Comparison of self-sufficiency of selected types of meat in the Visegrad countries

Porovnání míry soběstačnosti u vybraných druhů masa u států Visegradu

Josef SLABOCH* and Pavel KOTYZA

Department of Economics, Czech University of Life Sciences Prague, Kamycka 129, 165 21 Prague 6 – Suchdol. *correspondence: jslaboch@pef.czu.cz

Abstract

This article compares the rate of self-sufficiency of selected types of meat (beef, pork, and poultry) in the Visegrad countries. The data are obtained from Eurostat and from national statistical offices of the Czech Republic, Slovakia, Poland and Hungary. The rate of self-sufficiency is evaluated for the time period 2003 - 2013 and its results are compared to trade coverage ratio that indicates competitiveness of country in given commodity. Degree of self-sufficiency is an important indicator of country's ability to meet demand of domestic supply. From the obtained results, it can be concluded, that the situation in the Czech Republic with regard to self-sufficiency significantly deteriorated after EU accession, especially in the area of pork and poultry. The self-sufficiency for pork meat decreased to 57% and to 73% in the case of poultry. The situation is quite stable for beef. However beef creates only a small portion of the Czech consumption. A similar situation can be observed in Slovakia, its degree of self-sufficiency of pork and poultry declined down to 53% and 78% respectively. To cover production of poultry and pork from national resources in both countries, production would need to increase by millions of swine and chicken, which may be complicated with respect to existing infrastructure. The production of beef, poultry and pork is sufficient in Poland, production covers consumption. Self-sufficiency in beef increased above 400% mainly due to decline in beef consumption. Since 2009, self-sufficiency in pork has slightly risen and in 2013 it reached 117%. Consumption and production of poultry is on the rise, poultry become a substitute to beef; processing industry doubled its output between 2003 and 2013. Also Hungary, similarly to Poland, is able to cover domestic consumption by domestic production. The self-sufficiency in the case of poultry meat reach 170%, which is positively reflected in the trade balance. Between 2003 and 2013, the rate of self-sufficiency in pork meat fluctuates between 105 and 120%. The trade balance in beef is balanced and correlated with the degree of self-sufficiency moving slightly above 100%.

Keywords: beef, degree of self-sufficiency, meat consumption, meat production, pork, poultry, trade coverage, Visegrad countries

Abstrakt

Článek porovnává míru soběstačnosti u vybraných druhů masa (hovězí, vepřové, drůbeží) u států Visegradu. Data jsou získány z Eurostatu a z národních statistických úřadů České republiky, Slovenska, Polska a Maďarska. Míra soběstačnosti je hodnocena za období 2003 – 2013, výsledy jsou porovnány s ukazatelem krytí dovozu vývozem, který naznačuje konkurenceschopnost státu v dané komoditě. Míra soběstačnosti je pro každou zemi důležitým ukazatel z hlediska možností uspokojení poptávky domácí nabídkou. Z výsledků je patrné, že v České republice se situace ohledně míry soběstačnosti po vstupu do EU značně zhoršila hlavně v oblasti vepřového a drůbežího masa. U vepřového masa klesla míra soběstačnosti až na 57% a na 73% v případě drůbežího masa. Poměrně stabilní je situace u hovězího masa. Nicméně hovězí se podílí pouze malým podílem na celkové spotřebě. Obdobná situace je také sledována na Slovensku, kde se míra soběstačnosti snížila u vepřového a drůbežího masa na 53%, respektive na 78%. Pro pokrytí domácí spotřeby z národní produkce by bylo potřeba navýšení počtu chovaných prasat a kuřat o miliony kusů, což ale může být limitováno existující infrastrukturou. V Polsku je produkce hovězího, vepřového a kuřecího dostačující, produkce pokrývá spotřebu. Soběstačnost u hovězího masa překročila 400% hlavně z důvodu razantního poklesu spotřeby hovězího masa. U vepřového masa je patrný od roku 2009 růst míry soběstačnosti, v roce 2013 dosáhla soběstačnost 117%. Spotřeba drůbežího masa je v poslední době v Polsku na vzestupu, drůbeží se stalo substituentem hovězího, zpracovatelský průmysl zdvojnásobil výrobu mezi lety 2003 a 2013. Taktéž Maďarsko, podobně jako Polsko, je schopné pokrýt u všech analyzovaných druhů maso domácí spotřebu domácí produkcí. U drůbežího masa dosáhla v roce 2013 míra soběstačnost 170%, což se pozitivně projevuje v obchodní bilanci s touto komoditou. Mezi lety 2003 a 2013, míra soběstačnosti u vepřového masa osciluje v rozmezí 105 a 120%. Obchodní bilance u hovězího masa je velmi vyrovnaná, což koreluje i s mírou soběstačnosti pohybující se lehce nad hranicí 100%.

Klíčová slova: drůbeží, hovězí, krytí dovozu vývozem, míra soběstačnosti, produkce masa, spotřeba masa, státy Visegrádu, vepřové

Introduction

Food self-sufficiency must be understood as the ability to cover all domestic consumption by domestic production. Therefore there exists efforts to avoid imports from other countries (Minot and Pelijor, 2010). Policy makers put special effort to support local production, as national food self-sufficiency belongs to the strategic components of national security. Under socialism, food self-sufficiency belonged among the main priorities in Czechoslovakia, no matter economic or environmental costs (Orsilo, 2008). A similar strategy (policy) has been applied in other socialist states - Bulgaria, Hungary, East Germany or Romania. Between 1970 and 1976 it is possible to track the gradual increase in the rate of self-sufficiency for meat and meat products in those countries (Tiraspolsky, 1980). According to Stachowiak (1999), self-sufficiency belongs among the internal factors of the state security and therefore

it should be given sufficient attention. Stachowiak (1999) also defines 5 main factors that have a crucial impact on the self-sufficiency rate of a given country. The factors are economic, political, social, natural and environmental.

