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Obsah

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Economic Value of Recreation – Determinants Influencing the Willingness to Pay in Natural Region with Low-Intensity Agriculture

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Anotace

Předkládaný příspěvek se zaměřuje na studium nepřímé ekonomické hodnoty rekreace v přírodních oblastech s nižší intenzitou zemědělství. Mezi vybrané studované oblasti patří regiony, kterým zpřísněná ochrana přírody nedovoluje extenzivní formy hospodaření, NP Šumava a NP Podyjí. Cílem výzkumu je stanovit faktory, které ovlivňují nepřímou hodnotu rekreace, stanovenou na základě metody ochoty platit. Mezi studované faktory patří pohlaví, věk, vzdělání a denní výdaje během pobytu ve studovaných regionech. Data jsou zpracována pomocí ordinální logistické regrese.

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Klíčová slova

Přírodní turismus, národní park, ochota platit, logistická regrese, ordinální model.

Abstract

The presented article deals with an indirect economic value of recreation in natural areas with a low-intensity agriculture. A high focus on nature preservation does not allow the high-intensity agriculture in some region. The conducted research is focused on two regions: Šumava National Park and Podyjí National Park. The aim of conducted research is to determine factors influencing the tourists´ willingness to pay. Data gathered from tourists´ survey are elaborated by ordinal logistic regression. Among studied factors are sex, age, education and daily expenditures per person during a stay.

Pieces of knowledge introduced in this paper resulted from a solution of the institutional research intention MSM 6046070906 „Economics of resources of Czech agriculture and their efficient use in frame of multifunctional agri-food systems“ and the Internal Grant Agency (IGA) of the Czech University of Life Science in Prague, Registration Number 201111110049.

Key words

Nature based recreation, national park, willingness-to-pay, logistic regression, ordinal models.

Introduction

Agriculture landscape makes a significant part of nature-based tourism. A strong preservation of nature does not allow high-intensity agriculture is some regions. This is a case of protected landscape areas and national parks. In the Protected Area Management Categories adopted by the World Conservation Union, a national park is defined as an area managed mainly for ecosystem protection and recreation (Puhaka, 2008). Since the first national parks were designed, they have been given a double role both as the destinations of nature conservation recreation and tourism. Although national parks have had recreational and tourist goals since the founding of the park movement, many stakeholders have debated the interaction between natural conservation and tourism. Berzina-Livina (2008) pointed out that nature-based tourism creates 50% of all international tourism in Europe and has been increasing between 10 and 30% per year, with global spending increasing on average by 2% per annum. Eagles (2002) confirms that nature-based tourism has an increasing tendency.

In recent years, the role of protected areas in society has been re-evaluated. The cost of preservation competes with the public need and increasing demand for land and sources places pressure on governments (Walpole et al., 1999). Wood (2006) summarizes the findings of several pieces of research and points out that parks often supply the most important part of the nature-based tourism experience yet captures very little of its economic benefits. The majority of protected areas charge low entrance fees and these revenues cover only a part of the costs of management. Consequently, government lacks hard fiscal evidence to justify the allocation of public funds to park management despite its importance to tourism. Walpole et al. (1999) adds that protected areas do not generate significant direct revenues.

The value of recreation is commonly determined by travel cost method and by contingent valuation methods; especially willingness to pay (WTP) approach is commonly applied. The contingent valuation methods are used in several studies for estimating recreation value (e.g. Chen et al., 2004; Wielgus et al., 2009; Scarpa et al., 2000). Togridou et al. (2006) analyzed determinants of visitors´ willingness to pay in the National Marine Park of Zakynthos. Using logistic regression they realized that visitors´ characteristics were not significant determinants of visitors´ responses to the payment questions. Nationality was either significant parameter in their model.

Vervič - Slaber-Erker (2008) analyzed recreation in Volčji Potok landscape area in Poland and future possible development scenarios. They found out that visitors´ willingness to pay is positively influenced by respondents' income; consciousness; concerns about unplanned development; perception of probable damage to the area; and perception of natural and cultural heritage.

Hakim at al. (2010) studied the economic value of nature-based tourism in Rawapening in Indonesia and found out that predictors of income and education were statistically significant in developed logit model, whereas predictors of age and gender were not statistically significant.

Mmopelwa et al. (2007) found out, in their research of visitors´ willingness to pay for park fees in Moremi Game Reserve in Botswana, that the WTP was not related to age, gender and visitors´ experience. Nevertheless, the WTP was influenced by expenditures for the trip.

Kim at al. (2007) analyzed determinants of willingness-to-pay in Changdeok Palace in South Korea. The results of their research elaborated by logistic regression proved income as statistically significant parameter of WTP; while predictor of age, education, and job were not statistically significant. Ellingneson - Seidl (2007) analyzed the determinants in Eduardo Avaroa Reserve in Bolivia and they concluded that nationality and income were not significant determinants. Lee - Mjelde (2007) valued ecotourism in Korea and realized that parameters of age, gender, education where not statistically significant.

Lee – Han (2002) estimated the use value of tourism in national parks in Korea. They studied five national parks and they found out that sex, education and age were statistically significant only in one of the studied parks.

Above mentioned studies do not provide obvious relation between tourists´ willingness to pay and tourists´ personal characteristics. Conducted research aims to determine key factors influencing tourists´ willingness to pay in national parks in the Czech Republic. The main research question to answer is: "What are the factors influencing the tourists´ willingness to pay for recreation in national parks?"

Materials and Methods

To evaluate the recreation value the willingness to pay approach is applied. The take-it-or leave-it approach with follow-up is of elicitation format was used (the elicitation formats are discussed in Antouskova, 2012). The take-it-or-leave-it with follow-up method supposes an additional question to accepting/rejecting the initial bid. This process forms the intervals in dependent variable, so ordinal models are applicable. If there is only one additional bid, then four intervals are created and the probabilities for these sequences are given as follows:

- "no" then "no": $P = Prob\ (W_n < k_{nl}) = \Phi\ ((k_{nl} – W)/б)$;
- "no" then "yes": $P = Prob\ (k_{nl} < W_n < k_n) = \Phi\ ((k_n – W)/б) - \Phi\ ((k_{nl} – W)/б)$;
- "yes" then "no": $P = Prob\ (k_{nl} < W_n < k_{nu}) = \Phi\ ((k_{nu} – W)/б) - \Phi\ ((k_n – W)/б)$;
- "yes" then "yes": $P = Prob\ (W_n > k_{nu}) = 1 - \Phi\ ((k_{nu} – W)/б)$,

where W_n represents the true willingness to pay of person n, k_n is a prompt, k_{nu} is the second prompt

if the person answers "yes", k_{nl} is the second prompt if the person answers "no", Φ *(.)* is standard cumulative normal function.

Studied areas

The Podyji National Park is the smallest of national parks in the Czech Republic (63 km2). It extents a canyon of the Dyje River, which is characterized by deeply incised meanders, cliffs and stone-seas. It is the last well-preserved river valleys in the Central Europe. The predominant part of national park is covered by grass. Meadows and grasslands are situated especially along the Dyje River. These areas are handled by the National Park Authority, which intends to preserve and extend grasslands. Other areas are covered by vineyards. In the east, there are mooreland and steppe grasslands situated.

Šumava National Park is situated in the South-West of the Czech Republic with the area of 680 km^2. The national park protects a typical ecosystems of the central European mountain countryside, forests, glacial lakes, peat bogs and mountain meadows. A relief of forest and non-forest enclaves are typical for a landscape of national park. Non-forest areas make around 15% of all areas, however only 4.5% are farmed. The Šumava National Park Authority intends to support and conversion of non-forest areas into meadows and grass lands. The plant production is mainly focused on fodder and pasture land.

Data collection

Data were collected in Šumava National Park and Podyjí National Park during the summer 2011. Before asking valuation question, the interviewer made sure, that respondents are familiar with the value of recreation to be evaluated. Tourists without proper knowledge of the value (e.g. being in studied areas for the first time and just in the beginning of their stay) were excluded from other questioning.

Tourists were asked a following valuation question: "What maximum amount are you willing to pay for being in this area and still having the same utility from the visit?" The initial bid was CZK 100 per day. If the respondent rejected, he/she was offered a second bid at a half of initial amount (CZK 50). A similar process was applied, if the respondent accepted the initial offer. In this case they were offered the double amount of the initial bid (CZK 200).

Tourists were also asked a series of socio-economic questions, including the respondent's gender, age, educational level, spending during their visit. In total, 491 observations were elaborated.

Logit model specification

The data gathered by questioning tourists in studied areas enable to indicate the cut points for prepared ordinal model (for more see Hilbe, 2009). The cut points of ordinal model are given by 50 CZK, 100 CZK, 200 CZK. This enables to create five intervals of willingness to pay answers: 1–49 CZK; 50–99 CZK; 100–199 CZK; 200 and more. The willingness to pay for admission fee is a depended variable in developed models.

The independent variables in proposed models correspond to the factors that may influence tourists´ decision about their willingness to pay (sex, age, education, and daily expenditures per actual visit). The general model function is characterized as follows:

$\ln (p/(1-p)) = \alpha + \beta 1\,(\text{sex}) + \beta 2\,(\text{age}) + \beta 3\,(\text{level of education}) + \beta 4\,(\text{daily expenditures per visit}) + e$, where

ln (p/ (1–p)) is logit or log odds ratio of dependent variable, α is constant, β is coefficient of dependent variable, and *e* is error term.

The independent categorical variables are subsequently coded according to the studied variables. The sex is coded as: m – man, reference category is women. The age is coded as: age group 0–19 (-20); age group 20–29 (-30); age group 30–39 (-40); age group 40–49 (-50); age group 50–59 (-60). The reference category of age is an age group with tourists 60 years old and older. The parameter of education is coded as: without education (1); elementary education (2); high school education (3); technical institute/college (4). The reference category for education is tourists with university degree. Expenditures, which stand for daily expenditures per actual visit, are coded as follows: spendings up to 499 (1); spendings 500 – 999 CZK (2); spendings 1,000 – 1,499 CZK (3); spendings 1,500 – 1,999 (4). The reference category group are tourists spending more than 2,000 CZK a day on their trip in national parks.

Chi – square test, Cox&Snell R Square and Nagelkerke R Square and McFadden test are applied. Cox & Snell R Square, Nagelkerke R Square and – 2 log likelihood are for guidance only since they can take moderate or low levels, even when the estimated model could be appropriate and useful, due to the fact that the dependent variable is categorical.

Results

1. Šumava National Park region

Tourists coming to Šumava National Park are mainly in the age category 20–29 years (37.3%), and 30–39 years (22.0%). Tourists coming to studied area have obtained above all high-school education (39.1%), and 39.7% of tourists have obtained a university degree. Tourists spent 1,654 CZK per their visit in average. The highest costs are spent for accommodation and boarding. Most tourists spend between 500-999 CZK per day/person during their stay in Šumava National Park (51.4%). There are 29% of tourists spending up to 500 CZK day/person; and 13.8% of tourists spending 1,000-1,499 CZK day/person.

There are 20.0% of tourists who are not willing to pay any hypothetical entrance fee 34.3% of tourists are willing to pay up to 49 CZK. 31.4% of tourists are willing to pay more than 50 CZK and less than 99 CZK. 23.6% of tourists are willing to pay in the interval 100–149 CZK. Only 3.6% of tourists are willing to pay between 150 and 199 CZK, and 7.1% of tourists are willing to pay more than 200 CZK.

Willingness to pay in Šumava NP

The results proved the tourists´ spendings are statistically significant predictor in developed model. Tourists spending on their trip more than 2,000 CZK (day/person) are 1.02 times more likely to be willing to pay higher admission fee for a park entrance fee than those tourists spending on their trip up to 500 CZK. Tourists spending on their trip over 2,000 CZK are also 1.09 times more likely to pay higher admission fee than tourists spending between 500 and 999 CZK; 1.07 times more likely than tourists spending 1,000 - 1,499 CZK; and 1.08 more likely times than those spending 1,500 - 1,999 CZK.

The analyzed parameter of age proved that tourists in the age categories under 60 years are more likely to be willing to pay for admission fee than those tourists older than 60 years. The only statistical significant age group is indicated to the age category up to 20 years. Tourists younger than 20 years old are 6.0 times more likely to be willing to pay higher entrance fee than those 60 years old and older.

The parameter of sex is not statistically significant in the developed model, however, the results show that women tends to be willing to pay higher admission fee than men do. The parameter of education indicates that tourists with elementary education and without education are more likely to be willing to pay higher admission fee than those

		Estimate	Std. Error	Sig.
Threshold	[interval = 1,00]	-2.508	1.648	0.128
	[interval = 2,00]	-0.962	1.647	0.559
	[interval = 3,00]	0.703	1.634	0.667
	[interval = 4,00]	1.18	1.634	0.47
Location	Sex (m)	-0.314	0.324	0.333
	Age (-20)	1.794	1.011	.076*
	Age (-30)	1.373	0.89	0.123
	Age (-40)	1.173	0.885	0.185
	Age (-50)	1.407	0.952	0.14
	Age (-60)	1.503	0.943	0.115
	Education (1)	1.075	1.317	0.414
	Education (2)	1.058	0.56	.059*
	Education (3)	-0.156	0.378	0.681
	Education (4)	-0.216	0.594	0.716
	Spendings (1)	-3.873	1.428	.007**
	Spendings (2)	-2.432	1.399	.082*
	Spendings (3)	-2.704	1.46	.064*
	Spendings (4)	-2.712	1.576	.085*

**Statistical significance α = 0.05
*Statistical significance α = 0.1
Source: Own calculations

Table 1: Logit model parameters of Willingness to pay (Šumava NP).

Model Fitting Information					Pseudo R-Square	
Model	-2 Log Likelihood	Chi-Square	df	Sig.	Cox and Snell	0.191
Intercept Only	290.358				Nagelkerke	0.203
Final	261.159	29.199	14	0.01	McFadden	0.076

Source: Own calculations

Table 2: Logit model tests.

	Estimate	Estimate	Std. Error	Sig.
Threshold	[interval = 1,00]	-4.24	1.421	0.003
	[interval = 2,00]	-3.339	1.41	0.018
	[interval = 3,00]	-0.767	1.379	0.578
	[interval = 4,00]	-0.505	1.38	0.715
Location	Sex (m)	-0.727	0.332	.029**
	Age (-20)	-2.808	1.197	.019**
	Age (-30)	-2.933	0.959	.002**
	Age (-40)	-2.299	0.968	.018**
	Age (-50)	-2.529	1.006	.012**
	Age (-60)	-3.071	1.018	.003**
	Education (1)	2.379	1.419	.094*
	Education (2)	0.633	0.579	0.275
	Education (3)	0.496	0.363	0.173
	Education (4)	0.395	0.581	0.497
	Spendings (1)	-0.984	1	0.325
	Spendings (2)	-0.56	0.994	0.573
	Spendings (3)	-0.22	1.038	0.832
		-0.684	1.217	0.574

**Statistical significance α = 0.05
*Statistical significance α = 0.1
Source: Own calculations

Table 3: Logit model parameters of Willingness to pay (Podyjí).

with university degree, however, those tourists with high school education and those with technical institute are less likely to be willing to pay higher admission fee.

2. Podyjí National Park

Tourists coming to Podyjí National Park are mainly in the age category 20–29 years (36.4%), 30–39 years (27.8%) and 40–49 years of age (17.2%). The research shows that most tourists have at least high-school education (72.2%), from whom 36.4% of tourists have obtained a university degree. There are 21.9% of tourists are not willing to pay any hypothetical entrance fee. There are 29.1% of tourists willing to pay up to 49 CZK. 18.5% of tourists are willing to pay more than 50 CZK and less than 99 CZK. There are 42.4% of tourists willing to pay in the interval 100–149 CZK. Only 2.0% of tourists are willing to pay between 150 CZK and 199 CZK, and 7.9% of tourists are willing to pay more than 200 CZK.

There are 33.8% of tourists spending up to 500 CZK. There are 18.5% of tourists spending 500-999 CZK day/person, and 42.4% spending 1,000-1,499 CZK.

Developed model of willingness to pay in Podyji National Park showed that tourists´ spendings are not a statistically significant predictor. Tourists spending more than 2,000 CZK a day are more likely to be willing to pay higher admission fee then those tourists with lower expenditures on their trip per day.

The developed model proved that women are 1.9 times more likely to pay higher admission fee than men do. The predictor of age is also statistically significant parameter in developed model. Tourists

Model Fitting Information					Pseudo R-Square	
Model	-2 Log Likelihood	Chi-Square	df	Sig.	Cox and Snell	0.157
Intercept Only	303.326				Nagelkerke	0.169
Final	277.78	25.546	15	0.043	McFadden	0.065

Source: Own calculations

Table 4: Logit model tests.

up to their 20 years old are 1.1 times more likely to be willing to pay higher entrance fee than tourists 60 years old and older. Similarly probability may be identified in all other age groups, all tourists younger than 60 years are 1.1 times more likely to be willing to pay higher admission fee.

Analyzing the parameter of education, the only statistically significant group is tourists without education. These tourists are 4.6 times more likely to be willing to pay higher admission fee than tourists with university degree. Tourists with other than university degree also tend to be willing to pay higher admission fee than those with university degree.

Conclusion

Willingness-to-pay is one of a methods used for evaluation recreation value in nature based areas. This method supposes questioning tourists about willingness to pay for natural resources used for recreation. The data gained for such as questioning are often elaborated by logistic regression. The analyzed natural areas with a high focus on nature preservation and low-intensity agriculture in the Czech Republic are Podyjí National Park and Šumava National Park. The results proved that tourists are willing to pay for hypothetical admission fee. The mean value of such an admission fee is 100 CZK (person/day).

To study factors influencing tourists´ willingness to pay, two models of ordinal logistic regression are developed. Even if the models themselves are statistically significant, not all of all studied parameters are statistically significant. The parameter of spendings is statistically significant only in the model of Šumava NP. However, the same tendencies can be seen in both models, that means that tourists spending more 2,000 CZK a day are more willing to pay higher entrance fee than tourists spending less.

Both models prove that women tend to be more willing to be higher admission fee than men do. However, this parameter is statistically significant only in the model of Podyjí NP.

On the contrary, the parameter of age does not show similar tendencies. This parameter is statistically significant only in NP Podyjí. Similarly, the parameter of education does not show the same tendencies.

The results of conducted research in the Czech Republic proved the disunity in factors influencing tourists´ willingness to pay. This confirms results of previous studies in which such as disunity is seen.

The results of conducted research may be influence by the number and structure of respondents. Nevertheless, methods used in presented research are applicable, and may be used for higher sample of respondents in other natural and agricultural regions for evaluating indirect economical value of recreation, consumer surplus and factor influencing respondents' willingness to pay.

Acknowlegdement

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Competitiveness of Domestic Production of Poultry Meat on the EU Market and on the World Market

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Anotace

Zpracovaný článek poskytuje základní přehled o vývoji produkce a obchodu v případě drůbežího masa v ČR. Cílem vlastní analýzy je identifikace hlavních vývojových trendů a tendencí formujících vývoj české produkce a obchodu v případě drůbežího masa. Z výsledků analýzy lze vypozorovat v čase rostoucí růst domácí poptávky po drůbežím mase (zejména mase kuřecím), a dále pak i určitou míru stagnace v oblasti tuzemské produkce, jejíž tempo růstu je výrazně nižší v porovnání s tempem růstu vlastní spotřeby. Tuzemský trh se v průběhu let stává více závislým na importech drůbežího masa zejména ze zemí EU. Záporné saldo obchodní bilance České republiky ve vztahu k partnerským zemím výrazně vzrostlo. Co se týká komparativních výhod českého obchodu s drůbežím masem, ty se v čase postupně více a více vytrácejí – respektive se prohlubuje komparativní nevýhoda a to jak ve vztahu k zemím EU, tak i ve vztahu ke třetím zemím. Komparativní výhody jsou schopné si udržet pouze některé sub-agregace, které jsou navíc charakteristické nízkým stupněm zpracování.

Klíčová slova

Drůbeží maso, produkce, obchod, trh EU, trh světový, komparativní výhoda.

Abstract

The article provides a basic overview of the development of production and trade in the case of poultry meat in the Czech Republic. The goal of the actual analysis is to identify the main developmental trends and tendencies forming the development of Czech production and trade in the case of poultry meat. From the results of the analysis, we can observe the increasing growth in time of domestic demand for poultry meat (primarily chicken meat), and further, also a certain level of stagnation in the area of domestic production, whose rate of growth is significantly lower as compared to the rate of growth of actual consumption. In the course of the years, the domestic market is becoming more dependent on imports of poultry meat primarily from EU countries. The negative trade balance of the Czech Republic in relation to partner countries increased significantly within the analyzed period. As far as the comparative advantages of Czech poultry meat trade are concerned, those are gradually fading away more and more in time – or rather, the comparative disadvantage is deepening, both in relation to the countries of the EU, as well as in regard to third countries. Only some sub-aggregations are capable of maintaining comparative advantages, which are additionally characterized by a low level of processing. This paper was supported by the institutional research intentions MSM 6046070906.

Key words

Poultry meat, production, trade, EU market, world market, comparative advantage.

Introduction

Within recent years, the global market in agricultural and food products has been undergoing very dynamic development. The demand for agricultural products is continuously growing. The source of the actual growth in demand is not only the growth in population (Jeníček, 2010), but also the continual growth of the purchasing power of a significant part of the population (Jeníček, 2011; Svatoš, 2009). The very dynamic development of the world economy together with the processes of globalization, internationalization and liberalization of the world economy are significantly changing the shape of individual markets – the agricultural market not being an exception (Hambálková, 2008;

Svatoš, 2008). These changes are not caused only by the growing demand for individual agricultural and food products, but are also affected by changes in the area of the development of culture and consumption habits of consumers not only on a regional level, but also on a global level (Horská et al., 2011). The volume of global agriculture production within the last several decades grew very significantly. Just in the years 1960 – 2010, the volume of plant production continually grew, on average by more than 100 mil. tons per year, and in the case of animal production the growth in the volume of actual production reached, on average, approximately 12 mil. tons per year. If we focus on the development in the area of the production of meat, we find that the global production in the years 1961 – 2010 increased from approximately 71 mil. tons to nearly 300 mil. tons. The most dynamic segment of the global meat market within the analyzed period was poultry meat, whose volume of production within the analyzed period increased on average by 5% per year. The actual volume of global production of poultry meat increased from just under 8 mil. tons in 1961 to more than 98 mil. tons in 2010. In the course of the analyzed period, the proportion of poultry meat in global production increased from just under 13% to more than 33%. In this regard, it is then appropriate to state that not all segments of poultry meat grew on the global market with the same dynamics. The greatest dynamic of growth and also the highest proportion in the current production was seen for chicken meat, the production of which within the analyzed period grew by 5% on average. Currently, chicken meat has a proportion in the total production of poultry meat of approximately 88%. The very significant development in the area of production and trade in poultry meat have affected all regions of the world – Europe included. The present article addresses the issue of the development of the production and trade in poultry meat in the Czech Republic, whose agricultural sector has been very significantly affected in recent years by global and regional processes affecting its structure and the volume of production. Just as in the case of the other regions of the world, in the case of the Czech Republic as well, the agricultural sector is very significantly formed by the development on the global food market. Besides the fact that the Czech market is formed by the development of the global market, it is additionally and to a much greater extent also formed through the effects of the market of the EU countries, which the Czech Republic is a part of. The very significant dynamic in the area of the formation of the current state of the agricultural sector has also impacted the sector of the production and trade in poultry meat.

Methodology

The present article provides a basic overview of the development of production of poultry meat in the Czech Republic, as well as in regard to the development of Czech foreign trade in poultry meat in relation to partners from EU countries as well as in relation to third countries. The goal of the actual analysis is to identify the main developmental trends and tendencies forming the development of Czech production and trade in the case of poultry meat. Besides the analysis of the effect of selected variables on the development of production and trade in the case of poultry meat, processed by way of a regressive function, the sensitivity of production and trade to changes of selected parameters of the external and internal environment is also analyzed, in order to identify the effect of selected variables on production and trade. In addition to the above, the article also aims to assess the competitiveness of Czech trade in poultry meat and to identify how the comparative advantages or disadvantages are distributed.

The present article analyzes the position of Czech production of poultry meat in terms of the domestic market as well as also in terms of the production of poultry meat on the world market and on the market of the EU countries. Primarily the effect of domestic consumption, price on the market of the Czech Republic and on the market of the EU countries, production on the market of the EU countries and production on the world market on Czech production of poultry meat are analyzed. The second part of the actual analysis then consists of an analysis of Czech foreign trade in poultry meat. Here, the development in the area of the value and volume of export and import is primarily monitored. The kilogram prices of both export as well as import are monitored. Attention is also paid to the territorial structure of Czech poultry meat trade. The development of individual characteristics associated with the development of Czech export and import of poultry meat is subsequently analyzed by way of a processed trend function.

In terms of methodology, the article analyzes the development of Czech production and trade in relation to the countries of the EU27 and in relation to third countries (the world without the EU). The main sources of data for the actual analysis are the databases of the UN FAO and of UN COMTRADE. The monitored data are production (Czech

Republic, EU, the world without the EU), prices of agricultural producers (Czech Republic, EU, the world), consumption of poultry meat in the Czech Republic, the value of export and import (Czech Republic, EU, the world, individual countries of the EU in relation to the Czech Republic) and the volume of export and import (Czech Republic, EU, the world, individual countries of the EU in relation to the Czech Republic). The data on Czech production and trade are collected on two levels - volume (tons) and value (USD or CZK). For the purposes of the analysis of the mutual relationship between individual variables having an effect on the volume and value of Czech production and trade, the following tools are used: correlation analysis, analysis of sensitivity (elasticity), a power function and a linear function.

The quantification of the effect of the main determinants is conducted with the utilization of regression analysis (Dougherty, 2002; Gujarati, 1988; Lind, Marchal, Wathen, 2005).

In individual periods, the "regular least squares method" is used to estimate regression functions in a power form describing the effect of selected factors on the selected explained variable. The regression function is thus estimated in the form of: $y = a \cdot x_1^b \cdot x_2^c \cdot x_3^d \cdot \ldots \cdot x_n^k$, where y is the explained variable, $x_1,...,x_n$ are explanatory variables, $a,...,k$ are estimated parameters. Parameters $b,...,k$ represent coefficients of flexibility, which express the percentage change of the explained variable upon a one percent change of the relevant explanatory variable. The actual analysis is based primarily on establishing the significance of the estimated parameters, i.e. the significant effect of the analyzed determinants of the poultry meat market. Besides the power function, a linear function is also used (Hušek 1999; Hindls et al., 2007). This function is used for the purposes of the estimate of the development trend in the case of selected characteristics of Czech poultry meat trade.

Besides the above tools pertaining to the analysis of Czech production and trade in the area of poultry meat, the article also uses the so-called Lafay index (LFI). By way of such index, we ascertain the existence of comparative advantages of Czech poultry meat trade in relation to the market of the EU countries, the market of third countries and primarily also in relation to the most significant trading partners of the Czech Republic on the market of the EU. The analysis of comparative advantages is processed on two levels. The comparative advantages of Czech poultry export are analyzed as a whole, and then, the comparative advantage of individual sub-aggregations representing the poultry meat trade is analyzed.

For the purposes of the analysis of foreign trade, the HS nomenclature is used. According to this nomenclature, Czech agricultural trade is divided up into 24 commodity aggregations and poultry meat trade is then divided up into 14 sub-aggregations:

H1-0207	Meat, edible offal of domestic poultry
H1-020711	Fowls, domestic, not cut, fresh
H1-020712	Fowls, domestic, not cut, frozen
H1-020713	Fowls, cuts & offal, fresh
H1-020714	Fowls, cuts & offal, frozen
H1-020724	Turkeys, not cut, fresh
H1-020725	Turkeys, not cut, frozen
H1-020726	Turkey cuts & offal fresh
H1-020727	Turkey cuts & offal frozen
H1-020732	Ducks, geese, not cut fresh
H1-020733	Ducks, geese, not cut frozen
H1-020734	Fatty livers of geese or ducks
H1-020735	Poultry cuts&offal, fresh
H1-020736	Poultry cuts&offal, frozen

The bilateral comparative advantage of total poultry meat trade and individual items representing poultry meat trade with respect to selected countries and group of countries is analysed by means of the Lafay index. Apart from export flows, the Lafay index (hereinafter only the LFI index) also takes into account import flows. As opposed to the standard RCA index, its advantage is its ability to take into account the intersectoral trade and also re-export. In this respect, its information value is stronger as compared to the traditional index of the obvious comparative advantage (Balassa, 1965). It is suitable to utilize this index in the cases when a relationship between two business partners is analysed. The advantage of the LFI index as compared to the RCA index is also its ability to include any distortions caused by macroeconomic fluctuations (Fidrmuc et al., 1999). The LFI index enables to analyse the position of every specific product within the foreign trade structure of every specific analysed country or a group of countries (Zaghini, 2003). The LFI index for the given "i" country and for every "j" analysed product or group of products is defined in the following formula:

$$LFI^i_j = 100 * [((x^i_j - m^i_j) / (x^i_j + m^i_j)) - (\sum^N_{j=1}(x^i_j - m^i_j)) / (\sum^N_{j=1}(x^i_j + m^i_j))] * ((x^i_j + m^i_j) / (\sum^N_{j=1}(x^i_j + m^i_j))$$

x^i_j and m^i_j represent exports and imports of "j" product realized by "i" country or a group of countries with respect to the rest of the world or with respect to a selected business partner (partner country). "N" is the number of analysed items (Lafay, 1992). The positive value of the LFI index indicates existence of a comparative advantage within the analysed traded aggregation or a group of aggregations in question. The higher is the resulting value of the index, the higher is the level of specialization of the country in question as regards trade with the given item or a group of items representing agrarian and food trade in this case. And vice versa, the negative value of the LFI index signals that specialization and hence comparative advantages are lacking (Zaghini, 2005).

Analysis and Discussion

Development of the Production of Poultry Meat in the Czech Republic on the Backdrop of the Production of Poultry Meat in the World and in the EU

The production of poultry meat in the Czech Republic in the years 1993 – 2010 increased from 133 thousand tons to nearly 200 thousand tons (i.e. in the course of the analyzed period, the volume of actual production increased by more than 45%). However, in relation to the development of the production of poultry meat, it is necessary to state that actual production has a tendency to significantly fluctuate in time. Production reached its peak in 2005 (more than 240 thousand tons of meat), and then in the subsequent years, a decline in the volume of production followed – primarily because of a loss of competitiveness of Czech poultry meat in relation to the biggest trade rivals. In this regard, a high level of competition is also seen in regard to other types of meat. In this regard, poultry meat is sailing through the storm that is raging on the Czech food market much more elegantly as compared to the other types of meat. While in the years 1993 – 2010 the rate of growth of production of poultry meat on the market of the Czech Republic grew on average by 2.5% per year, the volume of production of pork meat declined on average by 4.4%, and, in the case of beef meat, the volume of production of meat declined on average by more than 6% annually (see Table 1).

It is thus evident from the above that the proportion of poultry meat in the overall production of meat in the Czech Republic must grow in the long-term. While in the year 1993, the proportion of poultry in the production of meat ranged at a level of approximately 13%, in the year 2010 it was more than 32%. Chicken meat has a long-term dominant proportion in the production of poultry meat. The proportion of chicken meat in the production of poultry significantly strengthened within the analyzed period from approximately 87% to nearly 95%. The proportion of other types of meat in production is decreasing long-term – an exception in this regard is duck meat. The proportion of the production of other types of poultry is decreasing long-term in the Czech Republic, primarily because of poor economy of production, and also because of the high degree of competition. The following Table 2 provides a brief overview of the development of the structure of poultry meat on the market of the Czech Republic.

If we focus on the comparison of the structure and volume of production of poultry meat in the Czech Republic to development on the global market (Table 4) and primarily on the market of the EU countries (Table 3), we may state that the Czech Republic maintains a greater dynamic of the rate of growth of actual production of poultry meat as compared to the market of the EU countries. On average, the dynamics of production are higher primarily in the case of chicken meat and duck meat. On the other hand, in the case of goose meat

Production (tonnes)	item	1993	1997	2001	2005	2010	Basic index 2010/1993	GEOMEAN-Chain index 1993 - 2010
Czech Republic	Bovine Meat	216241	155706	109475	81031	77026	0.356204	0.937521
Czech Republic	Eggs	155018	166115	192168	89465	97600	0.629604	0.971498
Czech Republic	Pigmeat	614933	463556	414643	380290	300136	0.488079	0.95616
Czech Republic	Poultry Meat	133940	176700	240831	241256	184947	1.503636	1.025821
Czech Republic	Animal Fats +	284777	222656	200607	221867	186581	0.655183	0.973919
Czech Republic	Meat +	1006684	835768	807705	746111	620504	0.616384	0.97021
Czech Republic	Milk – Exc. Butter +	3474022	2805001	2796954	2828497	2791913	0.803654	0.986431
Czech Republic	Offals +	53439	44361	29486	28960	24673	0.461704	0.952846

Source: FAO, 2012

Table 1: Czech animal production development in 1993 - 2010.

		1993	1997	2005	2010	GEOMEAN-Chain index 1993 - 2010	Basic index 2010/1993
Chicken meat	Production (tonnes)	117140	158400	213481	184947	1.027	1.579
Duck meat	Production (tonnes)	2500	2800	8333	6942	1.062	2.777
Goose and guinea fowl meat	Production (tonnes)	4500	4700	3119	1500	0.937	0.333
Turkey meat	Production (tonnes)	9800	10800	16323	1864	0.907	0.19
Meat. Total + (Total)	Production (tonnes)	1006684	835768	744611	602699	0.97	0.599
Poultry meat (Total)	Production (tonnes)	133,940	176700	241256	195253	1.025	1.458
Share of poultry meat in total meat production		13.31%	21.14%	32.40%	32.40%		
Chicken meat	Share in poultry meat production	87.46%	89.64%	88.49%	94.72%		
Duck meat	Share in poultry meat production	1.87%	1.58%	3.45%	3.56%		
Goose and guinea fowl meat	Share in poultry meat production	3.36%	2.66%	1.29%	0.77%		
Turkey meat	Share in poultry meat production	7.32%	6.11%	6.77%	0.95%		

Source: FAO, 2012

Table 2: Development of Czech poultry meat production in 1993 - 2010.

item		1993	1997	2005	2010	GEOMEAN-Chain index 1993 - 2010	Basic index 2010/1993
Bird meat, nes	Production (tonnes)	3560	3760	4068	4310	1.011	1.211
Chicken meat	Production (tonnes)	6844371	7853240	8522342	9765171	1.021	1.427
Duck meat	Production (tonnes)	250905	344863	437964	487995	1.040	1.945
Goose and guinea fowl	Production (tonnes)	53066	66094	83534	62540	1.010	1.179
Turkey meat	Production (tonnes)	1461861	1844148	1829597	1739950	1.010	1.190
Meat, Total + (Total)	Production (tonnes)	41711132	42117469	42558463	44770683	1.004	1.073
Poultry meat	Production (tonnes)	8613763	10112105	10877505	12059966	1.020	1.400
Share of poultry meat in total meat production		20.65%	24.01%	25.56%	26.94%		
Bird meat, nes	Share in poultry meat production	0.04%	0.04%	0.04%	0.04%		
Chicken meat	Share in poultry meat production	79.46%	77.66%	78.35%	80.97%		
Duck meat	Share in poultry meat production	2.91%	3.41%	4.03%	4.05%		
Goose and guinea fowl	Share in poultry meat production	0.62%	0.65%	0.77%	0.52%		
Turkey meat	Share in poultry meat production	16.97%	18.24%	16.82%	14.43%		

Source: FAO, 2012

Table 3: Development of EU poultry meat production in 1993 - 2010.

and turkey meat, the rate of growth of production in the Czech Republic is far below the average of the EU countries, or rather, it is actually negative. In relation to the world market, the growth of the volume of production of poultry meat in the Czech Republic is far below average. While in the years 1993 – 2010 the volume of production of poultry meat in the world increased by more than 4%/year, the growth in the volume of production in the Czech Republic was approximately half of that. In this regard, it is interesting to compare the proportion of the production of poultry to the overall production of meat. While in relation to the EU, the proportion of poultry in the total production of meat in the Czech Republic is highly above-average, in relation to the world market the proportion is nearly comparable. This fact then attests to the fact that the Czech consumer has not yet reached primarily the income opportunities of the EU15 countries. Poultry meat, which is among the cheaper meats, as compared to pork meat and beef, plays a very significant role for consumers. In this regard, we can see certain identical features not only in relation to the situation on the global market (where the majority of consumers live in developing countries), but also in relation to all new EU member countries EU, which are significantly "poorer" when compared to the old EU members. Further, an interesting characteristic of the Czech poultry meat market is the extremely high proportion of the production of chicken meat – which comprises almost 95% of total poultry production, which is significantly more than in the case of both the EU market as well as the world market.

item		1993	2005	2010	GEO-MEAN chain index 1993 - 2010	Basic index 2010/1993
Bird meat, nes	Production (tonnes)	17 958	57 519	70 864	1.084	3.946
Chicken meat	Production (tonnes)	41 313 332	70 127 365	86 544 760	1.044	2.095
Duck meat	Production (tonnes)	1 721 592	3 336 503	4 031 481	1.051	2.342
Goose and guinea fowl	Production (tonnes)	959 619	2 075 847	2 521 416	1.058	2.628
Turkey meat	Production (tonnes)	4 094 100	5 178 676	5 348 861	1.016	1.306
Meat, Total + (Total)	Production (tonnes)	192 908 848	260 981 576	295 462 319	1.025	1.532
Poultry meat (Total)	Production (tonnes)	48 106 601	80 775 910	98 517 382	1.043	2.048
Share of poultry meat in total meat production		24.94%	30.95%	33.34%		
Bird meat, nes	Share in poultry meat production	0.04%	0.07%	0.07%		
Chicken meat	Share in poultry meat production	85.88%	86.82%	87.85%		
Duck meat	Share in poultry meat production	3.58%	4.13%	4.09%		
Goose and guinea fowl	Share in poultry meat production	1.99%	2.57%	2.56%		
Turkey meat	Share in poultry meat production	8.51%	6.41%	5.43%		

Source: FAO, 2012

Table 4: Development of world poultry meat production in 1993 - 2010.

Domestic supply quantity (tonnes)	**item**	**1993**	**1997**	**2001**	**2005**	**2010**	Basic index 2010/1961	GEOMEAN-Chain index 1993 -2010
Czech Republic	Poultry Meat	125438	190544	247166	269943	262162	2.0899	1.0471

Source: FAO, 2012

Table 5: Czech poultry meat domestic consumption development 1993 - 2010.

Self sufficiency	**item**	**1993**	**1997**	**2001**	**2005**	2010
Czech Republic	Poultry Meat	106.78%	92.73%	97.44%	89.37%	76.82%

Source: FAO, 2012

Table 6: Czech poultry meat market self sufficiency development in 1993 - 2010.

Therefore, if we summarize the development of the production of poultry meat in the Czech Republic, we can say that despite the high level of fluctuation of actual production, the average year-on-year rate of growth of production in the years 1993 – 2010 was positive (approximately 2.5%/ year). Nevertheless, the production was not able to compensate the large increase in demand for poultry meat and its products. In the years 1993 – 2010, the consumption of poultry meat on the market of the Czech Republic grew on average by 4.7% per year – meaning that within the monitored period, the volume of consumption increased from approximately 125 thousand tons to more than 260 thousand tons of meat (Table 5). Therefore, as a result of the above development, despite the growth in the volume of actual production, the gradual decrease in self-sufficiency of the Czech market in the area of the supply of poultry meat of domestic origin occurred within the analyzed period (Table 6).

A specific phenomenon affecting the development of the Czech poultry meat market is the price development. Despite the continual growth of input prices, inflation and other phenomena, the price of one ton of poultry meat has been continually declining since the years 1997 respectively 1998. In 2010, the prices of poultry meat reached approximately 85 – 90% of the value of poultry meat in the year 1993 (for details, see Table 7).

The alarming development in the area of the worsening profitability in the area of the raising and sale of poultry meat is very significantly affecting the position of poultry producers on the Czech market. The Czech poultry meat market is under very significant pressure not only from the global market, but also from the market of the EU countries. Primarily Poland represents a very significant competitor of Czech production of poultry meat.

If we analyze the development of Czech production of poultry meat, we can see a high rate of correlation of the volume of production to the volume of production in EU countries (in relation to the

market of third countries, the rate of correlation is relatively low and insignificant, see Table 8).

On the basis of the conducted regression analyzing the relationship of the Czech poultry meat market and the market of the EU countries or the world market, we can state that Czech production reacts very elastically to changes in production primarily on the market of the countries of the EU (if production in EU countries changes by 1%, production in the Czech Republic changes on average by approximately 1.9%). On the other hand, in relation to the market of third countries, the sensitivity of Czech production is very low (on average, a percentage change on the world market leads to a change in production in the Czech Republic of approximately 0.12%). As an exogenous parameter, the development of production on the world market in relation to the production of the Czech Republic (endogenous variable) is seen as insignificant. The subsequent power regression models the relationship of Czech production of poultry meat and the production of poultry meat in the countries of the EU (Table 9).

Czech production of poultry meat reacts very insensitively to price development. The price on the domestic market is seen long-term as an insignificant parameter (mutual correlation between the volume of production and the price on the market is also very low, i.e. minus 0.31) in relation to the development of domestic production of meat. The mutual relationship is best explained by power regression, the results of which show that if the price of one ton of production changes by a percent, production will change by minus 0.58%. In relation to the development of prices on the market of the EU countries, the situation is much more problematic yet. Within the years 1993 – 2010, the prices of poultry meat on the market of the EU countries are once again seen as an insignificant parameter in relation to the volume of Czech production. The mutual correlation is once again very low (see Table 10) and if we factor in the results calculated by way of the regressive function (which is seen as the most acceptable), we can state that the sensitivity of production to a change in price on the EU market EU by a percent is only minus 0.7% (according to linear regression only, the result is even worse, approximately 0.12%).

From the results of correlation analysis, the goal of which was to assess the effect of prices on domestic production of poultry meat, at least one interesting finding arose. That finding is that there does exist a correlation between the development of the price of poultry meat on the market of the Czech

item	1993	1997	2001	2005	2009	2010	GEOMEAN – chain index 1993 - 2010	Basic index 2010/1993
Chicken meat	30 504	35 736	34 429	28 245	26 151	25 791	0.990	0.845
Duck meat	39 901	46 443	42 764	37 777	38 885	36 347	0.995	0.911
Turkey meat	39 454	46 649	44 415	37 500	38 460	35 653	0.994	0.904

Source: FAO, 2012

Table 7: Czech Republic – Producer Price (Local Currency/tonne) (LCU).

Variable	Correlation N=18 Significant correlations are highlighted at the significance level. p < .05				
	Average	Stand. deviation	Poultry meat production in ČR	Poultry meat production in EU	Poultry meat production in World (without EU)
Poultry meat production in ČR	198623	36995	1	0.756583	0.452573

Source: FAO, own processing 2012

Table 8: Czech poultry meat production development in relation to EU market and global market (without EU) – mutual correlation.

N=18	Results of regression with dependant variable: Production in ČR R= .80293083; R2= .64469792; Corrected R2= .62249154 F(1,16)=29.032 p<,00006 Stand. Error of Estimation: .12697; D-W 1.65, alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b	t(16)	p-value.
Abs. item			-18,6263	5.717564	-3.25773	0.00494
Production in EU	0.802931	0.149018	1.9052	0.353588	5.38814	0.00006

Source: FAO, own processing 2012

Table 9: The results of power regression analyzing the mutual relationship between Czech poultry meat production and EU poultry meat production.

Variable	Correlation N=18 Significant correlations are highlighted at the significance level. p < .05				
	Average	Stand. deviation	Poultry production in ČR	Poultry meat price in ČR	Poultry meat price in EU
Poultry production in ČR	179412.9	34194.97	1.000000	-0.024752	-0.066665
Poultry meat price in ČR	1130.7	216.43	-0.024752	1.000000	0.970354
Poultry meat price in EU	1481.9	267.32	-0.066665	0.970354	1.000000

Source: FAO, own processing 2012

Table 10: Mutual correlation between Czech poultry meat production and Czech and EU poultry meat market price.

