

Foodstuffs self-sufficiency of Czech Republic in the Context of Long-term Structural Changes in Primary Agricultural Production

Marie Prášilová, Radka Procházková, Pavla Hošková

Abstract: *Farming sector is a significant part of CR national economy. It belongs to sensitive economic areas, since its specifics are directly connected to natural and climate phenomena. Farming sector has accounted for 2.7% only of total employment, however, farmers have been cultivating about 60% of CR territory. The paper analyzes long-term development tendencies of Czech agriculture's efficiency and the impact of these upon self-sufficiency of Czech Republic in basic agricultural commodities production. It is aimed at an analysis of the development of selected natural indicators such as areas sown, crop production, livestock numbers and livestock production. Applying advanced statistical methods the long-term development tendencies have been described and modeled and future development forecasts set up. The solution connects to accessible EuroStat, Czech Statistical Office and CR Ministry of Agriculture data bases. Therefore, the time series have not been limited explicitly. Data analyzed have further on been applied in statistical modeling of the balance of agricultural production and food-stuffs self-sufficiency. Even in spite of the adequate soil-ecological conditions of Czech rural countryside there has not so far been much success registered at the efforts to reverse or at least mitigate the decline of economically demanding commodities' domestic production. The paper examines current self-sufficiency level in traditional commodities of Czech agriculture, regarding possible alternatives connected with the new CAP and with CR Ministry of Agriculture's efforts for sustainable development of farming and countryside and with CR nutrition policy.*

Key words: Agriculture CR · Natural indicators · Animal production · Plant production · Self-sufficiency

JEL classification: C8 · C22 · Q10

1 Introduction

Czech farming sector is a part of European markets and it is subject to the EU CAP rules. The CAP's target is to secure sustainable food production and stable food supplies within the EU. At the same time it answers to the questions of food security, rural economy, good living conditions for the animals, social interests and environment. Since CR accession to the EU a significant change of Czech agriculture arrived. It has been connected namely with commodities production profitability as given by the agriproducers' prices, the cost competitiveness of Czech producers, but with the competitors' strength from the neighbouring EU states, too.

Agriculture's share on GDP total has shown a decreasing trend similar as employment's development in the farming sector. The decline of relative indicators has been accompanied, in case of Czech agriculture, by a permanent decline of the industry size, too. Predominance of crop production and expansion of the extensive farming types can be considered a significant structural change. Species diversity of farm crops has been reduced. The strategy for Czech agriculture and foodstuffs industry is presuming a further expansion of energy crops and biofuel production. However, this should not endanger foodstuffs self-sufficiency of Czech Republic (Hlaváček et al., 2012). The Czech Republic is getting still more dependent on imports of some foodstuffs. The range of farm products where home production is below the consumption level is expanding.

There are different views concerning importance of food self-sufficiency and its healthy level. Most often it has been proclaimed that it should not fall below 80% for the important commodities (ÚZEI, ČTK, 2012). Toman (2012) states that, self-sufficiency of every State in the strategic industries of national economy, i.e., in foodstuffs and energy first of all, raises its sovereignty and security and it is the basis of its stability, too. According to the level of self-sufficiency also the degree of economy openness can be assessed (Mankiw, 2000). Some of the authors have stated that, a country should aim at such a sector where it can reach a comparable advantage against other countries. Other sectors, that the country cannot manage most efficiently, should be left to other countries and products or services from those sectors should be obtained by means of foreign trade and exchange. In such a case, of course, self-sufficiency cannot be considered any more.

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In reality, the concept of self-sufficiency can be considered in the sense of preservation a certain limit acreage of land, by means of which aiming at a threshold of foodstuffs security can be secured. This has been understood in developed countries to be a fuse for the case of an extensive failure of supply, due to some unexpected emergencies (Kraus, 2007). The self-sufficiency problem analysis and the comparison of it between separate countries are becoming complicated due to the wide scale of production conditions, varying structures of foodstuffs produced, varying consumer traditions and varying total agricultural production levels, too (Jurášek, 2012). Currently, food security is being secured by means of free markets, but the foodstuffs self-sufficiency in agricultural production is significantly influenced by the EU Common Agricultural Policy and it is oriented more at the crops for exports and energy crops.