According to Barker (1976), rate of self-sufficiency is to a large extent dependent on governmental policies that can directly affect behaviour of the market. Achieving food self-sufficiency through policy actions usually brings significant budgetary costs that may be a limiting factor for the further development of the country (Nasko, 1989). Some governments apply the policy of encouraging the consumption of locally produced foodstuffs in order to promote the local economy and thereby contribute to the sustainability of agriculture and access to food for the general population (Morrison et al., 2012).

Currently Visegrad countries are part of the European Union, therefore they are required to comply with the rules of the Common Agricultural Policy, which among other things aims to maintain food self-sufficiency of the EU as a whole.

There are long-term theoretical discussions, whether food self-sufficiency strategy is useful for achieving food security. From this perspective, it is interesting to compare different countries and their potential of agriculture. Kazuo (2008) states, how many persons may be fed from one hectare of agricultural land and he finds significand differences among countries. For example, Australia can feed 0.1 person from 1 hectare; USA – 0.8; France – 2.9; Germany – 4.5; Japan – 10.5. The diversity in agricultural potential is given by amount of subsidies that are distributed among farmers. In Europe, farm income is generated by 50% from subsidies, while in Japan subsidies generate only 20% of farm income. Price support and area payment are one of the main components of the Common Agricultural Policy of the EU. Its introduction resulted in significant reduction of imports of many agricultural products (Demekas et al., 1988).

According to Warr (2011), protectionist policy including tariffs, quantitative restrictions or intervention support increases food sovereignty, but at the expense of food security for the poorest residents as their food expenditures are an important item of family budgets. For this reason, it is preferential to increase food sovereignty of the state by increasing agricultural production, which is limited by efficiency of production. Therefore it is necessary to ensure permanent food production, thus ensure greater self-sufficiency and reduce number of people suffering from insufficient amount of basic food (Azani et al., 2011).

According to the Food and Agricultural Organisation (FAO, 2006), 850 million people suffer from the lack of basic food, despite the fact, that there is enough potential to feed world's population from global agricultural production. Redistribution of food among various continents belongs among the main problems of today's society (Grofova and Srnec, 2012). The worst situation can be observed in Sub-Saharian Africa, South Asia and other developing countreis, where 30% of populaiton does not have enought food. To compare, in Europe only 3% of population does not have sufficient access to food. Agricultural land covers 4,973 million ha (approximately 32% of the Earth surface in 2008); it represents about 0.65 ha of agricultural land per one person (Lyuri, 2008).

The growth of food demand is not only caused by growth of population but also by increasing income. Both factors play important role and will determine future food demand (Dyson, 1999; Kydd et al., 1997; Rask, 1991).

The discussions about the future needs of food concludes, that among other factors (poverty, land availability, price of food), population growth will be the most important factor affecting the global increase in food production. Evans (2009) in his study concludes that climate change, water shortages and non-food land utilisation will largely prevent growth of food supply on the world markets. According to Evans (2009) increase in supply would not be sufficient response to upcoming challenges; he calls for creation of a sustainable and fair production and distribution system of food in the world.

International Food Policy Research Institute Study (von Braun, 2007) stresses that food supply problems will be mainly determined by increase of income in low-income countries (China, India, etc.). Pingali (2006) analysed significant changes in Asian diet; Asian nutrition decisions are converging to decisions taken by consumers in Western developed countries (impact of globalisation). Aforementioned authors expect increasing consumption of general food, but Kearney (2010) expects especially increase in consumption of meat, as per capita consumption in emerging economies was one third of per capita meat consumption in developed countries of the rich North (Delgado, 2003). Increasing demands of the population will not have impact only consumption and production, but at the same time it will result in increase in the international trade in meat. Accessing meat consumption may also result in limited availability on the world markets, especially in the periods of geopolitical or natural disaster crises. For this reason, question of national food self-sufficiency becomes up-to-date topic.

This article aims at self-sufficiency development analyses of Visegrad countries after EU accession in mostly consumed types of meat. According to Svatos et al. (2013), agricultural production in Visegrad countries was significantly affected during the period 1993 – 2010. Meat production was reduced in Czech Republic (Belova et al., 2012; Gebeltova, 2012) and the Czech Republic is not self-sufficient in aggregated meat production (Svobodova, 2014). Also in Hungary and Slovakia meat production declined, while increased in Poland (Bielik et al., 2014). As Kotyza and Slaboch (2014) observed, EU accession influenced self-sufficiency of a country in selected field crops. Therefore it is expected that significant changes may also occur in the meat market.

Materials and methods

Aim of this article is to analyse rate of self-sufficiency development in beef, pork and poultry meat in the Czech Republic, Hungary, Poland and Slovakia (so called Visegrad countries). The rate of self-sufficiency is analysed between 2003 and 2013, based on the data from national statistical offices (CZE - CSU; HUN - KSH; PL - GUS; SVK - SU SK).

According to Staatz (1991) there are several options of explanations of national self-sufficiency calculations in a certain commodity. Calculations could be based on the following possibilities: (1) complete specification of commodity (cultivar, class,

place of cultivation, manner of cultivation, use of fertilisers etc.). It is the most accurate method; (2) use of only a specified commodity with respect to species (e.g. rice); (3) use of a wide category of goods (e.g. cereals) containing several commodities mutually complementing one another (as a possible substitute). Here the self-sufficiency policy strives to achieve equation between domestic supply and efficient demand for a wide class of goods while allowing export or import of particular commodities in the given group.

In this article has been applied approach no. 2 - use of specified commodity. Only selected meat categories, that are consumed the most, are selected. Other kinds of meat are only supplementary to main meat types - beef, poultry and pork. Among self-sufficiency, there are other indicators taken into consideration - intensity of production (heads of livestock per capita), slaughter production per capita and foreign trade coverage with life animals, meat and meat products, indicated both in value (EUR) and volume (kg). The calculation of the indicators is carried out according to the following formulas:

Formula 1. Rate of self-sufficiency = (domestic production / consumption) × 100 (%) (Lohoar, 1981)

Formula 2. The intensity of production = number of animals (pieces) / population of the country ($pcs*head^{-1}$)

Formula 3. Per capita meat production = carcases production (kg) / population of the country ($kg*head^{-1}$)

Formula 4. Trade coverage = (export / import) * 100 (%) (OECD, 2005).