N=18	Results of regression with dependant variable: Price in Czech market (USD/tonne) R= .96845942 R2= .93791365 Corrected R2= .93403326 F(1.16)=241.71 p<.00000 Stand. Deviation of estimation : .04845; D-W: 2.1, alfa = 0.05					
	b*	Stand. Error In relation to b*	b	Stand. Error In relation to b	t(16)	p-value
Abs. item			-0.589788	0.489204	-1.20561	0.245496
Price in EU market (USD/tonne)	0.968459	0.062293	1.043525	0.067121	15.54688	0.0000

Source: FAO, own processing 2012

Table 11: The results of power regression analyzing the mutual relationship between Czech poultry meat unit price and EU poultry meat unit price development.

Republic and on the market of the EU countries (average price of poultry meat on the market of the EU countries) (Table 10). The subsequent power regression (Table 11) provides information on the mutual sensitivity of the price of poultry meat on the market of the Czech Republic in relation to the prices on the market of the EU countries (a percentage change in the price on the market of the EU countries means a change in the price on the market of the Czech Republic of 1.04%). At least in this regard, it appears that there is existing a certain dependency of the market of the Czech Republic on the market of the EU.

Analysis of Competitiveness of Czech Poultry Meat on the Market of the EU Countries and on the Market of Third Countries

In the overall volume of agricultural foreign trade of the Czech Republic, foreign trade in poultry meat represents only a minor, supplementary item. In the years 1996 – 2011, the proportion of poultry meat in Czech agricultural export oscillated between 2 – 5%, whereby at the end of the analyzed period, it achieved approximately 2.3%. On the other hand, in the case of agricultural import, the proportion of poultry is continuously increasing. While at the beginning of the analyzed period, the proportion ranged at a level of approximately 2.3%, at the end it was up to 5.9%. The value of trade in poultry meat is continuously increasing. At the same time, the rate of growth of the value of exports is significantly lower when compared to the rate of growth of the value of imports. Within the analyzed period, the value of exports increased from USD 46 mil. to more than USD 154 mil.; within the same period, the value of imports increased from just under USD 48 mil. to approximately USD 525 mil. A specific feature of Czech foreign trade in poultry meat are higher, on average, kilogram prices of export as compared to kilogram prices of imports (caused primarily by the low import prices of Polish poultry meat). Nevertheless, even here, the rate of growth of unit prices of imports is higher when compared to the rate of growth of unit prices of export. As a result of the high dynamic of growth of the value and volume of imports (19% or 15%, respectively, on average per year) as compared to the growth in the value and volume of exports (9%, or 8% respectively, on average per year), a significant worsening of the negative trade balance occurred within the analyzed period. That increased within the monitored time period from just under 2 mil. to more than USD 370 mil. As imports increased, a worsening of the coverage of imports by exports also gradually occurred in time. While at the beginning of the period, the level of coverage was at just under 97%, at the end of the period it was just under 30%. In terms of the territorial structure of Czech poultry meat trade, it is further appropriate to state that the Czech Republic trades poultry meat primarily within the territory of the EU countries. Currently, these countries represent approximately 98% of exports or 76% of imports, respectively (details on the development of trade in poultry meat can be found in the following Table 12). Worsening indicators in the area of poultry meat trade can be seen not only in relation to the territory of the EU countries, but also in relation to third countries. The proportion of third countries in Czech poultry meat trade significantly weakened in time (the effect of

		Mil. USD; kg	1996	2002	2004	2008	2010	2011	GEO-MEAN chain index 1996 - 2010	Basic index 2010/1996
Export	EU27	Trade Value	41.7	36.7	107.9	117.4	123.8	151.1	1.1	3.6
Export	EU27	NetWeight (kg)	16.8	23.1	47.7	42.9	50.4	51.5	1.08	3.1
Import	EU27	Trade Value	29.5	38.4	99	259.7	289	396.1	1.2	13.4
Import	EU27	NetWeight (kg)	14.1	25.8	64.4	102.8	132.2	164.5	1.19	11.7
Export	EU27	unit price	2.49	1.59	2.26	2.74	2.46	2.94	1.01	1.2
Import	EU27	unit price	2.1	1.49	1.54	2.53	2.19	2.41	1.01	1.1
	EU27	Coverage ration import/export	141.20%	95.50%	108.90%	45.20%	42.80%	38.20%		
	EU27	Balance	12.1	-1.7	8.9	-142.3	-165.2	-245		
Export	EU27	share	90.60%	95.30%	98.70%	98.60%	97.80%	97.90%		
Import	EU27	share	62.00%	57.50%	54.90%	76.80%	80.00%	75.50%		
Export	World	Trade Value	46	38.5	109.3	119	126.6	154.4	1.09	3.4
Export	World	NetWeight (kg)	18.3	24	48.4	43.2	52.2	53.3	1.08	2.9
Import	World	Trade Value	47.6	66.8	180.5	338.3	361.5	525	1.19	11
Import	World	NetWeight (kg)	27.5	39.9	106.1	127.8	157.2	198.6	1.15	7.2
Export	World	unit price	2.52	1.61	2.26	2.75	2.43	2.9	1.01	1.2
Import	World	unit price	1.73	1.67	1.7	2.65	2.3	2.64	1.03	1.5
	World	Coverage ration import/export	96.50%	57.60%	60.60%	35.20%	35.00%	29.40%		
	World	Balance	-1.7	-28.3	-71.2	-219.2	-234.9	-370.6		
Export	World without EU	Trade Value	4.3	1.8	1.4	1.7	2.8	3.2	0.98	0.8
Export	World without EU	NetWeight (kg)	1.5	0.9	0.7	0.3	1.8	1.8	1.01	1.2
Import	World without EU	Trade Value	18.1	28.4	81.4	78.5	72.5	128.9	1.15	7.1
Import	World without EU	NetWeight (kg)	13.4	14.2	41.7	25	24.9	34.1	1.07	2.5
Export	World without EU	unit price	2.87	2.1	2.02	4.88	1.51	1.77	0.97	0.6
Import	World without EU	unit price	1.35	2	1.95	3.14	2.91	3.78	1.08	2.8
Export	World without EU	share	9.37%	4.66%	1.29%	1.40%	2.18%	2.10%		
Import	World without EU	share	38.03%	42.50%	45.13%	23.22%	20.04%	24.55%		
	World without EU	Coverage ration import/export	23.80%	6.30%	1.70%	2.10%	3.80%	2.50%		
	World without EU	Balance	-13.8	-26.6	-80	-76.9	-69.7	-125.6		

Source: UN Comtrade, own processing 2012

Table 12: Czech poultry meat foreign trade basic characteristic.

the entry of the Czech Republic into the EU), but, nevertheless, the decline affected primarily Czech export. The level of coverage of the mutual trade exchange is worsening significantly faster than in the case of the EU countries, and further, the negative balance of mutual trade is also growing very dynamically. In relation to third countries, it is also additionally true that, unlike the market of the EU countries, where Czech unit prices of export exceed the price of imports, unit prices of imports are currently almost doubly higher as compared to the kilogram prices of exports.

If we analyze the competitiveness of Czech agricultural trade in poultry meat, we can state that such competitiveness is gradually disappearing or worsening in time. While at the beginning of the analyzed period, the Czech Republic achieved comparative advantages in trade at least in relation to the territory of the EU27 countries, currently we can see a trend of growth of comparative disadvantages. The value of the LFI index is decreasing both in relation to EU countries, as well as in relation to third countries (for details, see Table 13).

If we focus on the structure of poultry meat trade, we can state that it currently has the following structure (for details, see Table 14). Chicken meat trade has the dominant position within overall trade. Further more significant types of meat are turkey meat and duck meat. The table set out below contains the basic information on the development of trade within the individual sub-aggregations. The Czech Republic is capable of achieving a positive trade balance in relation to the EU in the case of

LFI	1996	1998	2000	2002	2004	2005	2006	2007	2008	2009	2010	2011
EU	1.2	0.86	0.56	0.25	0.87	-0.39	-0.98	-0.79	-0.98	-1.3	-1.13	-1.43
World (without EU)	-0.69	-0.91	-2.01	-2.06	-4.49	-3.13	-2	-1.71	-2.48	-2.58	-2.55	-3.73

Source: UN Comtrade, own processing 2012

Table 13: Competitiveness development of Czech poultry meat export in relation to EU and World market (third countries).

	mil.	EU27	EU27		Share	Kg price	World without EU	World without EU		Share	Kg price
Trade Flow	Commodity Description	Trade Value	Weight (kg)	Balance			Trade Value	Weight (kg)	Balance		
Import	Meat, edible offal of poultry	198.04	82.25	-122.48	50.00%	2.41	64.43	17.04	-62.81	50.00%	3.78
Import	Fowls, domestic, not cut, fresh	24.25	12.45	-17.64	6.12%	1.95	0	0	0	0.00%	X
Import	Fowls, domestic, not cut, frozen	3.29	1.82	0.03	0.83%	1.81	0.05	0.03	-0.05	0.04%	1.66
Import	Fowls, cuts & offal, fresh	49.68	17.72	-30.79	12.54%	2.8	0.01	0.01	0.16	0.01%	1.06
Import	Fowls, cuts & offal, frozen	55.28	31.29	-12.41	13.96%	1.77	61.65	16.32	-60.83	47.84%	3.78
Import	Turkeys, not cut, fresh	2.96	1.03	-2.94	0.75%	2.87	0.01	0	0	0.00%	3.47
Import	Turkeys, not cut, frozen	1.37	0.43	-1.35	0.35%	3.17	0.22	0.06	-0.22	0.17%	3.57
Import	Turkey cuts & offal fresh	24.69	6.22	-24.2	6.23%	3.97	0.27	0.04	0.34	0.21%	5.98
Import	Turkey cuts & offal frozen	3.8	0.94	-2.87	0.96%	4.02	2.24	0.57	-2.24	1.74%	3.94
Import	Ducks, geese, not cut fresh	1.23	0.22	-0.59	0.31%	5.54	0	0	0	0.00%	X
Import	Ducks, geese, not cut frozen	22.82	8.07	-22.12	5.76%	2.83	0	0	0	0.00%	X
Import	Fatty livers of geese or ducks	0.27	0.02	-0.24	0.07%	11.46	0	0	0	0.00%	X
Import	Poultry cuts&offal, fresh	1.25	0.16	-1.05	0.32%	7.93	0	0	0	0.00%	X
Import	Poultry cuts&offal, frozen	7.15	1.88	-6.31	1.81%	3.8	0	0	0.03	0.00%	X
	Total	396.09	164.49	-244.97	100.00%	2.41	128.87	0	-125.62	100.00%	X
Export	Meat, edible offal of poultry	75.56	25.73		50.00%	2.94	1.62	0.92		50.00%	1.77
Export	Fowls, domestic, not cut, fresh	6.61	2.75		4.37%	2.4	0	0		0.00%	X
Export	Fowls, domestic, not cut, frozen	3.31	1.57		2.19%	2.1	0	0		0.00%	X
Export	Fowls, cuts & offal, fresh	18.89	6.52		12.50%	2.9	0.17	0.03		5.21%	6.48
Export	Fowls, cuts & offal, frozen	42.86	13.81		28.36%	3.1	0.81	0.8		25.04%	1.02
Export	Turkeys, not cut, fresh	0.03	0.01		0.02%	3.88	0.01	0		0.16%	4.06
Export	Turkeys, not cut, frozen	0.02	0.01		0.01%	3.26	0	0		0.00%	X
Export	Turkey cuts & offal fresh	0.49	0.15		0.33%	3.29	0.6	0.09		18.56%	7.01
Export	Turkey cuts & offal frozen	0.93	0.19		0.61%	4.98	0	0		0.00%	X
Export	Ducks, geese, not cut fresh	0.64	0.17		0.42%	3.69	0	0		0.00%	X
Export	Ducks, geese, not cut frozen	0.7	0.24		0.47%	2.9	0	0		0.00%	X
Export	Fatty livers of geese or ducks	0.04	0		0.03%	18.13	0	0		0.00%	X
Export	Poultry cuts&offal, fresh	0.2	0.04		0.13%	5.36	0	0		0.00%	X
Export	Poultry cuts&offal, frozen	0.85	0.27		0.56%	3.16	0.03	0		1.02%	12.73
	Total	151.12	51.46		100.00%	2.94	3.25	1.83		100.00%	1.77

Source: UN Comtrade, own processing 2012

Table 14: Czech poultry meat trade structure in relation to EU and World market (2011).

only a single aggregation (frozen unjointed meat), while in relation to third countries, the Czech Republic achieves a positive trade balance only in the case of chilled jointed chicken meat and in the case of chilled jointed turkey meat. The above data clearly show the very bad situation of Czech export in relation to foreign partners.

If we focus on the competitiveness of individual sub-aggregations representing Czech poultry export carried out in relation to EU countries and in relation to third countries, we can state a worsening comparative advantages on all levels. In relation to EU countries, the Czech Republic achieves comparative advantages only in the case of frozen unjointed and jointed chicken meat, as well as in the case of chilled unjointed duck meat. In relation to third countries, the Czech Republic achieves comparative advantages only in relation to

chilled jointed chicken meat and chilled jointed and unjointed turkey meat. Details on the current state of comparative advantages in the case of individual export sub-aggregations carried out in relation to EU countries and in relation to third countries can be found in the following Table 15.

As has already been stated above, the most significant export partner of the Czech Republic are the countries of the European Union (for details, see Table 16). In 2011, the Czech Republic exported and imported poultry meat to 20 EU countries, or, respectively, from 19 EU countries.

LFI 2011	EU	World without EU
Meat, edible offal of domestic poultry	0	0
Fowls, domestic, not cut, fresh	-0.7	X
Fowls, domestic, not cut, frozen	0.54	0
Fowls, cuts & offal, fresh	-0.02	0.25
Fowls, cuts & offal, frozen	5.76	-1.09
Turkeys, not cut, fresh	-0.29	0.01
Turkeys, not cut, frozen	-0.13	-0.01
Turkey cuts & offal fresh	-2.36	0.88
Turkey cuts & offal frozen	-0.14	-0.08
Ducks, geese, not cut fresh	0.04	X
Ducks, geese, not cut frozen	-2.12	X
Fatty livers of geese or ducks	-0.02	X
Poultry cuts&offal, fresh	-0.07	X
Poultry cuts&offal, frozen	-0.5	0.05

Source: UN Comtrade, own processing 2012

Table 15: Competitiveness of individual categories representing Czech poultry meat export in EU and World market.

2011	LFI	Import	Export	Balance	Share in Import	Share in Export	Export kg price	Import kg price
Austria	0.05	3,201,052	3,298,704	97,652	0.81%	2.18%	2.12	2.45
Belgium	-0.69	6,845,044	830,602	-6,014,442	1.73%	0.55%	1.7	0.8
Bulgaria	-1.08	1,169,230	750,296	-418,934	0.30%	0.50%	1.04	4.52
Cyprus	1.91	0	94,190	94,190	0.00%	0.06%	1.18	X
Denmark	-1.6	5,228,620	641,398	-4,587,222	1.32%	0.42%	1.88	1.56
Estonia	-1.31	142,196	0	-142,196	0.04%	0.00%	X	0.82
Finland	-0.12	40,318	0	-40,318	0.01%	0.00%	X	0.44
France	-2.19	17,655,462	191,820	-17,463,642	4.46%	0.13%	1.48	1.73
Germany	-0.48	36,257,954	11,496,326	-24,761,628	9.15%	7.61%	2.26	2.15
Greece	0.24	0	129,330	129,330	0.00%	0.09%	1.06	X
Hungary	-5.62	46,018,720	3,989,326	-42,029,394	11.62%	2.64%	1.5	3.14
Ireland	-0.01	35,846	106	-35,740	0.01%	0.00%	1.89	1.6
Italy	0.02	1,591,624	1,752,846	161,222	0.40%	1.16%	2.07	2.92
Lithuania	0	0	1,968	1,968	0.00%	0.00%	17.26	X
Malta	6.29	0	340,752	340,752	0.00%	0.23%	2.54	X
Netherlands	4.41	15,908,586	22,104,058	6,195,472	4.02%	14.63%	2.53	1.59
Poland	-6.99	202,329,880	797,868	-201,532,012	51.08%	0.53%	2.37	2.59
Romania	-3.93	4,954,678	1,452,786	-3,501,892	1.25%	0.96%	1.08	4.29
Slovakia	-0.79	50,491,752	103,208,876	52,717,124	12.75%	68.29%	3.58	2.83
Slovenia	-1.03	355,360	11,030	-344,330	0.09%	0.01%	4.57	1.94
Spain	-0.05	1,216,014	190	-1,215,824	0.31%	0.00%	5.59	3.07
Sweden	-1.67	1,381,738	0	-1,381,738	0.35%	0.00%	X	2.32
United Kingdom	-0.51	1,265,418	30,096	-1,235,322	0.32%	0.02%	0.56	3.54
Total		396,089,492	151,122,568	-244,966,924	1	1	2.94	2.41

Source: UN Comtrade, own processing 2012

Table 16: Competitiveness of Czech poultry meat trade in relation to EU partners.

The most significant trading partners in terms of exports were Slovakia, the Netherlands, Germany, Hungary and Austria (approximately 95%). On the other hand, the most significant import partners were Poland, Slovakia, Hungary, Germany, France and the Netherlands (over 93%). The Czech Republic achieves the most significant positive balance in relation to Slovakia and the Netherlands (approximately USD 60 mil.). On the other hand, it shows the worst results in relation to Poland, Hungary, Germany and France (the cumulative value of the negative balance is at a level of approximately USD 285 mil.).

An analysis of the current state of the distribution of the comparative advantages of Czech poultry meat export into individual EU countries shows that the Czech Republic achieves comparative advantages in relation to Austria, Cyprus, Greece, Italy, Malta and the Netherlands. On the other hand, Czech export has a very significant comparative disadvantage primarily in relation to Poland, Hungary, Romania and France. A comparative disadvantage can also be identified in relation to Belgium, Bulgaria, Denmark, Estonia, Finland, Germany, Ireland, Slovakia, Slovenia, Spain, Sweden and Great Britain.

Summarization of the Developmental Trends on the Poultry Meat Market

If we summarize the findings set out above, we can state that the competitiveness of Czech agricultural trade, both in relation to the EU countries as well as in relation to third countries, is decreasing long-term. The rate of growth of the negative value of the LFI index ranges year-on-year at a level of -0.19 in relation to the EU countries, and -0.13 in relation to third countries (results of a processed regressive function). The negative value of the agricultural trade balance is deepening long-term, and its growth can be expected. Currently, the trend of growth of the value of the negative trade balance ranges at a level of approximately USD 23 mil. per year. In regard to such dismal result of Czech agricultural trade in poultry meat, a definite role is played by the significantly greater dynamic of the rate of growth of the value of imports (the trend is approximately USD 32 mil./year) as compared to the growth of the value of exports (a trend f approximately USD 8.2 mil./year). In the future, we can expect the gradual worsening of the coverage of import by export (the trend for the monitored period was approximately 4% per year). In the future, we can further expect a growing proportion of EU countries both in Czech exports (a trend of approximately 0.3% per year), as well as primarily in Czech imports (a trend of approximately 2% per year). As far as the development of production of Czech poultry meat and its consumption is concerned, we can expect, on the basis of knowledge of the current developmental trends, a growth in production (approximately 4700 tons per year), which will, however, be significantly lower as compared to the rate of growth of the volume of consumption (approximately 8500 tons per year). The result of this development will then be the above-mentioned growth in the value of imports, which will not grow only by way of growth in the volume of imported meat, but also by way of growth in the average kilogram prices of imports. A more detailed overview of selected trends of the Czech poultry meat market is summarized in the following Table 17.

Conclusions

The processed analysis provides a basic overview of the development of poultry meat production, as well as in regard to the development of Czech foreign trade in poultry meat. On the basis of the acquired findings, the main development trends and tendencies are identified, both in the area of the development of production, consumption, as well as in the area of the development of foreign trade in poultry meat. The results of the analysis are the following. Domestic demand for poultry meat (primarily chicken meat) has been continuously increasing. Domestic production is characterized by a certain level of stagnation. The rate of growth of production is significantly lower in comparison with the rate of growth of actual consumption. In the course of the years, the domestic market is becoming more dependent on imports of poultry meat, primarily from EU countries. The value and volume of imports in the years 1996 – 2011 increased much more significantly compared to the growth in the value and volume of Czech agricultural export. The negative trade balance of the Czech Republic in relation to partner countries increased within the analyzed period from approximately 2 mil. to more than 370 mil. USD, whereby approximately two thirds of this result are in regard to EU countries. The price on the Czech poultry meat market has been stagnating in time. The rate of dynamics of the value growth of import kilogram prices is significantly higher compared to the rate of growth of export kilogram prices. Such fact is primarily affected by the lesser quality of Czech export, as well as the fact that a large portion of imports is, unlike in the case of exports, represented by raw products, or by already processed products with a significantly greater level of added value. The

N=15	Results of regression with dependant variable: EU share in export R= .58861192 R2= .34646399 Corrected R2= .29619199 . F(1.13)=6.8918 p<.02098 Stand. Error of Estimation: .02246. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			0.942482	0.012204	77.22673	0
Time	0.588612	0.224214	0.003524	0.001342	2.62522	0.020977
N=15	Results of regression with dependant variable: EU share in import R= .68315665 R2= .46670301 Corrected R2= .42568017. F(1.13)=11.377 p<.00500 Stand. Error of Estimation: .09965. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			0.505829	0.054144	9.342264	0
Time	0.683157	0.202541	0.020086	0.005955	3.372931	0.004996
N=15	Results of regression with dependant variable: ExportTrade Value R= .88866763 R2= .78973016 Corrected R2= .77355556. F(1.13)=48.825 p<.00001 Stand. Error of Estimation: 19.629. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			12.16806	10.6654	1.140892	0.274497
Time	0.888668	0.127179	8.19661	1.17304	6.987512	0.00001
N=15	Results of regression with dependant variable: ImportTrade Value R= .94250930 R2= .88832379 Corrected R2= .87973331. F(1.13)=103.41 p<.00000 Stand. Error of Estimation: 52.211. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			-64.3167	28.36933	-2.26712	0.041087
Time	0.942509	0.092685	31.7293	3.12021	10.16897	0
N=15	Results of regression with dependant variable: Export unit price R= .07022138 R2= .00493104 Corrected R2= -----. F(1.13)=.06442 p<.80361 Stand. Error of Estimation: .45072. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			2.21037	0.244903	9.025497	0.000001
Time	0.070221	0.276665	0.006837	0.026936	0.253813	0.80361
N=15	Results of regression with dependant variable: Import Unit price R= .71815819 R2= .51575119 Corrected R2= .47850128. F(1.13)=13.846 p<.00257 Stand. Error of Estimation: .29266. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			1.437152	0.15902	9.037565	0.000001
Time	0.718158	0.193002	0.065079	0.01749	3.720982	0.002565
N=15	Results of regression with dependant variable: Kryti R= .92742228 R2= .86011209 Corrected R2= .84935148. F(1.13)=79.932 p<.00000 Stand. Error of Estimation: .08112. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			0.883798	0.044079	20.05022	0
Time	-0.927422	0.103733	-0.043344	0.004848	-8.94044	0.000001
N=15	Results of regression with dependant variable: Bilance R= .93634496 R2= .87674189 Corrected R2= .86726049. F(1.13)=92.470 p<.00000 Stand. Error of Estimation: 40.950. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			76.4848	22.25039	3.43746	0.004413
Time	-0.936345	0.097372	-23.5327	2.44722	-9.61612	0
N=15	Results of regression with dependant variable: LFI EU R= .92009444 R2= .84657378 Corrected R2= .83477176. F(1.13)=71.731 p<.00000 Stand. Error of Estimation: .37377. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			1.410963	0.203093	6.94737	0.00001
Time	-0.920094	0.108637	-0.189184	0.022337	-8.46943	0.000001
N=15	Results of regression with dependant variable: LFI (World – third countries) R= .54661826 R2= .29879153 Corrected R2= .24485241. F(1.13)=5.5394 p<.03499 Stand. Error of Estimation: .91817. alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			-1.33976	0.498894	-2.68546	0.018705
Time	-0.546618	0.232248	-0.12914	0.054871	-2.3536	0.034991
N=18	Results of regression with dependant variable: Consumption R= .91022208 R2= .82850424 Corrected R2= .81778576. F(1.16)=77.297 p<.00000 Stand. Error of Estimation: 21227. . alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			139325.8	10438.61	13.34716	0
Time	0.910222	0.10353	8478.5	964.36	8.79186	0
N=18	Results of regression with dependant variable: Production R= .74682718 R2= .55775084 Corrected R2= .53011027. F(1.16)=20.179 p<.00037 Stand. Error of Estimation: 23440. . alfa = 0.05					
	b*	Stand. Error of b*	b	Stand. Error of b*	t(13)	p-value
Abs. item			133968.2	11526.98	11.62215	0
Time	0.746827	0.166255	4783.7	1064.91	4.49207	0.00037

Source: UN Comtrade, FAO, own processing 2012

Table 17: The analysis of selected trend characterizing Czech poultry meat market development.

comparative advantages of Czech poultry meat trade gradually disappear in time – or rather, the comparative disadvantage deepens, both in relation to EU countries, as well as in relation to third countries. Only certain aggregations are capable of maintaining the comparative advantages, which are additionally characterized by a low level of processing (generally, these are frozen or chilled unprocessed meat). The market of the EU countries represents the most significant destination of Czech export of poultry meat. Just in the year 2011, approximately 98% of the value of exports was carried out on that market. Nevertheless, the Czech Republic achieved comparative advantages only in relation to Austria, Cyprus, Greece, Italy, Malta and the Netherlands. In relation to the other countries, we can clearly see a deepening of comparative disadvantages. The most significant comparative disadvantage is seen in relation to Poland, Hungary, Romania and France. The cumulative value of the negative balance in relation to these countries actually represents USD 264 mil. The most significant worsening of the balance and competitiveness is evident primarily in relation to Poland. Polish imports represent approximately half of the value of all imports from EU countries, and in relation to volume, these imports represent approximately 48% of all imports from EU countries. A large portion of domestic production of poultry meat carried out in Czech meat processing plants is in fact represented by Polish imports of live poultry, or unprocessed chilled, or frozen poultry meat. In relation to the outlook into the future, we can expect the gradual worsening of the position of Czech production of poultry meat both in relation to the domestic market, as well as in relation to the external market represented by the EU countries and third countries.

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The Competitiveness of Agricultural Foreign Trade Commodities of the CR Assessed by Way of the Lafay Index

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Anotace

Článek se zabývá agrárním zahraničnim obchodem České republiky v období 2008 – 2011. Pro celou odvětvovou strukturu agrární produkce – 24 agregací komodit v členění podle kapitol potravinového zboží se snaží zjistit, jak se jednotlivé komodity na zahraničním trhu uplatňují. K ocenění konkurenceschopnosti uvádí několik nástrojů. Je to především Balasssův pomocný ukazatel RCA zjevné konkurenční výhody (Revealed Comparative Advantage) a Lafay index. Využito bylo poslední nejkomplexnější kriterium – Lafay index. Pro uvedená léta je nejdříve věnována pozornost celkovému vývoji agrárního zahraničního obchodu (AZO), je shrnuta hodnota exportu a importu, spočteno saldo, obrat. Ukázána je teritoriální struktura, sledován je celkový vývoz, vývoz do zemí EU 27, do tří zemí, které jsou největšími obchodními partnery (Německo, Slovensko, Polsko) a do třetích zemí. Pro poslední rok 2011 jsou výsledky pro agregace komodit, které se na daném trhu uplatňují, zpracovány do přehledných tabulek, ukázáno je pořadí prvních pěti agregací komodit. Stručně jsou uvedeny výsledky pro rok 2008, diskutovány jsou změny struktury, ke kterým za poslední čtyři roky došlo.

Klíčová slova

Agrární zahraniční obchod, zahraniční obchod, konkurenceschopnost, konkurenční výhoda, Balassův index, Lafay index.

Abstract

The article deals with agricultural foreign trade of the Czech Republic in the period of 2008 – 2011. For the whole sector structure of agricultural production – 24 aggregations of commodities structured according to chapters of food goods - it attempts to ascertain how the individual commodities are faring on the foreign market. It presents several tools for the assessment of competitiveness. Primarily, this includes the Balassa auxiliary RCA (Revealed Comparative Advantage) index, and the Lafay index. The last, most comprehensive criterion was utilized – the Lafay index. For the years in question, attention is first given to the overall development of agricultural foreign trade (AFT), the value of export and import is summarized, and the balance and turnover is calculated. The territorial structure is shown, total export is studied, as well as export into the EU 27 countries, into the three countries that are the biggest trading partners (Germany, Slovakia, Poland) and into third countries. For the last year, 2011, the results for the aggregations of commodities that show up on the given market are processed into clear tables, with the order of the first five aggregations of commodities being shown. The results for the year 2008 are set out briefly, and changes in the structure that occurred within the past four years are discussed.

The article was prepared as part of the Research Project MSM 6046070906 “Economics of Resources of Czech Agriculture and Their Effective Utilization within Multifunctional Agricultural-Food Systems”.

Key words

Agrarian foreign trade, foreign trade, competitiveness, competitive advantage, Balassa index, Lafay index.

Introduction

Foreign trade (FT) is among the decisive factors affecting economic growth of individual countries, as well as of the whole world economy. Foreign trade has an effect on the creation of internal economic balance (transformational function), and has a share in the international division of labor with the resulting effect of saving national labor and resources (growth function). (Jeníček, Krepl,

2009). Agricultural trade is an important part of the global merchandise trade. Despite of its low share in global trade value, it plays an important role in global human society development (Proudman, Redding, 2000).

Agricultural foreign trade (AFT) within the conditions of the Czech Republic represents only about 5% of the total Czech foreign trade turnover value. A characteristic feature of the commodity and territorial structure of Czech agricultural trade is its relatively narrow diversity (Svatoš, Smutka, 2012a). Czech agrarian trade is concentrated especially on EU market. The EU members' share in Czech agrarian export and import is 92% respectively 85%. The high concentration of Czech agrarian trade is also visible in case of commodity structure development. The most important six commodity aggregations' share in Czech agrarian export (CN 04, CN 10, CN, 21, CN 22, CN 24 and CN 19) and import (CN 02, CN 04, CN 08, CN 21, CN 22 and CN 07) is about 50% (Svatoš, Smutka, 2012b). In view of the securing of food commodities, there cannot be doubt about Czech agrarian trade important position both from the export and import point of view. Agricultural trade enables to the Czech Republic to consume many types of commodities and foodstuff products which cannot be produced in local conditions. It also provides to Czech farmers and producers a the possibility to penetrate other countries' markets and for the Czech consumers foreign trade represents a possibility to have an access to many different types of products for reasonable prices (Vološin, Smutka, Selby, 2011).

The Czech AFT balance is negative on a long-term basis; within recent years, the percentage of coverage of agricultural import by export has been ranging between 75% and 82%. Despite of high value of Czech agrarian trade balance, it should be mentioned that the value of agrarian trade is constantly growing and in period before the global crisis (2000 – 2008), the export year-on-year growth rate was even higher in comparison with agrarian import value year-on-year growth rate (Svatoš, Smutka, 2009). In general, the period after the Czech EU accession is characterized by a significant increase in the volume as well as the value of export and import (Bašek, Kraus, 2009).

Within recent years, on a national as well as multinational level, increasing attention is being placed on matters of competitiveness. Successfulness in foreign trade activity is one of the gauges of the successfulness of the given sector as well as of the entire national economy. For the given aggregation of commodities, the assessment of competitiveness is usually conducted on the basis of easily ascertainable, quantifiable data by way of the utilization of certain recommended indicators. The Czech agrarian trade does not have a comparative advantage both in the EU market and world market. Nevertheless individual segments of Czech agrarian trade are able to get comparative advantage in relation to individual countries (Smutka, Belova, 2011). The processed paper analyses the comparative advantage of Czech agrarian export in relation to selected partners. The own analysis in concentrated especially on comparative advantage development during global economy crisis period (2008 – 2011).

Objective, material and methods

The objective of the work is to identify changes in the AFT of the Czech Republic that occurred within the past four years; and, with the utilization of the chosen indicators, to illustrate for the entire structure of agricultural trade (24 commodity chapters – for details see Tab. 1) - how the individual commodities (the analysis is concentrated especially on the most important commodities) are prospering on the European market. The main idea is to analyze the impact of crisis on Czech agrarian trade comparative advantage development in relation to selected trade partners. The Czech statistical office foreign trade database and the Institute of agricultural economics and information are the main data sources.

The said matter is dealt with within the research project Economics of Resources of Czech Agriculture and Their Effective Utilization within Multifunctional Agricultural-Food Systems, No. MSM 6046070906, PEF ČZU material phase no. 4. The work analyzing the effectiveness of agricultural production in terms of assertion on the foreign market is dealt with in section 4.8 – "Competitiveness of Agricultural Foreign Trade of the Czech Republic and Its Effect on the Economic and Social Development of Rural Areas".

Utilization of RCA and LFI Indexes

A gauge of the competitiveness of individual agricultural foreign trade commodities of the Czech Republic can be the net export of the given economy in relation to the total turnover of the given commodity or the total turnover of agricultural trade. Applicable for this is, for example, the auxiliary RCA index – the index of revealed comparative advantage. The RCA concept

CN 01	Live animals
CN 02	Meat and edible meat offal
CN 03	Fish and crustaceans, molluscs and others
CN 04	Milk and dairy produce
CN 05	Products of animal origin, not elsewhere specified
CN 06	Live trees and other plants
CN 07	Edible vegetables and certain roots and tubers
CN 08	Edible fruit and nuts
CN 09	Coffee, tea, mate and spices
CN 10	Cereals
CN 11	Products of the milling industry, malt, starches, etc.
CN 12	Oil seeds and oleaginous fruits
CN 13	Lac, gums, resins and other vegetable saps and extracts
CN 14	Vegetable plaiting materials
CN 15	Animal or vegetable fats and oils
CN 16	Preparations of meat, of fish or of crustaceans
CN 17	Sugars and sugar confectionery
CN 18	Cocoa and cocoa preparations
CN 19	Preparations of cereals, flour, starch or milk bakers' wares
CN 20	Preparations of vegetables, fruit or nuts
CN 21	Miscellaneous edible preparations
CN 22	Beverages, spirits and vinegar
CN 23	Residues and waste from the food industries
CN 24	Tobacco and manufactured tobacco substitutes

Source: Czech Statistical Office, 2012

Tab. 1. The list of aggregations representing the commodity structure of agrarian and food trade.

was expressed by its author (Balassa, 1965, 1985):

$$RCA_j = (X_j - M_j) / (X_j + M_j)\ 100$$

Xj and *Mj* … values of export and import of agricultural foreign trade of a j-th commodity into the given area. RCA indices can be determined for aggregations of commodities, as well as for a more detailed sector structure of agricultural production.

Competitive commodities can be considered to be those that achieve stable high positive RCA index values within the analyzed period. Commodities with a non-competitive position on the market can be assessed as those whose RCA index values range in highly negative numbers on a long-term basis.

The author of the concept of RCA (Balassa, 1977) also proposed the index of revealed comparative advantage in the form of a ratio. RCA 1 is defined as

$$RCA\ 1_j = (X_j / M_j) / (X / M)$$

X_j and M_j … values of export and import of agricultural foreign trade of a j-th commodity

X and *M* … total value of export and import of agricultural foreign trade for all 24 chapters of basic food goods.

For the assessment of the results of RCA 1 indexes, it applies that if the value of the RCA1 index of an analyzed commodity regularly ranges above the number one, such a commodity can be considered to be competitive. On the other hand, a commodity with a RCA 1 index value under the number one is a non-competitive commodity.

The revealed comparative advantage indices are often utilized not only for the assessment of the competitiveness of a selected commodity on the foreign market, but also for the comparison of the competitive advantage for the selected product exported from various production regions (Nin, A., Ehui, S., Benin, S., 2007). The utilization of these indicators (RCA and RCA1) is also documented in (Burianová, 2005; Qineti et al., 2009). According to some already published papers (Burianová, 2008; Smutka, Belova, 2011) analyzing AFT data through the utilization of the RCA index, as well as the RCA1 index - the order of commodities with the highest values (both RCA and RCA1) was

completely identical; both indexes apparently have the same statement value.

The RCA and RCA1 indices represent very simple way of comparative advantage analysis. They are analyzing country's trade competitiveness at the global level. It takes in consideration not only trade flows realized between analyzed country and its partners, but they are taking also in consideration global market trade performance. If we are interested in analyzing of bilateral trade comparative advantage distribution (country's comparative advantage development in relation to its trade partners), it is better to apply Lafay index. As opposed to the standard RCA index, its advantage is its ability to take into account the intersectoral trade and also re-export. In this respect, its information value is stronger as compared to the traditional index of the obvious comparative advantage. It is suitable to utilize this index in the cases when a relationship between two business partners is analyzed. The advantage of the LFI index as compared to the RCA index is also its ability to include any distortions caused by macroeconomic fluctuations (Fidrmuc et al., 1999). The LFI index enables to analyze the position of every specific product within the foreign trade structure of every specific analyzed country or a group of countries (Zaghini, 2003).

Lafay index LFI (Lafay, G. 1994) defined as

$$LFI_j^i = \left(\frac{X_j^i - M_j^i}{X_j^i + M_j^i} - \frac{\sum_{j=1}^{N}(X_j^i - M_j^i)}{\sum_{j=1}^{N}(X_j^i + M_j^i)} \right) \frac{X_j^i + M_j^i}{\sum_{j=1}^{N}(X_j^i + M_j^i)} \; 100$$

where:

x^ij and m^ij represent exports and imports of "j" product realized by "i" country or a group of countries with respect to the rest of the world or with respect to a selected business partner (partner country). "N" is the number of analysed items.

If we mark the individual elements of this relationship

$$LFI_1 = \frac{X_j^i - M_j^i}{X_j^i + M_j^i}$$

$$LFI_2 = \frac{\sum_{j=1}^{N}(X_j^i - M_j^i)}{\sum_{j=1}^{N}(X_j^i + M_j^i)}$$

$$LFI_3 = \frac{X_j^i + M_j^i}{\sum_{j=1}^{N}(X_j^i + M_j^i)}$$

it is apparent that

$$LFI = (LFI_1 - LFI_2) LFI_3 \; 100$$

The first element LFI_1 measures the net export for the given commodity by way of the turnover for such commodity; this is the well-known Balassa RCA index.

The second element LFI_2 compares the total net export (the sum for all commodities) to the total turnover. The parenthesis has a positive value if $LFI_1 > LFI_2$ i.e. the RCA (revealed comparative advantage) index of the given commodity is greater than the RCA assessed as the sum for all commodities.

The third element LFI_3 adjusts the value of the parenthesis; it expresses what share the given commodity has in the total turnover.

The positive value of the LFI index indicates existence of a comparative advantage within the analysed traded aggregation or a group of aggregations in question. And vice versa, the negative value of the LFI index signals that specialization and hence comparative advantages are lacking (Zaghini, 2005).

Results and discussion

Development of the AFT of the Czech Republic

For the analyzed time period, 2008 – 2011, attention is first focused on the overall development of AFT value. For the 24 aggregations of commodities segmented according to CN chapters (for details see Tab. I), the value of export and import was summarized, and the balance and turnover was calculated. The results are in Tab. 2.

The AFT results within the years 2008 – 2009 were affected by the overall stagnation of the national economy as a result of the world economic crisis (crisis affected the majority of world economy sectors), which the European area did not manage to avoid. Czech agrarian export reduced its value about cc 5.2 bill. CZK and import reduced its year-on-year growth rate below the previous ten years average. In 2010, there was a certain recovery of the economy of the Czech Republic, but a significant improvement in the parameters of export in the area of agriculture did not come until 2011, when, compared with the year 2010, AFT value turnover increased by CZK 30.8 billion (both Czech agrarian export and import increased their values by more than 15 bill. CZK). The increase in export was 14.6% and the value of import increased

/CZK mil./	2008	2009	2010	2011
Export	106 931.0	101 707.7	105 364.2	120 725.4
Import	131 048.0	133 735.2	140 007.8	155 466.2
Balance	-24 117.1	-32 927.5	-34 643.6	-34 740.8
Turnover	237 979.0	235 442.9	245 372.1	276 191.6

Source: ÚZEI, own processing

Tab. 2. AFT within the Years 2008 - 2011.

Turnover /mil. CZK/	2008	2009	2010	2011
Total	237 979.0	235 442.9	245 372.1	276 191.6
EU 27	218 205.6	222 027.4	215 805.8	242 747.5
Germany	57 072.2	57 514.5	56 297.0	59 089.7
Slovakia	42 267.6	41 011.1	43 236.4	46 630.3
Poland	28 922.6	30 070.8	30 845.4	36 547.8
Third countries	18 315.7	16 570.6	29 566.2	33 444.2

Source: ÚZEI, own processing

Tab. 3. Territorial Structure of the AFT Turnover of the Czech Republic.

by 11% (the highest year-on-year growth rate of export value in comparison with import value was the positive feature of the year 2011). Taking in consideration the Czech AFT value development during the whole period, it can be seen that the world economy crisis did not affect Czech AFT seriously. The pro-growth AFT value development was interrupted only in 2009, but during the whole analyzed period the average value of year-on-year export and import growth rate reached the following results 4.1%/year respectively 5.9%/year. The problem of the whole monitored time period is higher year-on-year growth rate of imports in comparison with exports. It resulted in significant growth of Czech AFT negative balance.

A significant part of the turnover in agricultural trade is created with EU countries. As Tab. 3 shows (it contains summarizing information regarding territorial structure) in 2011, trade with the EU 27 countries comprised 87.9% of the total turnover, 51.5% with third neighboring countries, of which 21.4% was with Germany, 16.9% with Slovakia, and 13.2% with Poland, and 12.1% with third countries. During the analyzed time period the share of third countries (all trade partners without EU members) in total Czech AFT turnover value increased from 7.7% to more than 12%, on the other hand the share of EU 27 members declined from 91.7% to about 88%. If we take in consideration the share of the Czech most important agrarian trade partners development, it can be seen the share of Poland increased by 1.1% and the shares of Germany and Slovakia decreased by about 1%. In general, it is possible to say that the impact of crisis on Czech AFT in relation to main trade partners was very limited.

A further section focuses on the analysis of the structure and especially competitiveness of agricultural trade within the last analyzed year, i.e. 2011; the structure of AFT is briefly compared to the situation in 2008. In view of the territorial structure, we will focus on total trade, trade with EU 27 countries, trade with the three largest partners (Germany, Slovakia and Poland) and trade with "third countries".

Utilization of the LFI Index

In 2011, the competitiveness of AFT for the 24 aggregations of commodities segmented according to CN chapters was assessed with the utilization of the LFI index. The Czech AFT as a one category does not have comparative advantage in relation to all trade partners (all trade partners are taken as a one big group), but if we are analyzing individual AFT components'(aggregations) competitiveness, we can see that at least some aggregations are able to get comparative advantage in relation to global market. The results in Tab. 4 are shown as values of the overall index and its partial elements for the best five commodities. The ascertained order shows the following: the aggregation of commodities CN 10 (cereals) distinctly has the best pro-export position in overall trade; CN 4 (milk and dairy products) is in the second place. The others (the most important aggregations) are the following: CN 01 (live animals), CN 24 (tobacco and manufactured

CN	LFI_1 (RCA)	LFI_2	LFI_3	LFI Overall	LFI Order Overall
10	0.6738	-0.1258	0.0515	4.1144	1
04	0.1343	-0.1258	0.1030	2.6797	2
01	0.5220	-0.1258	0.0274	1.7748	3
24	0.1807	-0.1258	0.0528	1.6186	4
17	0.1457	-0.1258	0.0397	1.0771	5

Source: ÚZEI, own processing

Tab. 4. LFI Index - 2011 Overall .