2 Materials and Methods

2.1 Data sources

Statistical analysis here is mostly based on the resources of Czech Statistical Office and the CR Ministry of Agriculture. Data employed have been obtained based on the new ESA 2010 method. Other data sources for the analysis have come from the National Accounts and other official statistics of agriculture. The long-term time series have not been limited explicitly. Selected methods of time series analysis have been applied in the analysis of development of the Czech agriculture natural indicators.

2.2. Analytical smoothing of time series

Real economic criteria should form the basis of decision making based on the appropriate trend function type. Finding the appropriate trend function type is then mostly dependent on the analysis of empirical data. The paper offers a criterion based on the comparison of sums of squares of deviations of the empirical time series values from the smoothed ones:

Mean Absolute Percent Error (MAPE)

$$\text{MAPE} = \frac{100}{n} \sum_{t=1}^n \frac{|y_t - y'_t|}{y_t}, \quad (1)$$

where y_t, \dots empirical time series values,

$y'_t \dots$ smoothed time series values.

The model with the lowest MAPE criterion values is generally preferred. It is important to realize, anyway, that none of such criteria is of a universal nature, rather these offer a partial information on the quality of the model studied (Hindls, Hronová and Novák, 2000).

Besides trend functions, the adaptive models, too, have been applied in the trend description. Models of this type quickly react on the structural changes occurring in time, they are very suitable for prognosticating future course of the time series loaded by irregularities and breaks in the trend. For significance testing of the models and their parameters, the $\alpha = 0.05$ significance level has been chosen. Statistical computations have been performed using the STATISTICA software, version 12.

2.3 Self-sufficiency balance

Self-sufficiency balance is understood as reaching zero level of the balance of trade payments. It is expressed as value equality in money terms:

$$Q + D = P + V, \quad (2)$$

where: Q – value of production output volume, D - value of imports volume, P - value of consumption volume and V – value of exports volume (Jeníček, 1984).

In order to establish the balance level of the agrifood products foreign exchange it holds that, the degree of self-sufficiency balance is given as the relation of the domestic production volume value to the domestic consumption volume value:

$$S = (Q / P) \cdot 100 \quad (3)$$

3 Results and Discussion

The presumption for self-sufficiency balance analysis in selected agricultural commodities typical for traditional farm production and consumption in CR has been an analysis and statistical description of development trends in the agricultural primary production natural results.

Since CR accession to the EU a significant change of Czech agriculture has arrived. While the areas where wheat, maize and oilseed rape have been cultivated, increased until 2015 significantly, the areas of potatoes, vegetables grown,

or the numbers of pigs and poultry bred, sank strongly (Table 1). This has been connected namely with profitability of the commodities given, which is based on the agriproducers' prices, the cost competitiveness of Czech producers, but with the competitors' strength from the neighbouring EU countries, too.

Table 1 Principal changes in the production areas and livestock numbers after CR accession to the EU

Commodity	units	(Average 2001 - 2003)	Year 2015	Change (%)
Wheat	th. ha	808.1	829.8	+2.7
Barley	th. ha	512	365.9	-28.5
Maize	th. ha	67.6	93.6	+38.5
Potatoes	th. ha	42.8	22.7	-47.0
Oilseed rape	th. ha	302.7	366.2	+21.0
Sugar beet	th. ha	77.6	57.6	-25.8
Vegetables	th. ha	20.4	9.2	-54.9
Fruit orchard	th. ha	17.9	15.6	-12.6
Pigs	th. pcs	3465.8	1559.6	-55.0
Cattle	th. pcs	1525.3	1407.1	-7.7
Poultry	mill. pcs	29.6	22.5	-24.0