The structure of the article matches the structure of the used formulas. The results are divided into 3 main parts, while each part is dedicated to one type of meat. In each part self-sufficiency, intensity of production, meat production per capita from slaughterhouses (processed) and trade coverage (TC) are calculated based on values and volumes. Domestic production and slaughter production was defined in the weight of carcases.

Cattle carcases are defined as the whole body of a slaughtered animal after bleeding, evisceration and skinning, without head, legs, abdominal and genital organs, without the udder and tallow.

Carcases of pigs are body of slaughtered pig, bled and eviscerated, without tongue, bristles, hooves, genital organs, flare fat, kidneys and diaphragm.

Poultry carcases are defined as a body that is plucked and gutted, without head, feet, necks, hearts, liver and stomach.

Different indicators are calculated based on the values of domestic production and consumption (based on national commodity balances, weight in carcases), exports and imports are based on values provided by statistical offices (weight of traded items), number of animals and number of inhabitants are published by the Eurostat.

The trade coverage (TC) indicator was calculated from foreign trade statistics, defined by foreign trade nomenclature that is expressed in euros and kilograms. Analysed period range from 2003 to 2013, data are gathered based on HS 4 system. Trade in beef covers HS 0102 (life bovine animals), 0201 (meat of bovine animals,

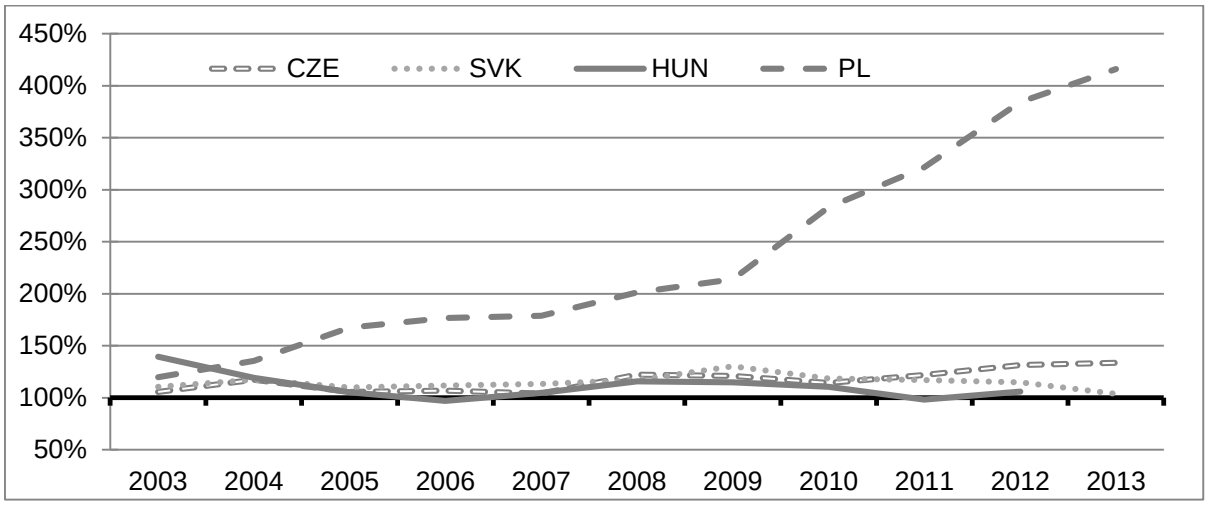
fresh or chilled) and 0202 (meat of bovine animals, frozen), trade in pork covers HS 0103 (live swine), 0203 (meat of swine, fresh, chilled or frozen) and 0209 (pig fat, free of lean meat). Poultry meat covers categories HS 0105 (live poultry) and 0207(meat and edible offal, of the poultry).

Trend functions were determined using Statistica software. Time period was defined as independent variable (x), determined by values in analysed years. For individual functions was calculated also coefficient of determination (R^2) and p-value. Calculations were performed in StatSoft's Statistica and Microsoft's MS Excel.

Results and discussion

Beef meat

The Figure 1 presents that all countries are able to cover domestic consumption by domestic production as rate of self-sufficiency reach 100% and more. The Czech Republic, Hungary and Slovakia represents balanced results in terms of the analysed self-sufficiency (rate of self-sufficiency ranges from 106 to 130%), i. e. only small portion of the commodity needs to be exported/imported. Fluctuations are caused by changes in consumption and production in individual years. In 2013, consumption of beef was 7.5 kg per capita (p. c.) in the Czech Republic, 4.4 kg p. c. in Slovakia and only 2.4 kg p. c. in Hungary (2012). The situation in Poland is vastly different. The rate of self-sufficiency was growing rapidly, in 2013 it reached 416%. Main growth of self-sufficiency occurred after 2009 and was mainly driven by fall in domestic consumption (-70%), grounded by significant decline in meat consumption per capita. It felt from 7 kg to only 1.6 kg per capita between 2003 and 2013.