CN	LFI_1 (RCA)	LFI_2	LFI_3	LFI Overall	LFI Order Overall
10	0.7050	-0.0873	0.0565	4.4796	1
24	0.2617	-0.0873	0.0552	1.9255	2
04	0.0649	-0.0873	0.1076	1.6385	3
01	0.4684	-0.0873	0.0276	1.5357	4
17	0.1103	-0.0873	0.0407	0.8041	5

Source: ÚZEI, own processing

Tab. 5. LFI Index - 2011 EU 27.

tobacco substitutes), and CN 17 (sugar and sugar confectionery).

It is worth noticing the fact that this order of commodities is not identical to the order that is given by the value of the LFI1 (RCA) index. The structure of export four years ago, in 2008, was analogous to the year 2011. In general, the same commodities dominated the list of the most competitive aggregations. The order of the first chapters was as follows: CN 04 (milk and dairy products), CN 12 (oil seeds and oleaginous fruits), CN 10 (cereals), CN 24 (tobacco and manufactured tobacco substitutes) and CN 01 (live animals). The only significant difference existing between the years 2008 and 2011 is competitiveness decreased in the case of CN 12.

If we want to analyze the Czech AFT competitiveness, it is necessary to analyze separately trade in relation to EU market and trade in relation to third countries. Trade in relation to EU is affected by the existence of EU common market and trade in relation to third countries is affected by EU Common trade and agricultural policies (there are also the EU's obligations in relation to WTO – for details see for example Svatoš, Smutka, 2011; Vološin, Smutka, Selby, 2011). The pro-export position of commodities in trade with the EU 27 countries is shown in Tab. 5.

In view of the fact that a significant part of agricultural trade is conducted with EU 27 countries, significant deviations from Tab. IV cannot be expected. The first five places are held by the same commodities; only commodity CN 24 (tobacco and manufactured tobacco substitutes) moved to a second place ranking in terms of trade with the EU 27.

In 2008, the structure of trade with the EU 27 was in the following order of chapters: CN 10 (cereals), CN 12 (oil seeds and oleaginous fruits), CN 24 (tobacco and manufactured tobacco substitutes), CN 04 (milk and dairy products), CN 01 (live animals). If we compare the years 2008 and 2011, it can be seen that CN 12 left the top ten list of the most competitive aggregations and it was replaced by CN 17. It should be highlighted that the year 2011 was the first year after the crisis when the significant growth of AFT value in relation to EU 27 was recorded. In 2011, Czech agricultural export into EU 27 countries increased (in comparison with the previous year) its value by 14.9%, and import increased by 10.6%. The negative balance of Czech agricultural trade in relation to EU 27 decreased by 1.7 billion CZK.

The largest partner in foreign trade as well as in AFT on a long-term basis is Germany. Tab. 6 shows the order of the first five the most competitive commodities according to assessment by way of the LFI index.

In the first place, with a substantial interval, is the aggregation CN 10 (cereals). The subsequent ranking is occupied by CN 04 (milk and dairy products), the third place is held by a specific commodity group for trade with Germany - CN 12 (oil seeds and oleaginous fruits). The fourth place

CN	LFI_1 (RCA)	LFI_2	LFI_3	LFI Overall	LFI Order Overall
10	0.9384	-0.1807	0.1205	13.4834	1
4	0.0358	-0.1807	0.1590	3.4428	2
12	0.3515	-0.1807	0.0518	2.7551	3
1	0.3164	-0.1807	0.0247	1.2286	4
22	0.0394	-0.1807	0.0450	0.9913	5

Source: ÚZEI, own processing

Tab. 6. LFI Index - 2011 Germany.

CN	LFI_1 (RCA)	LFI_2	LFI_3	LFI Overall	LFI Order Overall
16	0.8881	0.4798	0.0504	2.0587	1
02	0.6869	0.4798	0.0935	1.9361	2
24	0.9991	0.4798	0.0270	1.4000	3
07	0.7104	0.4798	0.0464	1.0699	4
23	0.7609	0.4798	0.0354	0.9947	5

Source: ÚZEI, own processing

Tab. 7. LFI Index - 2011 Slovakia.

is occupied by commodity CN 01 (live animals), and the fifth analyzed place is held by commodity CN 22 (beverages, spirits and vinegar). In 2008, the following aggregations reached comparative advantage in trade with Germany: CN 10 (cereals), CN 12 (oil seeds and oleaginous fruits), CN 04 (milk and dairy products), CN 22 (beverages, spirits and vinegar), and CN 01 (live animals). They were the same commodities as in 2011, with only the order being slightly modified.

The second most important Czech AFT partner is Slovakia. Slovak republic is very important for the Czech Republic especially because of positive agrarian trade balance. Slovakia is for the Czech important the most important export partner and it must be highlighted, that Czech agrarian export is much more competitive in relation to Slovakia than it is visa verse (for details see Smutka, Svatoš, 2010). Specific distribution of comparative advantages in agricultural trade with Slovakia is documented in Tab. 7. The first place is held by CN 16 (preparations of meat, of fish or of crustaceans), in the second place is CN 02 (meat and edible meat offals). The third place was occupied by commodity CN 24 (tobacco and manufactured tobacco substitutes). The next commodity is CN 07 (edible vegetables and certain roots and tubers), and in the fifth place is CN 23 (residues and waste from the food industries).

In 2008, the following commodities fared well in trade with Slovakia: CN 16 (preparations of meat, of fish or of crustaceans), CN 02 (meat and edible meat offals), CN 23 (residues and waste from the food industries), CN 22 (beverages, spirits and vinegar) and CN 24 (tobacco and manufactured tobacco substitutes). In 2011, CN 22 (beverages, spirits and vinegar) was no longer among the highest ranked categories – its position among the five the most competitive aggregations took CN 07.

Poland is the third the most active Czech agrarian trade partner. The mutual agrarian trade balance is negative for the Czech Republic. After the EU accession Polish export on Czech market started to growth its value. The average inter annual growth rate of Polish exports on Czech market is much higher in comparison with Czech exports on Polish market (Svatoš, Smutka, 2012b). Only in the period 2008 – 2011, the Czech agrarian exports and imports on Polish market recorded the following average values of year-on-year growth rate (geomean): 3.5% respectively 11.1%. Czech agrarian export in relation to Poland has only limited comparative advantage. Nevertheless some aggregations are able to get a good competitive position in trade with Poland (Tab. VIII includes the list of top five the most competitive aggregations). In the first place is the aggregation CN 10 (cereals), in the second place is CN 11 (products of the milling industry, malt, starches, inulin), in the third place is CN 23 (residues and waste from the food industries). The subsequent ranking is held by CN 15 (animal or vegetable fats and oils), and the fifth place is occupied by CN 01 (live animals).

In 2008, the following commodity chapters fared

CN	LFI_1 (RCA)	LFI_2	LFI_3	LFI Overall	LFI Order Overall
10	0.8702	-0.2791	0.0629	7.2324	1
11	0.8357	-0.2791	0.0315	3.5125	2
23	0.2966	-0.2791	0.0498	2.8667	3
15	0.0619	-0.2791	0.0734	2.5039	4
01	0.7953	-0.2791	0.0157	1.6825	5

Source: ÚZEI, own processing

Tab. 8. LFI Index - 2011 Poland.

CN	LFI_1 (RCA)	LFI_2	LFI_3	LFI Overall	LFI Order Overall
04	0.9148	-0.4048	0.0695	9.1725	1
01	0.9413	-0.4048	0.0257	3.4556	2
12	0.3034	-0.4048	0.0421	2.9803	3
17	0.4692	-0.4048	0.0323	2.8253	4
22	-0.1271	-0.4048	0.0813	2.2567	5

Source: ÚZEI, own processing

Tab. 9. LFI Index - 2011 Third Countries .

well in trade with Poland: CN 10 (cereals), CN 11 (products of the milling industry, malt, starches, inulin), CN 12 (oil seeds and oleaginous fruits), CN 23 (residues and waste from the food industries), and CN 01 (live animals). If we compare the results for the year 2008 with the results for the year 2011, we can see that in top five the most competitive aggregations the aggregation CN 12 was replaced by CN 15. In this case should be mentioned that aggregation CN 12 did not lose its comparative advantage, only the value of LFI index was reduced from 3.647 to about 1.478. The aggregation CN 15 was able during the last four years to improve its competitiveness. While in 2008 the value of LFI index was about minus 1.5, in 2011 LFI index value was highly positive about plus 2.5.

Except for the EU market the Czech Republic is realizing its agrarian trade in relation to non-EU members – third countries. During the last decade the importance of third countries as trade partners was decreasing. Their share in Czech AFT was reduced especially after the Czech EU accession. Nevertheless within the period 2008 - 2011 Czech AFT with third countries had an increasing tendency. In 2011, it was 12.1% of total AFT, while in 2008 it was only 7.7%. It should be mentioned that the Czech Republic has extremely negative trade balance in relation to third countries. Trade with third countries is represented especially by imports of tropical and subtropical products and commodities mainly from developing countries. Czech agrarian trade competitiveness in relation to this group of countries is very low (for details see Vološin, Smutka, Selby, 2011). The list of the most competitive aggregations is in Tab. 9.

The order of commodities in 2011 was as follows: CN 4 (milk and dairy products), CN 1 (live animals), CN 12 (oil seeds and oleaginous fruits), CN 17 (sugars and sugar confectionery), and CN 22 (beverages, spirits and vinegar). In 2008, the list of top five the most competitive aggregations was the same, with only the order being slightly modified.

Conclusion

The accession of the Czech Republic into the EU in 2004 meant significant changes for AFT (Svatoš, Smutka, Miffek, 2010). In the subsequent years, the value of agricultural export turnover increased significantly. While the total turnover was at a level of CZK 155 billion in 2004, in 2008 it was CZK 237.9 billion and last year, in 2011, it was up to CZK 276.2 billion.

The structure of exported commodities also changed. In order to assess which commodities are competitive, and/or which ones show a certain level of specialization in export, specific indicators can be utilized. These can include the Balassa revealed comparative advantage (RCA) or Lafay index (LFI). For the year 2011, the LFI index value was calculated for all 24 chapters representing Czech agrarian foreign trade. The LFI index was calculated for trade with EU countries (especially trade with Germany, Slovakia, and Poland was analyzed in

detail) and third countries, and the order of highest LFI index values was determined. In 2011, in terms of the values of the LFI index, the following commodity aggregation chapters fared the best: CN 10 (cereals), CN 04 (milk and dairy products), CN 24 (tobacco and manufactured tobacco substitutes), CN 17 (sugars and sugar confectionery), CN 01 (live animals). In trade with Germany, the aggregations CN 12 (oil seeds and oleaginous fruits) and CN 22 (beverages, spirits and vinegar) are also in good competitive position. Some specific commodities and aggregations are also successful in trade with Slovakia and Poland (CN 16 - preparations of meat, of fish or of crustaceans, CN 02 - meat and edible meat offals, CN 07 - edible vegetables and certain roots and tubers, CN 15 - animal or vegetable fats and oils, CN 23 - residues and waste from the food industries).

In relation to the main aim of this paper it can be stated, that the analyzed time period affected Czech AFT value and structure development only minimally. The impact of crisis on competitiveness of Czech agrarian export was only minor. The main aggregations were able to keep their comparative advantages both in relation to EU 27 market and third countries' market. Also the Czech agrarian export competitiveness in relation to main trade partners (Germany, Slovakia and Poland) was not significantly affected by the global economy crisis.

The presented results show that the selected indicators can serve as appropriate tools for the analysis of foreign trade, and the conducted analyses can be useful information regarding the opportunities for the success of selected commodities on foreign markets.

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Proposal of the Creation of Resources for the Maintenance of the Production Capability of the Agricultural Land Fund by Way of Tax Savings

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Anotace

Článek obsahuje návrh metodiky tvorby zdrojů, peněžních prostředků do zemědělství prostřednictvím daňových úspor. Ty jsou vytvořeny uplatněním odčitatelných položek od základu daně. K výpočtu odpočitatelných položek byla použita průměrná úřední cena zemědělské půdy za katastrální území a autory navržená „pozemková sazba“ (3,3%). Pozemková sazba byla vypočtena jako inversní hodnota doby návratnosti investice do zemědělské půdy. Vypočtená daňová úspora dle příslušné daňové sazby a výše odčitatelné položky představuje částku 306 - 388 Kč/ha zemědělské půdy v závislosti na typu podnikatelského subjektu. Vzniklá úspora odpovídá např. kompenzaci za zrušené TOP-UP (2010) platby na zemědělskou půdu. I další rezervy v současném ekonomickém systému (nezdaněné zemědělské dotace) by mohly vést např. k ochraně zemědělského půdního fondu z hlediska kvantity a kvality. Uvedené výsledky mohou být důležité nejen z hlediska informačního, ale především metodologického. Příspěvek byl zpracován v rámci VZ MSM 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systému“.

Klíčová slova

Zemědělský půdní fond, produkční schopnost, bonitovaná půdně ekologická jednotka, daňová úspora, odčitatelná položka od základu daně, úřední a tržní cena zemědělské půdy, náklady.

Abstract

The article contains a proposal of the methodology for the creation of resources, monetary funds into agriculture by way of tax savings. Those are created by way of the utilization of items deductible from the tax base. The average official price of agricultural land for the cadastral area and a proposed “land rate” (3.3%) were used for the calculation of deductible items. The land rate was calculated as the inverse value of the return time for investments in agricultural land. The calculated tax savings according to the relevant tax rate and the amount of the deductible item constitutes the amount of CZK 306 - 388/ha of agricultural land depending on the type of business entity. The arisen savings correspond, for example, to the compensation for the cancelled TOP-UP (2010) payments for agricultural land. Other reserves within the current economic system (untaxed agricultural subsidies) could also lead, for example, to the protection of the agricultural land fund in terms of quantity and quality. The said results can be important not only from an information standpoint, but primarily from a methodological standpoint. The article was drawn up as part of VZ MSM 6046070906 “Economy of Resources of Czech Agriculture and Their Effective Utilization within Multifunctional Agricultural-Food Systems”.

Key words

Agricultural land fund, production capability, estimated pedologic-ecological unit, tax savings, item deductible from the tax base, official and market price of agricultural land, costs.

Introduction

The scope of land is fixed. The number of inhabitants on earth is growing, and so are their increased demands for space and subsistence. Primarily quality agricultural land is and will be an appealing investment. The significance of agricultural land in the Czech Republic, as well as in the EU, is not

yet fully appreciated, despite the fact that according to Article No. 7 of the Constitution of the Czech Republic "the state is to see to the considerate utilization of natural resources and the protection of the natural wealth, the basis of which is land".

The objective of the analyzed issue is to propose measures that would provide advantages for the purchase of agricultural land, primarily of arable land, as opposed to its renting, and, at the same time, find resources for the maintenance of its production capability.

The objective will be achieved (1) by way of the calculation of tax savings in the form of items deductible from the tax base (economic result) with demonstration of the impact of the proposal on business entities and government revenue and (2) proposal of calculation in which the subsidies paid to cropland not included in the taxable income of farms.

Deininger et al. (2004) emphasize that land markets act as a medium for the transfer of agricultural land from passive farmers to active farmers, or, more generally, from less effective farming to more efficient agricultural producers. The decline in the amount of quality agricultural land in China is addressed by Skinner et al. (2001). The decline and degradation of land is occurring in connection with the faulty interpretation of the legal framework for the protection of land with the growing transformation of agricultural land into commercial, industrial and residential areas in China. Reduced areas of cultivated land in China have been caused by the transformation into pastures and forests. This process is also taking place the other way around and thus, even with the transformation of agricultural land into building sites, food security has not been jeopardized. The author supports the opinion that it does not have to be so in the future either. Thanks to economic growth, cultivated land will be inevitably shifted to other purposes. It is then necessary to utilize land rationally for the preservation of the current level of food self-sufficiency and employment (Deng et al., 2006). The implementation of European agricultural policy that would support the maintenance of land with low intensity for production purposes is an ineffective manner in which to react to the negative consequences of the abandonment of land. In some countries, the process of specialization in production brings about the increased monotony of the countryside and the loss of biological diversity of agricultural land occurs. Abandoned localities with a high natural value can have further ecological benefits (Renwick et al., 2012). Models that create scenarios for the future utilization of land confirm that, in industrial regions, it will be necessary to utilize land in an intensive manner. However, that requires improvement of the ties between agriculture, forestry, the energy sector, innovation technologies and agro-environmental policies (Lambin et al., 2000). The European Union (EU) has set ambitious goals for itself for an increase in the utilization of renewable energy resources. Germany is the leading country in the world in the production and consumption of biodiesel (two fifths of world production). However, going forward, this state will be difficult to sustain in terms of the negative impact on the environment and in view of the global shortage of agricultural land (Bringezu et al., 2009). Authors Bartolini and Viaggi (2011) established what the intentions of farmers are in relation to the extent of farmed agricultural land. Approximately 26% of farmers in the EU who intend to continue to remain in agriculture state the intention to increase the extent of their own as well as rented land within the next ten years. Approximately 5% of farmers state the intention to decrease the amount of rented land. According to a survey by Raggi et al. (2012), there are 15.4% of farmers in the EU who intend to leave agriculture under the current form of EU Common Agricultural Policy (CAP). The scope of variability within the analyzed states is relatively broad in regard to this decision. In Poland, with the existing form of the CAP, 3.6% of farmers will leave farms, and 35.7% of farmers in the Netherlands will do so.

Autors Viaggi et al. (2010) state, that the financial stability of agricultural businesses is secured by subsidies. Payments for the support of income reduce the resources reallocated toward prospering farms and it is not desirable that they help to maintain the activity of economically weak farms.

The economic situation of European agricultural businesses is not favorable. Development within recent years shows that agriculture in the EU is characterized by a continuing decline in the number of agricultural businesses and work forces. There is a continual process present consisting in the termination of the activities of agricultural businesses. The number of agricultural businesses in the EU 27 between the years 2003-2007 decreased on average by 9%; in some countries, the rate of decrease was more than double as compared to the EU average (European Commission, 2010).

Lindstrom (2008) presents options of aid that are not typical instruments of subsidy policy. He supports tax benefits in the United States that are provided to those owners of land who will support the protection of nature on private land – by way of a reduced inheritance tax, land tax and income tax deductions. Ravenscroft (1999) points out the growing dimension of rented land in Europe. Ravenscroft examines the changing nature, form and structure of agricultural renting in various social, political and economic contexts. The renting of private land is a significant element of the agricultural environment that exists and has an impact worldwide. Despite the fact that it is difficult to establish a comprehensive overview of the scope of rented land on a global level, data on the European Union show that in some countries, rental agreements represent as much as 70% of agricultural area. However, rental relations are not comparable to ownership relations in terms of the quality of the agricultural land. Duke at al. (2004) describe the agricultural land market in Slovakia. Traded land plots are smaller than 5 ha. and are of a low quality. It is very difficult to obtain information on transactions pertaining to land, as they are registered by cadastral authorities. This information is protected by laws on the protection of privacy that are very strict. Agricultural land markets are very weak and market prices of land are undervalued. For example, the interest rate from savings exceeds the rate of return from agricultural land. That leads to a low demand for agricultural land and it is very difficult to use agricultural land in order to secure an investment loan. That sends the signal onto the agricultural land market the signal that land is perceived as a disadvantageous investment. The authors of the article criticize the fact that the basis for the calculation of taxes is official (administrative) prices and not market prices. It is a matter for consideration whether one can agree with the authors when they criticize high fees for the transfer of land for non-agricultural use and do not agree with legal regulations that complicate foreign ownership of land. They consider them to be types of interventions that explain the inelasticity of the land market and the low prices of agricultural land. Marks-Bielska (2013) focuses on the agricultural land market in Poland. Farming in Poland is carried out on private and family farms (84.84%). In addition, 80.34% of surveyed farmers in the study by Marks-Bielska confirmed that they will pass their land on to their children or grandchildren. The motifs presented by the lessees and purchasers of agricultural land are the following: (1) the desire to establish a new farm or to expand a current one, or, (2) investments in regard to the anticipated increase in prices of agricultural land, and (3) in order to obtain aid from EU funds. Nevertheless, after 1989, the agricultural land market was formed through factors such as primarily the following: respect for the land as a multifunctional factor of production, the support of ownership rights to land which are a significant precondition for increases in the effectiveness of farming on agricultural land and the possibility of integration into the EU.

Ryan at al. (2001) emphasize that direct payments have a positive effect on the amount of rent, as they increase the revenue from agricultural production. That increases the demand for agricultural land. A differing opinion is presented in the Czech Republic by Vigner (2011). Vigner states that aid is a part of revenues and thus has a significant effect on the creation of net added value, income and profit of a business. The inclusion of aid into revenues increases the rental effect and thereby also the tax on the land, which is derived from the official price in the Czech Republic.

Material and Methods

The article utilizes the basic methods of research, such as analysis and synthesis of documents, the study of secondary data: the Income Tax Act No. 586/1992 Coll., as amended, Act No. 151/1997 Coll., on the Appraisal of Assets including annexes with estimated pedologic-ecological units and assigned official prices.

Further, research reports of the Institute of Agricultural Economics and Information (IAEI) in the area of the analysis of the production capability of land in the Czech Republic from the period of 1998-2004, the database of the Czech Statistical Office (Agrocenzus), the database of IAEI (FADN), were utilized. Were processed data from the database of the Creditinfo Company Monitor, (Collected by Creditinfo Czech Republic, s.r.o.; data in the years 2006 – 2010)

The authors of the article utilize the assumption that resources for the purchase and maintenance of the production capability of land, primarily of arable land, can be created through the effective utilization of tax savings, for example by way of items deductible from the tax base.

In order to ascertain the period for which the investment expenditure will be gradually applied, the correlation according to Valach was used:

$$T = \frac{I}{NRRE} \quad [year] \qquad (1)$$

T Return time on the investment

I Investment expenditure for purchase of land

NRRE Net annual rental effect = HRRE – income tax

The gross annual rental annual (HRRE) represents the difference between the normative value of production from a hectare in CZK with the given structure of crops and the given hectare yields and the sum of normative inputs for their production. HRRE is utilized in the correlation because there is a direct proportion between it and the official price of agricultural land (OPL). OPL is established on the basis of the capitalization of a normatively determined HRRE of agricultural land. (ŠTOLBOVÁ, 2004).

The land rate (Rland) was calculated as the inverse value to the value of the investment return time:

$$R_{land} = \frac{1}{T} \quad [\%] \qquad (2)$$

R = Proposed "tax-land rate"

T = Investment return time [years]

The amount of the item deductible from the tax base of farmers who are individuals and legal entities Xland is derived from the proposed tax-land rate (Rland).

$$X_{land} = R_{land} * PL_c \quad [CZK] \qquad (3)$$

X_{land} Item deductible from tax base

R_{land} Proposed "tax-land rate"

PL_c Average official price of agricultural land for the cadastral area

Tax savings (TS)

$TS = X_{land}$*tax rate for income of legal entities and individuals [CZK] (4)

Legal entities = businesses according to Act No. 513/1991 Coll., the Commercial Code, as amended; Income tax rate for legal entities = 19% p.a.

Individuals = agricultural businesses according to Act No. 252/1997 Coll., on Agriculture, as amended, and individuals conducting business in agriculture on the basis of a trade licensing authorization – Act No. 455/1991 Coll., the Trade Licensing. Income tax rate for individuals = 15% p.a.

Income Tax Act No. 586/1992 Coll., as amended.

Results and Discussion

In the Czech Republic, 76.7% of agricultural land is rented (CSO, 2012a). The ownership relationship to land ensures a manner of farming in consideration of the quality and protection of agricultural land, and thus it is necessary to strengthen new ownership relations in regard to land. In 2010, the Supporting and Guarantee Agricultural and Forestry Fund (SGAFF) supported the purchase of 2,790 ha of non-state agricultural land. (MOA, 2010). The amount of aid funds pertains to only 2.64% of traded agricultural land. It is appropriate to seek constantly new alternative aid solutions in view of the fact that financial situation of farmers is negatively affected by the following factors:

(1) Until 2010, the State Agricultural Intervention Fund (SSIF), as part of direct aid, paid out "National Supplementary Payments for Direct Support (Top-Up)" for agricultural land. For 2012, National Supplementary Payments (Top-Up) were cancelled by Cabinet Decree No. 107/2012 Coll. and replaced with "specific support according to Article 68 of Council Regulation (EC) No. 73/2009. "Specific support" does not pertain to agricultural land. (EU Council, 2009)

(2) The reduction in tax benefits of agricultural business relates to the planned change in the maximum threshold for tax expenditures of businesses. As of now, agricultural businesses utilize 80% of applicable expenditures from the value of income. Such value will likely be decreasing in the future.

(3) As of now, farmers in the Czech Republic pay only 40% of the consumption tax on the price of fuel. In 2013, the paid consumption tax will increase to 60%. In plant production, for the analyzed year 2010, 85.71% of consumed diesel is consumed in agriculture. The Czech Republic does not decide alone on the amount of the consumption tax in the case of diesel in agriculture. Discussions regarding the cancellation of the subsidy on the consumption tax will take place in accordance with the rules of the EU (MOA, 2012).

(4) A further general negative feature in agriculture is wage disparity. The overall economic revival in 2010 was also reflected positively in agriculture; wage growth slightly exceeded growth in industry as well as in the national economy. Nevertheless, wage disparity only got up to 77% of the national economy (CSO, 2012b).

(5) Wage disparity is reflected in the decline in the number of agricultural entities in the Czech Republic. Just in the period from 2000 to 2010, the number of agricultural entities decreased from 26,539 to 22,864 entities, whereby only in the group of individuals the decline was enumerated at 3,933 entities (CSO, 2012a).

(6) In terms of quantity, there is a decline of approximately 5 ha. of quality agricultural land per day, without pressure being exerted on the part of the state for the utilization of "brownfields" and reserves in urban city areas. Correctly set standards for agricultural practice, e.g. by way of direct payments and tax benefits, can affect the negative development not only (1) in the jeopardizing of agricultural land by erosion, which is currently at a level of approximately 50% for arable land, but also (2) in the stopping of the decline in the amount of quality agricultural land (MoA, 2010).

(7) With the correct technological procedure, agricultural land is not depreciated and therefore there is no reason to amortize it. The business entity thus does not have the opportunity to include an investment for the purchase of agricultural land gradually into costs and thus lower the tax base.

In order to maintain self-sufficiency in the food area in the Czech Republic and for the growth of export of agricultural commodities, it is appropriate to support interest in agricultural business. This statement must also be understood in connection with the growing world demand for food.

1. Proposal of Items Reducing the Income Tax Base

1.1. Proposal of Calculation of Basic Tax-Land Rate (R_{land})

One of the options of how to support the purchase and protection of agricultural land and also positively reflect such fact into the area of income tax, is to apply expenditures for the purchase of agricultural land in items deductible from the tax base. In current legal practice, the acquisition price of land becomes a one-time tax cost only upon its sale (Art. 24(2)(t) of the Income Tax Act).

In the theoretical section of the proposal, the period for the possible application of expenditures associated with the purchase of land is calculated. An annual tax rate is proposed – a "tax-land rate - R_{land} (%)".

The calculation is based on the assumption that the sought return time will at least correspond to the average investment expenditure return time on the acquisition of agricultural land. The investment expenditure is set in the amount of the official price of land in such a way so that it correlates to the production capability of the land. It is paid from the net normative effects (NRRE) created through agricultural activity. The solution utilizes the official price of land which is derived from the estimated quality of the agricultural land. That allows for the objective establishment of the amount of the deductible item for the specific case.

The investment return time was established from the average official price for the cadastral area of CZK 61,849/ha and the average NRRE = CZK 2,010/ha. The calculated time T_1 = 30.77 years was, for the purposes of the methodical procedure, adjusted to a time of T_2 = 30 years. From the average official price

Average official price (PL_C)	NRRE	Calculated time T_1	Adjusted time T_2	Tax-land rate R_{land}
[CZK/ha]	[CZK/ha]	[year]	[year]	[%]
(a)	(b)	(c) = (a)/(b)		
61 849	2 010	30.77	30	3.3

Source: Own processing according to:
1) Average official price of agricultural land for the cadastral area PL_c= CZK 61,849/ha (MoA, 2010, p. 77)
2) NRRE = HRRE * (1-D); Income tax rate D=19%; average HRRE in the Czech Republic = CZK 2,482/ha (Voltr, 1998)
3) T [year] - Method: correlation /1/
4) R_{land} [%] – Method: correlation /2/

Table 1: Proposal of calculation of annual "Tax-Land Rate" - R_{land} (%).

of CZK 61,849/ha, accepting the return time of 30 years, it is possible to apply 1/30 of the investment expenditure annually as a deductible item. That corresponds to 3.3% of the average official price of the land per year. R_{land} = 3.3% is understood as the tax-land rate that will be applied in the calculation of the amount of the item deductible from the tax base for acquired arable land.

The proposal works with the notion that the tax-land rate for permanent grass lands should be zero (Table 2). The subsidy policy of the EU implements a great number of programs for the maintenance of permanent grass lands with the goal of the implementation of the non-production functions of agriculture. SAPS[1], subsidies into LFA (Less Favored Aareas), for agro-environmental measures, into ecological agriculture and for protected lands within the "Natura" program are paid out for the maintenance of permanent grass lands. Financial aid from EUR 154.49 to 806.49/ha. can be obtained for permanent grass lands. For arable land, the resources are in the amount of EUR 154.49 – 329.05/ha. (SSIF, 2012). The substantial funds for the maintenance of permanent grass lands then also represent a significant part of the economic result of agricultural enterprises for such areas (FADN, 2010).

The proposal works with the option that the item deductible from the tax base will be utilized by each new acquirer of land according to the estimated quality of the land.

1.2. Calculation of Item Deductible from Tax Base for Individuals and Legal Entities and Its Effect on Tax Savings of Businesses

If an agricultural business applies the item deductible from the tax base (economic result), its average tax savings, converted to 1 ha. of arable land, will be as follows (Table 3).

The average annual tax savings of individuals after the application of the proposed item deductible from the tax base is CZK 306 CZK/ha and CZK 388/ha for legal entities.

It is appropriate to compare the results with other aid paid out per hectare of agricultural land. In 2011, the Czech Republic cancelled national supplementary support on agricultural land in the amount of CZK 514.10/ha. The application of deductible items would be a corresponding compensation for owners of arable land. It would be appropriate to allocate resources obtained in the proposed manner back into agricultural land.

1.3. Effect of Proposed Tax Savings on the Income of the State Budget of the Czech Republic in 2010

Variant No. 1: Tax Measures Pertain Only to Newly Implemented Transactions in Regard to Arable Land.

The application of the item deductible from the tax

[1] In new member countries, a simple (unified) single area payment scheme is utilized (SAPS). The amount of the payment is calculated for each state on the basis of agricultural production.

Type of land	Type of rate	Tax-land rate R_{land}	Adjusted time T_2
		[%]	[year]
Arable land; land of vineyards, hop gardens and fruit grove	basic	3.3	30
Permanent grassland, other area	-	0	0

Source: Authors

Table 2: Proposed tax-land rate (Rland) according to the adjusted return time (T_2).

Entrepreneur	Average official price (PL_c)	Item deductible from tax base (X_{land})	Tax savings (TS)
	[CZK/ha]	[CZK/ha]	[CZK/ha]
	(a)	(a)* R_{land} = (b)	(b)* income tax rate
Individuals	61 849	2 041	306
Legal entities	61 849	2 041	388

Source: Own processing according to:

1) Average official price of agricultural land for the cadastral area PL_c = CZK 61,849/ha (MoA, 2010, p. 77)
2) R_{land} [%] = 3.3% p.a. – Method: correlation /2/
3) X_{land} [CZK/ha] – Method: correlation: /3/
4) TS [CZK/ha] – Method: /4/
5) Income tax rate for individuals = 15% p.a, income tax rate for legal entities PO = 19% p.a

Table 3: Tax savings (TS) of agricultural businesses in 2010.

base for individuals and legal entities will reduce the income into the state budget of the country from business entities that:

a) carry out the purchase of agricultural land in cash or by way of a long-term investment loan,

b) apply costs both in the actual amount (Income Tax Act, Art. 23 to 33), as well as by way of a flat deduction (Income Tax Act, Art. 7(7)).

In 2010, 105,838 ha were traded, i.e. approximately 2.5% of the agricultural land fund. Of that, 27,582 ha of state land were sold for an average price of CZK 5.99/m^2. The SGAFF supported, within the program "Purchase of Land", transactions having a volume of 2,790 ha. of land for an average price of CZK 9.53/m2. Other purchased land was, according to the representative inquiry of the Institute of Agricultural Economics and Information (IAEI), conducted for CZK 9.65/m^2. The average selling price of agricultural land was calculated by way of the weighted average, in the amount of CZK 8.65/m^2 (MoA, 2010). In 2010, arable land was represented in the conducted transactions with 63 percent (IAEI internal inquiry, 2012). The Czech Surveying and Cadastral Institute does not state the type of acquirer within the analyzed transactions in regard to agricultural land (individual or legal entity). A sectional survey among 5 districts conducted by the IAEI based on purchase agreements shows that agricultural legal entities purchased 30% of traded land, on average, within the 2008-10 period. This percentage representation was used in the estimate of changes of income within the state budget of the Czech Republic (Table 4).

In the event that the tax obligation of all individuals and legal entities is greater than 0 and in the event that business entities apply tax savings associated with the acquisition of agricultural land, income for the state budget will decrease by CZK 30.9 mil. In terms of restricting the expenditures of the state budget and seeking out new and additional income, every proposal reducing the income into the state budget is difficult to push through. However, a reduction in the income in variant no. 1 comprises only 0.2% of subsidies paid out from the resources of the Czech Republic into agriculture (MoA, 2010).

Variant 2 – Application of the Proposal to All Arable Land Owned by Individuals, Legal Entities

Variant No. 2 represents a more significant reduction in the income for the state budget, but is more comprehensive in terms of the significance for agriculture. It includes business entities that have acquired arable land:

a) through a purchase from their own or others' resources (investment loan),

b) within the transformation of agriculture and conduct business activity,

Item deductible from tax base						
Area of traded arable land	Selling price of agricultural land	Price traded of arable land (total)	Tax-land rate (R_{land})	Item deductible from tax base (X_{land})		
				Total /100%/	Individuals /70%/	Legal entities /30%/
[ha]	[CZK /ha]	[thousand CZK]	[%]	[thousand CZK]	[thousand CZK]	[thousand CZK]
(a)	(b)	(a) * (b) = (c)	(d)	(c) * (d) = (e)	(e) * 0.7 = (f)	(e) * 0.3 = (g)
66 677.94	86 500	5 767 642	3.3	190 332	133 233	57 100
Reduced income into the state budget						
Income tax rate for individuals		Income tax rate for legal entities		TS for individuals	TS for legal entities	TS (total)
				(f) * 15% = (j)	(g) * 19% = (k)	(j)+(k)
[%]		[%]		[thousand CZK]	[thousand CZK]	[thousand CZK]
15		19		19 985	10 849	30 934

Source: Own processing according to:
1) Area of traded arable land = 66,677.94 ha (63% of the traded 105,838 ha of agricultural land. (V. Jelínek, IAEI survey, 2012; MoA 2010))
2) Selling price of agricultural land for the year 2010 established by way of a weighted average: CZK 86,500/ha
3) X_{land} [CZK/ha] – method correlation /3/
4) TS [CZK/ha] – method correlation: /4/

Table 4: Effect of proposed changes on income of state budget 2010 – variant no. 1.

c) by way of inheritance or gift and conduct business activity thereon.

In variant no. 2, official prices of agricultural land from tax returns for the year 2010 are used, according to surveys by the CSO. The prices set out in tax returns are governed by the Ordinance of the Ministry of Agriculture No. 427/2009 Coll. – List of Cadastral Areas with Assigned Average Prices of Agricultural Land. With the implementation of the proposal, the owners of arable land have similar tax benefits in comparable production conditions. The same starting conditions are also established for those who acquired land in previous periods for a reduced price. Table 5 sets out the amounts of tax savings of farmers that, at the same time, represent the amount of financial resources by which the income into the state budget will be reduced.

Table 5 contains the theoretical change in the amount of paid taxes, as the basis is the assumption that the tax savings will be applied by every business. Individuals and legal entities paid CZK 1,992 mil. in income tax into the state budget for the year 2010 (MoA, 2010). The total tax savings with the utilization of the average official price (2010) is theoretically in the total amount of CZK 168.090 mil. (8.44% of the paid tax). With the value of annual income tax paid by individuals into the state budget being in the amount of 444 mil., individuals can theoretically reduce their tax obligation by CZK 83.469 mil. (18.79% of the paid income tax). In 2010, legal entities paid income tax in the amount of CZK 1,548 mil. into the state budget. The implementation of the proposal would save them CZK 84.622 mil. in income tax (5.47% of the paid tax). With the application of items deductible from the tax base for businesses owning arable land, the state budget will reduce its tax income by a maximum of 168.090 mil. This value comprises 1.14% of agricultural subsidies paid from the Czech budget for the year 2010.

In order to optimize the conclusions, the Creditinfo database (data for the years 2004-2010) was used, which enables one to obtain a set of businesses for which the proposals are realistic. The database for that period contains a total of 16,605 agricultural legal entities (for example, in the year 2004: 1,789 entities; in the year 2005: 1,946 entities; 2008: 2,677 entities; and, for example, for the year 2010, the database contains 2,360 agricultural legal entities). In 2010, 3,083 legal entities were registered in agriculture (CSO, 2012a), and therefore the inclusion of legal entities in the database for individual years is considered to be sufficiently representative. Out of the analyzed 16,605 entities, according to the available accounting statements, 3,751 entities had a zero due legal entity income tax, which represents 22.59%. We can thus say that the proposed measures pertain to 77.4% of legal entities that pay income tax into the state budget.

Item deductible from tax base						
Entrepreneur	Acreage owned arable land	Official price of agricultural land (PL_c)	The average value of owned land	Tax-land rate (R_{land})	Item deductible from tax base (X_{land})	
					Individuals	Legal entities
	[ha]	[CZK/ha]	[thousand CZK]	[%]	[thousand CZK]	[thousand CZK]
	(a)	(b)	(a) * (b)= (c)	(d)	(c) * (d) = (f)	(c) * (d) = (g)
Individuals	272 637	61 849	16 862 326	3.3	556 457	
Legal entities	218 213	61 849	13 496 256	3.3		445 376
Reduced income into the state budget						
Income tax rate for individuals	Income tax rate for legal entities		TS for individuals		TS for legal entities	TS (total)
			(f) * 15% = (j)		(g)*19% = (k)	(j) + (k)
[%]	[%]		[thousand CZK]		[thousand CZK]	[thousand CZK]
15	19		83 469		84 622	168 090

Source: Own processing according to:
1) Farmed agricultural land (CSO, 2012a)
2) Average official price of agricultural land for the cadastral area PL_c = CZK 61,849/ha (MaA, 2010, p. 77); used for the valuation of arable land owned by individuals and legal entities.
3) X_{land} [CZK/ha] – method correlation /3/
4) TS [CZK/ha] - method correlation /4/

Table 5: Effect of proposed changes on income of the state budget 2010 – variant no. 2.

The theoretical tax savings for legal entities can thus be reduced from CZK 84.622 mil. to the real value of CZK 65.497 mil.

The analyzed sample of tax entities from the sphere of individuals, acquired by way of surveying individual financial authorities in Czech Republic, is not representative enough to the extent that its results could be used for conclusions. However, the partial results show that income tax on individuals is paid by approximately 44% of entities in Czech Republic.

2. Proposal of Changes in Terms of Subsidies That Are Included in Revenues of Agricultural Businesses

If we assess the economic significance of agriculture as a sector of the national economy, i.e. its share in the GDP, then all of the profit of this "clean sector" is generated by way of agricultural land. The current system and the manner of the provision of aid in agriculture distorts, to a great extent, the actual situation also in terms of the value of land and thereby its rational utilization and protection. Aid, whether on a Union level or from national resources into agriculture, is a part of revenues and thereby affects net added value in agriculture, income and profit. Aid into agriculture is a significant item for the balancing of disparities and social differences in relation to other sectors of the national economy. However, in terms of agricultural land, this manner only balances out the differences in the production capability of land, but does not deal with the issue of the protection of agricultural land. A typical example is payments per area, so-called SAPS, which could be rationally utilized in agriculture in terms of the protection of the agricultural land fund. Aid for farmers should be utilized in the full amount, i.e. it should not be included in revenues and thus taxed twice. By aid being included in revenues, taxes on land are also increased at the same time and thereby also rent (Vigner, 2011). It is not right for the state to take away a part of subsidies in this way in the form of tax on income, which is often achieved in agricultural businesses only thanks to subsidies.

In order to demonstrate the proposal, direct SAPS support, paid out per 1 hectare of agricultural land, was selected. The intention is to exempt from taxation that aid which directly relates to agricultural or arable land. It is appropriate to allocate financial resources from such acquired opportunities back into the land in such a way so that the production capability of agricultural land does not decrease. Land cannot be made and the long-term strategy of every state should be its protection and maintenance for future agricultural utilization.

In the event of the exclusion of SAPS from taxation, a financial resource in the amount of CZK 609-772/ha is created, according to the type of business. The theoretical decrease of the income for the state budget as a result of proposed tax benefits for farmers owning arable land is CZK 334.4 mil. This value comprises 2.26% of agricultural subsidies paid from the Czech budget for the year 2010.

Discussion and Conclusion

Approximately 77% of agricultural land in the Czech Republic is rented. Such fact affects the approach of farmers to the protection and effective utilization of agricultural land. The proposed tax instruments can enable the creation of partial resources that can make agricultural businesses more effective and create funds for the support of

	Arable land	SAPS/ha of agricultural land	Income tax on direct aid SAPS	Income on the state budget from SAPS (Arable land)
	[ha]	[CZK/ha]	[CZK/ha]	[thousand CZK]
	(a)	(b)	(b) * Income tax rate = (c)	(c) * (a)
Acreage owned arable land (indivisuals)	272 637	4060.8	609	166 069
Acreage owned arable land (legal entities)	218 213	4060.8	777	168 363
Total	490 850			334 432

Source: Own processing according to:
1) Farmed agricultural land (CSO, 2012a)
2) Tariff SAPS/ha (The state agricultural intervention fund, available: www.szif.cz)
3) Income tax rate for individuals FO =15%, income tax rate for legal entities =19%

Table 6: Income tax on direct aid SAPS and the effect on income on the state budget for the year 2010.

the quality of agricultural land.

The defined objective was achieved by way of proposing a methodical procedure for the deriving of the annual land rate (R_{land}) in the amount of 3.3% for a period of 30 years. For such period of time, a tax benefit can be applied (Table 2). On the basis of such land rate and average official land prices the amount of the item deductible from the tax base of agricultural businesses was established. The application of deductible items would create tax savings per one hectare of arable land in the amount of CZK 306-388 depending on the type of business entity (Table 3). In view of the amount of the calculated savings, it is necessary to view such resource as only one of the partial resources coming into agriculture. In the event that direct aid, paid out per 1 hectare of agricultural land (SAPS), will not be taxed, the tax savings per one hectare of arable land will be increased by a further CZK 609-771/ha. (Table 6).

The funds gained by way of the proposal appear to be compensation for the cancelled TOP-UP payments for agricultural land in the amount of CZK 514.10/ha., paid out in the Czech Republic until 2010. At the same time, the created resources are also capable of covering a part of some material costs expended for agricultural production. For example, the consumption of purchased fertilizers for the year 2010 was in the amount of CZK 1,949/ha. (FADN, 2010).

The application of the land rate in the amount of 3.3% would, in the said example of the year 2010, theoretically create a reduction in the income of the state budget in the amount of CZK 168.090 mil., which constitutes 1.14% of agricultural subsidies paid from the Czech budget for the year 2010. (Variant no. 2, Table 5).

A reduction in the income for the state budget of the Czech Republic, upon the acceptance of both tax proposals, would, in aggregate, theoretically mean a maximum of CZK 503.5 mil., which represents a new partial resource of funds aimed at businesses that own arable land. (Table 5, Table 6).