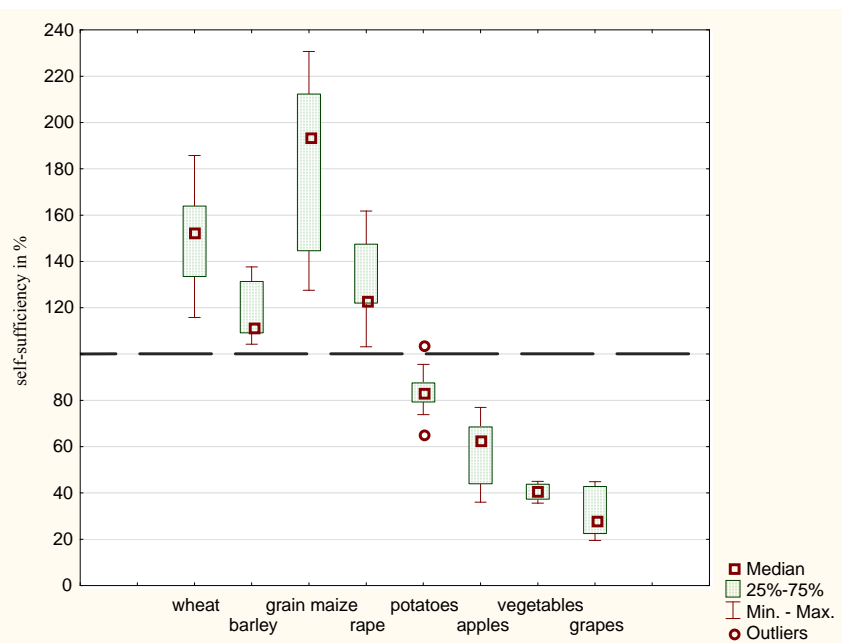
Source: CZSO, CR Ministry of Agriculture

3.1 Self-sufficiency balance in selected crop commodities production in CR

Czech Republic reports a negative balance in foodstuffs foreign trade in long-term look. A neuralgic point in the CR foodstuffs foreign trade first of all is its wrong structure seen from the VAT viewpoint. The largest share of foodstuffs exports accounts on the Cereals item, forming in the long-term look about one fifth of all the exports of foodstuffs. At the lowest was this share of exports in 2006 with 17.5%, at the highest then in 2012 with 23.5%. The volume of cereals exports has depended on harvest quality in the year and on price conditions on the world commodity markets. On the opposite, vegetables and fruits dominate in the imports.

In spite of good soil and climate conditions in the part of CR, almost 30% of potatoes consumed over the last years have been imported from abroad. Potato growers have continued reducing the planted areas due to low profitability and meeting the domestic demand to an increasingly lesser extent.

Figure 1 Self-sufficiency in the production of selected crop commodities in CR (2005 – 2015)



Source: own calculation

Imports of apples have shown a permanently increasing tendency over the last 10 years and the current volume of imports has doubled as compared with the imports volume before CR accession to the EU, it now represents 49% of total consumption. Similar it is, e.g., in plums where the imports cover full half of the consumption. Significantly worse is the situation in peaches, the Czech fruit growers have ceased to grow these. As it concerns the peaches and nectarines category, the share of imports on Czech consumption makes it 96%! In strawberries the share of imports is 75%. Con-versely, from CR mainly apples for ciders and other industrial processing go abroad.

In fresh vegetables, which the Czechs have learned to eat all the year round, even in winter time, when these cannot grow here, self-sufficiency fell to less than 40%. Also 70 to 80 percent of grapes come from imports (Figure 1). The consumers' growing demand for wine cannot be satisfied from Czech and Moravian vineyard areas.

3.2 Self-sufficiency balance in selected livestock commodities production

Following the long dated reduction of cattle and pig numbers the production of these animals fell. While in 1989 there were 525 th. tons of cattle live weight and 763 th. tons of pig live weight produced in this country, in 2014 the total weight of animals slaughtered reached 170 th. tons only (decline to 32.35%) in cattle, or 305 th. tons (decline to 39.97%) in pigs. The total numbers of poultry between the record year 1984 and 2015 fell by 34.2%. Numbers of hens only dropped by more than three fifths during this period.