Source: authors based on data from statistical authorities

Note: for Hungary data of 2013 were not available

Poznámka: pro Maďarsko nebyly dostupné údaje za rok 2013

Figure 1. Rate of self-sufficiency of beef meat (%, 2003-2013)

Graf 1. Míra soběstačnosti hovězího masa (%, 2009-0213)

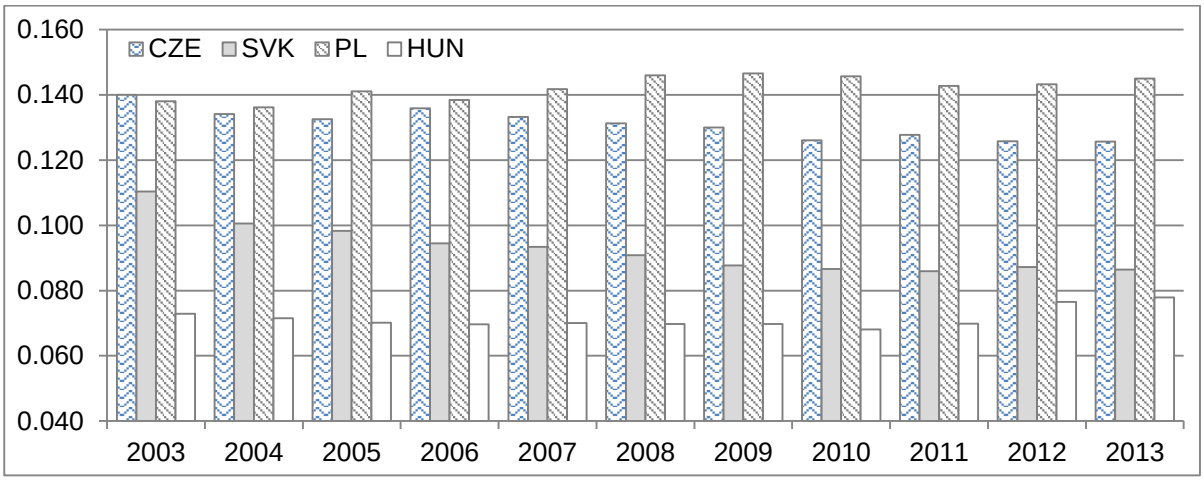
Fall in consumption was analysed by several Polish authors (Konarska et al., 2014; Kosicka-Gebska et al., 2010; Mroczek, 2009). They all defines 2 main reasons staying behind beef meat consumption decline. The first one is connected to Poland's accession to the EU. Borders were opened and export of Polish beef increased rapidly. Export practices resulted in increased price on the domestic market. In 2004, the price has increased by almost 27%. The second reason is connected to quality of meat sold. Despite its high price, it is difficult for consumers to buy beef of constant quality as quality of beef meat is hardly recognisable at purchase. Thus, mainly the price and quality of beef meat have forced consumers to substitute beef for pork and mainly for dietetic poultry. Table 1 presents basic trend characteristics.

Table 1. Basic trend characteristics of self-sufficiency for beef meet

Tabulka 1. Základní trendové charakteristiky soběstačnosti hovězího masa

	Trend characteristics	R^2	P-value
CZE	$Y = 1.1-0.01346x+0.00321x^2$	0.7252	<0.00570
SVK	$Y = 1.192-0.078x+0.0216x^2-0.0014x^3$	0.6391	<0.05568
HUN	$Y = 1.707-0.3884x+0.0703x^2-0.00386x^3$	0.7866	<0.01961
PL	$Y = 1.339-0.04064x+0.02754x^2$	0.9808	<0.00000

Source: authors (program Statistica)



Source: The authors based on data from EUROSTAT

Figure 2. Number of cattle animals per capita (average pieces)

Graf 2. Množství skotu na osobu (kusů průměrně)

The Figure 2 indicates how many heads of cattle is allotted to 1 inhabitant. The results show a relatively balanced situation in the Czech Republic and Poland. In both countries approximately 0.12 - 0.14 heads of cattle are bred per capita, no major changes are observed during the last decade. But there exists difference in expected trends. While in the case of the Czech Republic, beef breeding has slight downward tendencies, tendencies in Poland has been slightly ascending since 2006.

In Slovakia beef breeding was also relatively stable after 2008, as number of heads per capita ranges from 0.087 to 0.091. The lowest and least stable breeding intensity can be observed in Hungary, it ranges from 0.068 in 2010 up to 0.079 in 2000. Despite Hungarian volatility, slightly ascending tendency has been observed since 2010.

Table 2. Slaughtering of beef per capita and year (carcass weight, kg)

Tabulka 2. Porážka hovězího na osobu a rok (JUT, kg)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	10.74	9.48	7.95	7.80	7.74	7.74	7.39	7.10	6.88	6.25	6.16
SVK	5.31	4.76	4.91	3.98	4.28	3.69	2.93	2.52	2.09	1.81	1.76
HUN	3.90	3.74	3.21	3.33	3.43	3.22	2.97	2.79	2.60	2.49	2.28
PL	8.40	7.81	8.02	9.31	9.57	10.01	10.10	10.11	9.86	9.63	8.80

Source: authors based on data from statistical authorities

Note: calculations according to the Formula 3

Poznámka: výpočet byl proveden podle vzorce 3

Looking more closely at the values in Table 2, it is evident that CZ, HU and SK experienced a significant decrease in the amount of the slaughtered beef meat in kilograms per capita per year. Value of slaughter production decreased in Hungary from 3.9 to 2.28 kg (- 41%) per capita and year, while total beef production (gained from beef meat balance) decreased only by 32%. In the Czech Republic, value of slaughter production fall from 10.5 kg to 6.16 kg (-41%) even though the overall beef production decreased only by 14%. Slovakia experienced far more critical situation. Amount of slaughtered meat felt from 5.8 to 1.76 kg per capita and year (- 69%) between 2003 and 2013, even though total production fell only by 26%. Aforementioned facts indicates, that slaughterhouse production was significantly reduced in CZ, HU and SK after the EU accession. Since decline of slaughterhouse production is greater than the decline in total production, it can be assumed, that live animals are slaughtered abroad and export of live animals increased. The situation in Poland is vastly different, production expanded. Between 2003 and 2013, total production increased by 21%, while the production of Polish slaughterhouses increased by less than 5%. Thus it is possible to assume, that also in the case of Poland, foreign slaughtering capacities are used, domestic capacities are possibly not sufficient.

