 1.18 |

Source: Own survey of the sample farms

Table 5: Development of current ratio.

## 5. Evaluation of the financial health

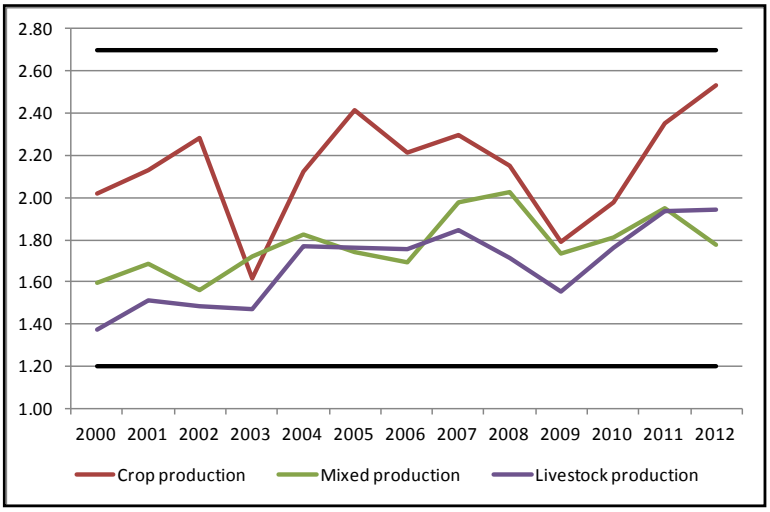
The Altman's model is one of the most widely used models for assessing the financial health of a company. Its purpose is that it provides different weights for different areas of the financial health of a company. In practice, this index accurately predicts the financial difficulties in a two-year prediction. For this reason, it is a good index to monitor the evolution in time. For an average farm we observe an increasing trend of this indicator, while the average farm during the period was ranging within thresholds. Classified by the LFA, the development of the Altman Z-score were very similar with the highest values in an average farm in the NON-LFA. According to the size of a farm, the developments of values of the Z-score were also very similar, with higher values reached by medium-sized farms, small farms in 2002 and 2003 reached the lower limit. Figure 5 shows the evolution of the Altman Z-score by type of production. The average company specializing in crop production achieved (excluding the crisis years) significantly higher values of the Z-score; other types of production followed the evolution of an average enterprise (Figure 5).

The IN05 Index of the Czech economists Mr. and Mrs. Neumaier has been considered as the most appropriate for the evaluation of Czech enterprises. The introducing presentations at the conference (Neumaier and Neumaierová, 2005) showed that the overall success of the index is 80%, which is relatively high value, since the result were compared to a sample of 1526 Czech companies. The average farm was reported in the grey zone with the exception of the crisis years of 2002, 2003 and 2009; it means that with 50% probability of bankruptcy and creating value in 70%. Upper limit was exceeded only in the last two years by the average farm with crop production that is a 92% probability of not going bankrupt and create value in 95%. Classified by the LFA, the lowest average value of the IN05 was reported in other LFA. Developments of farms by their size were very similar, with higher values reached by middle-sized farms.

The G-index takes into account the specificities of agriculture. According to Kopta (2009), the G-index is very effective in the evaluation of farms. According to this indicator, farms are classified as prospering ($G \geq 1.8$), average ($-0.6 > G > 1.8$) and unprofitable ($G \leq -0.6$). In our sample, the average farm came under the lower limit of the G-index only in 2002 and 2003, but the upper limit was not approached. The largest value of the G-index was reported in the average farm in 2012. According to the LFA classification, the best values for this indicator, were reported in the mountain LFA since 2004 and the lowest values were reached in other LFA (Fig. 6). Classified by the production type, the development was average in all types of production. In 2002, farms with livestock and mixed production got under the lower limit, similarly, for livestock production in 2003. The highest G-index throughout the period was reported in farms with crop production. Small farms reported significantly worse values of the G-index between 2002 and 2003, but in the other years they were higher than medium-sized enterprises (table 6).

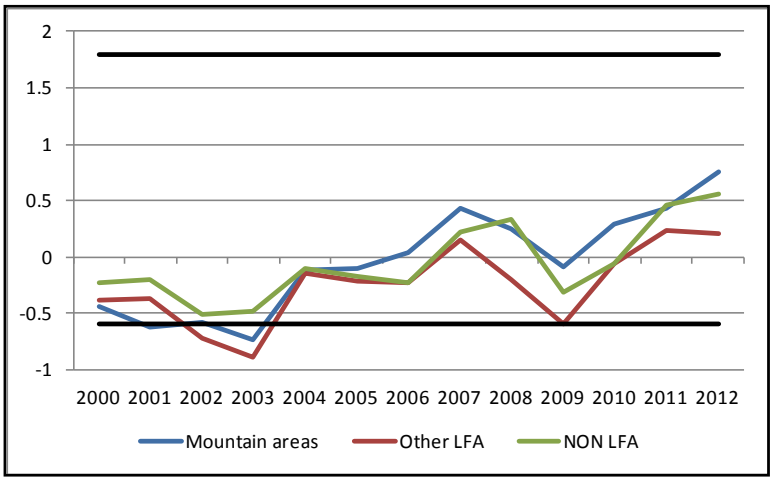
## 6. Dependence on subsidies

The average growth rate of subsidies reached 9% per year during the period with the largest increase of subsidies converted per hectare of agricultural land after the accession to the EU, and the most dynamic increase in the first three years




Source: Own survey of the sample farms

Figure 5: Development of the Altman Z-score model in the average farm by production type.