By way of our own investigation according to the Creditinfo company database, it was established that the tax savings could be achieved for 77.41% of agricultural legal entities that pay income taxes into the state budget.

The proposal of the authors can be a benefit for another reason as well. Because of the fact that the presented tax savings are not of a cost nature, they do not affect the assessment basis for the calculation of social security and health insurance, and thereby the amount of levies for social security and health insurance into the state budget is not affected either.

Trends within recent years show that worldwide losses of agricultural land and natural disasters cannot be sufficiently compensated in the future through the intensity of agricultural production, which also has its limits. In a short time, the situation in terms of supply and price of agricultural commodities can be opposite. The proposals for dealing with such a situation, contained in the article, are based on current trends, which means that aid that is provided to farmers for extensification in areas where agricultural land fulfills non-production functions can soon be necessary in order to maintain the production function of agriculture. The proposals in this article take into consideration such development which cannot be taken care of immediately, but rather needs to be dealt with a certain time in advance. Therefore, going forward, the examined issue can be dealt with, for example, on the basis of a change in the legislative framework, pertaining, for example, to the leasing of agricultural land. In the Czech Republic, the leasing of land is only conducted in the form of operative leasing. The purchase of agricultural land could be conducted not only in the form of a long-term loan, but by way of financial leasing (long-term renting). Leasing installments would thereby be reflected in tax-deductible costs. The conditions for the application of leasing in the purchase of agricultural land would thereby be adjusted so as to be in line with other long-term tangible assets purchased by way of leasing.

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Impact of the CAP´s Second Pillar Budget Reform on the Czech Economy

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Anotace

Tento příspěvek aplikuje model obecné rovnováhy pro analýzu tří scénářů možného vývoje rozpočtu SZP, které jsou realizovány v roce 2014 a kvantifikovány do roku 2020. Výsledky ukazují, že změny ve financování druhého pilíře SZP přinesou pouze marginální dopady na ekonomiku. Nicméně, přesun zdrojů mezi pilíři vyvolá výraznější pokles přidané hodnoty a zaměstnanosti v zemědělství než samotný pokles rozpočtu druhého pilíře. Na druhou stranu, realokace zdrojů mezi pilíři má pozitivní efekt na HDP, v důsledku stimulace ostatních odvětví ekonomiky.

Poznatky prezentované v této disertační práci jsou součástí řešení výzkumného záměru 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systému“ a „ Výzkumného tematického úkolu ÚZEI, MZe-TÚ 4241/2011“.

Klíčová slova

Společná zemědělská politika, druhý pilíř SZP, rozpočet, investiční dotace, CGE model, simulace, zemědělství.

Abstract

In this paper, three scenarios concerning different budget options of the reformed CAP are analysed based on the general equilibrium approach. The simulations consider a policy shock in 2014 and assess its impact until 2020. The results suggest that the changes in financing the second pillar CAP will produce only marginal effects on the economy. However, the reallocation of funds from the first to the second pillar has considerably larger negative effects on gross value added and employment in agriculture than the case of the second pillar budget reduction. On the other hand, the reallocation of funds will produce small but positive effects on the remaining sectors of the economy and the GDP.

Research presented in this paper is the result of a research grant MSM 6046070906 “Economics of Czech agricultural resources and their efficient usage within the framework of multifunctional agri-food systems” and a Research Task of UZEI conducted for the Ministry of Agriculture TÚ 4241/2011”.

Key words

Common Agricultural Policy, Second pillar, budget, investment subsidies, CGE model, simulation, agriculture.

Introduction

The Common Agricultural Policy (CAP) is one of the core policies which, since its establishment in the 1950s, has contributed significantly to the process of integration of the European Union. Since the reform carried out in the Agenda 2000, CAP has been implemented in two pillars, pursuing different policy goals. Whereas the first pillar of CAP concentrates on income support mostly via direct payments, the second pillar, with a gradually increasing yet considerably smaller share, aims at supporting the competitiveness of farmers and the socio-environmental functions of agriculture.

In connection with the approaching end of the current programming period, a debate on further reform of CAP has been opened and various legislative proposals have been produced that discuss the future shape of the Common Agricultural Policy. From the EU Budget Proposals (EC 2011a) it follows

that the Union's budget allocated to the CAP will likely stay constant in the nominal terms of the 2013 level. However, what remains unclear is the proportion of spending between both pillars on the national and regional level. The impact assessment study (EC, 2011b) highlights existing disparities in the allocation of national envelopes among member states and proposes several scenarios how to address them in the new CAP. The Multi-annual Financial Framework (EC, 2011c) sums up the suggestions of the impact study in three alternatives of the CAP budget reallocation to the second pillar. Based on the MFF, the second pillar budget for the Czech Republic will unlikely grow, in the most dramatic scenario it might decline up to 30%. This decline can be partially compensated by reallocating funds from the first to second pillar.

In view of these proposals, this paper aims at quantifying the impact of different scenarios of Pillar 2 budget allocation including the transfer from Pillar 1 on the Czech agriculture and the whole economy.

The above formulated general objective can be translated in three research questions to be answered by the model:

* What is the effect of the second CAP pillar reduction resulting in a decline of investment support, on the performance of the agricultural sector (output, income and employment)?
* What is the effect of the reallocation of CAP budget from the first to the second pillar on the performance of the agricultural sector (output, income and employment)?
* What are the effects of these alternative financing options on the performance of the national economy (GDP and macroeconomic balances)?

In order to capture the spill-over effects of the CAP budget scenarios on the non-agricultural/non-food economy, a general equilibrium approach is applied. Due to the specific CAP focus of the study, a detailed disaggregation of the agricultural sector was carried out.

The paper is structured as follows: in the next section we describe the applied CGE model, data and considered scenarios. The model results are presented in Section 3. Finally, a brief summary and discussion of the results are presented.

Material and Methods

1. Description of the Applied CGE model

The choice of the CGE approach is supported by various arguments. According to Piermartini (2006), general equilibrium models (CGE models) provide a consistent, rigorous and quantitative way of assessing economic policies and they serve as supporting tools in the decision making process. Robinson et al. (1999) further explain that multi-sector CGE models provide a versatile empirical simulation laboratory for analyzing quantitatively the effects of economic policies and external shocks on the domestic economy.

One of the earliest CGE applications in the geographical region of the Czech Republic can be found in the study on the impact of the EU accession on the agricultural markets (Tangermann and Banse, 2000); further contributions in this area were provided by Ratinger and Toušek (2004). Besides a regional CGE model applied for the scenarios concerning rural areas of the Czech Republic (Bednaříková and Doucha, 2009), there is very scarce evidence on the agriculture-oriented CGE applications with a specific focus on the economy of the Czech Republic. Most of the research on the impact of agrarian policy is performed by widely spread multi-country CGE models focused on agriculture, in which the Czech Republic is usually aggregated into a group of CEEC countries, or is not included at all. Furthermore, the nature of the multi-country models implies that the model closures are defined on a global scale, allowing for a macroeconomic disequilibrium on the individual country level[1].

The presented CGE model (CZNATEC) refers to small open economy and is structurally very similar to the IFPRI standard (Lofgren and Robinson, 2003). Due to this similarity we do not present the model in all details (the reader can find it in the cited Lofgren et al. or in Křístková, 2010b), instead we concentrate on the most distinguishing features of CZNATEC. The specific focus of the study on agriculture is reflected in the production and commodity structure of the model. The national economy is disaggregated into 13 production sectors; of which 8 represent individual agricultural sectors, and the other represent the sectors of industry (food processing, non-food industry) and services (research and development and other services).

[1] The presented CGE model is thus the only currently existing CGE model with agricultural policy extensions, built for the economy of the Czech Republic.

In the model, perfect competition and constant returns to scale are assumed at the production side. Total gross production of a sector is represented by a nested production function with a fixed-factor Leontief combination of intermediate consumption and value added

Two groups of production sectors are distinguished for the modelling of added value: sectors that use land as a production factor (secland) and sectors that use only labour and capital (secnland). In the first stage, value added is formed by the combination of labour (Li) and capital-land bundle (KDi) based on the CES I production function (Equation 1):

$$CES\ I:\ VA_i = aF_i \cdot \left(\chi F_i \cdot KD_i^{-\rho Fi} + (1-\chi F_i)\cdot L^{-\rho Fi}\right)^{-1/\rho Fi} \quad (1)$$

where aF_i is the efficiency coefficient and χF_i and $(1-\chi F_i)$ are the distribution parameters of the production function. Parameter ρF_i in the exponent is derived from the elasticity of substitution σF_i between the production factors KD_i and L_i.

In the second stage, the optimal combination of capital stock K_i and land D_i is modelled analogously with the use of the CES II production function (Equation 2):

$$CES\ II: KD_i = aG_i \cdot \left(\chi G_i \cdot K_i^{-\rho Gi} + (1-\chi G_i)\cdot D^{-\rho Gi}\right)^{-1/\rho Gi}. \quad (2)$$

The production structure further incorporates the depreciation of capital stock, which is modelled as a fixed proportion from the current level of capital stock.

The behaviour of households in the Czech economy is simulated by introducing two representative households – farmer households and other households, which optimise their utility subject to a budget constraint. Whereas microeconomic theory provides numerous suggestions, a standard choice in the field of CGE models is the Stone-Geary Linear Expenditure System (*LES*) which incorporates a subsistence level into the utility function (Equation 3).

$$U = \prod_j \left(C_j - \mu Hj\right)^{\alpha HLESj}, \qquad \sum_j \alpha HLES_j = 1 \quad (3)$$

where U is the consumer's utility, C_j is the amount of consumption of the j-th commodity, μH_j represents the subsistence level of consumption of each j-th commodity[2] and $\alpha HLES_j$ is a preferential parameter of the respective j-th commodity in the consumer basket.

The households' consumption budget is determined by the net value of its income after taxation and transfers, reduced by its savings.

In the CGE model, government is also introduced as an optimizing agent that maximizes utility subject to the disposable budget, derived from incomes received on the basis of tax collections. Contrary to households, it is not necessary to incorporate subsistence level in the government´s utility function, which enables to work with the simpler Cobb-Douglas type of utility function:

$$U = \prod_j CG_j^{\alpha CG_j}, \text{ where } \sum_j \alpha CG_j = 1, \quad (4)$$

where CG_j is governmental consumption of a commodity j and αCG_j represents a preferential parameter in the government´s consumption basket.

The closure of the governmental account is arranged by fixing a ratio of governmental consumption to GDP. Governmental savings are thus adjusted to the difference between governmental incomes and expenditures.

Total supply in the market is represented by a composite commodity consisting of the bundle of domestically produced goods supplied to domestic markets, and imports. The composite commodity is a result of two simultaneous forces in the model: first, the intention of the producer to find the most profitable combination of supply between foreign and domestic markets, modelled with a Constant Elasticity of Transformation (*CET*) function, and secondly the intension of the consumer to find an optimal combination of an imported and domestically produced commodity, modelled with a *CES Armington* function. An extension to the foreign market equations has been carried out in order to model trade and financial flows on a disaggregated level comprising the EU foreign sector and the Rest of the World (RoW).

Furthermore, the model is based on the following closure options and factor market assumptions: *(i)* supply of labour and land is fixed; the capital stock grows at the rate of net investments, *(ii)* capital is fully employed in all sectors, whereas land is employed only in sub-sectors of agriculture, *(iii)* certain amounts of labour are not employed,

[2] If μH = 0, the *LES* utility function is reduced to the Cobb-Douglas utility function.

modelled by a Phillips curve determining the level of unemployment, *(iv)* the model follows a standard macroeconomic balance of savings and investment, *(v)* based on the assumption of a small country, both world export and import prices are fixed, (vi) two foreign sector closures (for the EU and the RoW) consist of an endogenous exchange rate adjusting to the exogenously-set foreign savings.

The CGE model follows a recursive form of dynamization with a Tobin's Q investment function, which allocates investments to the sectors according to their ratio of profitability to user costs (for a detailed description, see Křístková, 2010 a). In the dynamic part, the expected growth rates of the exogenous variables were taken from the following official sources: the prediction of EU GDP is based on the Economic Forecasts of the European Commission (EC, 2010b), world prices and world GDP are taken from the IMF predictions (IMF, 2010), and the growth rates of the domestic exogenous variables, such as transfers and the GDP deflator, are taken from the Czech Ministry of Finance (MF, 2010). CZNATEC is calibrated on the economy of 2006 and provides simulations until 2020.

The instruments of the Common Agricultural Policy included in the CGE model concern direct payments (1st pillar) and investment subsidies (2nd pillar). Given the fact that in the Czech Republic the direct payment rate per hectare greatly exceeds the land's rent[3], modelling direct payments solely as land subsidies would cause computational problems, which is also alerted by other CGE modellers (see Gohin and Bureau, 2006). In order to eliminate this problem, part of the direct payment subsidy is allocated to land and the rest is modelled as a production subsidy. Furthermore, the sources of financing the direct payments are recorded in the balance of payment equation of the EU (for the *SAPS/SPS*[4] payments from the EU) and in the governmental expenditures equation (for the "*Top-Up*" payments). The investment subsidies in the 2nd pillar are incorporated into the investment allocation function for the recipient sectors.

2. Description of used data sources

The application of the CGE model requires data arranged in the form of a Social Accounting Matrix (SAM). The Social Accounting Matrix represents a consistent accountancy framework which is used in the set of simultaneous equations to quantify the intensity of shocks introduced in the system. The SAM contains information about the economy recorded in the System of National Accounts. Nowadays, after a pause in the field of economic modelling caused by a lack of relevant data, the Czech national accounts are fully compatible with the other countries of the European Union. The general form of the Social Accounting Matrix (SAM) is based on data provided by the Czech Statistical Office (CSO) in their published version of the SAM for the year 2006. Given that the purpose of the CGE model is to provide agriculturally oriented policy simulations, the general SAM does not provide sufficient details on the agricultural accounts. This refers to the proper disaggregation of the production accounts, representing key agricultural activities, the commodity accounts, representing flows of domestically produced, imported and exported key agricultural commodities, the production factors account with a specific treatment of land and the institutional account with independent farmer households' treatment.

In order to provide sufficient details with regards to the agricultural accounts, the SAM that was used in this CGE model was built on basis of data provided by the Institute of Agricultural Economics and Information (UZEI). Two major sources of information were used – the commodity balances and the cost surveys of agricultural enterprises. The disaggregation of household account into farmer and other households was carried out with the use of the Statistics of Household Accounts, where the groups of incomes and expenditures are recorded individually for each type of household[5].

A representation of all markets and institutions included in the CGE model and SAM is displayed in Table 1.

3. Definition of scenarios and main assumptions

In line with the different alternatives of the 2nd pillar financing, four scenarios are analyzed in the paper. It is important to note here, that out of the four axes of the CAP's second pillar, the CGE model only allows for the explicit modelling of subsidies in the first and the third axes due to their investment character. The second axis is mainly associated with the production of public goods in agriculture, such as landscape maintenance or

[3] For instance, in 2010, the direct payment rate (approx. 160 EUR/ha) was almost 3 times higher than the land's rent (approx. 50 EUR/ha).

[4] Single Area Payment Scheme (SAPS) is the current regime of the direct payments distribution in the Czech Republic, which will be replaced by the Single Payment Scheme (SPS) from 2014 on.

[5] The final SAM, representing a matrix of 43x43 size, is available upon request.

Sets	Elements of sets	Sets	Elements of sets
Production sectors / Commodity markets	Cereals	Production factors	Labour
	Fruits and vegetables		Land
	Sugar beet		Capital
	Oilseeds	Institutions	Firms
	Cattle		Farmer households
	Pigs and poultry		Other households
	Milk		Government
	Food processing	Foreign sector	EU
	Industry		
	Research and development		Rest of the World
	Services		

Source: Authors´calculation

Table 1: Representation of agents and markets in the CGE model.

Scenario	Modeling 1st pillar CAP	Modeling 2nd pillar CAP
Scenario 1	SPS = 252 EUR/ha from 2014	2nd pillar budget declines by 10%
Scenario 2	SPS = 252 EUR/ha from 2014	2nd pillar budget declines by 20%
Scenario 3	SPS = 227 EUR/ha from 2014	10 % of 1st pillar reallocated to 2nd pillar (+25% national cofinancing)
Baseline	SPS = 252 EUR/ha from 2014	2nd pillar budget remains on the level of 2013

Source: Authors´elaboration

Table 2: Overview of the Scenarios applied in the CGE model.

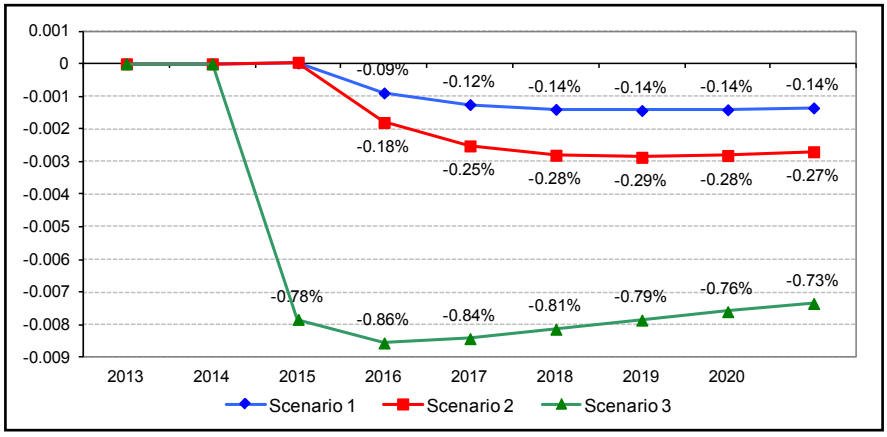
biodiversity. Despite the attempts to introduce the agro-environmental payments into the CGE model (e.g. in works of Rødseth, 2008 or Parra-Lopez et al., 2009), due to its complexity, the presented analysis only concentrates on the investment subsidies and therefore, all alternatives concerning different budget allocations to the second pillar are analyzed as if they were investment subsidies.

An overview of the applied scenarios is presented in Table 2. Scenario 1 considers a modest decline of the funds allocated to the second pillar of the CAP (10% decline from 2014), followed by Scenario 2 with a 20% decline in budget. Scenario 3 analyses the situation of a 10% budget reallocation from the first to the second pillar of the CAP, accompanied by a proportional increase of national co-financing. Finally, the baseline scenario represents a status-quo situation, in which the direct payment rate per hectare reaches 252 EUR from 2014 on (based on EC 2011c) and the budget allocations in the second pillar remain at the level of 2013 without change.

Given the investment nature of the subsidies included in the 2nd pillar, it is expected that their reduction would have stronger repercussions in the longer term, due to the adverse effect on the capital formation in agriculture. On the other hand, the reallocation of subsidies from the first to the second pillar could negatively influence the competitiveness of the agricultural sector in the very short run as the first pillar subsidies usually act as production subsidies covering producer costs.

Results

The results obtained from the CGE model simulations should always be interpreted relative to the baseline scenario in order to obtain an insight into the impact of the policy instruments on the variables of interest. General equilibrium models provide a comprehensive overview about the economy taking into account the complexity of linkages among various markets and sectors. In line with the research questions stated in the introduction chapter, the results of the simulations are interpreted in the following order: at first, the effects on the agricultural sector are analyzed in larger detail and consequently the implications on other industries and national economy are discussed.



Source: Authors´ calculation

Figure 1: Evolution of Gross Agricultural Production in c.p. 2006 (deviation against baseline).

1. Impact of Pillar 2 budget alternatives on the agricultural sector

In this section, the impacts of the 2nd pillar budget alternatives on the sector of agriculture are analyzed. It should be noted that until 2014, the scenarios converge as there is no change in the agricultural policy. After 2014, different evolutions across the scenarios can be observed. In line with the assumptions, the reduction of funds to second pillar in Scenario 1 and 2 would have a negative effect on the gross agricultural production (GAP). However, these effects are rather marginal as they maximally produce only a 0.3% decline of GAP against the baseline (Figure 1). Also in line with the assumptions, the effects become more pronounced over time, with negligible impacts in the short run. The most significant repercussions could be expected under Scenario 3 in which the gross agricultural production would decline by 0.8% compared to the baseline. Moreover, it is observed that the effects are immediate as the production declines sharply from the beginning of the simulation. This finding is explained by the fact that in Scenario 3, financial means are reallocated from the first to the second pillar of the CAP, which is translated into a lower direct payment rate per hectare and an immediate decline of farmers' competitiveness due to rising producer costs.

Figure 1 offers yet another interesting observation – although the level of magnitude of the quantified effects on the GAP is rather insignificant, the reallocation of funds from the first to the second pillar in Scenario 3 causes a much stronger contraction of agricultural production, than a simple decline of the second pillar budget in Scenarios 1 and 2. Taking into account that the funds allocated to the second pillar in Scenario 3 are even higher than funds allocated in Scenario 1 and 2 (the reallocated budget is topped-up by the national government due to the rule of 25% co-financing in Scenario 3, see Table 3), it is clear that the agricultural sector is much more sensitive to reductions in the 1st pillar subsidies compared to the second pillar subsidies.

The CGE model also enables to analyze the impact of the budget alternatives on the individual agricultural commodity markets. Figure 2 displays an average percentage deviation of the domestic production of agricultural commodities against the baseline. Concerning Scenario 1 and 2 in which the budget allocated to the second pillar declines by 10% and 20% respectively, the negative effects are distributed symmetrically across all commodities. However, in Scenario 3, the effects vary per each commodity and the strongest decline is observed in case of cereals, sugar beet, cattle and milk, whilst the commodity group of fruits and vegetables even slightly benefits from the new budget situation. This is closely related to the distribution of the direct payments in form of the SPS in which the production of commodities such as cereals is subsidized considerably more than poultry or vegetables (because of Direct Payments bound to land). Thus, when the funds are reallocated to the second pillar, previously highly subsidized land intensive commodities suffer more than low-subsidized commodities.

The analysis of the commodity structure reveals that the contraction of the agricultural sector in Scenario 3 is mainly driven by the decline of the commodities sensitive to direct payments contributions.

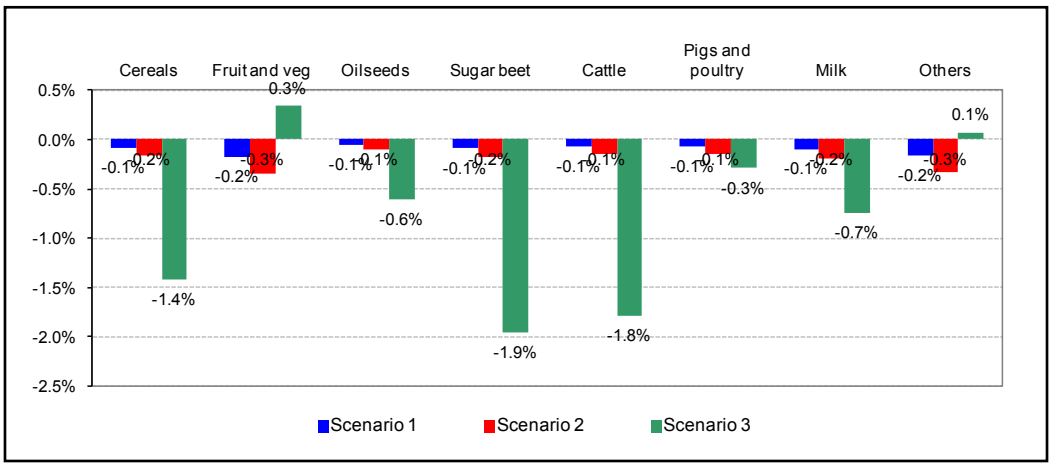
The overall effect of the analyzed budget alternatives on employment in agriculture is displayed in Table 4. It is visible that the decline in

million CZK	1st Pillar CAP budget (annualy) including Chapter 68		2nd Pillar CAP budget (annualy)		Total CAP Budget		% Change
	Before Reform (2013)	After Reform (2014-2020)	Before Reform (2013)	After Reform (2014-2020)	Before Reform (2013)	After Reform (2014-2020)	
Baseline	23,456	25,162	8,414	8,414	31,870	33,576	5.4%
Scenario 1	23,456	25,162	8,414	7,572	31,870	32,734	2.7%
Scenario 2	23,456	25,162	8,414	6,731	31,870	31,893	0.1%
Scenario 3	23,456	22,993	8,414	11,306	31,870	34,299	7.6%

Note: The decline of the 1st pillar by 10% does not include Chapter 68, therefore the effective change is less than 10%

Source: Authors´ calculation

Table 3: Comparison of the budget allocations before and after the CAP reform.



Source: Authors´ calculation

Figure 2: Impact of the scenarios on production of agricultural commodities (average percentage deviation against baseline).

	2014	2015	2016	2017	2018	2019	2020	Průměr
Scenario 1	0.00%	-0.05%	-0.07%	-0.08%	-0.09%	-0.09%	-0.09%	-0.06%
Scenario 2	0.01%	-0.09%	-0.14%	-0.16%	-0.18%	-0.18%	-0.18%	-0.12%
Scenario 3	-1.25%	-1.28%	-1.27%	-1.24%	-1.22%	-1.19%	-1.17%	-1.08%

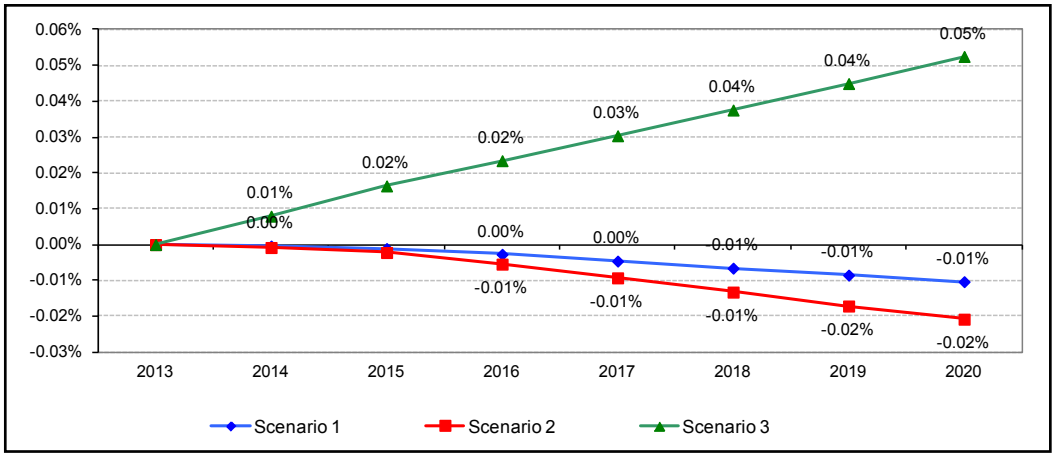
Source: Authors´ calculation

Table 4: The impacts of the scenarios on the employment in agriculture (% deviation against baseline).

the gross agricultural production is transmitted to a lower demand for labour leading to a decrease in employment in agriculture. However, it is notable that the reduction in the second pillar budget produces milder shocks to labour market than the reallocation of funds from the first to the second pillar. This is closely related to the role of the second pillar subsidies in the economy. As these subsidies are linked to investments, their reduction would slow down investment activity in agriculture and the formation of physical capital. Therefore, the decline of the agricultural production in Scenarios 1 and 2 is mainly caused by decelerating capital formation in agriculture. On the other hand, the reallocation of funds from the first to the second pillar would produce much stronger effects on the labour market because of limited substitution of labour by capital as the capital is fixed in the short-term.

2. Impact of Pillar 2 budget alternatives on other sectors of the economy

The general equilibrium approach applied in this paper also enables to assess the effects of the different budget alternatives on the other sectors of the national economy, which are interlinked with agriculture through their intermediate consumption and the markets of production factors. Figure 3 plots the evolution of the gross value added in industry and services (calculated as a percentage



Source: Authors´ calculation

Figure 3: Impact on Gross value added of industry and services (% deviation against baseline).

deviation against the baseline). Although the reported changes are relatively small, they still provide an interesting insight into the impact of the CAP funds in the economy. It can be observed that whereas the reduction of the second pillar budget would negatively influence the remaining sectors of the economy, the reallocation of subsidies from the first to the second pillar would in fact boost them. This finding is related to the nature of the second pillar support; due to the fact that investment subsidies in the second pillar are also distributed to rural development projects in industry and services, their reduction has much broader effect across all industries (although these are small in terms of the magnitudes). Under Scenario 3, in which funds are reallocated to the second pillar, value added in industry and services goes up via two channels – directly as there are more rural development projects financed outside agriculture and indirectly as the farmers lose competitiveness and resources from agriculture are reallocated to industry and services. Furthermore it is observed, that these effects become more pronounced over time as the reported values do not converge back to the baseline. This shows that a policy shock that happens in 2014 has ongoing repercussions beyond 2020.

3. Impact of the 2nd pillar budget alternatives on macroeconomic situation

Finally, the effects of the CAP budget reform on the macroeconomic stability can be assessed. Table 5 contains an overview of the impacts of the selected macroeconomic variables. For most of the variables, the effects are negligible. This is understandable as the agricultural sector participates only by a small share in the total GDP of the country and therefore policy simulations directed to agriculture will have limited impact on the whole economy.

In spite of these small effects, it is still possible to interpret the obtained macroeconomic effects as they can indicate the direction in which the scenarios affect the economy. Concerning the wage rate, with a 10% reduction of the second pillar funding, there is no impact. A small negative effect can be registered in case of Scenario 3, which is in line with the decline in agricultural employment discussed in chapter 3.1. The reaction of the land market is much stronger than of the labour market. Unlike labour, which can freely move from agriculture to other industries, the use of land is restricted to agriculture and in addition, its supply is limited. Therefore, a minor change in demand for land causes a major reaction in the rental prices of land. This is well illustrated in case of Scenario 3, in which the reallocation of funds in the first pillar to the second pillar produces a decrease in the demand for land, which results in a considerable decline of the land rental prices.

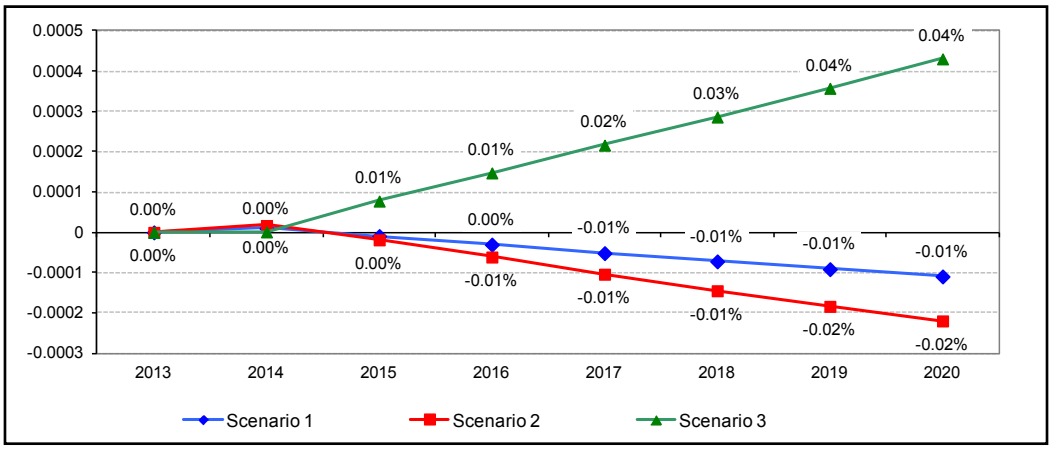
As a consequence of the decline in agricultural employment, the unemployment index goes slightly up in Scenario 3. The effect of the total domestic savings is positive in case of Scenarios 1 and 2 because the reduction of the second pillar subsidies from the EU also reduces the burden of national co-financing and thus has a positive effect on the governmental budget. When funds are reallocated from the first to the second pillar, the requirements for co-financing increase and the effect on national savings is negative, as shown in Scenario 3.

The evolution of the Gross Domestic Product in

	Scenar 1	Scenar 2	Scenar 3
Wage index	0.00%	-0.01%	-0.02%
Index of land rent	-0.06%	-0.12%	-19.73%
Unemployment	0.03%	0.07%	0.13%
Total Savings	0.03%	0.06%	-0.13%

Source: Authors´ calculation

Table 5: Impact on the macroeconomic indicators (average % deviation against baseline).



Source: Authors´ calculation

Figure 4: The impact on the Gross Domestic Product (% deviation against baseline).

all scenarios is displayed in Figure 4. This figure clearly shows that, whereas the reduction of the second pillar budget in Scenarios 1 and 2 has a negative effect on the overall GDP, the reallocation of funds from the first to the second pillar has a positive effect on GDP. This result is in line with the evolution of value added in industry and services.

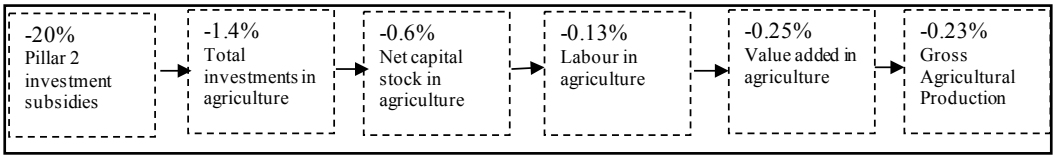
Discussion

The results of this analysis must be interpreted in the context of the applied modelling approach. The CGE approach is characteristic by its reliability on a range of assumptions, such as optimization behaviour of all agents or flexibility of prices to achieve equilibrium on all markets. Furthermore, due to a shortage of reliable econometric estimates, most of the elasticity parameters in the CGE models are taken over from existing literature. Furthermore, the use of the CGE models requires a very detailed representation of the economy, which is often not readily available, especially when analysing the effects of specific sector policies. Despite these shortcomings, the CGE models are one of the few methodological instruments that enable to assess various policy simulations in a very comprehensive way.

In this study, the applied CGE model CZNATEC was used to assess the impact of the alternative financing options of the second CAP pillar on the agricultural sector and the total economy. It was found out that the effects have long-term implications on the economy and therefore, the dynamic modelling approach applied in this study is appropriate. Also, the directions of changes caused by the considered policy simulations are logical and they show that the agricultural sector is more sensitive to changes in the first pillar subsidies, due to a significant role of direct payments in the competitiveness of the agricultural sector. Direct payments also strongly influence prices on land market due to the capitalization of direct payments in land rents which is also observed in case of the Czech Republic[6]. The simulated reduction in direct payments rate thus creates strong pressures in land market and leads to an extreme decline of land rents as shown in Scenario 3. However it should be noted that in the reality, land prices would not decline so dramatically because of existing transaction costs that cause high rigidity of land market, as discussed in Ciaian and Swinnen (2006).

Probably the most disputable finding of the study

[6] Land prices in the Czech Republic have increased by 50% between 2003 – 2009, partially as a result of direct payments allocations (evidence from MA, 2009 and 2010).



Source: Authors´elaboration

Scheme 1: Chain reactions caused by the Pillar 2 budget reduction by 20%.

is the negligible effect of the concerned scenarios on the agricultural sector. As the results show, even under a 20% reduction of the second pillar budget, the gross agricultural production declines by less than a percent. This is explained by the fact that in the baseline scenario public investments financed from the CAP budget represent only about 17% of total investments in the sector. Private investments are thus major drivers of capital formation in agriculture. Therefore, a reduction in investment subsidies by 20% causes only a one percentage decline in total investments, resulting in less than a percentage decrease in net capital formation and less than a quarter percent fall of value added in agriculture (the graphical representation of these causal relations is displayed in Scheme 1).

The results of this research can be only partially compared with other papers, since the multi-country CGE models, such as the GTAP, have a different model structure. As opposed to the micro-level, where the effects on particular agricultural commodity markets are more comparable, macro-level comparisons can be misleading due to different macro closures in each model.

Conclusion

In this paper, three scenarios concerning different budget options of the reformed CAP were analysed. In order to quantify both the direct effects on the agricultural sector, but also the indirect effects on the Czech economy, a general equilibrium approach was applied. The simulations considered a policy shock in 2014 and assessed its impact until 2020.

From the results reported in the previous section, it can be concluded that changes in financing the second pillar of the CAP that are realistic to expect (i.e. up to a 20% reduction of the budget, or a 10% reallocation between pillars) will produce marginal effects on the economy. However, when comparing these effects across the scenarios, the reallocation of funds from the first to the second pillar has considerably larger negative effects on gross value added and employment in agriculture than the case of the second pillar budget reduction. On the other hand, the reallocation of funds would produce small but positive effects on the remaining sectors of the economy and the GDP.

These results suggest that alternatives for the financing of the second pillar highly depend on the aim that the policy makers pursue. If sustaining employment in agriculture is the main goal, then any reductions in direct payments, despite being compensated by larger investment subsidies, might cause an outflow of labour from agriculture. However, allocating more funds to investment subsidies in the second pillar seems to be a better choice if the aim is to stimulate all sectors of the economy. Moreover, the benefits or investment subsidies are more pronounced in the longer run.

An interesting extension of this research would include a prolongation of the prognostic horizon beyond 2020 to trace the effects of the investment subsidies in agriculture in the longer run. Furthermore, the incorporation of the agri-environmental payments to the CGE model would enable a more complex assessment of the second CAP pillar budget effects in the economy.

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Modelling Brewing Industry Pricing

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Anotace

Cílem příspěvku je analyzovat cenové chování druhé až jedenácté nejsilnější pivovarnické společnosti na českém trhu na základě cenového chování cenového vůdce, kterým je Plzeňský Prazdroj (member of SABMiller). Při použití měsíčních cen (počet pozorování je zpravidla 108 období) je modelována délka zpoždění při změně ceny cenového vůdce a ostatních společností. K modelování je použita lineární regresní analýza. Jednotlivé značky piv jsou rozděleny do 3 segmentů: superpremium, mainstream a nealkoholická piva a cena je modelována zvlášť pro sudové a pro lahvové balení, pokud to disponibilnost dat umožňuje. Výsledky chování jednotlivých společností jsou na závěr zobecněny do syntézy.

Klíčová slova

Beer, brand, Plzeňský Prazdroj, cenový vůdce, cenová politika, oligopol.

Abstract

The aim of this contribution is to analyse the price behaviour of the second to eleventh strongest brewers on the Czech market on the basis of the price behaviour of the price leader, this being Plzeňský Prazdroj (a member of SABMiller). Using monthly prices (the number of observations is generally 108 periods), is modelled the length of delay between the price leader and the other breweries making a price change. A linear regressive analysis is used to produce the model. The beer brands are divided into 3 segments: super-premium, mainstream and non-alcoholic beer and prices are modelled separately for barrelled and bottled beer if the data is available to allow it. The results of each brewery's behaviour are summarised in conclusion. The information presented in the article is the product of working on the Research Plan MSM 6046070906, "The Economics of Czech agriculture resources and their efficient use within a multifunctional agri-food systems framework".

Key words

Beer, Brand, Plzeňský Prazdroj, price leader, pricing policy, oligopoly.

Introduction

In this paper the analysis of the pricing policy of ten Czech brewery companies on the basis of Plzeňský Prazdroj price leadership is carried out.

The make-up of the vertical production chain for beer is no different to that for other food industry vertical production chains. With a little simplification, it can be divided into a total of four levels:

1. Primary consumer demand, which can be viewed from two angles (demand and supply oriented approaches)
2. Demand from stores, specifically retail and wholesale stores and caterers; this demand arises directly from primary consumer demand.
3. Demand from higher level processors, i.e. brewery demand for ingredients, these being mainly malt and hop products. This demand arises directly from demand (B) and indirectly from total primary demand.
4. Demand from lower-level processors, i.e. the demand of malthouses for barley supplied by farmers (or mediated by marketing organisations), where relevant the demand of hop extract producers for their basic ingredients. This demand arises indirectly from consumer demand either via demand from consumers or demand from stores and directly via demand from higher level processors.

The following relationships between each basic link can be characterised according to competition type in the Czech Republic in the following way:

1. There is a state approaching perfect competition between store level subjects on the supply side, although this may have certain elements of monopolistic competition[1] .
2. There is monopsonic competition between store level subjects on the demand side, which may in some cases have elements of oligopoly, particularly for large chainstores which are partially able to affect product price.
3. There is an oligopoly among higher level processors on the supply side, with Plzeňský Prazdroj, a.s. (a member of SABMiller) the price leader.
4. There is monopolistic competition between higher level processors on the demand side, with Plzeňský Prazdroj (SABMiller) again displaying different behaviour, acting in the role of oligopolist[2].
5. There is roughly monopolistic competition between lower level processors on the demand side.
6. There appears to be perfect competition between primary producers on the supply side.

Nevertheless, in terms of the strength and quality of relationships between each level of the production chain, the beer production sector is exceptional in that the brewing industry is one of the most concentrated industries with a major price leader within the food sector. Graph 1 shows the development of concentration on the Czech beer market using the Herfindahl-Hirshman index (HHI) and the concentration coefficient for the five largest companies in the sector (CC5).

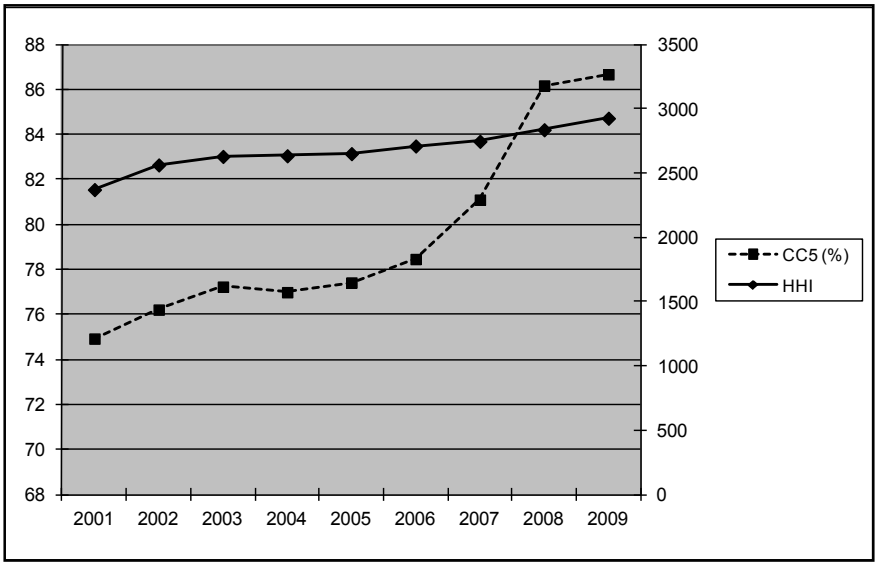
For the Herfindahl-Hirshman index, an index of 1 800 can be considered a critical value, above which the market is concentrated. In the second half of 2009, this value was 2 938.72.

From this standpoint, the Czech market, rather than the neighbouring German market, is much closer to the American market, where the Herfindahl-Hirshman index was 2 932.66 in 2005, actually representing a fall from 2000 (of 620.5 points)[3]. One striking feature in the U.S. brewing industry is that the number of independent mass beer producers decreased dramatically from 421 in 1947 to 24 in 2000 [Yao (2012)].

[1] The buying up of restaurants by economically strong breweries can cause a certain amount of deformation. This happens when a specific brewery becomes the exclusive beer supplier for a certain period on paying a certain amount of financial compensation. Large brewers tend to follow this practice.

[2] They can most exploit the advantages of a global company, due to their being the largest company on the market in the Central Europe region. They are in control of around 50% of the Czech beer market, roughly 40% in Slovakia and also have significant shares in Poland and Hungary. It purchases its ingredients centrally and thus has a strong bargaining position.

[3] Calculated on the basis of B. Yenne's book, The History of Beer in America, see References



Source: own calculation on the basis of data form RIBM* and Canadian, Market Insight 2010

Graph 1: Development of concentration on the Czech beer market**.

* Research Institute of Brewing and Malting in Czech Republic

** Because the values of these two indices are orders of magnitude different, for HHI the decimal point was moved two places left.