During the period after CR accession to EU there has been a sharp increase of both imports and exports of pork. Foreign trade with pork shows a negative balance. Mainly due to unfavourable ratio between pork imports and exports, a gradual decrease of self-sufficiency can be registered despite the rising volume of foreign trade. The CR exports consist mainly of live pigs, being taken from the EU perspective to be feedstock only, raw material, i.e., goods with low added value. In case of goods with higher added value (sausages, salamis) the foreign trade balance is positive since 2007. Since 2006 the pork imports from Germany have increased, currently forming almost a half of all pork imported. A significant part of pork imports is coming from Poland, too. Pork consumption in CR is the highest one, compared with other meats, (52% of total meat consumption) and recently it fluctuates about 40 kg/person/year.

Before CR accession to EU the exports of beef prevailed over imports. Since 2004 the trend of foreign trade has turned opposite. Even in spite of the negative beef foreign trade balance, the live cattle trade has reported a positive balance. While previously mostly animals destined for slaughter were exported, in 2004 the structure of exports changed. Currently the cattle exports mostly consist of animals intended for further breeding. Austria can be taken the principal trade partner now, for live cattle exports.

The highest beef consumption in CR was registered in 1989 and 1990, at that time it gathered about 30 kg/person/year. Since then the consumption has declined, recently it has been fluctuating about some 8 kg/person/year. Over the last five years self-sufficiency in beef in CR has been moving between 114 – 132%, while as it concerns pork and poultry meat, there has been a long-term downward trend of self-sufficiency felt.

Poultry farming industry is characterized by substantial differences against other livestock sectors. Compared with other branches poultry is not tied to farmland. It is characterized by very fast growth and a short reproduction process. Regarding the fact that, poultry reproduction process is not limited by natality such as in the mammals, poultry farming is characterized by easy control and flexibility. Development of poultry meat foreign trade was affected by the CR accession to EU at most. Average poultry numbers declined, production stagnated, poultry meat consumption increased, production costs got reduced and prices by agricultural producers declined. A significant growth of turnover followed. Over the 2004 – 2009 years 90 th. tons of poultry in live weight were imported annually, at an average. Compared with the years 2001 – 2003, when average annual imports were at 31.3 th. tons live weight, it is an increase in imports at 189.4%. Over the 2001 – 2003 period 19.7 th. tons live weight were exported annually at an average, over 2004 – 2009 years there were 64.9 th. tons live weight. The increase in poultry meat exports made it 229.4%. Anyway, the foreign trade balance remained passive.

Total poultry numbers decreased by 34.2% between the record year 1984 and 2015 year. Numbers of hens only decreased by more than three fifths during this period. Poultry production kept increasing until 2008. While in 2008 there were 329 th. tons of poultry live weight produced in CR, in 2014 247 th. tons only were supplied to further processing. In just 6 years poultry production fell by a quarter. In 2015 a slight increase of production followed (+2.02%). Production of eggs declined since 1985 following the decline of hen numbers. In 1984 egg laying reached the historically highest level of 3.70 billion eggs, however, until 2015 it fell down to 2.17 bill. (decrease by 41.4%). In 2005 the highest consumption of poultry meat in CR so far was registered, at 26.1 kg/person/year. In the years following consumption kept decreasing slowly, currently it has been fluctuating about 25 kg/person/year.