The following tables show results of trade coverage analyses. The Table 3 presents results of foreign trade in beef in monetary terms, while Table 4 presents volume based results calculated from weight traded. Hungary and Poland reached a positive balance of trade (export significantly exceeds import) both in monetary and volume terms. All 4 countries experienced significant changes after EU accession in 2004. In Hungary, imports and exports equalise the reporting period (both in monetary and volume terms). In the case of Poland, exports of beef exceeds imports more than 10 times in volume, while in some years exports exceeded imports more than 20 times in value. The difference originates in quality of meat traded; Poland imports higher

quality meat compared to exports. Differences are observed in price parities of the most frequently traded categories. In 2013, significant price difference was observed at carcases and half-carcases (+0.43 EUR*kg^{-1}); chilled meat (+0.75 EUR*kg^{-1}) or frozen meat (+1.61 EUR*kg^{-1}) with bone in. Those segments accounted for 70% of import volumes. Slovakia evince rapid decline in trade balance, as total amount of bred heads felt by 160 ths. pieces. The trade coverage indicator cut back by 240 percent points with respect to value. While in 2003 exports exceeded imports almost two times, in 2013 export represented only about 24% of imports in volume.

Table 3. Trade coverage of cattle (%, based on EUR values)

Tabulka 3. Krytí dovozu vývozem skotu (%, na základě hodnot v EUR)

TC	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	334.6	211.6	172.1	165.0	133.7	181.3	156.7	149.3	159.9	203.6	190.0
SVK	412.9	1059.1	468.2	318.9	241.2	200.0	325.3	202.9	161.8	171.5	182.6
HUN	552.6	283.5	257.7	230.4	288.3	323.0	311.9	226.7	206.6	176.7	184.1
PL	n/a	1664	1521	2202	1456	1880	2130	1545	1518	1432	1147

Source: authors based on data from statistical authorities

Note: calculations according to the Formula 4

Poznámka: výpočet byl proveden podle vzorce 4

Table 4. Trade coverage of cattle (%, based on weight values)

Tabulka 4. Krytí dovozu vývozem skotu (%, na základě údajů o váze)

TC	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	254	242	113	134	133	204	178	151	169	221	208
SVK	182	122	131	120	120	48	47	29	41	40	24
HUN	272	155	100	79	100	130	120	110	92	104	n/a
PL	1019	1881	1452	1638	603	1119	1140	1140	1278	1576	1695

Source: authors based on data from statistical authorities

Note: calculations according to the Formula 4

Poznámka: výpočet byl proveden podle vzorce 4

Situation of Slovakian beef meat industry could be depicted by following data. Value of export in live animals (HS 0102) exceeds imports 19 times due to slaughterhouse capacities. No other category evince trade surplus. Chilled beef meat with bone in (HS 020120) is most frequently imported commodity in Slovakia. Price of its exports was in 2013 by 0.23 EUR more expensive than price of meat imported. This fact underlines the situation, depicted in TC data, i.e. Slovakia exports lower amount of more expensive processed meat. A similar situation is found in the Czech Republic. The results show that the Czech Republic exports greater quantities of meat than it imports (in kg). In 2012 and 2013, quantities of exports exceeded imports more than 2 times. But since 2008, values of TC in value terms are lower than TC in volume. This suggests that the Czech Republic imports processed expensive beef (fresh or

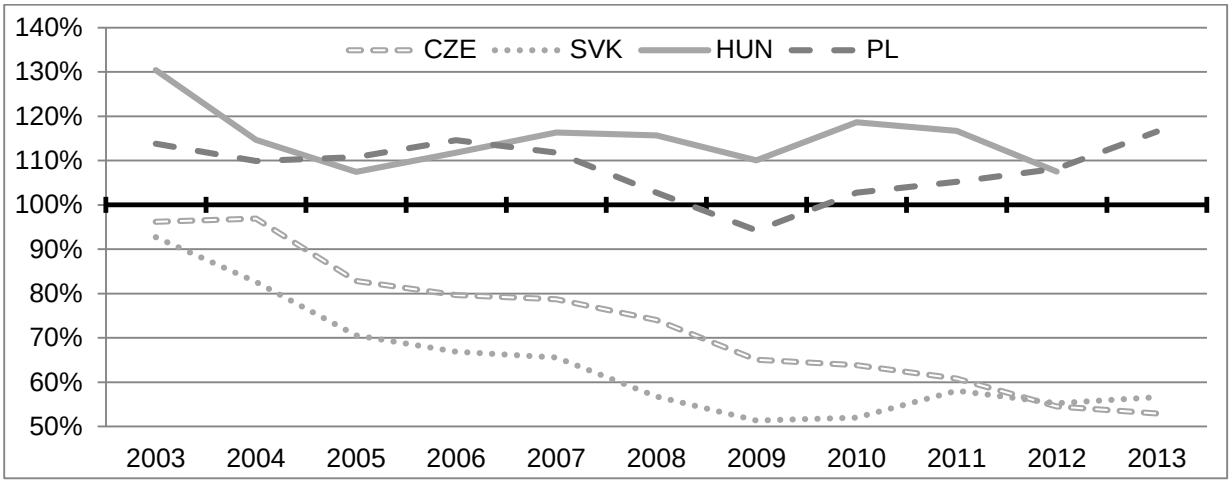
chilled boneless), while exports cheap raw (bone-in quarters, halves) meat or live animals. In addition, live pieces created about 81% and 90% of Czech exports in value and volume respectively.

Future production of beef meat will be driven by effects of globalisation and liberalisation. European beef producers can exploit growth in demand in developing countries. On contrary, under current EU trade negotiation, EU producers will need to tackle with non-EU producers that will gain access to the European market (Smeets Kristkova and García Alvaréz Coque, 2015). Therefore competitiveness of Visegrad beef producers will determine, whether country remains self-sufficient or whether it will become a net importer.