Source: Own survey of the sample farms

Figure 6: Development of the G-index in average enterprise by LFA.

| **Vulnerable** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
|---|---|---|---|---|---|---|
| Z-score | 7.8 | 13.8 | 19.6 | 18.4 | 14.3 | 15.1 |
| IN05 | 13.9 | 31.0 | 50.9 | 27.6 | 18.7 | 23.7 |
| G-index | 7.8 | 16.4 | 37.5 | 15.3 | 12.1 | 8.6 |
| **Grey zone** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
| Z-score | 70.4 | 67.2 | 61.6 | 61.2 | 58.2 | 59.1 |
| IN05 | 40.0 | 42.2 | 35.7 | 41.8 | 33.0 | 39.8 |
| G-index | 87.0 | 78.4 | 58.9 | 79.6 | 78.0 | 82.8 |
| **Prosperous** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** |
| Z-score | 21.7 | 19.0 | 18.8 | 20.4 | 27.5 | 25.8 |
| IN05 | 46.1 | 26.7 | 13.4 | 30.6 | 48.4 | 36.6 |
| G-index | 5.2 | 5.2 | 3.6 | 5.1 | 9.9 | 8.6 |

Source: Own survey of the sample farms

Table 6 Vulnerable and prosperous farms according to the model (in %).

| | Slope (b) | Intercept (a) | Correlation coefficient | Coefficient of determination |
|---|---|---|---|---|
| LFA M | 0.366 | −745.1 | 0.732 | 0.536 |
| LFA O | 0.391 | −378.1 | 0.574 | 0.330 |
| NON-LFA | 0.484 | −118.9 | 0.609 | 0.371 |
| Small farm | 0.487 | −1094.8 | 0.718 | 0.515 |
| Middle farm | 0.400 | −93.2 | 0.597 | 0.357 |
| Crop production | 0.594 | −500.6 | 0.614 | 0.377 |
| Mixed production | 0.379 | −150.5 | 0.584 | 0.341 |
| Livestock production | 0.371 | −303.9 | 0.663 | 0.439 |
| Total | 0.418 | −305.8 | 0.633 | 0.400 |

Source: Own survey of the sample farms

Table 7: Dependence of profit on subsidies in average farm in 2000-2012.

after the accession. In 2012, the subsidies for the average enterprise reached to 8476 CZK/ha, with the fact that most grants were received by an average farm in the mountain LFA, where the average growth rate was 10.4%. The slowest growing subsidies were revealed for an average farm focused on crop production (6.6%). The cost/revenue ratio adjusted for subsidies can be described as an index of dependence on subsidies, the value above 100% indicates what proportion of the company's costs are to be covered by subsidies. In subsequent years, this figure varies considerably, the average increase was 0.8 percentage points in the mountain LFA, 0.3 in the other LFA and 0.2 percentage points in the NON-LFA. A similar development was reported in farms classified according to size and type of farming; only farms specializing at crop production showed a slight decrease in this indicator.

The highest dependence of the profit on the amount of subsidies was evident in the average farm in the mountain LFA, where 53.6% of the profit variability can be explained by the variability of subsidies; however, an increase in subsidies by 1 CZK increased the profit by 0.37 CZK (table 7). The correlation coefficient of the effect of subsidies on profit ranges from 0.57 to 0.73, which is a relatively high degree of dependence. Farms focused on crop production were the least dependent on subsidies, so that the proportion of subsidies that make up the profit was the highest there, almost 60%.

## Conclusion

Development of economic indicators in farms since 2000 is characterized by the growth of production, which increased in 2012 by more than 58% in an average farm, which is a significantly higher increase than we can see in the monitored period with the agricultural production in the CR - by 21% (CSO, 2013). It is possible to explain this disharmony by the narrowing of the sample by long-term non-profitable subjects, showing the unwillingness to take part in further investigation and thus the sample includes prevailingly developing subjects showing the increase of production. The production volume grows faster in a smaller company than in a middle-sized one. According to the orientation of production the production grows faster in a company concentrated on a vegetable production and according to LFA it grows faster in an average company operating outside LFA. The slowest growth in production was reported in mountain LFA. Production growth is mainly due to increased revenues from crop production, the share of income increased in all categories of enterprises, while the share of income from livestock production and non-agricultural production was declining. In the NON-LFA, the most significant change occurred in the structure of production, with the fastest growing share of crop production and non-agricultural production and the share of income from livestock production markedly decreasing. The growth of labour productivity was a significant trend in the research period, which was influenced primarily by reducing the number of workers more than the growth of production. Labour productivity in current prices in a monitored complex increased to 230% in 2000 (in Czech agriculture it is 215%) with an average growth rate of 7.2% annually. The number of employees in a selective complex of agricultural companies decreased to 69% from 2000, which means the more moderate

decrease than in the agriculture in general, where it decreased to 56% of the state of 2000. The most significant decrease of workers could be seen in mountainous LFA (to 54% of the state of 2000). The slowest decrease of workers is evidently in a small company (to 95% of the state of 2000). In small companies there is not enough space for savings of workforce.

Due to the high dependency of profit in agriculture on environmental conditions, the development of indicators is characterized by significant fluctuations. The greatest loss occurred in 2002, 2003 and 2009. An average farm in other LFA was the most vulnerable in this respect. Before joining the EU, an average small farm had lower profit and higher loss than a medium-sized farm, since 2004 the situation improved, results of operations were at a similar level to that of a medium-sized farm. Classified by type of farming, the lowest profits and highest losses were reported in farms with mixed production. Evaluating the financial health of farms revealed farms in other LFA as the most vulnerable. Classification by the size did not reveal any major differences in farms. Classified by the type of production reported more favourable values in farms focused on crop production, although the differences were not significant. The dependence of the average farm on subsidies manifested itself most strikingly in the mountain LFA. This means the stability of the economic indicators of a farm in the crisis years. Crop production farms were the least dependent on subsidies with the greatest effect of changes in external economic conditions and the level of profit/loss was very sensitive to these changes.

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