Analyzing market structure and market behavior is essential to investigate the impact of companies on (consumer and producer) welfare. Market structure refers to the type of market in which firms operate. Breweries do not operate in perfectly competitive markets, because the number of competing firms is too small (especially if you focus on the lager market). A simplistic measure to estimate potential market power is the concentration ratio. For example the C3 (= the turnover of the largest three enterprises as a % of the turnover of the sector) of the Belgian beer market was 0.84 in 2000, indicating an oligopolistic market. A similar oligopolistic market structure can be found in the majority of countries worldwide [(Benson-Armor et al., 1999), Wauters E., Van Passel S. (2007)].

Oligopolistic markets can be related to a process of creative destruction, where oligopolists face strong competition from existing rivals and cannot afford the more relaxed life of the monopolist. But at the same time, oligopolists can keep a good share of the profits that they earn from their innovative activity. The public challenge is to keep oligopolistic companies competing rather than colluding [Schumpeter (2008)].

In comparison with other alcoholic drinks, price elasticity is the lowest for beer. Leung and Phelps come to the conclusion that price elasticity approximately equals -0.3 % for beer, -1.0 % for wine and -1.58 % for spirits. [Leung and Phelps (1999)]. Clements, Yang and Zheng's study comes to the conclusion that price elasticity is -0.35 % for beer, -0.68 % for wine and -0.98 % for spirits. Although the conclusions of both studies differ, it is still clear that in contrast to other alcoholic drinks producers, breweries need not be so cautious in their pricing policies [Clements, Yang and Zheng (1997)].

The studies did not deal with levels of elasticity for the reaction of brands between themselves, with the only exception being Langan: 'price reaction results suggest most brands within a given segment follow pricing of other brands rather than not reacting or engaging in price rivalry.'[Langan (1997)].

Material and methods

Modelling the pricing policies of individual selected products of the second to eleventh largest companies can in general form be systematically described by the economic relationship:

$$price\ \mathrm{pB}_t = f\left(price\ \mathrm{pPPB}_{(t-1,\,t-2\ldots t-18)}, \mathrm{ZO}\right), \qquad (1)$$

where

p is packing (barrel – ba or bottle – bo),

B is name of brand,

PP is brand produced by Plzeňský Prazdroj,

ZO is a zero-one vector (changing of excise duty).

For the exogenous variable (beer price from Plzeňský Prazdroj's production) delays of length 1 to 18 periods were considered (with monthly periodicity), any longer delay can no longer be considered relevant. The criterion for selecting the most appropriate function (specific delay) is the maximum of intensity of dependence. The significance level is 0.01.

Simplifying the product categories was somewhat objective, and resulted in separation into the following segments:

1. Super-premium products, in which the products Budvar12, Stella Artois and bottled Bernard with a resealable cap (boBernardRC) are included from the second to eleventh largest companies. The prices of these products were modelled on the basis of the price development for the super-premium Pilsner Urquell brand (produced by Plzeňský Prazdroj).
2. Non-alcoholic beer from the second to eleventh largest companies, whose prices were modelled on the basis of price development for Radegast Birell (produced by Plzeňský Prazdroj).
3. Mainstream products from the second to eleventh largest companies, whose prices were modelled on the basis of the price development of the Gambrinus brand (produced by Plzeňský Prazdroj). During the period monitored, the Gambrinus brand held on to a share of around 25% of the Czech market. There was also a split in this category to so-called ten-degree beer[4] and eleven-degree[5] beer, whose price development was modelled on the basis of the price of the product Gambrinus světlý (produced with a little under 10 degrees of Plato) and so-called twelve-degree beer[6], whose development was

[4] In subsequent text, the number is placed after the brand name, for example Černá Hora brand ten-degree beer is referred to as Černá Hora 10.

[5] In subsequent text, the number is placed after the brand name, for example Černá Hora brand eleven-degree beer is referred to as Černa Hora 11.

[6] In subsequent text, the number is placed after the brand name, for example Černá Hora brand twelve-degree beer is referred to as Černa Hora 12.

modelled on the basis of the price development of Gambrinus premium (produced with a little under 12 degree of Plato)[7].

A dummy variable had to be included in the partial models in the form of a zero-unit vector, because from the beginning of 2010 there was an increase in excise duty which resulted in a price increase for beer from all companies which was in no way caused by Plzeňský Prazdroj's pricing policy. Naturally, this variable was not included in models analysing the price of non-alcoholic beers. In this connection, the conclusions of Manning, Blumberg and Molton's study can be noted, that very heavy drinkers were found to be less responsive to changes in price than any other drinking group. The implication of this finding is that while higher alcohol taxes may reduce consumption by light and moderate drinkers, it will have little impact on very heavy drinkers, many of whom impose considerable external costs on society. In a more recent study [Manning, Blumberg and Molton (1995), Freeman (2000)], after controlling for income, found that alcohol taxes only modestly impacted the consumption of beer, with short-run and long-run elasticities around 0.01 and 0.1.

For the same tax revenue, consumer welfare can be reduced or, for the same level of loss to consumer welfare, taxation revenue can be increased. Both these scenarios result in a reduction of pure alcohol consumption [Byrnes et al. (2012)].

For beer the minimum tax rate has been unchanged since 1993, and it is equal to 0.7448 Euros per hl/degree Plato or 1.87 EUR per hl/degree of alcohol of finished product [Lockwood, Migali, 2008].

The theoretical modelling is based on the following suppositions:

1. Super-premium products, in which the products Budvar12, Stella Artois and bottled Bernard with a resealable cap (boBernardRC) are included from the second to eleventh largest companies. The prices of these products were modelled on the basis of the price development for the super-premium Pilsner Urquell brand (produced by Plzeňský Prazdroj).
2. The other breweries attempt to increase their products' prices as soon as possible after the price leader increases its prices, but there is a certain delay before their prices are changed (see method).
3. The breweries maximise their economic profit and behave rationally.
4. Imports have no impact on Czech breweries' pricing policies.

Beer imports to the Czech Republic over the monitored period were lowest in 2002 (1.03 % of domestic consumption), however particularly due to the crisis of the past two years, this value had risen to 4.16 % by 2009. Nevertheless, not even this value can be considered significant enough to have a major impact on the pricing policies of domestic breweries, especially considering that there are a large number of importers who do not co-operate together. In addition, this imported beer is mainly in the economy segment, which is not a subject of this article's analysis. Nevertheless, some studies (e.g. Rojas, 2006) do model price development for imported beer8.

The official wholesale pricelists for each brewer were used as base data9. The data was used most commonly with monthly periodicity in the period April 2001 to October 2010 (i.e. a total of 108 periods), and only in exceptional cases did the time period have to be shortened because of some older data being unavailable from a few brewers. Nevertheless, care was always taken to ensure there was a sufficiently large number of degrees of freedom.

Some complication was caused during modelling by changes in the effective number of companies whose prices were being modelled, which was a result of concentration on the market over the period concerned due to mergers and acquisitions; at the beginning of the modelling period, Heineken only owned Starobrno, but subsequently the companies Drinks Union and Královský pivovar Krušovice were added to its portfolio. However, we can get around this situation by primarily modelling the price of separate brands or products.

The program *Gretl* was used for estimations and the relationships between variables are considered to be linear. The input data was tested by the

[7] Czech law doesn't recognise the terms 'ten-degree beer', 'eleven--degree beer' or 'twelve-degree beer'. This classification is an historic one and consumers as well as breweries use it more often than the official classification of light beer having 8 – 10.99 degrees Plato and lager having 11 – 12.99 degrees Plato.

[8] It is worthy of note that Plzeňský Prazdroj in particular has a totally different pricing policy abroad, which means it can occur that its products can be imported back in bulk from Germany or Poland to the Czech Republic.

[9] Except for Plzeňský Prazdroj, the brewers' wholesale pricelists were officially provided, although it was the case that smaller companies were more willing to provide them. Plzeňský Prazdroj resolutely refused to provide this information, and so this data was acquired by an unofficial way.

Doornik-Hansen test, the Shapiro-Wilk W test, the Lilliefors test and the Jarque-Bery test. The highest p-value achieved an exceptional significance level of 0.03 using the Jarque-Bery test (in other cases it was always significantly less than 0.01), so the input values were negatively tested for normal distribution.

Results and discussion

Pivovary Staropramen

Pivovary Staropramen (a member of StarBev) maintained a stable and steadfast second place over the whole of the modelled period with a market share of between 13.5 % and 16 %. The results for the modelled barrelled beer are unequivocal,

Company/product	delay	R2	Validity*)	Elasticity	Company/product	delay	R2	Validity*)	Elasticity
Pivovary Staropramen					Svijany				
baStaropramen10	1	0.94	yes	0.82	baSvijany10	2	0.94	yes	1.39
baStaropramen12	1	0.91	no	0.90	baSvijany11	2	0.94	yes	1.24
baStella	1	0.93	no	0.88	baSvijany12	2	0.92	no	1.39
boStaropramen10	13	0.76	no	0.83	boSvijany10	6	0.82	yes	2.16
boStaropramen12	11	0.33	no	0.31	boSviajny11	6	0.83	yes	1.78
boStella	7	0.79	no	1.17	boSvijany12	14	0.81	yes	1.83
nStaropramen	2	0.82	-	1.34					
					Platan				
Starobrno/Heineken					baPlatan10	1	0.94	no	1.19
baStarobrno10	2	0.96	no	1.00	baPlatan12	1	0.85	no	1.10
baStarobrno12	2	0.93	no	1.06	boPlatan11	12	0.69	yes	1.13
boStarobrno12	1	0.70	yes	0.45	Nplatan	12	0.70	-	0.43
nStarobrno	1	0.63	-	0.42					
					Černá Hora				
Krušovice/Heineken					baCernahora10	4	0.94	yes	0.62
baKrusovice10	1	0.94	no	1.07	baCernahora11	4	0.91	yes	0.58
baKrusovice11	1	0.83	no	0.71	baCernahora12	4	0.92	yes	0.64
baKrusovice12	2	0.93	no	1.09	boCernahora10	4	0.84	yes	0.66
boKrusovice11	12	0.37	yes	-1.08	boCernahora11	4	0.92	yes	1.16
Clausthaler	3	0.51	-	0.25	boCernahora12	3	0.84	yes	0.53
					NCernahora	2	0.45	-	0.44
DU/Heineken									
baZlatopramen11	1	0.95	yes	1.10	Bernard				
baBreznak12	1	0.91	yes	1.07	baBernard10	1	0.98	no	1.12
					baBernard11	5	0.79	no	0.42
Budějovický Budvar					baBernard12	2	0.97	yes	1.35
baBudvar10	9	0.92	yes	0.78	boBernard11	9	0.76	no	3.16
baBudvar12	2	0.91	no	0.74	NBernard	13	0.63	-	0.95
boBudvar10	17	0.52	no	1.28	boBernardRC	13	0.83	no	1.77
boBudvar12	2	0.82	no	1.21					
NBudvar	1	0.82	-	1.35					
PMS Přerov									
baZubr10	4	0.95	yes	0.79					
baZubr12	11	0.93	no	0.96					
boZubr10	2	0.80	yes	1.13					

*) Statisticel validity of excise duty influence
Source: Own calculations on the basis of brewery pricelists

Table 1: Results of the estimations.

with the price increase reaction being the shortest possible, a delay of one period even for the non-domestic super-premium brand Stella Artois, which has however been produced since November 2004 under licence in the Czech Republic. In the mainstream brand bottled category, the reaction is 13 periods for the Staropramen 10 product and 11 periods for the Staropramen 12 product. The reason for this will undoubtedly be the pressure of chainstores for a slow increase in prices. The price reaction for Staropramen 12 also demonstrates a very low elasticity (0.31 %), because the strength of this product is very small. In contrast, Stella Artois showed a delay of 7 periods and elasticity of 1.17 % because the importance of this brand continues to rise and the company can allow the price to increase at a higher rate than the price growth is for the Pilsner Urquell brand. Non-alcoholic beers display a very short reaction period (2 months); the non-alcoholic beer market in the Czech Republic is very progressive and it is one of the few segments which are growing. With the exception of barrelled Staropramen 10, the impact of the excise duty rise was shown to be statistically insignificant. This may confirm the conclusion of Freeman's study (2000).

Heineken

Heineken is the youngest multinational company on the Czech beer market and over the monitored period increased its share from 4.66 % in 2003 when the company entered the Czech market and took over Starobrno to 12 % in 2009. This growth was as a result of acquiring the companies Královský Pivovar Krušovice and Drinks Union.

Starobrno

The mainstream Starobrno brand is more of a regional brand spread over the South Moravia region, where it has a very good position, meaning that it will have a regional market share much higher than the roughly 4% it has nationally. For barrelled beers, reaction is delayed by 2 months and elasticity is roughly proportional – at 1.00 % for the Starobrno 10 product and 1.06 % for the Starobrno 12 product. Here too, the increase in excise duty had a statistically insignificant effect. A similar sales policy is demonstrated by the Starobrno 12 bottled and non-alcoholic beer products. Delay in growth of the price level according to the model used is one period, although they demonstrate significant inelasticity, with elasticity values of 0.45 and 0.42. Here again, the strength of the chainstores and significantly higher competition in off-trade make themselves clear.

Drinks Union

In 2008, Drinks Union was bought by Heineken and it has two major brands in its portfolio – Zlatopramen 11 and Březňák 12. Partial models were estimated only for barrelled products, as bottled products had a low number of degrees of freedom, meaning an unequivocal conclusion could not be made in this case. The Zlatopramen 11 and Březňák 12 products display like results, the price level rising with a one-month delay and elasticity also proportional for both. In contrast to most of the previous beers, the impact of the increase in excise duty was statistically significant.

Královský pivovar Krušovice

Královský pivovar Krušovice was one of the few analysed companies to significantly lose market share on the Czech market over the modelled period from around 4 % in 2001 to 2.5 % in 2007, when it was bought by Heineken. Nevertheless, despite this negative trend, its pricing policy closely adhered to the market leader pricing policy in terms of barrelled beer. The Krušovice 10 and Krušovice 11 (trade name Mušketýr) products' prices rose with a delay of one period, and Krušovice 12 had a two month delay. No impact of the excise duty increase was seen. A result which is contrary to the suppositions is the pricing policy for bottled Krušovice 11, which showed negative elasticity. However, a detailed study of the base data makes clear that the pricing policy in this case was particularly inconsistent and sporadic, with alternating increases and decreases in price. In addition, the correlation is only 0.37 in this case.

The price of the non-alcoholic beer Clausthaler, the only one to be produced abroad, displays a delay of one period and very low elasticity (0.25 %). The significance of this product on the Czech market is negligent.

Budějovický Budvar

Budějovický Budvar maintained a market share of between 3.6 % and 5.78 % over the monitored period and almost half of its production is exported. The price behaviour of the super-premium Budvar 12 brand is very similar for both barrelled and bottled beer, with a delay of only two months. The high elasticity for bottled beer (1.21 %) is surprising and signifies that the prices of this product and bottled Pilsner Urquell are converging. The situation is completely different for the Budvar 10 product, which is mainstream and has been substituted by the Pardál brand from March 2007

in order to ensure that the Budvar brand is properly perceived as super-premium. The price of barrelled Budvar 10 was increased with a nine-month delay, bottled by up to seventeen months and with a very low correlation of 0.52. The price of non-alcoholic beer was raised a month after the price of Radegast Birell non-alcoholic beer's price was raised with an elasticity of 1.35 %. Over the monitored period, the non-alcoholic beer segment was the only segment to be growing well, meaning that a good sales policy could allow for even relatively large price increases, particularly from a low price base.

PMS Přerov

PMS Přerov is distributed mainly in Moravia and its market share over the monitored period ranged from 5.82 % to 4.59 %, although its local market share can be expected to be much higher. Its most well-known brand is Zubr. Barrelled Zubr 10 showed a growth in price levels with a delay of 4 months, bottled with a delay of two months. Barrelled Zubr 12 showed a delay of 11 months.

Pivovar Svijany

Pivovar Svijany can be considered a very atypical brewery. In 1998, production basically came to a stop, only for it to subsequently demonstrate very significant growth in production and market share. Over the monitored period, its share grew from 0.71 % to 2.53 %. The price modelling results also correspond closely with this development. For all three barrelled products (Svijany 10, Svijany 11 and Svijany 12), the company increased its price with a delay of two months after Plzeňský Prazdroj with high elasticity (1.24 – 1.39). The impact of the increase in excise duty was only statistically insignificant for Svijany 12. For bottled beer, there was a price increase after half a year for the Svijany 10 and Svijany 11 products and a price increase after 14 months for Svijany 12. Nevertheless, even for bottled beer elasticity was very high, and for Svijany 10 it even reached a value of 2.16 %. This very high elasticity for bottled beer is due to the fact that in the past, rather than the brewery's sales department actively contacting chainstores, it was the chainstores themselves which were more active in making contact, meaning the brewery had a simpler and more important position during discussions in terms of psychology than its actual significance on the market would suggest.

At the beginning of the monitored period, the Svijany brand could be perceived as only local, but today it is sold nationwide.

Platan

Similar to Starobrno and Zubr, Platan can be considered a brand active locally, particularly as far as barrelled beer sales are concerned. It is very difficult to ascribe the company's share of the Czech market, because over the monitored period the company produced the beers Primus and Klasik in the economy category for Plzeňský Prazdroj, without ownership connection between these companies. The author would estimate that its market share over the monitored period could range between 1 % and 1.5 %, although in its region the company has a much larger economic strength. In 2008, a newly emergent company, KBrewery Trade bought shares in the company, which had a positive impact on off-trade in particular. The price level of the modelled barrelled beer rose with a delay of one month with an elasticity of just over 1, which demonstrates the regional strength of the brand. In contrast, the price of bottled Platan 11 increased with a delay of a full year, as did the price of non-alcoholic beer.

Černá Hora

The Černá Hora brewery is also a strong regional brand with its share in the rest of the country significantly lower, even minimal. The national market share over the monitored period remained just below one percent.

For all three modelled barrelled beers (Černá Hora 10, Černá Hora 11 and Černá Hora 12), the results are basically identical and very stable. The company changes its price level 4 months after the price leader and its reaction is inelastic (0.56 % - 0.64 %). For bottled beers, the results are slightly less balanced. The delay length is similar, but the elasticity is significantly higher for the Černá Hora 11 brand, reaching a value of 1.16 %. The reason for this is that it is a relatively new product (from May 2004) and it had a low introductory price which rose significantly. Non-alcoholic beer showed a delay of 2 periods and an elasticity of 0.44 %.

Bernard

The Bernard brewery is markedly different to other similarly sized breweries. Although its market share over the monitored period was generally less than one percent, it is a brewery that operates nationwide and it is not a regional brewery. Even the sales and marketing tools it uses are those which are used by large breweries. This fact is reflected in the results, from which it is difficult to draw any conclusions, as the brewery does not even have economic strength

in its own region. This however in no way means that the brewery is economically unsuccessful.

Conclusion

On the basis of the above detailed analyses, many types of price behaviour were observed for the second to eleventh largest breweries in the Czech Republic. The conclusions can be summarised into the following general points:

- it is much easier for breweries to increase their prices for barrelled beer than it is for bottled beer, because they have a much better bargaining position dealing with caterers than they do with chainstores. Breweries most commonly raise their price level for barrelled beer one or two months after the market leader Plzeňský Prazdroj raises its prices
- it is much easier for breweries to increase their prices for barrelled beer than it is for bottled beer, because they have a much better bargaining position dealing with caterers than they do with chainstores. Breweries most commonly raise their price level for barrelled beer one or two months after the market leader Plzeňský Prazdroj raises its prices,
- for barrelled beer, even breweries which have a relatively small market share nationwide but which are strong at least regionally are able to increase their prices a relatively short period after the price leader. If the brewery's market strength is spread out over a number of regions, the modelling results are unclear,
- the least stable results for barrelled beer are seen by so-called eleven-degree beers, because at the start of the monitored period, only a couple of breweries had the product in their portfolios and so there was often a problem with achieving a sufficient number of degrees of freedom. Results are also inconsistent in that it is a dynamically developing segment,
- if we leave out the eleven-degree beer segment, ten-degree barrelled beer generally demonstrates slightly lower elasticity than barrelled twelve-degree beer. Thus, consumers of higher quality products do not take the price into account so much,
- for bottled beer, the opposite is true with stronger beers (larger degrees of Plato) showing lower elasticity,
- it is also interesting to note that in the non-alcoholic beer segment, larger companies (Pivovary Staropramen and Budějovický Budvar) show higher elasticity (1.34 % and 1.35 %) compared to smaller companies (Starobrno, Platan and Černá Hora) which have lower elasticity of comparable values (0.42, 0.43 and 0.44 respectively). Bernard is an exception, although its non-alcoholic beer in particular is supported with a large advertising campaign.

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Impact of Government Reform on Beef Market

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Anotace

Předložený článek se zabývá simulací dopadů vybraných opatření vládních reforem na trh s hovězím masem v České republice. V úvodní části jsou na základě dostupných zdrojů vymezena a specifikována vybraná opatření současných vládních reforem, která jsou v následné praktické části simulována v modelu dílčí rovnováhy definovaného trhu. Na základě dosažené ekonometrické kvantifikace a verifikace výstupů modelu jsou následně komentovány dopady jak na stranu nabídky, tak i poptávky zvoleného trhu. Analyzovaná vládní opatření jsou zahrnuta v podobě očekávaného zvýšení DPH, pohybu kurzu české koruny, vývoji spotřebitelských příjmů a cenových expektací ve vertikále hovězího masa. Dosažené výsledky predikují domácímu trhu negativní důsledky zejména na straně nabídky, a to v podobě relativně výrazného snížení počtu chovaných kusů, z čehož lze usuzovat na snížení počtu podniků s intenzivním výkrmem nebo přesun jejich orientace na jiné komodity rostlinného charakteru. Straně poptávky by pravděpodobně přinesly uvažovaná opatření krátkodobé snížení cen, ovšem s reálným předpokladem následujícího strmého růstu provázeným snížením kvality masných produktů. Příspěvek vznikl jako součást výzkumného záměru MSMT 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systémů“.

Klíčová slova

Hovězí maso, dílčí rovnováha, simulace, DPH, Česká republika.

Abstract

The present paper deals with the simulation of the impact of selected measures of government reforms in the beef market in the Czech Republic. The selected measures of government reforms are defined and specified on the base of available resources in the introduction. Subsequently, these measures are simulated by the model of partial equilibrium of defined market in the practical part. The impacts of the measures on both supply and demand of selected market are then commented, based on formal econometric quantification and verification of model outputs. The analyzed government measures are included in the form of an expected increase in VAT, the movement of the Czech crown, the development of consumer income and the price expectancy in vertical of beef. The results predict negative consequences on domestic market, in particular on the supply side, in the form of a relatively significant reduction in the number of pieces of cattle. These can result in reducing the number of enterprises with intensive fattening or in shifting their focus to other commodities of vegetable nature. On the demand side, the analyzed measures are likely to bring short-term price reductions. However, the steep growth accompanied by a reduction in quality of meat products can be reasonable expected in the long run. Pieces of knowledge introduced in this paper resulted from solution of an institutional research intention MSMT 6046070906 „Economics of resources of Czech agriculture and their efficient use in frame of multifunctional agri-food systems“.

Key words

Beef, partial equilibrium, simulation, VAT, Czech Republic.

Introduction

Within the last twenty years, significant changes in food consumption can be seen in the Czech Republic, reflected, among other things, in a decline in the overall demand for animal products. In an attempt to balance the excess of supply over demand, agricultural producers have been forced to decrease numbers of livestock and to thereby reduce their production. The said development has significantly affected the numbers of beef cattle, which thus show a declining tendency on a long-

term basis. In the course of the reference period of 1995 – 2009, they showed a decline of 33%. The above affects the supply of beef meat in the Czech Republic, which is comprised predominantly of domestic production (86%), but, nevertheless, in terms of the structure, a significant decline in the proportion of domestic production can be seen within the reference period, and, on the other hand, a significant increase in the proportion of foreign trade (Čechura, 2010, similarly Svatoš and Smutka, 2010). Abrahámová et al. (2010) adds that the supply of domestic beef meat is comprised primarily of the meat of dairy cows, while better quality meat of meat breeds is exported abroad.

Czech farmers face a number of significant problems that do not contribute to the satisfactory development of the production of beef cattle for slaughter. In this regard, this includes, for example, increases in the export of market beef cattle, which subsequently brings about increases in the import of beef meat, decreases in the consumption of grain feeds in general, as well as decreases in the consumption bulky feeds as compared to an increase in areas of permanent grass growth, a decrease in the utilization of the slaughter capacity of processing businesses and the associated food industry (Malý and Kroupová, 2006).

An unpleasant factor is also the constant decline in the consumption of beef meat, which has its impulse primarily in price development, as the Czech consumer is considerably sensitive to the price of beef meat (Malý and Malá, 2011 or Palát et al., 2012). Within the analyzed period, beef meat became the most expensive meat commodity, which was reflected in the partial shift of consumers to cheaper types of meat. In regard to the said development, the so-called rate amendment of the Act on Value Added Tax (VAT), approved by the Chamber of Deputies on 6 November 2011, can also be negatively reflected within the subsequent period. The said amendment increases the reduced rate of VAT from 10% to 14%, effective from 1 January 2012. Further, it also brings about the unification of the reduced and basic rate at a level of 17.5% effective from 1 January 2013. However, it is likely that, in the course of the year 2012, the unification of rates will continue to be discussed and the alternative of the unification of rates at a level of 19% is also realistic.

The goal of the presented article is to simulate the development of the beef meat market under the presumption of a change in the rate of value added tax, as well as other determinants of supply and demand functions – prices on all levels of the vertical, consumers' income, as well as the rate of the Czech crown.

Material and Methodology

For the purpose of the fulfillment of the above objective, the partial equilibrium model of the beef meat market quantified by Malý and Malá (2011) was utilized. The said model displays three levels of the product vertical. The basic level is comprised of agricultural producers, who are included in the said model as entities offering live animals for the purpose of slaughterhouse processing. The production behavior of the said entities is presumed as dependent on the price that was effected on the market within the previous period, but also on the currently valid price. The said variables explain the numbers of beef cattle from which the production of beef meat in live weight was subsequently derived.

The associated level of the vertical is represented by slaughterhouses, or meat processing plants including slaughterhouse processing, the product of which is jointed meat, which goes through the distribution chain to consumers. The supply from processors thus reflects not only the utilization percentage, but also the existence of derivative meat products (meat products and intermediate products), which are not further reflected within the presented model, however. The beef meat market is modeled as open, and thus the overall supply of beef meat on the consumer market is comprised of the sum of jointed meat acquired through domestic production and the import of foreign production. In the import function, the decisive effect of the import price and the exchange rate of the crown against the dollar is anticipated.

The demand side on the consumer market is comprised primarily of domestic consumption of beef meat, which is quantified at a household level in the said model. The explanatory variables of the consumption function are thus the consumer price of beef meat and the consumer's income. The overall demand is supplemented by the export of beef meat dependent on the dominance of the export price over the domestic processor price. In the described model, created inventories were also included on the demand side.

The quantified model, a detailed description and verification of which can be found in the publication of Malý and Malá et al (2011), had the following form:

$$\hat{S}_t = 5.1967 * CZV_{t-1}^{0.1856} * CZV_t^{-0.1906} * S_{t-1}^{0.8862} \quad (1)$$

$$\widehat{VZHM}_t = 0.00005 * S_t^{1.6877} \quad (2)$$

$$\widehat{PM}_t = 0.5239 * VZHM_t \quad (3)$$

$$\widehat{IM}_t = 116634.5 * IC_t^{-0.2465} * K_t^{-1.45} * IM_{t-1}^{0.4631} \quad (4)$$

$$\widehat{SPD}_t = 80.1634 * SPCH_t^{-0.8610} * PR_t^{0.3328} \quad (5)$$

$$\widehat{DS}_t = 2916117 * SPD_t \quad (6)$$

$$\widehat{EX}_t = 4465.56 * \left(\frac{ECK_t}{CPVV_t}\right)^{0.7056} * T^{0.7529} \quad (7)$$

$$PM_t + IM_t = DS_t + EX_t + Z_t \quad (8)$$

where:

S_t…numbers of beef cattle in head in the period t,

$VZHM_t$…weight of animals for slaughter in tons in the period t,

CZV_t…price of beef meat with the agricultural producer in CZK/t in the period t,

PM_t…production of beef meat in tons in the period t,

IM_t…imported amount of beef meat in tons in the period t,

$SPCH_t$…consumer price of beef meat in CZK/t in the period t,

IC_t…import price of beef meat in USD/t in the period t,

K_t…exchange rate of CZK/USD in the period t,

SPD_t…consumption of beef meat in the average household in tons in the period t,

PR_t…income of the average household in thousands of CZK/year in the period t,

DS_t…total domestic consumption in tons in the period t,

PD_t…average number of households for the period t,

EX_t…exported amount of beef meat in tons in the period t,

ECK_t…export price of beef meat in CZK/t in the period t,

CPV_t…price of beef meat at the processor level in CZK/t in the period t,

Z_t…inventories of beef meat in tons in the period t.

For the simulation of changes in the price of the agricultural producer, the above model was supplemented with a price function with explanatory variables in the form of average production costs, SAPS rates and subsidies preceding the said category within the years 1995-2003. The said function was modeled in power form and quantified by way of the common method of least squares, applied to its linearized version. The acquired estimate was statistically (t-test, F-test) as well as economically verified (Breusch-Pagan test, Lagrange Mulitiplier autocorrelation test, CUSUM test, Jarque-Bera test). Further in regard to the said tests - GREEN (2008).

The price of the agricultural producer quantified in the manner as described above subsequently entered into the power function of the price of the industrial producer, as an explanatory variable. The effect of further variables was abstracted by way of the trend. The function was statistically verified in the same manner as in the previous case. However, the relationship of the price on the individual levels of the vertical required a supplementation of the econometric verification in the form of Hausman and Sagar test (see Green, 2008).

The last considered price level was the consumer price, which was explained, in the power function, by the price of the industrial producer and the import price. The verification of the said function was identical to the above verification of the function of the price of the industrial producer.

Data for estimates of the said functions and for the simulation calculations were obtained from the Situational and Outlook Reports published by the Ministry of Agriculture of the Czech Republic and arranged within a time series for the period of the years 1995 – 2009. A further data source was also the statistics of family accounts, maintained by the Czech Statistical Office, from which data on the average consumption of beef meat, weighted consumer prices and the income of ten groups of households of employees within the above period were drawn. The acquired data were further extrapolated, with the use of the linear trend function. For the simulation of changes in income, the prediction of the inflation rate conducted by the Ministry of Finance of the Czech Republic was utilized. Data on the prediction of the rate of the crown against the dollar were also drawn from the Ministry of Finance of the Czech Republic.

Under the presumption of the full shift of value added tax to the consumer, an increase in the reduced rate of VAT to 14% will bring about a decline in consumption of 3%, if the basis is the year 2009, and thus with the maintenance of the tax base and the disposable income at the level of the year 2009. The consumption of beef meat would thus decline by 4.48 thousand tons of live weight and 2.42 thousand tons of slaughtered weight. With the maintenance of the imported amount as stated above, the surplus production could be exported,

which is, however, a rather unrealistic presumption in view of the situation on the market of the European Union as well as on the world market. According to the quantified function of export, the said increase would require a growth in the export price by 12.5%, or a decline in the processor price by 11.1%. The change in import is also unrealistic, which would, in the given case, require an increase in the rate of the crown against the dollar to 47 CZK/USD, or a five-fold increase in the import price. If production were to decline by such volume, it would be accompanied by a decline in the overall numbers of beef cattle by 5.8% as compared to the level of the year 2009.

With the linear extrapolation of the tax base, based on prices adjusted for VAT rates, i.e. by the 5% rate until the end of the year 2007, by 9% from 2008 until the end of the year 2009, and by the 10% rate from the year 2010, and with the linear extrapolation of the disposable income of individual income groups, a decline in overall consumption by 2.3% can be anticipated, with an increase in the rate of VAT to 14% in the year 2012, as compared to the year 2009. As a result of a change in the tax rate, a decline in the domestic consumption to 145.96 thousands of tons of live weight and 78.84 thousands of tons of slaughtered weight in the year 2012 can thus be anticipated. The trend functions from which the said extrapolations of explanatory variables were conducted, were based on annual data from the years 1995-2010. The coefficients of determination of the said functions attained values within the interval of <0.8013; 0.9853>.

If we consider an increase in the rate to 17.5%, the base 2009 allows for the definition of a decline in consumption by 5.5%, i.e. to a level of 141.18 thousand tons of live weight and 76.26 thousand tons of slaughtered weight. If the decline in consumption will be accompanied by a decline in production, the above would mean a decrease of overall numbers of beef cattle by 8.5% as compared to the situation in 2009. Alternatively, the said production could be exported. However, an increase in export by the said amount would only occur in the case of an increase in the export price by 23.3%, or in the case of a decline in the processor price by 18.9%.

The potential unification of rates at a level of 19% then brings about a decline in consumption of 8.6% with the base at a level from the year 2009, i.e. by 9.86 thousand tons of live weight and 5.33 thousand tons of slaughtered weight. If the above is accompanied by a decline in domestic production, it will require a decrease in numbers by 9.6% as compared to the year 2009.

If, within the simulation calculations of the impact of changes in the rate of VAT, we also consider a change in income, corresponding to the inflation predicted by the Ministry of Finance, at a rate of 3.2% in the year 2012, 1.6% in the year 2013, and 2.1% in the year 2014, the effect of the increase in the reduced rate of VAT will be modified. The mere increase in disposable income by 3.2% causes a rise in consumption of 1.05%, ceteris paribus, as compared to the year 2009. An increase in the disposable income by 1.6% would then bring about a rise in consumption of 0.52%. For completeness, the change in consumption in the case of a 2.1% increase in disposable income can be added, which represents a 0.68% increase as compared to the year 2009, ceteris paribus. Specific changes in consumption in the case of a change in income as well as the rate of VAT is set out in Table No. 1.

Besides the change in the rate of VAT, a change in the rate of the Czech crown against the dollar can also be expected. According to a prognosis by the Ministry of Finance of the Czech Republic a rate of 17.7 CZK/USD can be anticipated in 2012. The strengthening of the crown will likely stimulate an increase in the volume of import by 11.3% as compared to the year 2009, ceteris paribus. If an increase in import brings about a decline in domestic production, there will be a further decline in the numbers of beef cattle, by 4.3%, ceteris paribus. Together with the change in VAT to 14%, overall numbers of beef cattle will thus fall by 7.4% as compared to the year 2009.

However, a linear extrapolation of the import price and the volume of import for the year 2012, supplemented with a change in the rate, presumes a lower increase in import, by only 2.3%. From the predicted values supplemented with a change in the

		Income change		
		3.2%	1.6%	2.1%
	14.0%	-2.02%	-2.5%	-2.4%
VAT	0,0%	-4.5%	-5.02%	-4.9%
	19.0%	-5.6%	-6.1%	-5.9%

Source: Own calculation

Tab. 1. Change of consumption as a result of change of income and VAT with base in 2009.

rate of VAT, we can thus assume a smaller change in the numbers of beef cattle, by only 5.4%. In order for the said change to be absorbed by consumption, i.e. in order so that the declared decline in the numbers of beef cattle does not occur, the average disposable income would have to increase by 24.5%, which is, in view of the predicted development of the national economy, unrealistic.

For the year 2013, a further strengthening of the crown is predicted, to 17.4 CZK/USD, which will bring about a rise in the volume of import by 14.1% as compared to 2009 under the condition of ceteris paribus. However, with the substitution of the extrapolated values of the import price and the imported amount, only a 3.5% increase in the volume of import can be quantified. The supplementation of the said change in rate with an increase in the rate of VAT to 17.5% thus brings about a decline in the numbers of beef cattle by 8.9% as compared to 2009.

Changes in import can be analyzed not only in view of the exchange rate, but also in view of the volatility of the import price. If the fluctuation of the import price around the level of the year 2009 in the amount of the decisive difference is presumed, a 9.2% increase in the volume of import in the case of a decline in the import price and a 6.3% decline in import as a result of growth in the import price can be expected. An increase in volatility to double the decisive difference deviation is associated with a decline in import of 10.9% in the case of growth of the import price, and with a rise in import of 25.3% in the case of a decline of the import price.

Volatility can also be seen in the case of the export price, which, however, unlike the import price, is greatly variable. On average, the export price in CZK/t deviates from the average amount by CZK 16138. The range of export volumes is then much broader than was stated in the case of import. The fluctuation of the export price by a decisive difference around the value of the year 2009 thus brings about a decline in export of 10.2% in the case of a decline in the export price and an increase in export by 19.3% in the case of an increase in the export price.

Changes in the price of double the decisive difference are associated with even more substantial changes in the volume of export, with a 32.9% increase in export and with a 26.5% decline in the volume of export.

The volume of export is not dependent only on changes in the export price, but is also influenced by the level of the processor price. In regard to the said price category, it is useful to analyze the effect of price shocks. The maximum price jump can be quantified as the proportion of the maximum price to the average price effected within the period of the years 2004-2009. This shock achieves a value of 3%. The said change in the CPV would bring about a decline in export by 4.7% as compared to 2009, ceteris paribus. On the other hand, the maximum price decline, quantified by way of the proportion of the minimum price and the average price effected within the period of the years 2004-2009, would imply an increase in the volume of export by 14.3%, without a change in the export price (as compared with the year 2009). If we take into consideration the effect of the strengthening of the crown in 2012, we can, in the case of the extrapolation of the processor price as well as the export price in dollars, anticipate an increase in export of 16.9% as compared to the level in 2009. If we further take into consideration the impact of a change in the volume of import in the case of the said change in the rate and the impact of a change in the consumed amount as a result of an increase in the reduced rate of VAT, we can expect a slight increase in production, by 0.8% as compared to the year 2009. However, it is necessary to add that the said changes in the rate (17.7 CZK/USD, income (increase of 3.2%) and VAT (14%), with the maintenance of all other variables at the level of the year 2009, would bring about a surplus of domestic production in the amount of 2.3 thousand tons of live weight.

A change in the price of the agricultural producer will also have an effect on the said development. However, the development of the numbers of beef cattle, affecting the level of production of beef meat, is, for the analyzed period of the years 1995-2009, characterized by a decline in the numbers of beef cattle as well as by a decline in the production of beef meat. The numbers of beef cattle for the analyzed period fell by 33.5%, production decreased by 44.0%, while the price increased by 21.1%. The said development implied values of the parameters of the function of the numbers of beef cattle that show a negative elasticity in relation to price changes. Any anticipated increase in the price of the agricultural producer thus implies a decline in the numbers of beef cattle.

The price of the agricultural producer is significantly affected by the amount of the average production costs and the subsidy policy, and thus the price function with explanatory variables in the form of average production costs, SAPS rates and subsidies preceding the said category within the years

1995-2003, was also quantified. The results of the estimate including the statistical and econometric verification are set out in Table No. 2 and in Graph No. 1.

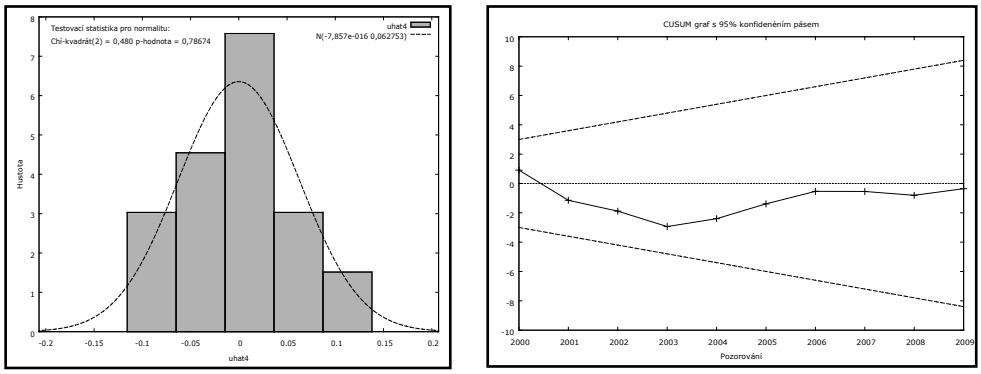
According to the said function, SAPS lower the price of the agricultural producer. If we then presume the maintenance of the SAPS rate in the year 2012 at the level of the year 2011, i.e. at a level of 4,686.5 CZK/ha, we can anticipate a decline in the price of the agricultural producer by 2.6% as compared to the level of the year 2009 in the case of the maintenance of the average costs at the level of the year 2009, and by 1.8% in the case of an increase of the average costs by the level of the predicted inflation.

The said change will affect the development of the price of the industrial producer, the price function of which in power form along with the statistical and econometric verification is set out in Table No. 3 and Graph No. 2.

	Parameter	Standard Error	t-value	p-value
Const.	14.0883	0.353265	7.488	0.0000209
SAPSt	-0.11053	0.0410814	-2.691	0.0227
ACt	0.246759	0.0892937	2.763	0.02
R2	0.459639			
F (2,10)	7.046705			0.012317
CUSUM test	-0.112616			0.912807
LMBP	1.79922			0.406728
LMAR1	0.0133287			0.910623

Source: Own calculation

Tab. 2. Results of estimation of farm price function in power form.



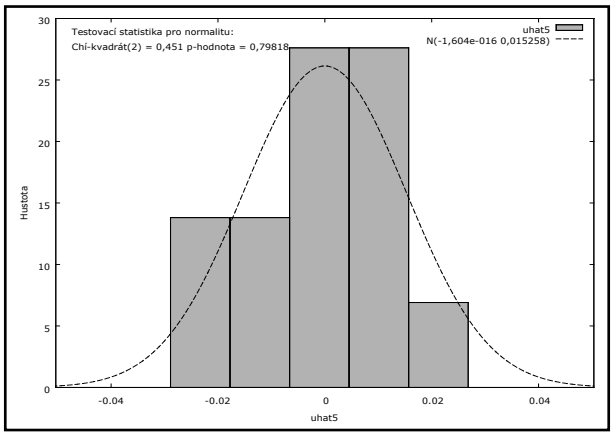
Source: Own calculation

Graph 1. Normality of residue and CUSUM test of farm price function.

	Parameter	Standard Error	t-value	p-value
Const.	9.691	0.261871	8.673	0.000
CZVt	0.608051	0.0757513	8.027	0.000
T	0.102888	0.00523749	19.64	6.44E-86
R2	0.971526			
F (2,10)	229.3843			0.000
Hausman test	0.0104709			0.918497
Sagar test	7.07634			0.00781086
Pesaran-Taylor test	1.175756			0.24
LMAR1	14.223487			0.00545

Source: Own calculation

Tab. 3. Results of estimation of producer price function in power form.



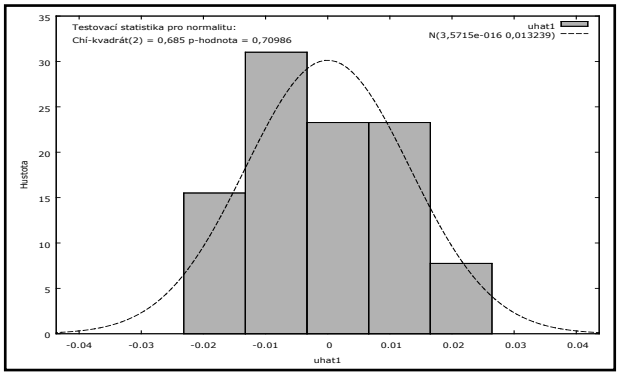
Source: Own calculation

Graph 2. Normality of residue of producer price function.

	Parameter	Standard Error	t-value	p-value
Const.	14.4743	0.268053	35674,0000	2.07E-23
CPVt	0.370702	0.0756126	4.903	0.000
ICt	0.0410828	0.0113351	3.624	0.0003
R2	0.946688			
F (2,10)	251.9037			0.000
Hausman test	0.0736609			0.786079
Sagar test	4.52231			0.10423
Pesaran-Taylor test	0.768833			0.441993
LMAR1	0.168356			0.692346

Source: Own calculation

Tab. 4. Results of estimation of consumer price function without VAT in power form.



Source: Own calculation

Graph 3. Normality of residue of consumer price fiction without VAT.