Pork meat

Pork meat consumption differs in the analysed countries. In 2013, per capita consumption was 40.3 kg in the Czech Republic, 30.9 kg in Slovakia, 35.5 kg in Poland and 24.5 kg in Hungary (2012). Degree of self-sufficiency for pig meat evince significantly differences in countries (see Figure 3). Poland and Hungary were able to cover domestic consumption by domestic production. In Poland, rate of self-sufficiency exceptionally felt below 100% in 2009, mainly due to the decrease in production that was caused by unfavourable price conditions in previous years. After EU entry, Hungarian self-sufficiency oscillates between 105 and 120%. Even if the Czech Republic evince the highest per capita consumption, similarly to Slovakia, after EU accession Czech and Slovak sufficiency in pork meat felt mainly due to fall in bred animals (- 1.4 million heads in CZ) that was caused by declining producer prices and growth in the prices of all inputs (Maly, 2013) and also due to the low competitiveness of production (Basek, 2010) and processing industry (Basek and Doucha, 2010). In 2013, Czech Republic covered only 53% while Slovakia 56% of consumption from national sources. The significant decrease was caused mainly by decline in production at relatively stable or slightly declining consumption.

In the Czech Republic consumption of pork is gradually reduced and replaced by other kinds of meat, but still holds an unrivalled position in the Czech diet. Total consumption decreased from 599 ths. tons (2003) to 555 ths. tons (2013; -7%). In parallel, production fell from 576 ths. tons (2003) down to 294 ths. tons (2013; -49%). Similar trend is observed in Slovakia. Production decreased from 181 ths. tons to 75 ths. tons (-59%), while consumption fell from 195 ths. tons to 134 ths. tons (-31%). The sharp drop in production is significantly reflected in the number of bred heads, in both cases has decreased significantly. Table 5 presents main trend characteristics. A significant decline in self-sufficiency of Czech Republic and Slovakia, may cause specific problems related nutrition diet. In order to cover domestic consumption by production, production in the Czech Republic and Slovakia would need to be increased by 116.2 ths. tons (approximately 1.5 million heads), and by 59 ths. tons (prox. 650 ths. heads) respectively. But increase of living stocks might be limited by amount of existing production infrastructure.



Source: authors based on data from statistical authorities.

Note: for Hungary data of 2013 were not available

Poznámka: pro Maďarsko nebyly dostupné údaje za rok 2013

Figure 3. Rate of self-sufficiency of pork meat (%)

Graf 3. Míra soběstačnosti vepřového masa (%)

Table 5. Basic trend characteristics of self-sufficiency for pork meat

Tabulka 5. Základní trendové charakteristiky soběstačnosti vepřového masa

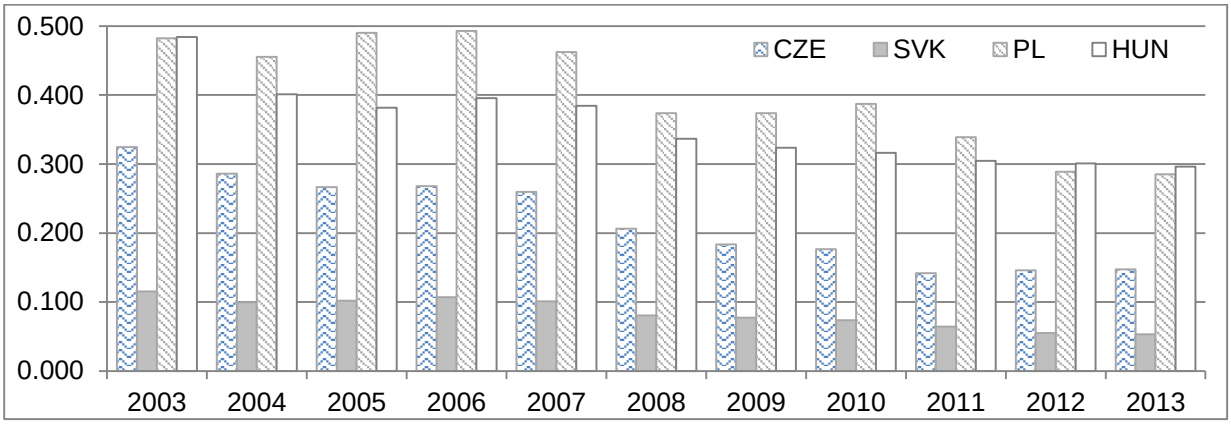
	Trend characteristics	R^2	P-value
CZE	$Y = 1.0354-0.06x+0.001238x^2$	0.9734	<0.00000
SVK	$Y = 1.03-0.1184x+0.007057x^2$	0.9628	<0.00000
HUN	$Y = 1.47-0.232x+0.0448x^2-0.0025x^3$	0.7469	<0.03189
PL	$Y = 1.06+0.0735x-0.0214x^2+0.00143x^3$	0.7059	<0.02818

Source: autors (program Statistica)

The Figure 4 indicates how many pigs are allotted to 1 inhabitant. The results show that all countries experienced fall of production intensity over last decade. In 2012 and 2013 intensity of production in Hungary and Poland was very similar, accounted 0.3 pig heads per capita. Until 2011, production intensity felt in CZ, but since 2011 it has slightly increased from 0.142 up to 0.147. The lowest production intensity is observed in Slovakia, descending trend has not stopped, in 2013 it was bred about 0.055 pig heads per capita.

Competitiveness of the pig production sector (see trade coverage) is projected into slaughter and meat processing. If the production competitiveness is low, most probably problems of slaughter industry could be observed. The development of the slaughter industry is assessed from the perspective of per capita performance (Table 6), that illustrate performance of the slaughterhouse industry in all Visegrad countries. Pork slaughterhouse production per capita decreased in Poland by 20%. This value corresponds to decrease of total production (-17%) that is replaced by imports of live animals. In Hungary, total slaughter production per capita felt from

50 kg down to 33.98 (- 33%), while the total production was determined by the reduction in the number of pigs by 1.9 million heads, which led to reduction of total production by 150 ths. tones (- 28%). In the Czech Republic, per capita slaughter production felt by 51%, It was caused mainly by reduction in total production (- 280 ths. tones; -48%) and also by growth of population (+ 250 ths. inhabitants, +2.3%) The fastest drop in slaughter production experienced Slovakia (- 72%), influenced by decline of pig population and total production, which was reduced from 181 ths. tons (2003) to 75 ths. tons (2013; -58%). Considerable difference between drop in slaughter production and total production indicates, that live animals need to be processed outside the country. Between 2009 and 2013, total weight of the exported live pieces increased in Slovakia (+ 103%), Hungary (+ 71%) and the Czech Republic (+ 37%), while exported weight declined significantly in PL (-63%).