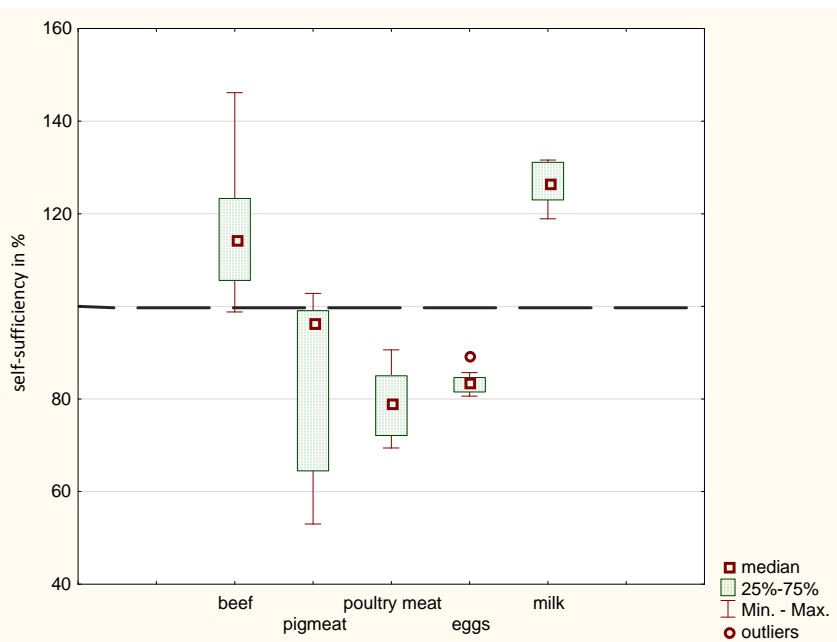
The decline of milk production in the Nineties connected tightly to rapidly reduced numbers of cows and low milk yield. If in 1989 in CR still 4.89 billion litres of milk were produced, in 1997 the domestic milk production reached 2.70 billion litres only. The following years have reported stagnation of production, but the 2011 – 2015 period shows a slight recovery due to higher farmer prices. In 2015 most milk was produced in CR over the last 19 years (2.95 bill. litres). Milk and dairy products represent the strongest commodity as seen from CR agrarian exports viewpoint. Share of milk and milk products exports on the total CR agrarian exports abroad is about 11%. The degree of total self-

sufficiency in milk has reached 125% recently. The mightiest contributors to imports into CR are dairy products such as cheese, cottage cheese, curd and butter. About half of exports volume is made of raw cow's milk. This situation is not favourable for Czech Republic, since a large part of the raw milk exported arrives back to CR in the shape of dairy products with higher value added. The largest imports of milk and dairy products into CR come mostly from Germany, Poland and Slovakia and they occupy 81.8% of total imports.

Consumption of fresh dairy products has been reported in CR since 2011. Change of the data according to EuroStat methodology occurred due to the need of comparison possibility of consumption data in CR and in EU. European Union and now the Czech Republic, too, report consumption of fresh dairy products without cheese, curds and canned milk, converted into the volume of milk needed for production of these. Further on, consumption of cheese is reported, inclusive of curds, and butter consumption.

Compared with other EU Countries the consumption of fresh milk products in CR is at an average level. Compared with Nordic countries, reaching the levels of 140 – 186 kg/person/year consumption of fresh milk products, the domestic consumption is low. In CR, consumption of fresh milk and dairy products has been fluctuating about 90 kg/person/year over the recent years. Consumption of cheese, inclusive of curds, ranks CR close to EU average. Its value has been fluctuating recently about 17 kg/person/year. Butter consumption in CR has been standing above the EU average with 5.2 kg/person/year.

Figure 2 Self-sufficiency in selected livestock commodities production in CR (2005 – 2015)



Source: own calculation

As to the main livestock commodities, CR was self-sufficient in milk and beef only, over the 2001 – 2003 period. At the average of 2004 – 2009 years, the level of self-sufficiency in these commodities, as compared with the pre-accession period of 2001 – 2003, deteriorated in milk by 8.4 p.p., in beef an improvement (slight) occurred, by 0.5 p.p. While purchase of milk slightly decreased at the average of 2004 – 2009 years compared with the preaccession period following the introduction of quota system, the domestic consumption increased. However, level of self-sufficiency has always remained at a high level (almost 130%). Beef is the only kind of meat where this measure's value stands rather high above 100%. The strongest self-sufficiency level decline has been registered in pork, over the 2004 – 2015 period the average inter-year decline made it 5.3%. Also in poultry meat, in spite of production increase, the parallel consumption increase caused a decline of self-sufficiency. The share of poultry meat imports on domestic consumption rose from 9.6% (2001 – 03 average) to 26.8% (2004 – 09 average) and now it is about 28%.