The actual decline in the price of the agricultural producer by 1.8% as compared to the year 2009 will cause a decline in the price of the industrial producer by 1.1%. As a result of changes of other factors affecting the level of the processor price, its increase by 0.7% as compared to the level for the year 2009 can be expected in the year 2012.

A change in the processor price will also affect the last level, i.e. the consumer price, by 0.3% ceteris paribus, see the estimate of the price function of the consumer price without VAT in Table No. 4.

With the addition of the change in VAT, it will mean an increase in the consumer price by 3.9% as compared to the level of the year 2009.

Overall, the said changes will bring about an increase in the volume of export by 8.8%, an increase in the volume of import by 11.3%, and a decline in the

consumed amount by 0.4% as compared to 2009. Overall numbers of beef cattle in view of the said changes will decrease by 0.3%, which will bring about a decline in the production of beef meat in live weight by 0.6%.

Discussion

The presented results of the simulation of the impact of changes in the value added tax rate on the level of consumption of beef meat, and potentially the entire market equilibrium in regard to the said commodity, is based on the assumption of the complete shift of the tax into the price of the said goods. That is also proven by empirical studies, e.g. Besley and Rosen (1999), Viren (2009). This assumption applies in their study also Syrovátka (2011) and Rumánková et al. (2012). David (2012) even assumes higher price increase than is the increase in VAT. An increase in consumer prices as a result of a change in the value added tax rate is also anticipated by the Czech National Bank (2011), but, nevertheless, according to its study, the shift of the tax into the price is not full. According to its estimates, an increase in the lower rate of VAT from 10% to 14% will be reflected in the rate of growth of food prices by 0.6 of a percentage point, and the subsequent increase to 17.5% will bring about further rates of growth of the prices of food products by 0.3 of a percentage point. However, in reality, according to a report by the Czech National Bank (2012), the increase in the rate of VAT was reflected in a 2.4% increase in the prices of food products, in advance, in the fourth quarter of 2011. A partial shift of value added tax into the price of beef meat would lead to a lesser decline in demand than the presented results presume, which would of course also affect other simulated values obtained from the partial equilibrium model. It would therefore be appropriate to further analyze the size of the shift of value added tax into the price of beef meat, and to adjust the simulations conducted with the use of the model described above based on the ascertained results.

Comprehensively, the presented results of the simulations of changes in the main determinants of supply and demand on the beef meat market can be summarized as follows. Within the short-term period of the positive prognostic horizon, a decline in domestic production as well as domestic consumption of beef meat and increasing volume of exports as well as imports of beef meat are anticipated. Based on the above, it can be assumed that the trend of the export of quality meat of meat breeds to foreign markets and the satiation of the domestic demand with lower quality meat will continue to exist. The decline in the supply of domestic production on the domestic market is also anticipated by Abrahámová et al. (2010). The deepening foreign trade deficit in beef meat and the decline of domestic production is also envisaged by the prognosis of the European Commission (2006).

Conclusion

On the basis of the achieved outputs, we can assume the real negative effects of the contemplated scenarios within the beef meat market. The effects described above will, in the final outcome, affect primarily the supply portion of the vertical, which will have to once again (as compared to the previous period of the nineties and the turn of the millennium) deal with the relatively significant decline in demand. Because the current numbers can be, even despite increases in the category of cows without market production of milk, considered marginal for the securing of reasonable food self-sufficiency, the anticipated development on the market will mean a necessary decline in numbers and the beef meat market will be exposed to similar pressure as in the current situation on the pork meat market, where, according to the representatives of the Agricultural and Food Chambers of the Czech Republic, more than half of pork meat for processing is imported from abroad. Therefore, the said effects necessarily bring along with them the liquidation of herds, the reduction in the number of businesses with intensive animal production, the likely shift of their orientation to purely plant production, with all other implications and consequences. For the consumer side, the achieved results can bring about short-term positive effects in the form of a reduction in prices on the basis of a domestic production surplus and the subsequent reaction of producers with a significant reduction of raised head associated with the import of very cheaply priced jointed meat from abroad. However, we can further expect the substitution of beef meat in intermediate meat products or meat-butchery commodities with cheaper types of meats, which will, however, very likely be reflected in the decline of the quality of meat products in the Czech Republic, which is already the subject of discussions.

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Time Series Properties and Their Influence on the Results of Price Transmission – Case Study of the Czech Pork Market

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Anotace

Tento článek zkoumá vlastnosti vybraných časových řad a dopad volby časové řady pro výsledky cenové transmise ve zvolené zemědělsko-potravinářské vertikále. Analýza se zabývá otázkou, zda výběr časové řady může ovlivnit výsledky cenové transmise. Analýza je zaměřena na vertikálu vepřového masa v České republice, je tedy zkoumána cena zemědělských výrobců, cena potravinářských výrobců a spotřebitelská cena vepřového masa. Nejprve jsou zkoumány vlastnosti a charakteristiky zvolených časových řad a následně je provedena analýza cenové transmise na základě časových řad o různé frekvenci a v různých časových obdobích. Analýza cenové transmise je založena na analýze vícerozměrných časových řad, konkrétně je použit Model korekce chyby a kointegrační analýza. Analýza neprokázala významný dopad frekvence časové řady na výsledky cenové transmise, zatímco vliv délky období se na základě provedené analýzy jeví jako významný.

Klíčová slova

Časová řada, cenová transmise, vepřové maso, kointegrační analýza, Model korekce chyby.

Abstract

This paper deals with an examination of the selected time series and an examination of price transmission in the selected agri-food chain. The analysis is connected with the working question of whether the selection of time series influences the results of price transmission. The analysis is focused on the pork agri-food chain in the Czech Republic; the time series of farm-gate price, wholesale price and consumer price is examined. First of all, the main properties of the selected time series are examined; subsequently, price transmissions based on time series of different frequency and in different periods are analyzed. The price transmission analysis is based on multivariate time series analysis; to be precise, the Vector error correction model and co-integration analysis are employed. The analysis shows that the choice of time series of different frequency should not significantly influence the results of price transmission, whereas the choice of time period might be crucial.

The results presented in this paper are outputs of the research project “P402/11/P591 Modelling of price transmission and its asymmetry in agri-food chain – theoretical-empirical implications” supported by Czech Science Foundation.

Key words

Time series, price transmission, pork meat, co-integration analysis, Vector error correction model.

Introduction

Price transmission in agri-food chains is a current topic with a relatively short history, especially in Central European countries. Nevertheless, the examination of price transmission is crucial, for example, at the level of national agricultural policy. The analysis of agri-food chains is usually based on time series analysis. For such an analysis, several features should be considered and examined. First, the nature of the selected time series based on the main statistical characteristics of the time series should be examined, as well as the short-term and long-term components of the time series. Then, its own price transmission should be examined and described. For price transmission analysis of the agri-food chain, it is also crucial to know the primary characteristics of the analyzed chain.

The pork sector, which was selected for the following analysis, is one of the most important agri-food chains, and not only in the Czech Republic. Many

authors have shown its importance for the national economy as well as the whole world. Malý et al. (2011) mentioned that the strong position of pork is connected with the customs and habits of the Czech people. The importance and features of the pork agri-food chain was also processed and published by Babović et al. (2011), among others.

The time series of prices are crucial for price transmission analysis. Matošková (2011) says that significant price volatility has been observed in global agri-food markets. She also mentioned that price is a motivating power in the development of supply and demand in global markets. She also mentioned that supply in agrarian markets can be characterized by low elasticity to actual production. Furthermore, production changes every year pursuant to variable weather conditions. In general, demand for basic agri-food commodities has increased steadily in line with population growth, and this does not indicate higher flexibility. The low demand elasticity of agri-food products means that a relatively small variability in production volume can induce significant changes (so-called shocks) in supply and demand, and consequently in price levels. Volatility in the prices of food products was also analyzed by, for example, Onour, Sergi (2011). Clark, Čechura (2011), among others, say that an examination of the features of a time series could be critical for time series analysis. Some seasonal components, as well as cyclical components or unexpected shocks, could influence the results.

This paper deals with vertical price transmission in the pork agri-food chain in the Czech Republic; therefore, the following literature review is focused on papers dealing with an analysis of vertical price transmission. The first studies of vertical price transmission were introduced by Heien (1980), Boyd, Brorsen (1985), and Kinucan, Forker (1987), among others. Later, vertical price transmission in meat agri-food chains was analysed by, e.g., Azzam (1999), Goodwin, Harper (2000), Peltzman (2000), Bojnec (2002), Lloyd et al. (2004), and Bakucs, Fertö (2005). Advanced techniques and new knowledge concerning the relevant topic in the current period were introduced and presented by Vavra, Goodwin (2005), Bunte, Vavra (2006), Lechanová (2006), and Jensen, Møller (2007), among others.

Vavra, Goodwin (2005) analyzed vertical price transmission in meat agri-food markets in the USA using co-integration analysis, the Vector Error Correction Model, and the Threshold Vector Error Correction Model. The analysis showed that price transmission in the pork agri-food chain is asymmetric. Bunte, Vavra (2006) analyzed vertical price transmission in meat agri-food chains in several countries using the Threshold Vector Error Correction Model. Analysis of price transmission in the pork agri-food chain in the Czech Republic showed that price transmission is asymmetric at all levels of the analyzed agri-food chain. Lechanová (2006) analyzed vertical price transmission, with an emphasis on supply and demand shocks in meat agri-food chains in the Czech Republic. The analysis showed inelastic and asymmetric reactions between pork prices.

Material and methods

The ***objective*** of the paper is to examine whether the choice of time series influences the results of the price transmission analysis. Thus, the working question of whether *the choice of time series may influence the results of the price transmission analysis* should be answered.

This hypothesis is based on the assumption that some specific features of individual time series may influence the nature of price transmission. For instance, some frequency of the time series may show a seasonal or cyclical component while the other frequencies do not. Also, one could assume that the length of the time series is crucial for price transmission analysis due solely to the number of observations and the different properties of the time series. The hypothesis is verified in a case study of the pork agri-food chain in the Czech Republic. If the hypothesis is accepted for the pork agri-food chain, then the same results could be anticipated for other agri-food chains.

The analysis is separated into two parts. First of all, time series frequency and its influence on price transmission are examined and subsequently, time series properties and their influence on price transmission are examined. The first part is based on the time series of the farm-gate price and wholesale price of pork, and the second part is focused on the wholesale price and consumer price of pork. Thus, results concerning the whole vertical price transmission could be defined based on the selected time series; i.e., price transmission between farm-gate price, wholesale price and consumer price in the pork agri-food chain.

The ***empirical part*** consists of the following steps:

1. Examination of the selected time series:

i. description of the main statistical characteristics of the selected time series;

ii. evaluation of extreme values of the selected time series;

iii. examination and description of short-term variation in the time series;

iv. examination and description of the long-term tendency of the time series.

2. Examination of price transmission between the selected time series:

i. the selection of maximal lag using the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC);

ii. examination of time series stationarity using the Augmented Dickey-Fuller test (ADF) and Phillips-Perron test (PP);

iii. detection of a long-term relationship between selected variables using cointegration analysis;

iv. description of the long-term relationship between selected variables in cases where this relationship is proven; for this purpose, the Vector Error Correction Model (VECM) is employed in the following form:

$$\Delta X_t = \eta + \Pi X_{t-1} + \sum_{s=1}^{p} C_s \Delta X_{t-s} + U_t \ ,$$

where $C_s = 0$ for $s > p$, X_t is a k x 1 vector of variables which are supposed to be integrated of order 1, (I(1)), u1, …, ut are nid (0,∑) and Π is a matrix of the long-run relationships;

v. processing of additional tests (test of exclusion, test of stationarity, and test of weak exogeneity are employed to verify the additional characteristics of selected variables and relationships of the model) and residual analysis (calculation and interpretation of information criteria, multicollinearity, autocorrelation of residuals, normality of distribution and heteroskedasticity is employed to verify statistical characteristics of the derived model);

vi. description and explanation of the nature of the price transmission based on the coefficient of price transmission elasticity.

Results and discussion

The paper is focused on price transmission analysis in the pork agri-food chain in the Czech Republic. An econometric approach which uses time series analysis is employed for this purpose. Therefore, it is crucial that the first step of the analysis be an examination of the selected time series. The following text first examines the time series frequency and its influence on the results of price transmission between farm-gate price (FP) and wholesale price of pork leg without bones (WP); subsequently, an examination of time series properties and their influence on price transmission between wholesale price of pork leg without bones (WP) and consumer price of pork leg without bones (CP) is provided.

I. Time series frequency

1. Description of selected time series

The main statistical characteristics of the analyzed time series are shown in Table 1. The mean value of farm-gate price equals 38.95 CZK/kg in the case of monthly data and 39.40 CZK/kg in the case of bi-weekly data. The mean value of wholesale price reaches a value of 87.89 CZK/kg in the case of monthly data and 88.35 CZK/kg in the case of bi-weekly data. Based on the table it is clear that the relative variation in farm-gate price time series is higher than the relative variation in wholesale price time series in both cases – the variation coefficient of farm-gate price time series equals 10.21 % in the case of monthly data, and 11.01 % in the case of bi-weekly data, while the variation coefficient of wholesale price time series reaches values of 7.24 % and 8.26 %, respectively.

Table 2 shows the minimal and maximal values of both the farm-gate and wholesale price of pork in the analyzed period in the case of monthly data, as well as bi-weekly data. The table shows slight differences between the monthly and bi-weekly extreme values. However, these differences are not fundamental. The minimal value of farm-gate price equals approximately 29 CZK/kg in both cases, while the maximal value reaches approximately 48 CZK/kg. The extreme values of wholesale price show larger differences than farm-gate price extremes. The minimal value of wholesale price in the case of monthly data equals almost 75 CZK/kg, while its maximal value equals approximately 103 CZK/kg. The minimal value of wholesale price based on bi-weekly data equals approximately 73 CZK/kg, while its maximal value equals almost 107 CZK/kg. Moreover, these extreme values were reached in approximately the same periods. The minimum of farm-gate price in the case of monthly data was reached in February 2004, whereas the minimum of wholesale price was reached in May 2010. Maximal values of both farm-gate price and

	Monthly data				Bi-weekly data		
	Mean (CZK/kg)	Std. deviation	Variation coefficient (%)		Mean (CZK/kg)	Std. deviation	Variation coefficient (%)
FP	38.95	3.98	10.21	FP	39.40	4.34	11.01
WP	87.89	6.37	7.24	WP	88.35	7.30	8.26

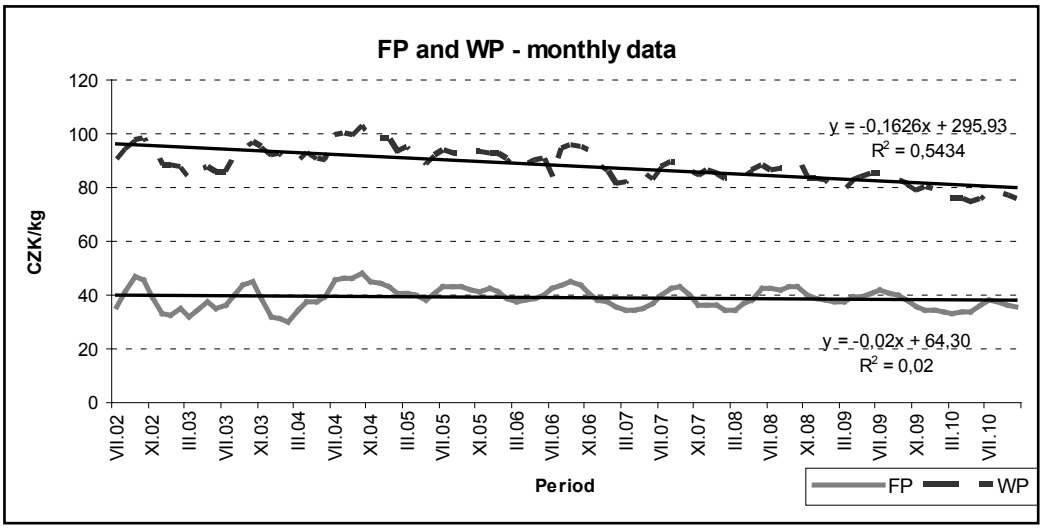
Source: own calculation

Table 1: Statistical characteristics of selected variables.

	Monthly data			Bi-weekly data	
	Min. value	Max. value		Min. value	Max. value
FP	29.70	47.88	FP	29.23	48.62
WP	74.64	103.02	WP	72.61	106.74

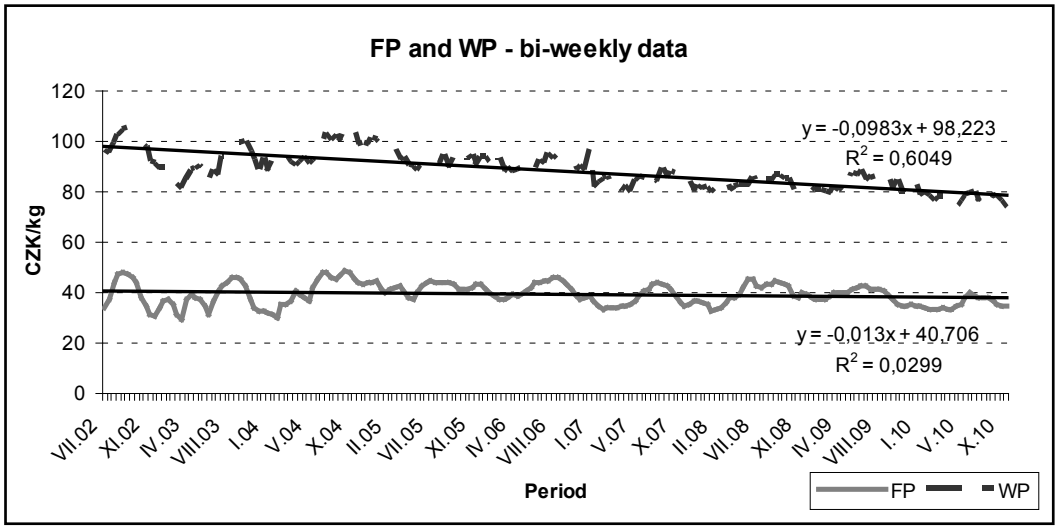
Source: own calculation

Table 2: Minimal and maximal values of selected time series (CZK/kg).



Source: own calculation

Graph 1: Time series of monthly data.



Source: own calculation

Graph 2: Time series of bi-weekly data.

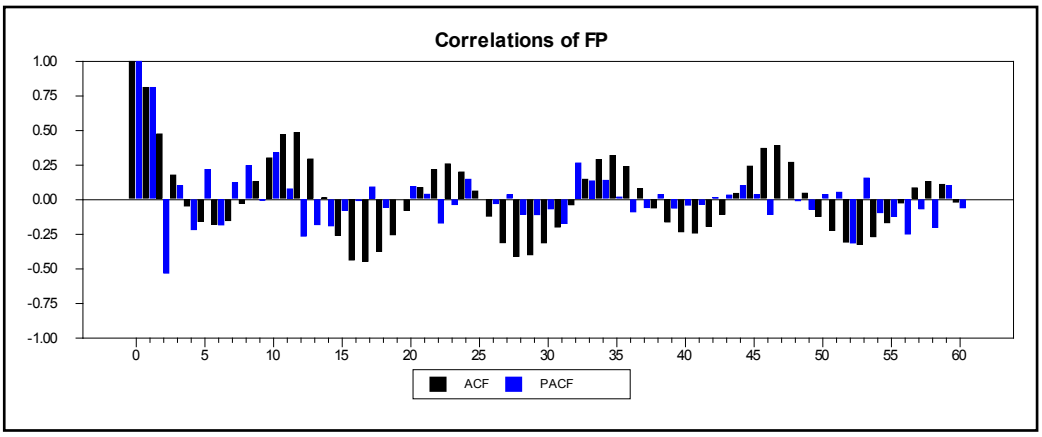
wholesale price in the case of monthly data were reached in October 2004. The minimum of farm-gate price in the case of bi-weekly data was reached in March 2004 and the minimum of wholesale price in April 2010. The maximum of farm-gate price was reached in September 2004, while the maximum of wholesale price was reached in October 2004. These results again show small differences in extreme values of the selected time series.

The time series of monthly data wholesale price show a slightly decreasing tendency in the analyzed period (see Graph 1). The long-term tendency of farm-gate price is almost stable. The long-term tendencies of the analyzed time series are described by linear trend functions.

The time series of bi-weekly data wholesale price also show a slightly decreasing tendency in the analyzed period (see Graph 2). In this case as well, the long-term tendency of farm-gate price is almost stable. The basic long-term tendencies of farm-gate as well as wholesale price are described by linear trend functions.

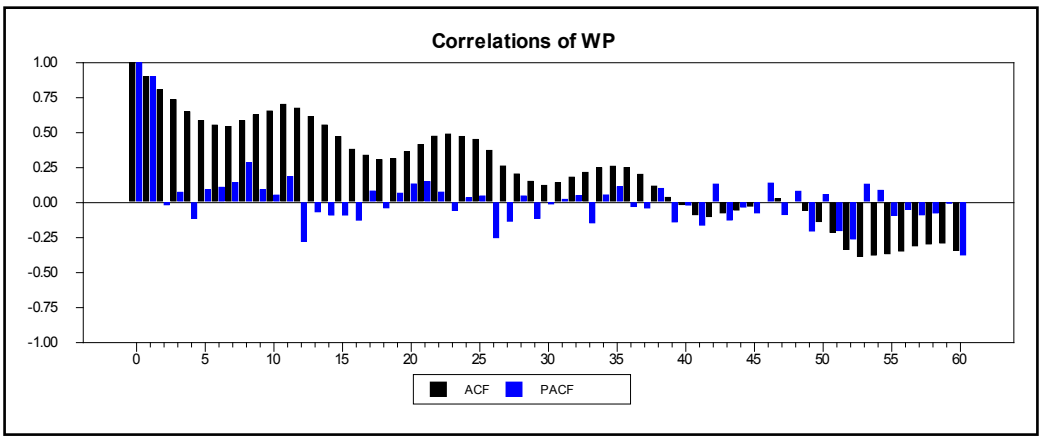
Next, the short-term behavior of the time series should be analyzed. Based on the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF), the seasonality of the time series can be detected. Graph 3 shows the ACF and PACF of farm-gate price in the case of monthly data, and Graph 4 shows the ACF and PACF of wholesale price for the same frequency. According to these functions, seasonal variation occurs in the time series of farm-gate price. The same frequency and amplitudes of the ACF confirm this statement. Nevertheless, no seasonal component in the time series of wholesale price was detected. The variation in this time series may contain a cyclical pattern which is not obvious in the analyzed period.

Graph 5 and Graph 6 contain the ACF and PACF for the time series of farm-gate price and wholesale price in the case of bi-weekly data. According to the



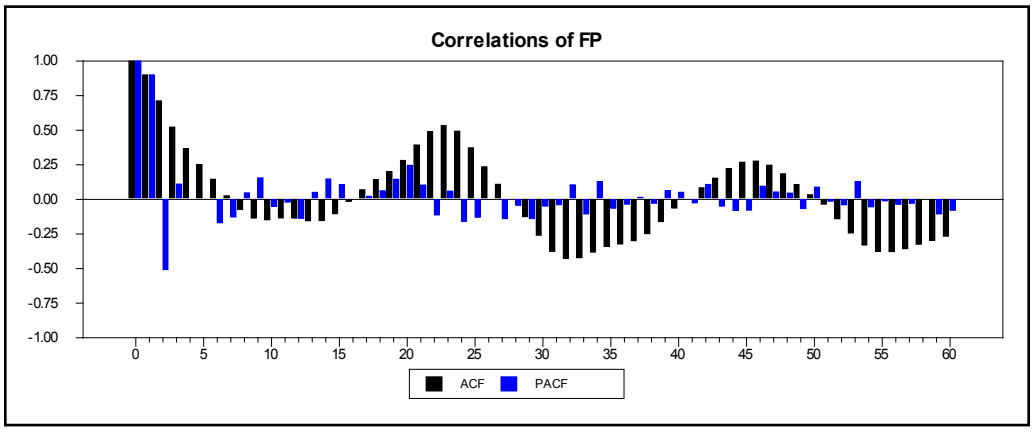
Source: own processing

Graph 3: ACF, PACF of farm-gate price – monthly data.



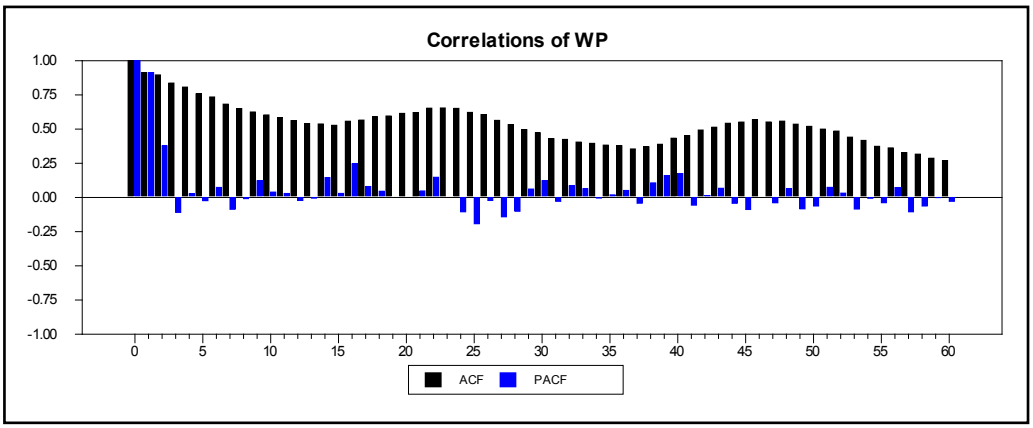
Source: own processing

Graph 4: ACF, PACF of wholesale price – monthly data.



Source: own processing

Graph 5: ACF, PACF of farm-gate price – bi-weekly data.



Source: own processing

Graph 6: ACF, PACF of wholesale price – bi-weekly data.

graph, the time series of farm-gate price contains a seasonal component. The ACF function again shows the repetitive frequency of the variation, and a pattern in the amplitudes of correlation coefficients. Similarly to the case of monthly data, the time series of wholesale price in the case of bi-weekly data does not contain a seasonal pattern. Moreover, in this case more differences are obvious compared to the time series of farm-gate price.

In conclusion, the long-term tendency of the selected time series shows a similar development in the analyzed period. In addition, the main statistical characteristics do not show significant differences. Nevertheless, small differences in the nature of the time series from a short-term perspective can be seen (i.e., differences in seasonality that can be described by individual time series). Only small differences were detected, and therefore one may conclude that in cases of both monthly and bi-weekly data, the nature of the time series is comparable.

2. Price transmission for time series of different frequency

Table 3 contains the results of the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) – criteria which suggest that each time series has significant lagged values. The results of these criteria are diverse. The maximal lag is then selected based partly on these suggestions and partly on knowledge of the pork market. The author decides to employ 4 lags as maximal significant lagged values in the case of monthly data and 10 lags in the case of bi-weekly data. Again, these results are very similar, and they show features similar to the inputs of consecutive price transmission analysis.

Table 4 and Table 5 contain the results of the Augmented Dickey-Fuller test (ADF) and Phillips-Perron test (PP) – tests which verify whether the time series is stationary. Table 4 contains the results for the time series of monthly data, while Table 5 contains the results for the time series of bi-weekly

Monthly data			Bi-weekly data		
	AIC	SBC		AIC	SBC
FP	16	5	FP	16	7
WP	4	4	WP	10	1

Source: own calculation

Table 3: Significant lag of selected variables.

Variable	ADF test			PP test		
	A	B	C	A	B	C
FP	-0.3070	-3.3678	-3.4631	x	**-3.7899**	-3.9005
difFP	**-5.4179**	**-5.3794**	**-5.3865**	x	**-6.5689**	**-6.5562**
WP	-0.9023	-1.5230	-3.0938	x	-1.8216	-3.6897
difWP	**-5.4319**	**-5.4591**	**-5.5073**	x	**-10.3238**	**-10.3400**

Note: A = without intercept and trend; B = with intercept and without trend; C = with intercept and trend. Italics = significant on significance level 5 %; bold = significant on significance level 1 %. Lag length for ADF and PP test = 4.

Source: own calculation

Table 4: Results of ADF and PP test – monthly data.

Variable	ADF test			PP test		
	A	B	C	A	B	C
FP	-0.1821	**-3.7932**	**-4.0561**	x	**-3.7773**	-3.9458
diffP	**-4.9593**	**-4.9419**	**-4.9555**	x	**-8.0235**	**-8.0238**
WP	-0.9303	-1.2910	-3.1979	x	-2.3754	**-5.1252**
difWP	**-4.8378**	**-4.8894**	**-4.8685**	x	**-22.0873**	**-22.0773**

Note: A = without intercept and trend; B = with intercept and without trend; C = with intercept and trend. Italics = significant on significance level 5 %; bold = significant on significance level 1 %. Lag length for ADF and PP test = 10.

Source: own calculation

Table 5: Results of ADF and PP test – bi-weekly data.

data. The time series of monthly data are analyzed based on 4 significant lagged values, while the time series of bi-weekly data are based on 10 significant lags. Both tests (ADF as well as PP) show all selected time series to be non-stationary and integrated of the first order, i.e., I(1). This means that a long-term relationship can then be analyzed.

Table 6 and Table 7 contain the results of co-integration analysis. Table 6 contains the results for the time series of monthly data, while Table 7 contains the results for the time series of bi-weekly data. According to the Trace test and Eigenvalue, both relations contain one co-integrating vector. This means that a long-term relationship does exist between farm-gate price and wholesale price in both cases.

Table 8 contains the Beta transposed vector – the vector which shows the nature of the long-term relationship between farm-gate price and wholesale price, in cases of both monthly and bi-weekly data. The values included in this vector show slight differences; however, the price transmission in both cases shows very similar characteristics. The coefficient of price transmission elasticity reaches a value of 0.171 % in the case of monthly data and 0.224 % in the case of bi-weekly data. According to these values, the pork agri-food chain can be considered oligopsonic in both cases (the coefficient of price transmission elasticity is lower than 1). This means that the position of farmers is not as strong as the position of processors or retailers. Moreover, the relationship between farm-gate price and wholesale price is inelastic. Thus, producers of pork can be considered price takers, and the pork agri-food chain can be considered demand-driven.

II. Time series properties

The assumption of the influence of time series of different properties is examined in two periods – before the EU accession and after the EU accession. It can be assumed that the situation in the pork market differs in these two periods in connection with the general situation and current agricultural policy in the examined periods.

H0:r	p-r	Eigenv.	Trace	Trace*	Frac95	P-value	P-value*
0	2	0.193	21.067	20.062	15.408	0.006	0.008
1	1	0.005	0.513	0.508	3.841	0.474	0.476

Source: own calculation

Table 6: Results of cointegration analysis – monthly data.

H0:r	p-r	Eigenv.	Trace	Trace*	Frac95	P-value	P-value*
0	2	0.082	17.509	17.509	15.408	0.023	0.023
1	1	0.006	1.159	1.159	3.841	0.282	0.282

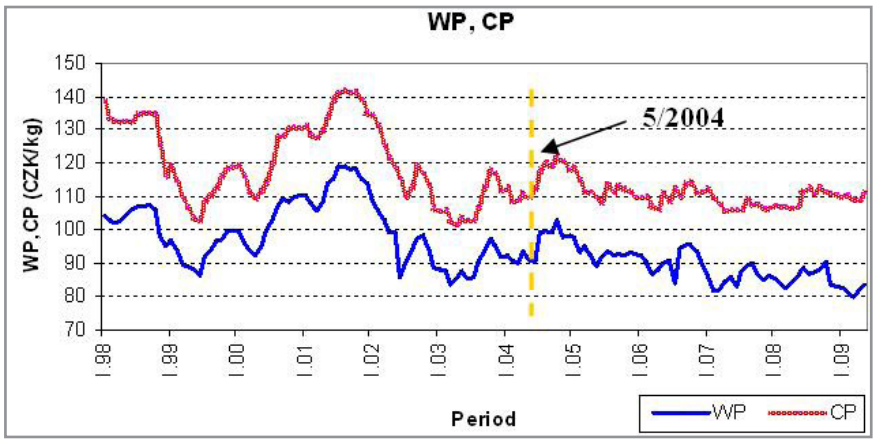
Source: own calculation

Table 7: Results of cointegration analysis – bi-weekly data.

Monthly data		Bi-weekly data	
FP	WP	FP	WP
1.000	-0.171	1.000	-0.224

Source: own calculation

Table 8: Nature of price transmission.



Source: own processing

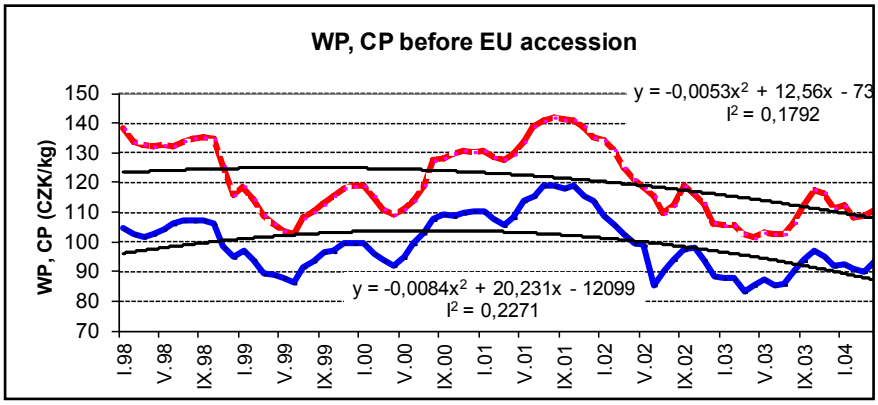
Graph 7: Wholesale price and consumer price of pork in the Czech Republic.

Price transmission between wholesale price and consumer price in the selected agri-food market is processed for the period from January 1998 to May 2009. In this period, seasonality was not proven. However, it is obvious that there was a structural break (the Czech Republic's accession to the European Union (EU)) which caused the wholesale price and consumer price time series to exhibit different behaviors (see Graph 7 and comments to Graph 8 and Graph 9), even though time series variability started to decrease in 2002. Therefore, price transmission is analyzed in two periods – before the EU accession and after the EU accession.

1. Description of selected time series

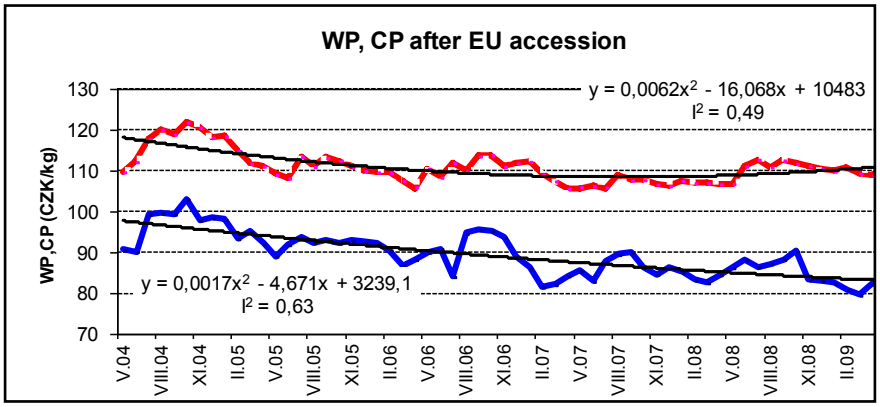
In the period before EU accession, the time series of the consumer price of pork almost copies the time series of the wholesale price of pork (see Graph 8). Similarly, in the period after EU accession, the time series of consumer price follows the time series of wholesale price (see Graph 9). The trend functions show the long-term tendency of each time series. However, in the period before EU accession the values of the index of determination are very low, whereas in the period after EU accession the values of indices of determination are sufficient.

Primary statistical characteristics such as the mean, standard error and coefficient of variation are shown in Table 9. These characteristics show that the relative variation in wholesale price and consumer price time series in the period before EU accession is almost the same, whereas in the period after EU accession the relative variation in



Source: own processing

Graph 8: Wholesale price and consumer price of pork in the Czech Republic - period before EU accession.



Source: own processing

Graph 9: Wholesale price and consumer price of pork in the Czech Republic - period after EU accession.

	Period before EU accession				Period after EU accession		
	Mean (CZK/kg)	Std. deviation	Variation coefficient (%)		Mean (CZK/kg)	Std. deviation	Variation coefficient (%)
WP	99.40	9.3563	9.41	WP	89.32	5.4394	6.09
CP	120.46	11.9227	9.89	CP	110.86	3.8429	3.47

Source: own calculation

Table 9: Statistical characteristics of selected variables.

wholesale price is higher than the relative variation in consumer price.

2. Price transmission for different periods of time series

The Akaike Information Criterion (AIC) and Schwarz Beyesian Criteron (SBC) suggested that one period (month) is a significant lag length for both the wholesale price and consumer price of pork, in both the analyzed periods. Thus, one lag of both variables is employed to analyze their mutual relationship using the Vector Error Correction Model (VECM) or Vector Autoregressive Model (VAR), respectively.

Subsequently, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test found that both the wholesale price and consumer price of pork in the Czech Republic, in the period before as well as after EU accession, were non-stationary at a 1 % significance level, whereas their first differences were stationary (see Table 10 and Table 11). The time series of wholesale price and consumer price are non-stationary and integrated of order one, i.e., I(1). Therefore, VECM is employed for the following analysis.

Variable	ADF test			PP test		
	A	B	C	A	B	C
WP	-0.3781	-2.0351	-1.9459	x	-1.6713	-1.7537
difWP	**-4.9966**	**-4.9274**	**-4.9625**	x	**-6.5357**	**-6.5356**
CP	-0.5434	-2.2616	-2.1529	x	-1.8049	-1.7809
difCP	**-4.8566**	**-4.8231**	**-4.8514**	x	**-5.2973**	**-5.2971**

Note: A = without intercept and trend; B = with intercept and without trend; C = with intercept and trend. Italics = significant at a significance level of 5 %; bold = significant at a significance level of 1 %. Lag length for ADF and PP test = 1.

Source: own calculation

Table 10: ADF, PP test - period before EU accession.

Variable	ADF test			PP test		
	A	B	C	A	B	C
WP	-0.4299	-4.2904	-1.8403	x	-2.0914	**-4.3141**
difWP	**-6.4946**	**-6.3956**	**-6.5171**	**x**	**-8.7629**	**-8.7848**
CP	-0.1683	-2.3919	-1.9751	x	-2.1822	-2.8103
difCP	**-5.6207**	**-5.5404**	**-5.5931**	**x**	**-8.5124**	**-8.5008**

Note: A = without intercept and trend; B = with intercept and without trend; C = with intercept and trend. Italics = significant at a significance level of 5 %; bold = significant at a significance level of 1 %. Lag length for ADF and PP test = 1.

Source: own calculation

Table 11: ADF, PP test - period after EU accession.

H0:r	p-r	Eigenv.	Trace	Trace*	Frac95	P-value	P-value*
0	2	0.354	35.353	34.954	15.408	0.000	0.000
1	1	0.034	2.629	2.619	3.841	0.105	0.106

Source: own calculation

Table 12: Co-integration analysis - period before EU accession.

H0:r	p-r	Eigenv.	Trace	Trace*	Frac95	P-value	P-value*
0	2	0.258	21.193	20.890	15.408	0.005	0.006
1	1	0.053	3.275	3.259	3.841	0.070	0.071

Source: own calculation

Table 13: Co-integration analysis – period after EU accession.

Co-integration analysis has discovered one co-integrating vector in the analyzed relationships, thereby verifying and demonstrating the long-run relationship between the wholesale price and consumer price of pork in the analyzed period (see Table 12 and Table 13).

Table 14 contains selected parameters of the VECM in the period before EU accession. Alpha parameters show the speed at which equilibrium sets up - the higher the value, the faster the reaction of the variable. Transposed Beta shows the nature of the market structure. The value 0.781 expresses price transmission elasticity. This value shows that an imperfect market structure should be considered. Matrix PI describes the long-run relationship between wholesale price and consumer price. The results of additional tests (test of exclusion, stationarity, and weak exogeneity) and residual analysis are sufficient. Table 15 contains selected parameters of the VECM model describing the relationship between wholesale price and consumer price in the Czech Republic in the period after EU accession. Beta transposed describes the nature of the market structure; the value 1.413 displays the price transmission elasticity. Alpha parameters show how fast each variable reaches equilibrium - the higher the value, the faster the reaction. Matrix PI describes the long-run mutual

Beta (transposed)		**Alpha**	
logWP	logCP	logWP	0.076
1.000	-0.781	logCP	0.527

PI	logWP	logCP	t-values	
			logWP	logCP
logWP	0.076	-0.059	0.612	-0.612
logCP	0.527	-0.412	4.409	-4.409

Observations: 76; Degrees of freedom: 72

Source: own calculation

Table 14: VECM model - period before EU accession.

Beta (transposed)		**Alpha**	
logWP	logCP	logWP	-0.162
1.000	-1.413	logCP	0.230

PI	logWP	logCP	t-values	
			logWP	logCP
logWP	-0.162	0.228	-1.564	1.564
logCP	0.230	-0.324	3.485	-3.486

Observations: 76; Degrees of freedom: 72

Source: own calculation

Table 15: VECM model - period after EU accession..

relationship between selected variables. The results of additional tests (test of exclusion, stationarity, and weak exogeneity) and the results of residual analysis are sufficient.

As already mentioned, price transmission elasticity before EU accession reaches a value of 0.781, whereas price transmission after EU accession reaches a value of 1.413. Therefore, the market structure in the first period could be considered oligopsonic, while the market structure in the second period could be considered either oligopolistic, or both oligopolistic and oligopsonic (see the theoretical model specified, e.g., by Lloyd et al (2004) or Čechura, Šobrová (2008)). These days, both an oligopolistic and oligopsonic market structure is rather likely. Retailers can have oligopoly power with respect to consumers and oligopsonic power with respect to wholesalers. Moreover, the method of pork processing and distribution can also influence price transmission.

Conclusion

The aim of this paper was to verify whether the choice of time series can influence the results of price transmission analysis. First, the analysis was based on an examination of frequency and other properties of the time series; subsequently, the influence of the time series properties on the results of price transmission in the pork agri-food chain was examined.

First of all, the time series of the farm-gate price and wholesale price of pork were analyzed. The main features and statistical characteristics of these time series were examined. Then, a price transmission analysis was processed for both monthly data and bi-weekly data. Finally, the results of the analysis were compared and discussed. The results of the analysis showed slight differences in almost all cases. Several substantial differences were detected as well; however, these factors are not so important and should not significantly influence the results of the price transmission. Thus, the assumption that the choice of time series frequency influences the results of the price transmission analysis was not confirmed. However, researchers should be careful, and choose the time series for empirical analysis cautiously. General conclusions about the nature of the time series and price transmission seem to be the same; however, detailed results might be dissimilar. For instance, consider the case of price transmission elasticity being an important aspect of

price transmission: the level of price transmission elasticity in the case of monthly data differs from price transmission elasticity in the case of bi-weekly data. However, results concerning the market structure remain the same. In conclusion, the differences in general price transmission results are not significant, while some detailed results could be marked as significant.

In the second part, the time series of wholesale price and consumer price, as well as their transmission, were examined in two periods: the period before EU accession and the period after EU accession. The analysis showed that the analyzed time series exhibited different behaviors and properties within these periods, and therefore one could conclude that the selection of time series period can significantly influence the results of price transmission. This result was also confirmed based on a subsequent analysis of price transmission in the analyzed periods. The price transmission analysis found a difference in the nature of the price transmission. Structural breaks and other factors which might cause changes in the nature of the time series could be crucial for price transmission analysis. Thus, when price transmission is analyzed, the properties of the time series should be examined properly.

In conclusion, the frequency of the time series should not be a critical factor in the results of price transmission; however, the choice of time series length can significantly influence the results of price transmission.