Source: The authors based on data from EUROSTAT

Figure 4. Number of pork heads per capita (average pieces)

Graf 4. Množství prasat na osobu (kusů průměrně)

Table 6. Slaughtering of pork meat per capita and year (carcass weight, kg)

Tabulka 6. Porážka vepřového na osobu za rok (JUT, kg)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	45.53	41.73	37.29	35.07	35.14	32.53	27.29	26.37	25.07	22.82	22.28
HUN	50.32	48.09	44.95	48.54	49.62	45.83	38.75	41.56	38.79	34.83	33.98
PL	54.80	50.37	50.44	54.29	54.84	49.53	42.17	45.63	47.00	43.99	43.71
SVK	34.09	30.70	26.05	22.75	24.91	19.05	13.03	12.73	10.55	10.02	9.68

Source: authors based on data from statistical authorities

Note: calculations according to the Formula 3

Poznámka: výpočet byl proveden podle vzorce 3

For each of the countries, foreign trade in pork products was analysed through trade coverage indicator (Table 7 and 8). Only Hungary experienced positive foreign trade with pork, both in value and volume terms during the reported period. A significant

breakthrough was the entry into the EU, when the indicator decreased sharply (from 528% to 142%, respectively from 390% to 137%). In the case of Poland, the TC indicator was highly volatile over the decade. If, however, the balance of trade is compared in volume and value, it is necessary to express, that volume based TC ratio achieve better results. Based on available data it is possible to state that Poland imports quality and more expensive pork. The largest price difference can be observed in HS 020311 category (meat fresh or chilled - carcases and half-carcases) and HS 0103 category (live swine); i. e. categories that contribute to imports by almost 45%. Declared import price was by 0.26 and 0.64 EUR*kg^{-1} higher compared to exports. With regard to the structure of the foreign trade, it is possible to conclude that Poland imports mainly live pigs and chilled products, both contribute by 93% to imports. On the other hand a significant part of export (40 - 45%) was formed by other frozen products (HS 020929) in 2013. Live animals were exported in fractional amount of about 2% both in volume and value terms. Trade coverage results presents that the Czech Republic is a net importer of pork both in monetary and volume terms. Import of pork distinctly exceeds export over the whole decade.

Table 7. Trade coverage of pork meat (%, based on EUR values)

Tabulka 7. Krytí dovozu vývozem vepřového masa (%, na základě hodnot v EUR)

Trade coverage	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	38.0	38.7	29.8	26.8	28.1	26.9	20.9	22.5	23.6	22.9	24.6
SVK	0.2	15.3	24.2	35.0	44.3	23.2	18.0	39.7	39.5	46.3	50.7
HUN	528.2	142.0	93.9	109.1	131.6	137.0	117.5	128.2	124.7	108.5	122.7
PL	n/a	118.4	95.8	141.0	83.4	49.3	32.7	46.0	50.7	55.1	57.9

Source: authors based on data from statistical authorities

Note: calculations according to the Formula 4

Poznámka: výpočet byl proveden podle vzorce 4

Table 8. Trade coverage of pork meat (%, based on weight values)

Tabulka 8. Krytí dovozu vývozem vepřového masa (%, na základě údajů o váze)

Trade coverage	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	43	85	30	27	29	30	23	25	25	24	22
SVK	2	16	36	33	38	30	21	35	44	49	60
HUN	390	137	116	127	139	135	115	128	123	107	n/a
PL	417	151	145	176	127	87	60	90	91	104	121

Source: authors based on data from statistical authorities

Note: calculations according to the Formula 4

Poznámka: výpočet byl proveden podle vzorce 4

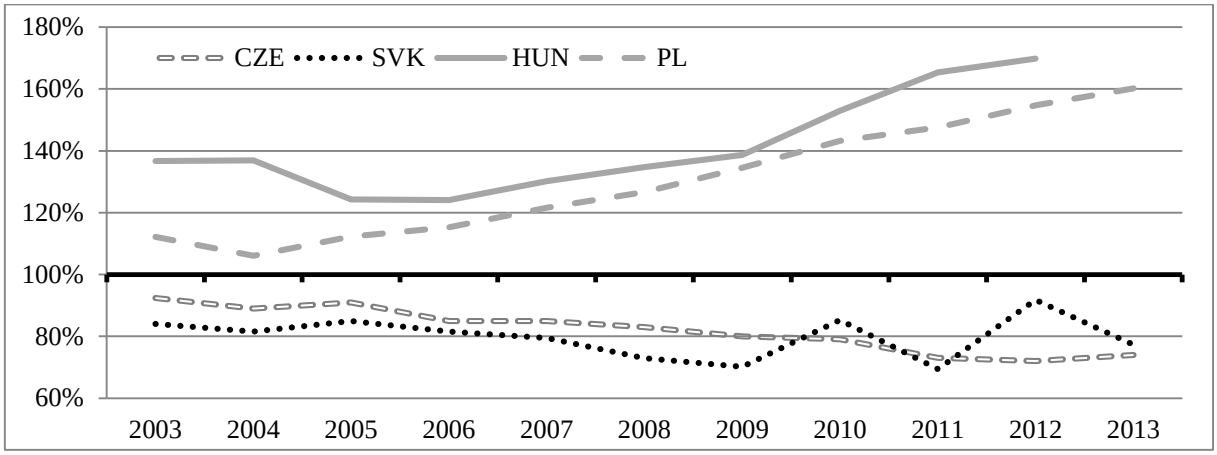
The EU accession opened Czech market for foreign producers and had devastating effect on the number of pigs and pork meat production. While in 2004 the Czech Republic was net exporter of living animals; in 2013, the trade balance was positive