The differences in self-sufficiency of current livestock production follow after the structural changes in primary agricultural production and the changes in diet habits and nutrition recommendations. Compared with the period a quarter century ago, Czechs consume about one third of beef only, but two and a half times more poultry meat. Pork and milk consumption is remaining at about the same level, in long-term look. The consumption of eggs declined significantly, too. The picture above (Figure 2) depicts self-sufficiency in the selected livestock commodities production.

4 Conclusion

Species diversity of crops cultivated in CR has decreased, producers are receding from cultivation of cereals (especially rye and barley), on the other hand the technical crops' areas are increasing. Crop production has become, at a higher degree, orientated at growing profitable crops, especially rape.

The harvest level in CR depends first of all on climate factors during the period of crops vegetation. An important role, too, is played by selection of an appropriate crop variety, good soil preparation and compliance with the agronomic principles for maintaining long-term soil fertility. For the farmers, the chance to market the production at a corresponding profitability is substantial. An important role here is played by the State who can orientate farmers' decision making using subsidy titles. This year (2016) farmers could gain, besides the unified area payment, a support connected to the so-called „greening“ and a support bound to production of sensitive commodities, i.e., potatoes, fruit, vegetables, hops, sugar beet and protein crops. Long-term development time series of livestock numbers and performance have not reported extreme fluctuations recently. In spite of the performance increasing, CR is not self-sufficient in livestock production.

Self-sufficiency currently has become an object of frequent discussions. There are many different views of self-sufficiency. A conflict often arises concerning the approach, whether it is needed to strive for achieving self-sufficiency in basic commodities at any price, or not. The condition of a maximal possible level of food self-sufficiency means that the Czech Republic becomes fully competitive as to prices and quality as compared with other countries.

Czech farmers face hard competition on both the domestic and foreign markets, and in order to reach self-sufficiency it is very important to maintain strong standing and competitiveness. Outcomes of the analyses from above comply with conclusions of studies by Doucha (2008) and Bašek (2010). Level of self-sufficiency, especially in commodities not regulated to a higher extent by agricultural policy measures, can be connected with the achieved level of summary profitability of these, but with the competitiveness force of downstream processing industries, too. The commodity self-sufficiency level significantly rose in crops except rape, and in all the products domestic production has highly exceeded domestic demand. In livestock products, in all the main commodities, except beef, the self-sufficiency level declined. Only in monogasters a more significant excess of domestic demand (consumption) over domestic production and a more significant increase in imports have been reported. A credit for improving the balance belongs, according to CR Ministry of Agriculture, besides others, to growing shopping patriotism of Czechs. On the other hand, self-sufficiency in Czech fruit and vegetables is declining significantly. As Bašek (2010) gives it, the decreasing shares of domestic products processed here, on domestic consumption and exports have signalled a loss of competitive position of some elementary branches of processing industry.

Compared with other EU Countries, Czech Republic moves in the first half of the chart in terms of self-sufficiency in the production of basic agricultural commodities. Fully self-sufficient within EU in the main commodities selected is France and (except wine) Poland, too. A high self-sufficiency level is maintained in Germany, Austria and Belgium. On the other hand, Cyprus is not self-sufficient in any of the commodities considered. A standing worse than CR occupy, e.g., Italy, Great Britain and Sweden. The conclusions from above comply with conclusions by Svatoš (2008) and Horská (2011). The very dynamic development of the world economy together with the processes of globalization, internationalization and liberalization of world economy are significantly changing shapes of separate markets, agricultural markets not being an exception. These changes are not only caused by the growing demand for separate farm and food products but they are affected, too, by changes in the area of culture development and consumption habits, not at regional level only, but at the global level as well. Volume of global agriculture production has grown very significantly over the last several decades. Further reduction of production capacities is undesirable. Structural imbalance with manifestations of negative impacts on the landscape represent a threat to long-term competitiveness of Czech agriculture.

It can be expected that, the current mild growth of economics and the strengthening households' consumption will do good to Czech agriculture over the next years. In addition, also a gradual transition of Czech consumers towards the home production of higher quality could do good to it. The CR Ministry of Agriculture are then going to pay attention to food self-sufficiency as based on their Strategy until 2030, mainly through support of livestock production and vegetables, potatoes and fruit growing.

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