Acknowledgement

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Impact of Complementary National Direct Payments on Cattle Breeding Sector

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Anotace

Tento příspěvek se zabývá problematikou Národních doplňkových plateb (Top-up) v České republice. Je sledována závislost mezi výší poskytnutých finančních prostředků v Kč a vybranými ukazateli chovu skotu jako jsou: stav (počet) dojných krav, dojivost, bilance mléka, soběstačnost v produkci mléka, stav krav bez tržní produkce mléka.

Hlavním cílem příspěvku je vyhodnocení dopadu národních doplňkových plateb do sektoru chovu skotu v České republice – konkrétně do sektoru dojnic a sektoru krav bez tržní produkce mléka v období let 2007-2012

Základními metodami, užitými v příspěvku, jsou řetězové a bazické indexy.

Příspěvek vznikl jako součást výzkumného záměru MSMT 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systémů“.

Klíčová slova

Národní doplňkové platby (Top-up), podpora, dojnice, krávy bez tržní produkce mléka, dobytčí jednotka.

Abstract

The article deals with a topic of Complementary National Direct Payments (CNDP) in the Czech Republic. It is focused on a relationship between allocated financial sources (in CZK) and selected indicators of cattle breeding as heads of dairy cows, milk yield, milk balance, self-sufficiency ratio and heads of suckler cows.

Main aim of the article is to evaluate an influence of CNDP on cattle breeding in the Czech Republic, especially on dairy sector and sector of suckler cows in the period 2007 - 2012.

Used methods are chain and base indexes.

Pieces of knowledge introduced in this paper resulted from solution of an institutional research intention MSM 6046070906 „Economics of resources of Czech agriculture and their efficient use in frame of multifunctional agri-food systems“.

Key words

Complementary national direct payments (CNDP), support, dairy cows, suckler cows, support, livestock unit.

Introduction

One of the original objectives of the Common Agricultural Policy of the EU was to stabilise agricultural markets. To fulfil this aim, it was necessary to create such conditions for European farmers which would enable to stabilise their production. During the 50 year existence of the CAP, many financial instruments have been implemented. Nevertheless, the continuous enlargement of the EU and increase of heterogeneity of the EU-agrarian sector has not resulted in finding optimal measures suitable for all European farmers. Many reform steps have been done and many analyses have been provided to contribute to an improvement of farmers´ situation and maintaining agricultural activities across the EU. Some works are critically evaluating progress in the current situation. BEARD and SWINBANK (2001) stated already at the time of Agenda 2000 CAP-reform process, that

the policy mechanisms are ill-suited to redress the pockets of poverty that are still to be found in rural areas throughout the EU; they have the potential to intensify the environmental pressures often associated with modern agriculture; and they do not allow European agriculture (or its food industries) to compete without subsidies on world markets.

Certain shortcomings regarding the representation of CAP instruments are summarized by UTHES et al. (2012). The authors compared developed impact assessment tools and explained, why European decision making on agricultural support requires integrated assessment. Nevertheless, market instruments and direct payments are according the study comparatively well represented.

In any case, it is to be stressed; a general assessment of impact of CAP measures is questionable because of different impact in various regions and various sectors. LOBLEY and BUTLER (2010) providing a regional investigation in South West England concluded that only a minority of farmers seem both well placed and well disposed to exploit opportunities offered by current CAP reform. An investigation provided in Scotland has made evident, the CAP reform policies have not been a success for Scotland's marginal pastoral systems (MORGAN-DAVIES, 2012). Mainly the beef and milk sectors seem to be very sensitive from this perspective.

Importance of financial support has been declared by many investigations. According to BERNUES et al. (2011) significant increase of animals per farm shown and per work unit observed in pasture-based livestock farming systems in the Mediterranean in recent years was likely a result of the process of capital intensification, which was largely determined by the Common Agricultural Policy (CAP) premiums that were paid on a per head basis. Another study dealing with the situation of cattle in the uplands of Wales underlines an importance of cattle support. MATTHEWS et al. (2006) concludes on the example of farms, that fixed costs have been reduced by eliminating, as far as possible, on-farm machinery and contracting machinery- and labour-intensive field operations. Even so, net margins are small and frequently negative.

Stabilization of the heterogonous situation and elimination of the greatest disparities may be ensured by national envelope (complementary national direct payments). Different amounts and different payments per hectare in individual member states analyze ERJAVEC et al. (2011), taking into account the role of national support. Nevertheless the role of national payments is expecting to slow down. Under developed scenario the national envelope for direct payments increases in only one Member State (Latvia), other Member States would, in 2020, lose on average more than 35% of their support when compared to the Baseline situation.

UTHES et. al. (2011) have analyzed impact of eventual abolishment of direct payments. An investigation provided in four EU-countries leads to a conclusion, that regions with less favourable conditions for agriculture, insufficient marketing, processing and sales structures, and a high dependence on direct payments would be hit most severely by a possible abolishment of direct payments. In contrast, regions with moderate dependence on direct payments, and either a relatively competitive agricultural sector or a highly diversified sector with agro-tourism opportunities and good marketing and sales structures, would be less hard-hit by such a change, although impacts could be felt as well.

On the other hand, the extension of co-financing to Pillar I of the CAP could also help mitigate against the negative impacts of comprehensive CAP reforms at the level of individual commodities such as beef. However, BUREAU and MAHÉ (2008) see the sustainability of maintaining individual commodities at existing production levels through the provision of budgetary support is questionable from long term perspective. If seemingly marginal agricultural activities are associated with significant non-commodity outputs, such as the maintenance of rural landscapes or prevention of land abandonment, such agricultural activities should be supported by measurable and directly targeted measures.

Another argument that higher support levels result in prices changes can not be confirmed. Experience from the US shows an interesting relationship between farmers´ support and prices for food. MILLER and COBLE (2007) have found, direct payments did not significantly affect the affordability of food, either in the aggregate or across specific food groups.

The main aim of this paper is an evaluation of the Complementary National Direct Payments (CNDP) impact on cattle breeding sector – especially on the dairy sector and sector of suckler cows. The impact of this national support is evaluated according to following indicators: heads of dairy cows, milk yield, milk balance, self-sufficiency ratio and heads of suckler cows.

Material and methods

Data used in this paper comes from the following sources: State Agricultural Intervention Fund (SAIF) annual reports 2007-2012, Czech Statistical Office (CZSO) database 2007-2012 Agriculture-time series-livestock, Statistical Yearbook of the Czech Republic 2011, Annual report of the cattle breeding in the Czech Republic 2011, internal materials-Ministry of Agriculture of the Czech Republic 2011-2012.

The used statistical methods are the Fixed Base Index Numbers and Chain Base Index Numbers. For Fixed Base Index Numbers (usually just called Index Numbers), the Base is given the value 100 and everything after that is given relative to the Base, going above 100 for higher values or below 100 for values which drop below the original. For Chain Base Index Numbers, each value is given an Index based on the previous value being used as the Base.

To analyse such subsidies paid on per hectare basis, there is necessary to determine theoretically exploiting of pastures. Analytical studies and professional publications of Institute of Animal Science (KVAPILÍK and KOHOUTEK, 2009) determine the maximum exploitation of pastures - permanent grasslands, MAX nSC.

MAX nSC = (nH * YDM) / (0,04* LWC *GT)

Where:

nSC = Number of suckler cows

nH = Number of hectares

YDM = Yield of dry matter (grass), (kg/ha)

LWC = Live weight/Cow, (kg)

GT= Grazing time (days)

Results and discussion

1. Basic overview

The Livestock production in the Czech Republic provides more than half of the total agriculture income. In 2011, cattle breeding reached 58.5 % of the animal production and 24.1 % of the agricultural production.

The increase of the milk yield per cow and year, the high quality and increasing domestic consumption of milk and milk products, high share of dairy cows in milk recording, suitable structure of cattle and dairy farms, good results of suckler cows herds, increase in labour productivity and implementation of arrangements within the CAP are the main positive figures of the last three-year period (KVAPILÍK et. al, 2011).

Less favourable (during the same period) were the economic results of beef production, reproduction results, decrease of the total cattle population and share of dairy cows, decrease of exports of certain products and beef consumption per capita etc.

The total costs per 1 litre of Czech milk producers are on the European average level with high production efficiency. The problem is only in the utilisation of basic production factors, especially land and labour (MACH and ŘEZBOVÁ, 2009).

On the basis of the above mentioned strong and weak points of the present situation in cattle breeding, the next development of the cattle sector should be focused on the tasks related to the Czech Republic's membership in the EU.

Under the EU conditions, it is extremely necessary to achieve a certain stabilisation in breeding of all categories of cattle within EU quotas, to increase domestic consumption of milk and beef, to improve production (especially reproduction) and economic results and to continue to improve the quality of bovine products.

Direct payments (applied in the form of SAPS in the Czech Republic) as well as Complementary National Direct Payments belong to important instruments which help to stabilize and improve situation in the whole cattle breeding sector in the Czech Republic.

2. Analysis of Dairy Cows Support

The total amount CZK 7,150,687 thousand has been allocated into the sector dairy cows in the Czech Republic in the period 2007 -2012 (including 2012 expected support) from subsidy titles Complementary National Direct Payments and "Ruminants". Based on the State Agricultural Intervention Fund (SAIF)[1] reports, a proportional amount of the subsidy title "Ruminants" has been calculated and incorporated into the monitored category dairy cows. There is a continual decrease in annual amounts intended for dairy cows within the CNDP since 2007. In 2007, more than CZK 2 billion (2.16 billion) were allocated into the sector of dairy cows; this figure fell to almost half (CZK 1,125 billion) in 2010, which is 52% of the amount of 2007. In 2012, the CNDP are scheduled to CZK

[1] The State Agricultural Intervention Fund is an accredited paying agency - an administrator of financial subsidies both from the European Union and from the national financial funds.

	2007	2008	2009	2010	2011	2012
Dairy cows	2 158 684	1 413 832	1 242 251	1 125 756	784 995	425 167
Chain index	x	-34.50%	-12.14%	-9.38%	-30.27%	-45.84%
Base index (2007= 100)	x	65.50	57.55	52.15	36.36	19.70

Source: Ministry of Agriculture of the Czech Republic, SAIF, own calculations

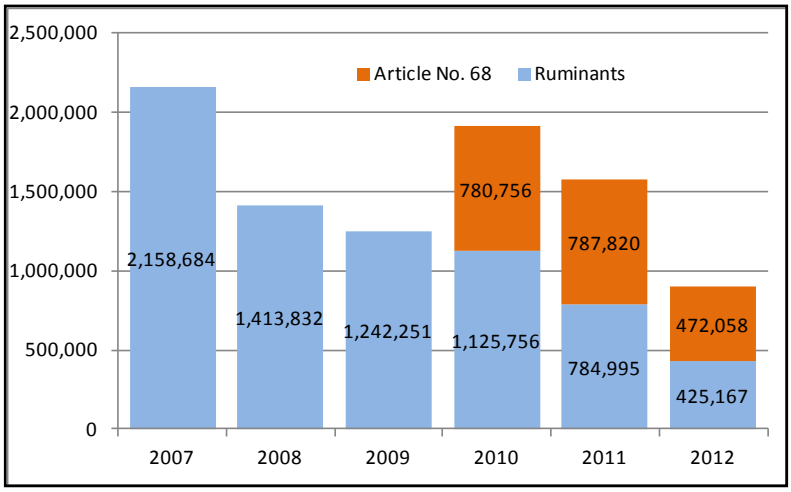
Table 1: Subsidies within Top-ups, title Ruminants, proportional amount for dairy cows, in thousand CZK.

	2007	2008	2009	2010	2011	2012
Dairy cows	0	0	0	780 756	787 820	*472 058
Chain index	x	x	x	x	0.90%	-40.08%

Remark: for 2012, there is another amount based on Art. 68 +221,429 million CZK determined for suckler cows.

Source: Ministry of Agriculture of the Czech Republic

Table 2: Subsidies based on Article No.68, Council regulation 73/2009, in thousand CZK.



Source: Tables 1 a 2, Ministry of Agriculture of the Czech Republic, SAIF, own calculation

Graph 1: Complementary National Direct Payments : Article No. 68 and title Ruminants, in thousand CZK

0.425 billion, which is only 19.7% of the amount comparing to the situation in 2007. The table 1 shows the allocation of subsidies in the time series 2007 – 2012.

In the years 2010 and 2011 (2012 is scheduled as well), the Czech Republic used the possibility of applying the Article No. 68 of the Council Regulation 73/2009 and supported extra so-called „sensitive sector“ of dairy cows. The level of additional subsidies granted by the Article No. 68 CZK is presented in the table 2.

Both above presented tables are summarized in the Graph 1. There is evident, a maximum of subsidies for the sector of dairy cows in the Czech Republic was reached in 2007, another peak (the second highest subsidy level) can be found in 2010 due to application of the Article No. 68 in the sector. A use of the article has increased essentially an inflow of subsidies into the sector. For 2012, there is scheduled an allocation of CZK 897,225 thousand which represents 47 % of the amount allocated in 2010 (CZK 1.91 billion). Nevertheless, an essential part of dairy cows financing is nowadays based on the Article No. 68 in the Czech Republic.

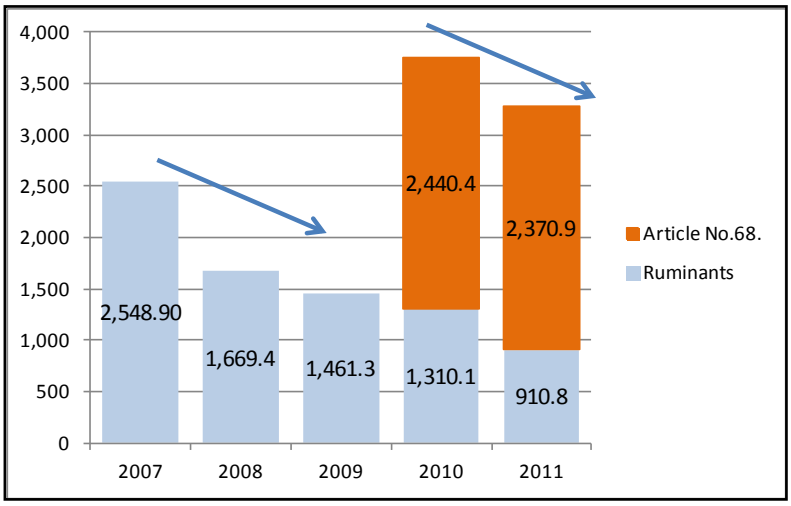
The table 3 presents Complementary National Direct Payments within the Article No.68 related to livestock unit (LU) as they were made within the State Agricultural Intervention Fund.

Payment on a livestock unit was calculated within the CNDP as a proportion of total expenditure, divided by the number of livestock units. The total amount of subsidies (used as numerator) was

	2007	2008	2009	2010	2011
Article 68	0	0	0	2 440.40	2 370.90
Ruminants	2 548.90	1 669.40	1 461.30	1 310.10	910.8
Total	2 548.90	1 669.40	1 461.30	3 750.50	3 281.70
Chain index	x	-34.51%	-12.47%	156.66%	-12.50%
Base index (2007=100)	x	65.49	57.33	147.14	128.75

Source: State Agricultural Intervention Fund

Table 3: Payments per livestock unit, in CZK/LU.



Source: State Agricultural Intervention Fund and Table 3

Graph 2: Payments per livestock unit, in CZK/LU

declining in the period 2007 – 2009, simultaneously the number of livestock units (used as denominator) dropped as well. Final payment per LU is presented in the table 3, graphical expression is illustrated in the graph 2.

Milk yield and the total amount of milk produced can be found as indicators of the „impact" of subsidies to the dairy sector. 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. Development of heads of dairy cows is presented in the graph 3.

As can be deduced from Graph 3 and Table 4, a significant decline in numbers of dairy cows occurred between 2009/2010 and 2010/2011. This decline was a response to the reduced purchase prices of milk because dairy sector experienced a significant restructuring characteristic by an increase in the average yield and subjects reaching low profitability left the industry. Current situation is much more stabilized. According to the inventory of animals made by the Czech Statistical Office (at the date April 1st, 2012), the number of heads recorded between 2011 and 2012f fell only by 0.19%.

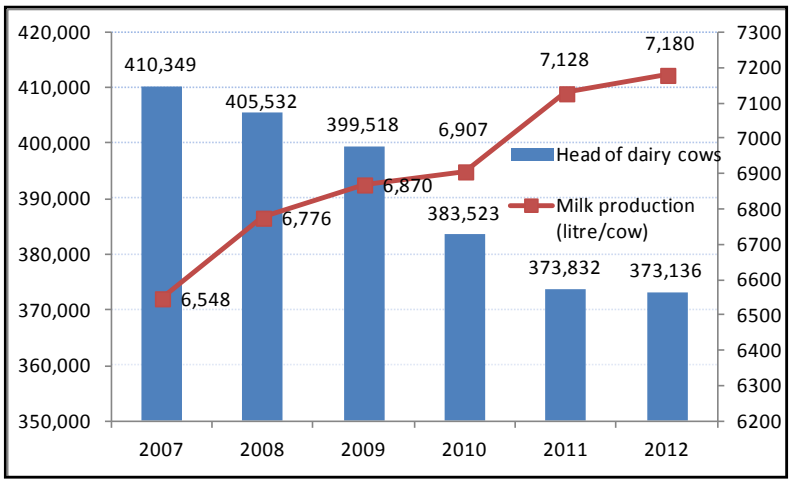
As evident from the Table 5, milk production is continuously declining in the Czech Republic and the self-sufficiency is getting worse. In the years 2009 and 2010, it fell nearly to the level of 100 %.

Cattle breeding sector is supported not only through livestock units, but also through the area of payments (effects of SAPS and LFA payments). The calculations are discussed in the next part.

3. Analysis of Suckler Cows Support

Suckler cows have been supported in the period 2007 -2012 (including estimated support for 2012) through a special title within the national envelope by an amount of CZK 1,674,896 thousand. Nevertheless since 2009, annually allocated amounts are rapidly declining.

Totally CZK 240.5 million were allocated for suckler cows in 2011 which represents 47 % of the financial support cleared off in 2009. A significant



Source: Czech Statistical Office (CZSO), own calculations, 2012 – estimation

Graph 3: Head of dairy cows and average milk production (litre/cow), 2007-2012

	2007/06	2008/07	2009/08	2010/09	2011/10	2012/11
Decline of heads	-3.22 %	-1.17 %	-1.48 %	-4.00 %	-2.53 %	-0.19 %
Yield increase	2.8 %	3.5 %	1.4 %	0.5 %	3.2 %	0.7 %

Source: Czech Statistical Office (CZSO) , own calculations, 2012 – estimation

Table 4: Decline of heads of dairy cows and increase of milk yield – Chain index.

Balance	**2003**	**2007**	**2008**	**2009**	**2010**	**2011**
Original stores 1)	132.6	55.7	71.1	97.7	59.9	60.7
Supply to processing	**2 530.9**	**2 381.2**	**2 368.6**	**2 291.7**	**2 251.4**	**2 303.9**
Import	281.4	836.0	810.2	853.7	848.8	853.0
Total supply	2 944.9	3 272.9	3 249.9	3 243.1	3 160.1	3 217.6
Domestic demand	**2 080.5**	**2 244.0**	**2 214.6**	**2 233.2**	**2 197.0**	**2 138.5**
Export1)	772.3	957.8	937.6	909.7	902.4	1 010.4
Final stores 1)	92.1	71.1	97.7	59.9	60.7	68.7
Share of import/consumption	13.5%	37.3%	36.6%	38.2%	38.6%	39.9%
Share of export/supply to processing	30.5%	40.2%	39.6%	39.7%	40.1%	43.9%
Self sufficiency rate (%)	**121.6%**	**106.1%**	**107.0%**	**102.6%**	**102.5%**	**107.7%**

Notes: [1)] Milk Equivalent conversion
Source: Czech Statistical Office (CZSO), own calculations

Table 5: Milk balance and Self-sufficiency (million liters).

reduction of suckler cows' support is evident. On the other hand, it must be stated, sector of suckler cows was additionally supported by national envelope, represented by a payment for ruminants. A proportional amount of the payment for ruminants has been calculated within this analyse and re-allocated into the sector of suckler cows.

As evident from the table 7, the title "Suckler Cows" has been supported by continuously lowering level of financial sources. An allocation in 2011 reached the level 55 % of payments done in 2009. The Graph 4 summarizes above presented tables 6 and 7. It illustrates, the total subsidies for suckler cows used in the Czech Republic reached their maximum in 2009, the total amount exceeded CZK 700 million. Since that time, the subsidy level is continuously declining. Expected support for 2012 which consists of CZK 130.6 million plus CZK 75 million (as seen in above presented tables), totally CZK 205.6 million, represents only 27.17 % of the

	2007	2008	2009	2010	2011	2012
Suckler Cows	0	445 346	511 274	347 065	240 597	130 614
Chain index	x	x	14.80%	-32.12%	-30.68%	-45.71%
Base index (2008= 100)	x	x	114.80	77.93	54.02	29.33

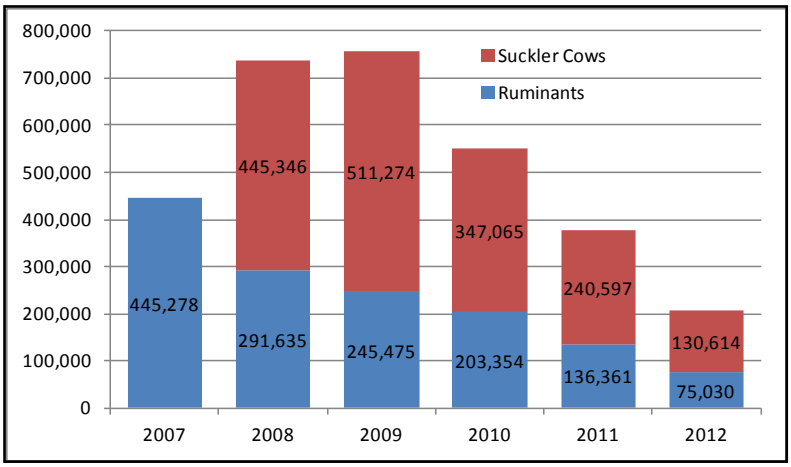
Source: Ministry of Agriculture of the Czech Republic

Table 6: Subsidies within Top-ups (CNDPs), title Sucler Cows , in thousand CZK.

	2007	2008	2009	2010	2011	2012
Suckler Cows/Ruminants	445 278	291 635	245 475	203 354	136 361	75 030
Chain index	x	-34.50%	-15.83%	-17.16%	-32.94%	-44.98%
Base index (2007= 100)	x	65.50	55.13	45.67	30.62	16.85

Source: Ministry of Agriculture of the Czech Republic, State Agricultural Intervention Fund, own calculation

Table 7: Subsidies within Top-ups (CNDPs), title Ruminants, proportional part for suckler cows, in thousand CZK.



Source: Ministry of Agriculture of the Czech Republic, State Agricultural Intervention Fund, own calculation

Graph 4: Subsidies within Top-ups (CNDPs), title Sucler Cows and title Ruminants, proportional part for suckler cows, Czech Republic, in thousand CZK.

	2007	2008	2009	2010	2011
Suckler Cows	0.00	2 939.70	3 280.40	2 119.60	1 393.80
Ruminants	2 548.90	1 669.40	1 461.30	1 310.10	910.80
Total	**2 548.90**	**4 609.10**	**4 741.70**	**3 429.70**	**2 304.60**
Chain index	x	80.83%	2.88%	-27.67%	-32.80%
Base index (2007= 100)	x	180.83	186.03	134.56	90.42

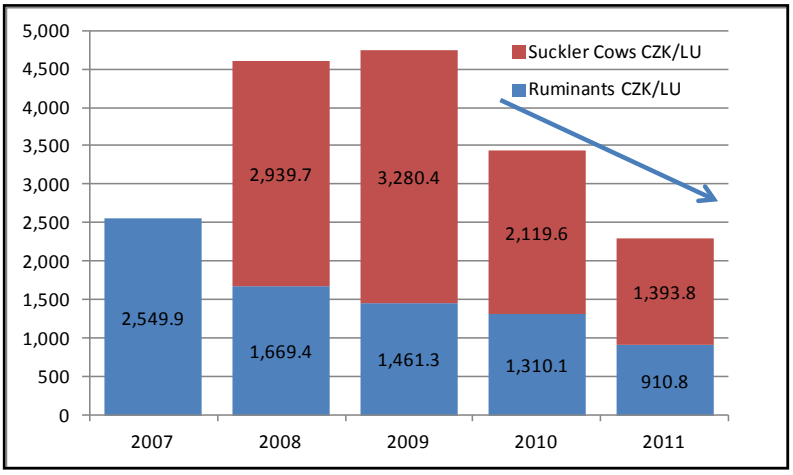
Source: State Agricultural Intervention Fund

Table 8: Payment per livestock unit, in CZK/LU.

level allocated in 2009.

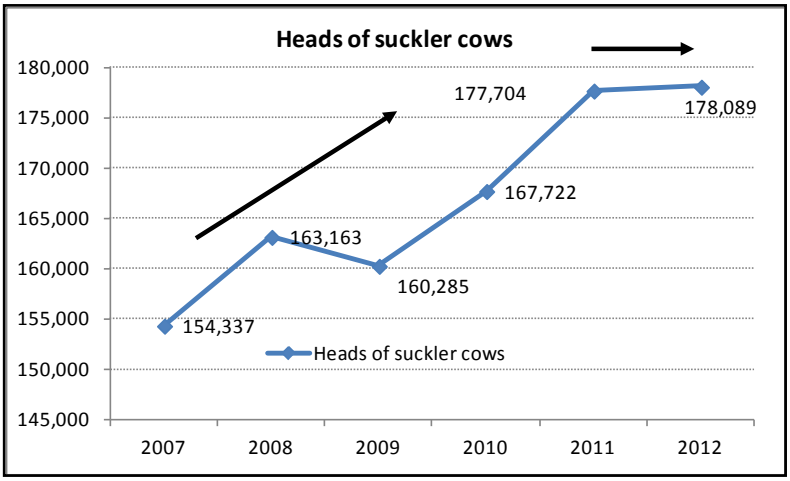
Table 8 presents levels of national envelope payments (suckler cows and ruminants) on per livestock unit basis, as executed by the State Agricultural Intervention Fund.

A payment per one livestock unit has been calculated within the national envelope through dividing the total financial allocation by number of livestock units. In the period 2009 till 2011, the total level of subsidies has been falling down (numerator), whereas number of livestock units has been rising (denominator). In 2008 for example, the SAIF system registered 151,944 LU in the category of



Source: State Agricultural Intervention Fund, Table 8

Graph 5: Payment per livestock unit, in CZK/LU.



Source: Czech statistical office (CZSO), 2012 forecasting

Graph 6: Heads of suckler cows and their development from 2007 till 2012, Czech Republic.

	2007/06	2008/07	2009/08	2010/09	2011/10	2012/11
Growth rate	10.47%	05.72%	-1.76%	4.64%	5.95%	0.22%

Source: Czech statistical office (CZSO), own calculations

Table 9 : Growth rate of heads of suckler cows- Chain index.

suckler cows; in 2011, it was already 172,620 LU. Final payment per livestock unit (LU) from 2007 till 2011 is presented in the Table 8 and illustrated in the Graph 5.

Tables 6 - 8 as well as Graph 5 clearly illustrate that the sector of suckler cows has been supported by declining amounts of finances. An Impact indicator should be constructed on heads of suckler cows and their development from 2007 till 2012 as shown in the Graph 6.

As evident from Graphs 5 and 6, the trends of allocated subsidies and heads of suckler cows are opposite (the items are negatively correlated). Also the subsidies for suckler cows drop (almost 50% reduction from 2009 to 2011), heads of suckler cows are continuously rising (since 2009, an annual increment represents 4.6 – 6 %), nevertheless the growth rate has been reduced and staying at 0.22 % during the period 2011 – 2012.

Decrease of subsidies allocated on suckler cows (on

per LU basis) in the period 2009 – 2011 (Graph 5) has influenced (with a certain delay) development of heads in years 2011 – 2012, which achieved almost zero growth.

There must be added, the sector of suckler cows is able to exploit not only the CNDP paid out directly on LU, but the SAPS payments and their development have influenced an acceleration of the sector as well as LFA payments and payments for agro-environmental measures. Sector of suckles cows is in this way supported not only through livestock units but also through area payments designated to grassland.

To analyse such subsidies paid on per hectare basis, there is necessary to determine theoretically exploiting of pastures. Analytical studies and professional publications of Institute of Animal Science (KVAPILÍK and KOHOUTEK, 2009) determine the maximum exploitation of pastures - permanent grasslands, MAX nSC. An example of calculation is mentioned above.

The theoretical calculations (Formula 1) gives a picture that one suckler cow requires approximately 1 hectare of permanent grassland.

Above mentioned consideration enables to conclude following statements. In 2011, when the CNDP were zero, an additional payment within SAPS of CZK 4.686 per hectare could be seen as payment dedicated to suckler cows. In addition, LFA payments may be imputed - for example HA (mountain) areas were supported by EUR 157/ha, which is about CZK 3 940 per hectare.

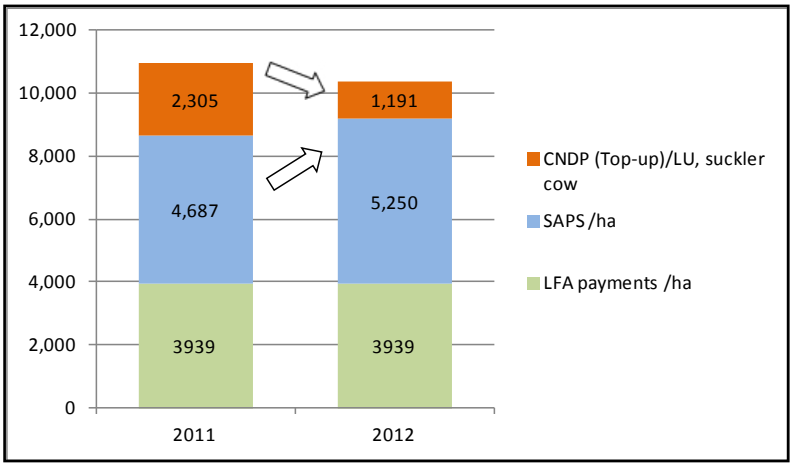
Comparing figures from the Table 8, there is evident that a payment within SAPS (CZK 4,686.5 per hectare) almost doubled the level of CNDP (CZK 2,304.60 per LU) in 2011.

The Graph 7 presents a structure of all subsidies with an exception of ago-environmental payments, which may be paid in connection with suckler cows breeding - assumed extension 1:1, also 1 LU per 1 hectare in mountain area, category HA (mountain). The level of subsidies for the year 2012 is estimated, based on above mentioned methodological approach.

MAX nSC = (nH * YDM) / (0,04* LWC * GT)			
nH	YDM	LWC	GT
Number of hectares	Yield of dry matter (grass)	Live weight/Cow	Grazing time
ha	kg/ha	kg	day
10	4 000	550	153
MAX nSC = (10 * 4 000) / (0,04* 550 * 153) = **11,8 suckler cows**			

Source: Kvapilík and Kohoutek, 2009, Certified methodology and own calculation

Formula 1: Theoretical calculations - exploitation of pastures (10 hectares).



Source: Ministry of Agriculture of the Czech Republic, State Agricultural Intervention Fund, own calculation

Graph 7: Structure of all subsidies for suckler cow, with an exception of ago-environmental payments, extension: 1 livestock unit per hectare in mountain area, CZK/LU and CZK/ha.

Conclusion

Investment costs as well as labour costs are relatively high concerning milk production. According to the yearbook of cattle breeding in the Czech Republic for 2010, total estimated cost of a dairy cow reaches CZK 58,400 per year. When deducting the value of calves and manure, the cost of the main product represents CZK 54,850, whereas milk sales reach CZK 50,085. The difference of revenues and costs gives a negative result CZK -4,765.

Such deficit should be eliminated through relevant subsidies. In 2010, a payment per one LU reached the level of CZK 3,750.5 (as presented in the Table 3); one year later, the payment achieved CZK 2,281.7 per LU.

Subsidies per livestock units are not able to cover the negative difference between revenues and expenses; the economy of milk production is indirectly influenced by the SAPS, partially also LFA payments (through dairy cows on grassland). All these facts are to be taken into account when evaluating overall impact of subsidies in the milk sector. Slowdown of the total milk production in the Czech Republic is coming close to the limit level of self-sufficiency. A danger of falling under the self-sufficiency level should justify an appropriate support of the milk sector.

Suckler cows sector requires much more complex approach if evaluating impact of provided subsidies. Not only national payments for suckler cows and ruminants are to be included. There is necessary to include all other relevant payments as SAPS, LFA, agro-environmental payments as well CNDPs per hectare until 2010. An estimation of the total support of suckler cow livestock unit for 2012 counts with more than CZK 10,000, whereas payment per LU within CNDP represents only about 10 % of the total amount (slightly over CZK 1,0000). The structure of payments may explain that head numbers of suckler cows are still rising, although payments per livestock unit are diminishing since 2009. Support of the sector is given mostly by area payments, which should achieve about 90 % of the total support in mountain areas in 2012.

Taking into account a development of cattle breeding in recent years as well as in 2012, a break of continuous slowdown should be seen as the main goal of this important sector. The goal shall focus as on a reverse of decline of heads as on an increase of milk and beef production. To improve current situation, measures on farm and institutional level may be applied. On a farm level, such measures may be focused on improvement of quality, organization of work as well as reducing costs.

Measures, which may be applied at an upper level, consist in support of business activities, regeneration of heads of cattle, achieving adequate level of farmers' prices and total sales, allocation of subsidies or support of consumption.

These measures require understanding, political support and cooperation of relevant institutions, production, processing and service enterprises as well as the whole society.

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Production Costs in the Fattening Period of Pigs and Assessment of the Influence of Selected Factors on the Amount of These Costs

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Anotace

Od 90. let minulého století se produkce jatečných prasat a výroba vepřového masa v ČR stala díky se snižující soběstačnosti ČR v této komoditě často diskutovaným tématem. Nízké a kolísavé realizační ceny (CZV), zvýšený dovoz živých zvířat i vepřového masa ze zahraničí a vysoké náklady na výrobu jsou často označovány jako jedny z hlavních důvodů současného kritického stavu v tomto odvětví živočišné výroby. Tento příspěvek se zabývá kalkulací výrobních nákladů ve výkrmu jatečných prasat a posouzením vlivu vybraných faktorů na výši těchto nákladů. Cílem tohoto příspěvku je poskytnout přehled o výrobních nákladech v konečné fázi produkce jatečných prasat a přehled o vlivu vybraných faktorů (cen kalendářního roku a výměry zemědělské půdy podniku) na výši těchto nákladů. K dosažení cíle byla využita data anonymního dotazníkového průzkumu podniků zabývajících se chovem prasat z let 2006 - 2010. K vyčíslení výrobních nákladů bylo využito dvoustupňové kalkulace. Pomocí analýzy rozptylu byla vyhodnocena programem STATISTICA statistická významnost vlivu vybraných faktorů na jednotlivé ukazatele – nákladové položky. Výše vlastních celkových nákladů na výkrm jatečného prasete od roku 2006 do roku 2008 meziročně rostla, v roce 2009 a 2010 byly zjištěny meziroční poklesy, a to v důsledku snižování nákladů na krmiva a mzdových a osobních nákladů. Průměrné celkové vlastní náklady výkrmu jatečných prasat za sledované období let 2006 – 2010 činily 1752,8 Kč/ 100KD. Náklady na krmiva jsou ve struktuře nákladů nejvýznamnější položkou, ve sledovaném období tvořily v průměru 65,6% celkových vlastních nákladů výkrmu jatečných prasat. U podniků bez výměry zemědělské půdy byl tento podíl o 2,4% vyšší. Poznatky prezentované v článku jsou výsledkem řešení výzkumného záměru MŠM 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systémů“.

Klíčová slova

Prase, výkrm, náklady, ekonomika, konkurenceschopnost, vliv, cena zemědělských výrobců, výměra, zemědělská půda.

Abstract

From the 90th years of the last century is the production of pigs and pork industry in the Czech Republic thanks to decreasing self-sufficiency CR in this commodity frequently discussed topic. Low and fluctuating producer´s price, increased imports of live animals and pig meat abroad and the high costs of production are often referred as one of the critical reasons for the current situation in the livestock sector. This paper deals with the calculation of cost of production in the fattening period of pigs and assessment of the influence of selected factors on the amount of these costs. The aim of this paper is to give an overview of the production costs in the final stage of pig production and overview of the influence of selected factors (the prices per year and the size of agricultural land area of farm) on the amount of costs. To meet the goal was used data of anonymous questionnaire survey of farms from the years 2006 – 2010. To quantify the cost of production was used two-stage calculation. Using analysis of variance and program STATISTICA was evaluated statistical significance of selected factors on indicators – cost items. The amount of total cost in the fattening stage of pigs increased from 2006 to 2008, in 2009 and 2010 were identified annual declines, as a result of reducing the cost of feed and labor costs. The average total cost in the fattening period of pig in the period of 2006 – 2010 amounted to 1 752.8 CZK /100 FD. Feed costs in the cost structure are the most important item in the period represented on average 65.6% of total cost in the fattening period of pigs. For farms without agricultural land, the proportion was 2.4% higher. Pieces of knowledge introduced in this paper resulted from solution of an institutional research intention MSM 6046070906 „Economics of resources of Czech agriculture and their efficient use in frame of multifunctional agri-food systems“.

Key words

Pig, fattening, cost, economics, competitiveness, influence, producer´s price, area, agricultural land.

Introduction

Current pig production is often implemented in three stages: breeding, rearing and fattening. Breeding stage involves piglet production and it is more complex to manage than rearing or fattening stage (Rodríguez, 2010). Usual units are for instance rearing stages producing young pigs and fattening stages producing pigs to be slaughter. Fattening stages involves feeding pigs from about 25 kg until they are ready to slaughter, typically at the weight about between 105 and 125 kg.

Pig and pork production is economically important agrarian sector in the Czech Republic and the EU. New trends, such as economic, social and ecological forces are redefining the EU pork industry (Backus and Dijkhuizen, 2002). Czech pig breeding and production and pork industry were affected by many changes during recent years. Unfortunately, not all subjects operating in this livestock sector have succeeded in adapting to the new conditions, which caused a strong competitive environment in the EU and globally. Many farms are diverted from pig production, focused on other sector of crop production or livestock or business in agriculture ended completely. Low and variable realization price together with high costs are for many years the cause of unprofitable production of pigs and result in long-term decline in self-sufficiency of the Czech Republic in the production of this commodity. This development in the Czech Republic mean in stagnant domestic consumption of pork higher dependence on foreign imports. The increasing demands of the legislative requirements in recent years involved in the declining profitability (Šlesinger, 2007). Den Ouden et al. (1997) reported animal welfare preferences have to be related to the cost of production.

To strengthen competitiveness and reduce loss of production of slaughter pigs is currently an important step for breeders effective cost reduction per unit of production. The aim of the paper is to give an overview of costs in the final stage of pig production and overview of the influence of selected factors on the amount of costs. It is possible to provide guidance to producers of pigs, the calculation of the cost in the fattening period of pigs.

Materials and methods

For objective evaluation of cost in the fattening period of pigs was necessary based on data collected on an anonymous questionnaire survey of farms using a closed herd turnover system. The input data for the calculation of costs were data from 85 pig farmers from the Czech Republic. Own costs in the fattening period of pigs were determined for each calendar year in the period 2006 - 2010. The calculations own costs had been treated in terms of costs tracked separately in specified category – fattening period of pigs. To calculate the costs in the fattening period of pigs was used two stage cost calculation. In the first step, calculations were made for costs in the fattening stage of pig. From the total cost of the animal category is subtracted the valuation of secondary product - pig manure. To expression the proportion of cost of the main product is used for calculation unit 100 feeding days (FD) and 1kg live weight gain. Costs of 1 kg live weight gain are calculated as a proportion of the daily costs in the fattening period of pigs and total daily live weight gain. In the second step are calculated the costs per 1 kg live weight of slaughtered pig. In such costs are included the costs of pig transferred from the previous category. Average live weight of slaughtered pig is calculated as a proportion of the total live weight of the animal and number of animals.

Formula for calculation of the total cost (C total) in the fattening period of pigs is made of 9 items:

$$C\ total = Fpurch + Fown + MD + ODM + ODES + LWtotal + WO + AA + O$$

where:

F purch	purchased feed and bedding
F own	own feed and bedding
MD	medication and disinfection
ODM	other direct material
ODES	other direct expenses and services
LW total	labour and wages total
WOd	write-off (direct)
AA	auxiliary activities
O	overheads (administrative and production overheads)

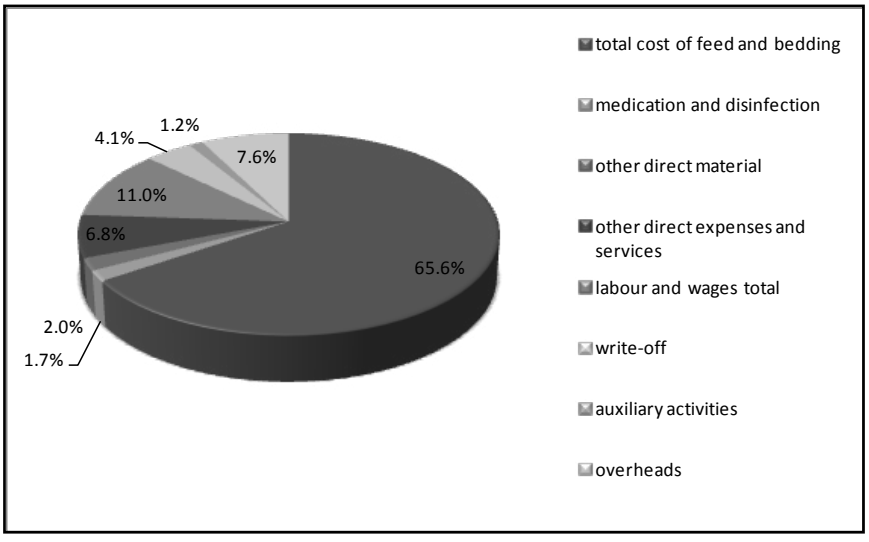
To be able to assess the influence of the size of agricultural land area and the influence of the prices per year on the value of costs is applied analysis of variance (ANOVA). If the factors examined have the appropriate measure and no effect, then the effect will not reflect on their statistical characteristics of this magnitude. If the influence of the factor is significant, this should be reflected in the statistical characteristics of the measured values – especially on the degree of variability (variance) and on the mean value. To search statistical significance influence of factors (the prices per year and the size of agricultural land area of farm) to the individual cost items in the fattening period of pigs, the results were evaluated by statistical program STATISTICA CZ Trail version 10th.

Results and discussion

The most important cost item is in the fattening period of pig, as observed by many authors, (Poděbradský, 1998; Pulkrábek et al., 2005; Poláčková, 2007, 2008, 2009; Weiβ, 2007; Bergmans, 2008; Abrahámová, 2009; Foltýn et al., 2009; Haxsen, 2012; Künzler, 2012), the cost of feed. Feed costs in the cost structure are the most important item in the period represented on average 65.6% of total cost in the fattening period of pigs (*Graph 1 Structure of the cost in the fattening stage of pig in the period 2006 - 2010 (CZK/100FD*). The growth performance of pigs is increasing demands on feed quality, which is reflected in the increasing cost for feeds (Sundrum et al., 2000, Jeroch et al., 2008; Morel et al., 2012). The average growth rate of the total cost of feed and bedding in the fattening period of pigs in the period amounted to 1.001. The cost of purchased feeds and bedding are the most important item of costs structure, represent in the period 2006 – 2010 average 47.97% of the total cost for fattening pig.

Table 1 The fattening period of pigs - development costs of purchased feed and bedding, annual average of farms examined companies in years 2006 – 2010 (CZK/100FD) provides information on the development costs of purchased feeds and bedding in the period and compares these data with the annual costs of feed for pigs according to CZSO. The average growth rate of the costs of purchased feed and bedding in the fattening stage of pigs in the period in the questionnaire survey is lower by 6.8% compared to the average rate of increase in the price of feed for pigs according to CZSO. The highest feed costs were recorded during the whole period in 2008, when market prices for feed grain and cereal-based compound feedingstuffs for pigs in world increased significantly. Dynamic increase in grain prices and consequently the cost of pig meat production since 2007 significantly dampened pig production in the Czech Republic (Abrahámová, 2009). The unfavorable development costs for feed due to the high prices of basic components of feed mixtures for pigs in 2008 refers Fowler (2009).

The highest average cost items purchased feed and bedding in the questionnaire survey was found in 2008 (975.31 CZK/100FD) and the lowest in 2010



Source: Calculations from Survey Data

Graph 1 Structure of the cost in the fattening stage of pig in the period 2006 - 2010 (CZK/100FD).

Indicator	2006	2007	2008	2009	2010
Purchased feed and bedding	**801.01**	**945.65**	**975.31**	**890.92**	**690.95**
Base index (2006=1)	1.000	1.181	1.218	1.112	0.863
Chain index	x	1.181	1.031	0.913	0.776
Average growth rate					*0.964*
Chain index of feed prices for pigs (CZSO)	**x**	**1.259**	**1.220**	**0.775**	**0.954**
Average growth rate					*1.032*

Source: Calculations from Survey Data, CZSO

Table 1: The fattening period of pigs - development costs of purchased feed and bedding, annual average of farms examined companies in years 2006 – 2010.

Indicator	2006	2007	2008	2009	2010
Medication and disinfection	**28.97**	**28.87**	**33.01**	**28.96**	**29.09**
Base index (2006=1)	1.000	0.997	1.139	1.000	1.004
Chain index	x	0.997	1.143	0.877	1.004
Average growth rate					*1.001*

Source: Calculations from Survey Data

Table 2: The fattening period of pigs – development costs of medication and disinfection, annual average of farms examined companies in years 2006 - 2010 (CZK/100FD).

(690.95 CZK/100 FD). Statistically significant influence of prices of the prices per year and the size of agricultural land area of farm has been demonstrated in cost of feed and bedding purchased. The average growth rate of this cost item in the period was 0.964.

Cost item own feed and bedding are on average in the period 17.66% of the total cost. On own feed and bedding was statistically significant only influence of the prices per year.

Development costs of medication and disinfection in the monitored period shows *Table 2 The fattening period of pigs– development costs of medication and disinfection, annual average of farms examined companies in years 2006 - 2010 (CZK/100FD)*. This cost item occupies the total cost for fattening pig 1.70%. The highest cost of medication and disinfection in the fattening period of pig were incurred in 2008, on average 33.01 CZK/ 100FD. In other years, these costs ranged between 28.87 – 29.09 CZK/100FD. The average rate of growth of costs of medication and disinfection in the fattening stage of pigs in the period 2006 - 2010 in the questionnaire survey was 1.001.Statistically significant influence of the prices per year and a statistically significant influence of the size of agricultural land area of farm have not been in the period 2006 – 2010 established.

Other direct material represents on average about 1.98% of the total cost of fattening period of pigs. The cost of medication and disinfection in the fattening stage of pig the examined farms ranged on average in the period up 19.79 to 44.65 CZK/100FD. Statistically significant influence of the prices per year and a statistically significant influence of the size of agricultural land area of farm have been in the period 2006 – 2010 established.

Direct material costs include from the total cost in the fattening stage the examined farms in the period on average 69.31%, other direct costs and services then 6.76%. Other direct costs and services ranged in the surveyed farms in the period on average up 104.05 to 142.35 CZK/100FD. The average growth rate of other direct costs and services was in the monitored period 1.055. At this cost item has been a statistically significant influence of the prices per year established and statistically significant influence of the size agricultural land area of farm too.

Labour and wages costs together represent 11.05% of total cost in the fattening period examined farms in years 2006 - 2010. Statistically significant influence of the prices per year and a statistically significant influence of the size of agricultural land area of farm have been in the period 2006 – 2010 established. The highest labour and wages costs were identified in 2006 and the lowest in 2010. Development of labour and wages costs shows

Table 3 The fattening period of pigs – development costs of labour and wages, annual average of farms examined companies in the period 2006 – 2010 (CZK/100FD). Park (2010) points to the increase in labour productivity in the sector pig production in many EU countries over the past six years. The average growth rate of labour and wages costs in the period was 0.971, i.e. lower by 9.1% compared with an average growth rate of labour and wages in agriculture, according to CZSO (1.062).

Write-off direct (depreciation of tangible and intangible assets) present about 4.09% of total cost in the fattening stage examined farms in the period 2006 – 2010. Statistically significant influence on this cost item was not in one factor established.

The costs of auxiliary activities presents on average about 1.22% of the total cost in the fattening stage examined farms in the period 2006 – 2010. On this cost items was statistically significant only influence of the size of agricultural land area of farm.

Administrative and production overheads are on average 7.56% of total cost in the fattening stage examined farms in the period 2006 – 2010. At this cost item has been not statistically significant influence of the size of agricultural land area of farm. The lowest average overheads was reached in 2006, namely 113.31 CZK/ 100FD. The highest average overheads then was reached in 2008, concretely 152.92 CZK/ 100FD.

In the period 2006 – 2010 ranged the total cost in the fattening stage up16.5 to19.2 CZK/FD. The lowest total cost in the fattening stage were identified in 2006 (1649.77 CZK/100FD), and the highest in 2008, namely 1920.99 CZK/100FD (*Table 4 The fattening period of pigs– development of total cost, annual average of farms examined companies in years 2006 - 2010 (CZK/100FD)*). The average growth rate of total cost in the fattening stage examined farms in the period (1.010) is lower by 1.5%, compared with an average growth rate of input prices of total, according to CZSO (1.025). Statistically significant influence of the prices per year and a statistically significant influence of the size of agricultural land area on the value of the total cost farm have been in the period 2006 – 2010 established.

Table 5 The fattening period of pigs– development of total cost, according to the size of agricultural land area of farms in years 2006-2010 (CZK/100FD) provides concrete value of total cost in the fattening period divided in groups according to size of agricultural land area of farm. The highest total cost in the fattening period examined farms in years 2006 – 2010 was reached in farms without agricultural, while the lowest in farms with a size of agricultural land area in the range of 501 – 2000 ha.

Only two cost items have during the survey period

Indicator	2006	2007	2008	2009	2010
Labour and wages	**202.45**	**200.98**	**200.29**	**184.30**	**180.09**
Base index (2006=1)	1.000	0.993	0.989	0.910	0.890
Chain index	x	0.993	0.997	0.920	0.977
Average growth rate					*0.971*
Chain index of labour in agriculture (CZSO)	**x**	**1.100**	**1.084**	**1.025**	**1.039**
Average growth rate					*1.062*

Source: Calculations from Survey Data, CZSO

Table 3: The fattening period of pigs – development costs of labour and wages, annual average of farms examined companies in the period 2006 – 2010 (CZK/100FD).

Indicator	2006	2007	2008	2009	2010
Total cost	**1 649.77**	**1 683.61**	**1 920.99**	**1 791.57**	**1 716.01**
Base index (2006=1)	1.000	1.021	1.164	1.086	1.040
Chain index	x	1.021	1.141	0.933	0.958
Average growth rate					*1.010*

Source: Calculations from Survey Data

Table 4: The fattening period of pigs – development of total cost, annual average of farms examined companies in years 2006 - 2010 (CZK/100FD).

Size of agriculture land area	0 ha	1 - 500 ha	501 - 2 000 ha	2 000 and more ha
Number of Data	75	135	105	110
Total cost (CZK/100FD)	1 768.62	1 649.41	1 588.25	1 634.39

Source: Calculations from Survey Data

Table 5: The fattening period of pigs – development of total cost, according to the size of agricultural land area of farms in years 2006-2010 (CZK/100FD).

of declining average growth rate. It is the cost of purchased feed and bedding (0.964) and labour and wages costs (0.971). This development was identical with the development of most European countries, supported by increasing productivity and reducing costs to feed. That is the key to the overall improvement of production costs in the pig production (Park, 2010).

Conclusion

Long-term monitoring and evaluation of the cost of production would by the usual activity farmers, especially at such a commodity that is exposed to strong competitive environment. The prices per year and the size of agricultural land area have a statistically significant effect on the amount of total cost in the fattening period of pigs, which is well supported by the demonstrated statistically significant effect of these two factors on the cost of purchased feed and bedding, which represent on average 47.97% of the total cost in the fattening period of pigs. Farms without agricultural land recorded in the period on average by 8.90 % highest of total cost, than was an average of farms with area of agricultural land. Amount of total cost in the fattening period of pigs from 2006 to 2008 increased year on year, in 2009 and 2010 were identified annual declines, as a result of reducing the cost of feed and labor costs. The average total cost in the fattening period of pigs in years 2006 – 2010 were 1752.8 CZK/ 100FD. The average growth rate of total cost in the fattening stage of pigs in years 2006 – 2010 amounted to 1.010, which is 1.5% less compared to the average growth rate of prices of total inputs by Czech Statistical Office (CZSO) 1.025.

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Analysis of the Effects of Subsidies on the Economic Behavior of Agricultural Businesses Focusing on Animal Production

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Anotace

Vstup do Evropské unie a přijetí Společné zemědělské politiky mělo zásadní dopad na ekonomické chování podniků živočišné výroby v České republice. Někteří autoři dochází dokonce k závěru, že útlum živočišné výroby je nejmarkantnějším projevem Společné zemědělské politiky. Předložený článek kvantifikuje dopad dotační politiky na produkci, náklady a technickou efektivnost zemědělských farem. Analyzuje ekonomické chování podniků čerpající dotace a podniků, jež dotace nečerpaly. V rámci výzkumu jsou analyzována mikroekonomická data 173 podniků živočišné výroby. Hlavním metodickým nástrojem je konstrukce produkčních a nákladových funkcí. Vliv dotační politiky na technickou efektivnost byl analyzován pomocí modelu hraniční produkční funkce.

Příspěvek řeší jeden z cílů výzkumného záměru MSMT 6046070906 „Ekonomika zdrojů českého zemědělství a jejich efektivní využívání v rámci multifunkčních zemědělskopotravinářských systémů“.

Klíčová slova

Živočišná výroba, dotace, produkce, náklady, technická efektivnost.

Abstract

Entry into the European Union and the acceptance of Common Agricultural Policy had a fundamental impact on the economic behavior of animal production businesses in the Czech Republic. Some authors have even reached the conclusion that the slump in animal production is the most prominent manifestation of Common Agricultural Policy. The submitted article quantifies the effect of subsidy policy on production, costs and technical efficiency of agricultural farms. It analyzes the economic behavior of businesses receiving subsidies and of businesses that did not receive subsidies. As part of the study, the microeconomic data of 173 animal production businesses are analyzed. The main methodological tool is the construction of production and cost functions. The effect of subsidy policy on technical efficiency was analyzed by way of the frontier production function model.

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Key words

Animal production, subsidies, production, costs, technical efficiency.

Introduction

The goal of the majority of subsidies in the first pillar and partially also in the second pillar of Common Agricultural Policy (CAP) is to support the income situation within the agricultural sector. The impact of such subsidies on the income of the farmer or the profit of agricultural businesses is evident and many businesses would generate a loss without subsidies (Chrastinová and Buriánová, 2009). Not only do subsidies determine the income or profit of agricultural businesses, but they also affect the level of production, costs and technical efficiency in a significant manner. The analysis of these effects is an important topic in agricultural economics and is also significant for drawing up the tools of Common Agricultural Policy.

The main methodical tool in the analysis of the effects of subsidies on the production behavior of agricultural entities is either mathematical programming (e.g. Arfini et al., 2001) or econometric

modeling (Bezlepkina et al, 2004, Henningsen et al., 2011, Bokusheva et al., 2012). Bezlepkina et al. (2004) analyzes the impact of subsidies on farm profit and input-output allocations among Russian businesses engaging in the production of milk. She reaches the conclusion that although subsidies deform the level of costs and production in such businesses, they have a significant effect on increasing the business profit. Henningsen et al. (2011) analyzed, by utilizing econometric methods, the effect of subsidies that are associated with production and which are fully separated from production. The results prove that subsidies that are tied to production have an effect on the utilization of inputs and the level of production. However, in the case of subsidies fully separated from production, such effect was negligible. Similar conclusions are also reached by Bokusheva et al. (2012). Direct payments have a negative effect on the level of production of farms, and thus, direct payments fulfill the original goal of not stimulating farmers to greater production. However, the results show non-optimal utilization of production resources.

In terms of the effect on technical efficiency, subsidies can have a positive as well as a negative effect. If subsidies constitute an impulse for the implementation of innovations or transition to new technologies for a business, then an increase in technical efficiency occurs (Zhu et al., 2008). A decrease in technical efficiency usually occurs if the higher income from subsidies weakens the effort of agricultural businesses for better performance. There are many empirical studies dealing with the effect of subsidies on technical efficiency among businesses with diverse production focuses. Some studies only focus on the effect of direct payments on technical efficiency, while others also deal with involvement in various investment programs, for example. Conclusions of a negative correlation between technical efficiency and subsidies within CAP are predominantly consistent; for example, see Iraizoz et al. (2005), Bakucs et al. (2006), Hadley (2006), Kleinhanss et al. (2007), Lambarraa and Kallas, (2009). Zhu et al. (2008) analyzes the impact of subsidies within CAP on the competitiveness of farms engaging in the production of milk in Germany, the Netherlands and Sweden. Zhu et al. (2008) reaches the conclusion that subsidies that are tied to production have a negative impact on technical efficiency in Germany and the Netherlands. Subsidies that are separated from production also contribute to a reduction in technical efficiency, in all three states. Further, Zhu et al. (2008) states that an increase in the volume of subsidies that are separated from production has a much greater negative impact on technical efficiency than an increase in the share of subsidies tied to production in the total volume of paid subsidies. Latruffe et al. (2011) analyzes the correlation between the volume of agricultural subsidies and the effectiveness of agricultural businesses also focusing on the production of milk. He utilizes data from the accounting data network FADN for the period of 1990 – 2007 and for seven EU countries. The results show that businesses with a greater dependence on subsidies and on hired labor forces have a lower level of technical efficiency, in all analyzed countries. His conclusion is consistent with the predominant portion of the existing literature – subsidies within CAP reduce the technical efficiency of agricultural businesses.

The main aim of the article is the assessment of the effects of CAP subsidies on the economic behavior of animal production businesses in the Czech Republic. While a greater share of animal production is typical for highly developed economies, where there is the opportunity to create greater added value, its decline is occurring in the Czech Republic. Such decline then brings with it a decrease in self-sufficiency among the majority of animal commodities. Svobodová (2011) states that the development of agricultural production, primarily of animal production, is suppressed throughout the territory of the Czech Republic, and reaches the conclusion that the slump in animal production is the most prominent manifestation of CAP. She attributes the decrease in the volume of animal production to external conditions set by EU CAP as well as by the approach of national policy, which is not capable of regulating the situation.

This paper is connected to previous paper dealing with the impact of subsidies on plant production in the Czech Republic (Malá, Červená, Antoušková, 2011). However, issue itself of determining the effects of receiving subsidies on animal production in the Czech Republic is dealt with insufficiently in the literature.

Material and Methods

The goal of the submitted report is the assessment of the effect of subsidy policy on the production, costs and technical efficiency of agricultural businesses engaging in animal production. A partial goal of this article is to assess the economic behavior of businesses receiving and not receiving subsidies.

In order to achieve the said goal, the following working hypotheses are subjected to verification:

H1: Subsidies predicate an increase in agricultural production (Kroupová, Malý, 2010; Malá, Červená, Antoušková, 2011).

H2: Subsidies bring about the wasting of resources (Zemplinerová, 2006), which leads to an increase in the costs of agricultural producers focusing on animal production.

H3: Subsidies cause a decline in the technical efficiency of agricultural farms (Kroupová, Malý, 2010).

The verification of the hypotheses is based on the panel data of 173 agricultural businesses – legal entities, with predominating animal production, acquired from the database of the Creditinfo Company Monitor. In terms of time, the said data base represents the economic activity of the said agricultural businesses within the years 2004 – 2009, which enables a comparison with previously conducted research of the effect of subsidies on businesses with predominating plant production, see Malá, Červená, Antoušková (2011).

Data from accounting statements were further supplemented with the volume of acquired subsidies in the following segmentation:

- direct payments (representing the sum of SAPS and TOP-UP payments),
- other subsidies including agro-environmental subsidies (paid out on the basis of both Horizontal Rural Development Plan (HRDP), as well as Czech Rural Development Program for the years 2007 – 2013 (PRV)), support of less favorable areas including NATURA 2000 areas (on agricultural land), other subsidies from the HRDP and the PRV, support of common market organization including intervention storage.

Further, the number of employees was added, determined as the proportion of wage costs of individual entities and the average wage in agriculture, actualized according to the database of the Czech Statistical Office within the region where the analyzed business had its registered address. The area of agricultural land was determined on the basis of the volume of SAPS subsidy as the proportion of the total amount of the received subsidy and the annual rate.

The elaboration of the analysis of the effect of subsidy policy required the definition of the indicator of the total production of the analyzed businesses. The said indicator was set at the level of accounting production. The effect of price development was, in the case of production, eliminated through conversion to real value by way of agricultural producer price indexes, taking into consideration the production specialization, as published by the Czech Statistical Office. The year 2005 was selected as the basic period. Price development was also eliminated in the case of production consumption entering into the production function as an explanatory variable, through the utilization of input price indexes also published by the Czech Statistical Office.

The data, acquired in the manner as stated above, were further adjusted to account for incomplete and remote observations, detected by way of graphic analysis. The resulting set of data utilized for the analysis contained 703 observations of 173 agricultural businesses with predominating agricultural production.

In order to verify hypothesis H1, a production function model was constructed, expressing the correlation between the amount of inputs into the production process of the analyzed entities and the amount of output, taking into consideration the effect of subsidies. The said correlation was modeled in the form of a Cobb-Douglas function:

$$y_{kt} = \alpha WU_{kt}^{\beta_{WU}} K_{kt}^{\beta_K} VS_{kt}^{\beta_{VS}} PP_{kt}^{\beta_{PP}} OD_{kt}^{\beta_{OD}} e^{e_{kt}}, \quad (1)$$

where:

y_{kt}…....volume of production of the *k-th* farm in time *t*,

WU_{kt}…amount of the factor of production of labor utilized by the *k-th* entity in time *t*,

K_{kt}…....amount of the factor of production of capital, corresponding to entity *k* in time *t*,

VS_{kt}…..performance consumption within the *k-th* entity in time *t*,

PP_{kt}…..value of direct payments, acquired by the *k-th* entity in time *t,*

OD_{kt}…value of other subsidies, acquired by the *k-th* entity in time *t*,

α…....constant,

$\beta_{WU,K,SV,PP,OD}$…parameters of the production function,

e_{kt}…....random variable of the model with assumed normal distribution $e_{kt} \sim N(0,\sigma^2)$,

$k = 1,2,....K,\ t = 1,2,...T.$

The output, quantified by way of the said function, was represented by production in constant prices from the year 2005 in thousands of CZK. The explanatory variables represented the basic factors of production and subsidies:

- Labor (WU), represented by the average number of workers;
- Capital (K), expressed in the form of the sum of the tangible and intangible long-term assets in thousands of CZK;
- Material, energy and services (VS), defined as performance consumption in constant prices from the year 2005 in thousands of CZK;
- Direct payments (PP), representing the sum of SAPS and TOP-UP payments in thousands of CZK;
- Other subsidies (OD), containing other subsidies provided from EAFRD and EZZF, expressed in thousands of CZK.

Alternatively, a production function with a dummy variable was quantified, representing the receiving of subsidies by the farm within the given year. The said specification change thus meant the elimination of variables PP and OD from the production function set out in formula 1 and the inclusion of zero-one variable D. The cost function was also derived from the above model, taking into consideration the effect of subsidies on the costs of agricultural businesses with predominating animal production. The reason for the construction of the cost function was the assumption regarding the positive effect of the amount of subsidies on the volume of costs of the analyzed farms, as subsidies provide agricultural producers with additional income, which implies a lesser rationality in the behavior of agricultural producers and the wasting of resources (see, for example, Zemplinerová, 2006). The cost function was derived by way of the Lagrange method dealing with the dependent minimization of the cost function under the assumption of a specific production technology given by the production function:

$$\begin{aligned} C(w,y) &= \min_{VS,WU} w_{VS}VS + w_{WU}WU, \\ s.t. y &= (\alpha + \beta_D D)\phi VS^{\beta_{VS}} WU^{\beta_{WU}}, \end{aligned} \tag{2}$$

where:

WVS…price of the factor of production of performance consumption,

WWU…price of the factor of production of labor,

D……dummy variable representing subsidies,

φ…….....constant effect of capital.

In order to verify hypothesis H3 regarding the effect of subsidies on the technical efficiency of agricultural producers, the recursive model of the stochastic frontier function and the function of the rate of technical inefficiency was modeled (for more, see Madau, 2007):

$$\begin{aligned} y_{kt} &= \alpha VS_{kt}^{\beta_{VS}} WU_{kt}^{\beta_{WU}} K_{kt}^{\beta_K} e^{e_{kt}-u_{kt}} \\ u_{kt} &= \delta_{PP} PP_{kt} + \delta_O ODH_{kt} + w_{kt}, \end{aligned} \tag{3}$$

where:

DPP_{kt}…volume of acquired direct payments by the *k-th* entity in time *t*,

OD_{kt}…..volume of other acquired subsidies by the *k-th* entity in time *t*,

δ_0…….....constant,

$\delta_{O,PP}$…..parameters of the function of inefficiency,

u_{kt}……..rate of technical inefficiency with semi-normal distribution $u_{kt} \sim iidN(0,\sigma_u^2)$,

e_{kt}……..random variable of the model with assumed normal distribution $e_{kt} \sim N(0,\sigma^2)$,

w_{kt}.....random variable of the model of the rate of technical inefficiency, $w_{kt} \sim N(0,\sigma_w^2)$,

$k = 1, 2, ...K,\ t = 1, 2, ...T.$

The utilization of panel data in order to estimate the above models required an analysis of the heterogeneity of the utilized variables to be conducted. The presence of heterogeneity, verified by way of an analysis of the variance of the values of the explained variables of the estimated models (see Jackson, 2009), defined the need to utilize a special construction of the model in the form of a fixed effects model (FE) and a random effects model (RE), for more see Hsiao (2003). The estimate of the parameters of the said models was conducted by way of the generalized least squares method. The quality of the acquired estimates was verified by way of standard statistical methods. The statistical significance of the estimated parameters was tested by way of the t test. The concordance of the estimated model with the empirical data was quantified with the coefficient of multiple

determination, also including in an adjusted form, and verified by way of the F-test.

The statistical significance of the parameters of the explanatory variables in the function of technical inefficiency was tested by way of the LR test with a zero hypothesis presuming a zero effect of the explained variable on the level of technical inefficiency and its changes, i.e. H_0: $\delta_j = 0$ for j = 1,2,…J. The acceptance of the said hypothesis meant that the chosen variables do not explain technical inefficiency.

The correctness of the specification of the model was tested by way of two methods:

- the construction of the model, taking into consideration farm specifics, i.e. FE or RE model as opposed to a model with an identical constant, was tested by way of the Baltagi-Li Lagrange Multiplier test (Green, 2008);
- the inclusion of farm specifics into the random variable, i.e. RE as opposed to FE, was tested by way of the Hausman test (Wooldridge, 2003).

The fulfillment of the general assumptions regarding the attributes of the random variable was further tested by way of the Baltagi-Li Joint Lagrange Multiplier test of homoskedasticity and serial correlation of the random variable (for more, see Baltagi et al., 2008), by way of the Breusch-Pagan test of homoskedasticity of the random variable, and by way of the Wooldridge test of autocorrelation (see Wooldridge, 2003). The established heteroskedasticity or autocorrelation of residues was subsequently eliminated by way of transformation of variables of the unbalanced panel (for more, see Green, 2007). Estimates of the parameters and the relevant tests were conducted through the NLogit econometric program, version 4.0.

Results and Discussion

Table No. 1 characterizes the selected set of businesses on the basis of the selected indicators for the period of 2004 – 2009 including the average values and the rate of growth. This overall set of businesses was further divided up according to the fact of whether the business did or did not receive subsidies, and subsequently, a characterization was also conducted for these two groups of businesses (Table No. 2 and No. 3).

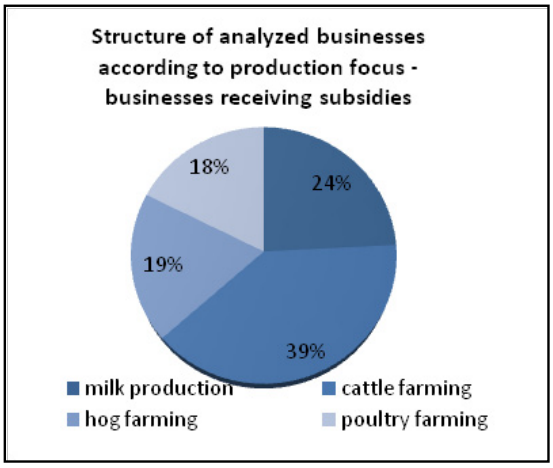
Graphs No. 1 and No. 2 document the average representation of businesses within the analyzed period according to the production focus in view of receiving or not receiving subsidies. Therefore, it is evident that businesses receiving subsidies have a 63% representation of businesses engaging in the production of milk and raising cattle. On the other hand, businesses in the group not receiving subsidies have a 91% constitution of businesses focusing on hog and poultry farming.

In terms of the development of the number of

Indicator	2004	2005	2006	2007	2008	2009	Growth rate	Average
Number of workers	42.2	38.2	33.4	39.1	38.1	34.8	-17.6	37.7
Land area	0.0	542.9	405.8	462.0	532.1	541.6	-0.3	414.1
Liabilities	99857.5	97451.6	76680.4	77398.6	83188.7	68348.6	-31.6	83820.9
Equity capital	58903.2	62159.1	44853.3	42440.4	44800.5	37000.5	-37.2	48359.5
Production	71173.3	57748.3	57647.9	63349.7	67701.5	39715.5	-44.2	59556.0
Added value	18597.1	18067.3	15358.3	14150.3	12106.0	12946.1	-30.4	15204.2
Operating ER	2754.9	3102.2	3054.1	891.8	-563.4	1506.0	-45.3	1790.9
Total ER	1678.6	2017.8	1659.7	-327.4	-1655.8	446.6	-73.4	636.6
Direct payments	0.0	1009.8	1706.4	2222.4	2719.7	3557.3	252.3	1869.3
AEO	0.0	1325.9	1202.3	1319.4	1619.6	1848.7	39.4	1219.3
LFA	462.4	937.6	1233.8	1282.6	1389.5	1351.6	192.3	1109.6
PRV	0.0	0.0	0.0	0.0	177.0	636.5	x	135.6
SOT	323.8	94.9	43.4	220.6	17.7	0.0	x	116.7

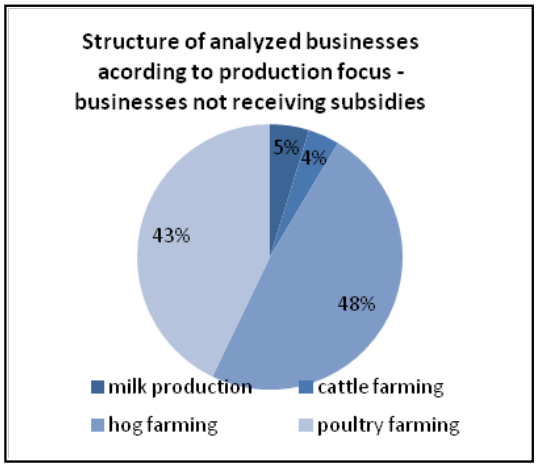
Note: Rate of growth is for the period of 09/04 and by land area, direct payments and AEO 09/05
Data other than the number of workers and land area are set out in thousands of CZK
ER = economic result
Source: Own processing

Table No. 1: Characterization of the set of agricultural businesses for the period of 2004 - 2009.



Source: Own processing

Graph No. 1: Structure of businesses receiving subsidies.



Source: Own processing

Graph No. 2: Structure of businesses not receiving subsidies.

Indicator	2004	2005	2006	2007	2008	2009	Growth rate	Average
Number of workers	30.9	39.4	31.0	42.5	40.8	41.1	33.2	37.6
Land area	0.0	542.9	405.8	462.0	532.1	541.6	-0.3	414.1
Liabilities	80367.6	74894.0	73533.5	77885.6	86493.8	77933.2	-3.0	78517.9
Equity capital	45518.0	48112.3	44129.5	45065.1	49305.8	39713.7	-12.8	45307.4
Production	49465.8	55012.7	45504.9	56615.9	58056.3	35572.6	-28.1	50038.0
Added value	14469.1	15945.0	13129.9	16025.0	13820.5	15748.9	8.8	14856.4
Operating ER	3228.0	4928.7	4175.5	3975.2	4361.9	4941.0	53.1	4268.4
Total ER	2485.2	3897.8	2937.8	2788.8	2840.6	2648.4	6.6	2933.1
Direct payments	0.0	1009.8	1706.4	2222.4	2719.7	3557.3	252.3	1869.3
AEO	0.0	1325.9	1202.3	1319.4	1619.6	1848.7	39.4	1219.3
LFA	462.4	937.6	1233.8	1282.6	1389.5	1351.6	192.3	1109.6
PRV	0.0	0.0	0.0	0.0	177.0	636.5	x	135.6

Note: Rate of growth is for the period of 09/04 and by land area, direct payments and AEO 09/05
Data other than the number of workers and land area are set out in thousands of CZK
ER = economic result
Source: Own processing

Table No. 2: Characterization of the set of agricultural businesses receiving subsidies.

workers, it is evident that among the analyzed animal production businesses, there was a decline of 17.6% in the years 2004 - 2009 (see Table No. 1). Such decline was primarily brought about by a sharp decline in the number of workers among businesses that did not receive subsidies within the analyzed period (Table No. 3), i.e. businesses engaging in hog and poultry farming, by 53.7%.

The land area of the agricultural business decreased among all of the analyzed businesses, by 0.3%. The land area among businesses not receiving subsidies could not be determined, as it was derived from the volume of SAPS payments.

The value of liabilities among the entire set of businesses decreased by 31.6% and once again, such decrease was caused primarily by the decrease in the amount of liabilities among businesses not receiving subsidies. However, businesses not receiving subsidies, i.e. primarily businesses with a production focus on hog and poultry farming, can be characterized as having a higher level of liabilities per business. The equity capital decreased in both groups of businesses, whereby among the group of businesses not receiving subsidies, such decrease was significant. The decline in equity capital is primarily caused by an accumulation of losses from previous years.

Indicator	2004	2005	2006	2007	2008	2009	Growth rate	Average
Number of workers	56.4	36.5	36.3	35.1	34.7	26.1	-53.7	37.5
Land area	x	x	x	x	x	x	x	x
Liabilities	124120.4	127946.2	80399.4	76818.5	79013.8	55112.6	-55.6	90568.5
Equity capital	74200.6	78547.0	45598.9	39507.0	39583.8	33253.7	-55.2	51781.8
Production	96424.8	60939.8	70710.9	70776.6	78531.1	45042.2	-53.3	70404.2
Added value	23146.2	20543.2	17485.5	12413.4	10301.2	9876.4	-57.3	15627.7
Operating ER	2252.9	1343.3	2102.6	-1692.8	-4970.3	-2256.1	-200.1	-536.7
Total ER	839.0	416.3	652.7	-2847.8	-5363.3	-2174.6	-359.2	-1412.9

Note: Data other than the number of workers and land area are set out in thousands of CZK
ER = economic result
Source: Own processing

Table No. 3: Characterization of the set of agricultural businesses not receiving subsidies.

The production of businesses within the analyzed period decreased overall by 44.2% and the added value decreased by 30.4%. The decline in production was seen in both groups of businesses. When looking at Tables No. 2 and No. 3, it is evident that businesses that do not receive subsidies achieve greater production and also generate greater added value when converted to a per business basis as compared to the first group of businesses. Even despite such fact, they achieve negative values of operating economic result as well as overall economic result. The group of businesses receiving subsidies ends, on average, with a positive economic result, which is undoubtedly the result of a significant increase in operating subsidies. Direct payments have created 48.1 % of total subsidies in 2009. Direct payments increased within the analyzed period by 252.3% and LFA subsidies by 192.3%. Among the group of businesses receiving subsidies, there was thus an increase in the overall economic result of 6.6%.

The impact of subsidy support in agriculture on the production of agricultural businesses primarily focusing on animal production was analyzed with the utilization of the production function model in Cobb-Douglas form. The results of the estimate of the said function by way of the generalized least squares method while taking into consideration group heteroskedasticity, verified by way of the Joint Baltagi-Li test (LMPLJ = 9513,1 with a p-value = 0.0000) as well as by way of the Breusch-Pagan test (LMBPG = 6990,4 with a p-value = 0.0000) are set out in the following Table No. 4.

Inter-farm heterogeneity was taken into consideration in the said model both by way of dummy variables, corresponding to the fixed effects model, as well as by way of the differentiation of the random variable, corresponding to the random effects model. The appropriateness of the said specification was declared with a probability of 99% by way of the Baltagi-Li Lagrange Multiplier test. On the basis of the results of the Hausman test (see Table No. 4), the construction of the model was then selected, including farm specifics in the random variable.

In economic terms, the parameters of the basic variables of the production function correspond to the economic assumptions. The increase of all analyzed factors of production implies an increase in production. The parameters of the said variables are also statistically significant, at a level of significance of 0.01. Out of the analyzed factors of production, the consumption of material, energy and external services shows the strongest effect, as a 1% increase in consumption of the said factor of production implies a 0.54% increase in production. The second most significant factor is labor with an elasticity of 0.26%. On the other hand, the production of businesses focusing on animal production is least affected by capital, a 1% increase of which brings about only a 0.09% increase in production. Both analyzed categories of subsidies show a negative effect on production. In the case of direct payments, a 1% increase in their receipt by an agricultural business decreases its production by 0.004%. However, in the said estimate, the parameter of direct payments is statistically insignificant. The said fact is associated with the low and indirect dependence of animal production on land. A stronger effect can be anticipated only in the case of a pastoral farming method, which is not, however, separately analyzed within the described model. The category of other subsidies also predicates a decline in production,

	Parameter	Estimate error	t-value	p-value
LWU	0.2549	0.0333	7.6434	0.0000
LHANM	0.0886	0.0239	3.6995	0.0002
LDVS	0.5478	0.0347	15.8079	0.0000
LPP	-0.0041	0.0037	-1.1201	0.2627
LODOT	-0.0168	0.0046	-3.6928	0.0002
ONE	2.5910	0.3233	8.0135	0.0000
Var [e]	0.0854			
Var [u]	0.3262			
AR1 (ρ_1)	-0.3330			0.0000
Baltagi-Li LM test versus OLS [1]	29.27			0.0000
Hausman [5]	0.13			0.9997
R2	0.4869			
F-hodnota$_{[5,379]}$	88.73			0.0000
kor.R^2	0.4858			

Source: Own calculation

Table No. 4: Results of the estimate of the production function in logarithmic expression with consideration of group heteroskedasticity.

with an elasticity of 0.02%. The parameter of other subsidies is statistically significant at a level of significance of 0.01, which enables the dismissal of hypothesis H_1.

The focus of the analyzed businesses on animal production is associated with a high representation of businesses that do not receive payments per area at all. For the said reason, the specification of the model was modified and an estimate working only with a dummy variable, expressing the receipt of any agricultural subsidy title within the given business within the analyzed year, was also conducted. The results of the estimate of the said model in the form of a random effects model and while taking into consideration heteroskedasticity ($LMBL_J$ = 31884,7 with a p-value = 0.000) are set out in Table No. 5.

As is evident, the described change in the specification significantly modified the estimate of all parameters. There was a strengthening in the effect of the consumption of material, energy and external services on the resulting production. The elasticity of the said variable increased to 0.94%, with the preservation of the statistical conclusiveness at a level of significance of 0.01. On the contrary, the elasticity of the factor of production of labor decreased to 0.09%, also with the preservation of the statistical conclusiveness at a level of significance of 0.01. On the other hand, the parameters of the variable of capital and intercept became statistically inconclusive. The parameter of the dummy variable is statistically significant in the described estimate at a level of significance of 0.01 and predicates a decline in the absolute element of the production function by 22% with the receipt of subsidy titles.

The said change also slightly increased the coefficient of determination, to 52.8%. The statistical significance of the coefficient of determination, verified by the F-test, remained established, at a level of significance of 0.01.

Further, a cost function with a dummy variable modifying its absolute element was derived from the above production function; see the following correlation:

$$C(w_{WU}, W_{VS}, y) = 2.042(1.582 - 0.282D)^{-0.969} w_{WU}^{0.087} w_{VS}^{0.913} y^{0.969}$$

The factor of production of capital, in view of the inconclusiveness of its parameter, entered the said cost function in a constant amount, corresponding to its average value within the analyzed selection set. The derived cost function thus describes the effect of production, the price of the factor of production of labor and the combined factor of material, energy and services on the costs of the business. Subsidies in the form of a dummy variable modify the intercept, as stated above. Cost functions can thus be more specifically divided up into the cost function of businesses that do not receive subsidies:

$$C(w_{WU}, W_{VS}, y) = 1.309 w_{WU}^{0.087} w_{VS}^{0.913} y^{0.969}$$

	Parameter	Estimate error	t-value	p-value
LWU	0.0898	0.0225	3.9891	0.0001
LHANM	0.0133	0.0146	0.9114	0.3621
LDVS	0.9421	0.0252	37.3317	0.0000
DUMMYDOT	-0.2445	0.0539	-4.5373	0.0000
ONE	0.3157	0.2313	1.3646	0.1724
Var [e]	0.1424			
Var [u]	0.2355			
AR1 (ρ_1)	-0.2561			0.0000
Baltagi-Li LM test versus OLS [1]	32.31			0.0000
Hausman [5]	0.47			0.9761
R^2	0.5282			
F-value$_{[5,379]}$	104.68			0.0000
kor.R^2	0.5272			

Source: Own calculation

Table No. 5: Results of the estimate of the production function in logarithmic expression while taking into consideration heteroskedasticity.

	Battese and Coelli with heterogeneity			
	Parameter	Estimate error (standard error)	t-value	p-value
ONE	3.0195	0.1468	20.5657	0.0000
LWU	0.1659	0.0191	8.6920	0.0000
LHANM	0.1097	0.0102	10.7993	0.0000
LDVS	0.6162	0.0126	49.0654	0.0000
λ	3.0296	0.0299	101.3170	0.0000
σu	0.9376	0.0705	13.3021	0.0000
PP	-0.0105	0.0125	-0.8392	0.4014
ODOT	0.0281	0.0057	4.9632	0.0000
Log-probability function	-269.7974			
AIC	0.7847			
σv2	0.0958			
σu2	0.8792			
σv	0.3095			
σ	0.9874			
Pseudo R^2	0.73			
H_0: γ_{PP} =0	4.63			0.0314
H_0: γ_{ODOT} =0	19.07			0.0000

Source: Own calculation

Table No. 6: Results of the estimate of the marginal production function.

And into the cost function of businesses that do receive subsidies:

$$C(w_{WU}, W_{VS}, y) = 1.404 w_{WU}^{0.087} w_{VS}^{0.913} y^{0.969}$$

From the comparison of the said functions, it is evident that businesses receiving subsidies have 7.3% higher costs on average than businesses that do not receive subsidies, with the same level of prices of the factors of production and the same production. Hypothesis H_2 can thus be considered verified.

The estimate of the production function with a fixation of capital at an average level and the derivation of the cost function also enables, with the inclusion of the price of production, the modeling of the profit functions of businesses with subsidies and businesses without subsidies; see the following correlations.

The profit function of a business without subsidies:

$$\pi = 1.582 WU^{0.089} VS^{0.0942} P - 1.309 w_{WU}^{0.087} w_{VS}^{0.913} y^{0.969}$$

The profit function of a business with subsidies:

$$\pi = 1.239 WU^{0.089} VS^{0.0942} P - 1.404 w_{WU}^{0.087} w_{VS}^{0.913} y^{0.969}$$

The above functions make it evident at first glance that, with a comparable level of all inputs, prices as well as production, the acquisition of subsidies causes a decline in the economic performance of the business.

It is appropriate to further expand the above results through the analysis of the effect of subsidy policy on technical efficiency. The said problem can be analyzed with the utilization of the marginal production function model, proposed by Battese and Coelli. The results of the estimate of the marginal production function with heterogeneity are set out in Table No. 6.

The given estimate, which achieves 73% congruence with available data and a statistical significance of all basic parameters of the stochastic frontier function according to the t-test at a level of significance of 0.01 and a statistical significance of the parameters of the function of technical inefficiency at a level of significance of 0.05 according to the LR test, shows a negative effect of direct payments on technical inefficiency, while other subsidies increase technical inefficiency. As has been mentioned, other subsidies are a decisive category within the set of agricultural businesses focusing on animal production, and thus the said conclusion deepens the negative effect of subsidies on the economic performance of agricultural animal production businesses as described above.

Agricultural animal production businesses receiving subsidies produce, on average, only 44.6% of the potential product, while businesses without subsidies achieve, on average, 60.4% of potential production. The greatest performance within the analyzed sample was quantified at a level of 97.6% of potential production and was achieved by a business without subsidies. Hypothesis H3 was thus also verified.

Conclusions

The volume of support for animal production is significantly determined by the focus of production and, as compared to plant production, is significantly lower, as there is a lower dependence of production on land in this case, with which the majority of direct payments are associated. Some production focuses even receive subsidies only indirectly through the consumption of their own feeds or only receive subsidies of an investment nature.

The economic situation of the analyzed animal production businesses differs significantly in view of their production focus, which subsequently affects the fact of whether the business receives subsidies or not. Among businesses that do not receive subsidies, i.e. among businesses with a production focus on hog and poultry farming, there was a significant decline in production as well as added value within the analyzed period. Nevertheless, on average, they generate higher production and greater added value than businesses that do receive subsidies. However, unlike those businesses, they have regularly been ending up since 2007 with a negative economic result. On the other hand, among businesses that do receive subsidies, there has been an increase in the economic result within the analyzed period, although business production has gone down.

On the basis of the results of the conducted analysis, it may be stated that the effect of subsidies on production among businesses that received direct payments was reflected in a negative manner. Businesses that received subsidies achieved 22% lower production than businesses not receiving subsidies. Direct payments do not motivate these agricultural businesses to greater production; therefore, they fulfill their original goal of not stimulating agricultural businesses toward greater intensity of production. However, the effect of direct payments on all of the monitored agricultural animal production businesses regardless of whether the given business did or did not receive them, cannot be considered statistically significant.

In terms of the effect of other subsidies, a negative effect on production was also established.

Upon comparing the cost functions of businesses receiving and not receiving subsidies, it may be stated that subsidies cause the wasting of resources, which is reflected in the increase of costs of agricultural producers focusing on animal

production. Businesses that received subsidies have costs 7.3% higher, on average, than businesses that did not receive subsidies.

On the basis of the conclusions arising from the production and cost functions of businesses receiving and not receiving subsidies, it may be stated that subsidies cause a decline in the economic performance of a business, as businesses that received subsidies had lower outputs and higher inputs as compared to businesses that did not receive subsidies.

Further, the effect of subsidy policy on technical efficiency was analyzed, whereby a decline in technical efficiency of agricultural farms as a result of the effect of the receipt of subsidies was shown. Businesses receiving subsidies achieved only 44.6% of the potential product as compared to businesses not receiving subsidies, which on average produced 60.4% of the potential product.

On the basis of the conducted analysis, it may be stated that agricultural businesses focusing on animal production would benefit from a limitation of subsidies with simultaneous measures that will lead to the greater protection of the domestic market, to the support of the creation of greater added value in the form of the processing their production, as well as to the support of the expansion of the sales opportunities of agricultural businesses with animal production.

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