for animals above 50 kg (by 100 ths. heads; HS 01039219) and negative in animals up to 50 kg (by 329 ths. heads; HS 01039110), i. e. mainly piglets. Live animals were the only export category, that evinced higher import to export prices (+0.38 EUR*kg^{-1}), logically. One kilogram of piglet is more expensive than one kilogram of matured pig. With respect to the commodity structure of imports, in 2013 imports of other pork products (HS 020319) greatly dominates, its import price was by 0.32 EUR*kg^{-1} lower than export price. In Slovakia, production of pork also felt significantly. It is also a net importer in value and volume terms. The production of meat decreased between 2003 and 2013 by 70% and therefore the lack of pork was covered by imports. Live animals and chilled meat accounted for about 88% of imports in 2013. Export is dominated by trade in live animals, it accounted about 70% of Slovakian trade value. This corresponds with decrease of slaughterhouse production - animals are not killed and cut into pieces in Slovakia but abroad and return in processed form as chilled semi-finished products (HS 020311, 020312, 020319) for lower price than Slovakian industry can offer. Trade with frozen pork products is marginal. It creates only about 10% of imports and 1% of exports.

Poultry

Poultry meat consumption differs in Visegrad countries. In 2013, the per capita consumption was 24.3 kg in the Czech Republic, 16.9 kg in Slovakia, 26.1 kg in Poland and 25.4 kg in Hungary (2012). The rate of self-sufficiency for poultry is depicted in the Figure 5. In the Czech Republic, the self-sufficiency rate decreased from 92% to 73% between 2003 and 2013. Domestic production is down by 70 ths. tons; -22%), even though domestic demand remains approximately at the same level; i. e. it fluctuated between 329 and 340 ths. tons. To maintain domestic self-sufficiency in chicken meat, it would be necessary to secure slaughter of additional 46 million broilers. A similar situation can be observed in Slovakia, its self-sufficiency in poultry meat was reduced from 84% to 70% between 2003 and 2009. Between 2003 and 2009, domestic production fell by 18 ths. tons (-15%), while domestic consumption remained relatively constant. After 2009 rate of self-sufficiency is widely volatile and fluctuates between 69 and 92%. The variation is caused by fluctuations in the consumption of poultry, ranging from 82 to 104 ths. tons annually. To secure Slovakian domestic demand by national production, it would require to secure additional slaughter of about 11.5 million broilers.

The situation is vastly different in Poland and Hungary. Self-sufficiency rate in these countries was above 100% throughout the whole monitored period, i. e. national consumption is secured and additionally has growing character over the years. In Hungary, growth of sufficiency is caused by faster decline in domestic consumption than in domestic production. The decline in consumption is rather caused by evolving dietary habits with reduction in meat consumption, rather than substitution of poultry by other kind of meats. Self-sufficiency, therefore grows mainly thanks to declining consumption. Poland was the only country, which experienced increase in production of poultry meat as well as increase of its consumption. National production grew faster. While consumption increased by 38% between 2003 and 2013, mainly as a substitute of beef, production has nearly doubled and surpluses were exported. Table 9 presents basic trend characteristics of poultry self-sufficiency.



Source: authors based on data from statistical authorities.

Note: for Hungary data of 2013 were not available

Poznámka: pro Maďarsko nebyly dostupné údaje za rok 2013

Figure 5. Rate of self-sufficiency of poultry meat (%)

Graf 5. Míra soběstačnosti drůbežího masa (%)

Table 9. Basic trend characteristics of self-sufficiency for poultry meat

Tabulka 9. Základní charakteristiky soběstačnosti drůbežího masa

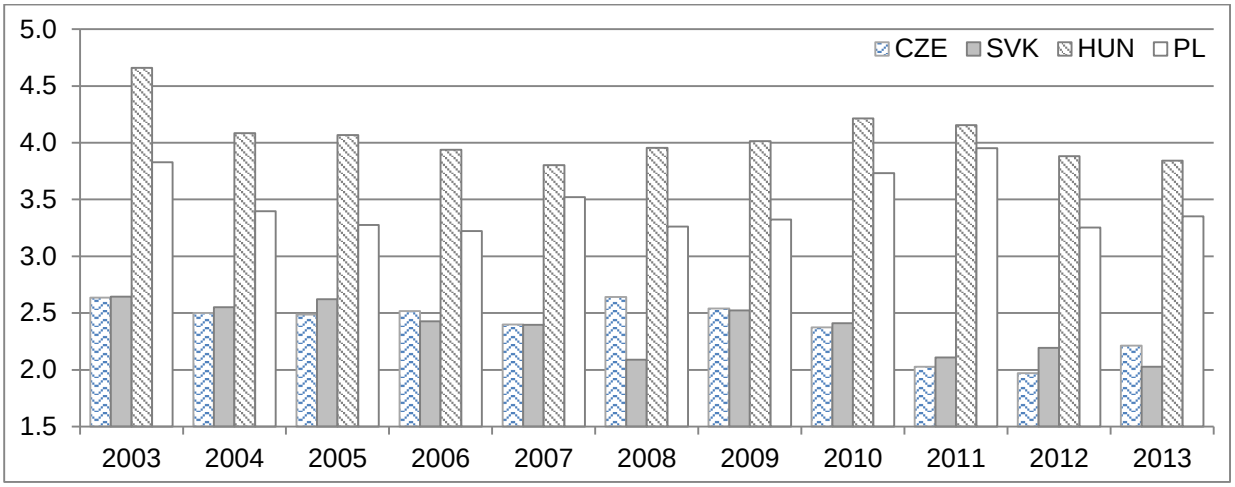
	Trend characteristics	R^2	P-value
CZE	$Y = 0.9469-0.021x-0.000011x^2$	0.9419	<0.00001
SVK	$Y = 0.863-0.0135x-0.0017x^2+0.00024x^3$	0.1656	<0.71694
HUN	$Y = 1.4496-0.0911x+0.0121x^2$	0.9475	<0.00003
PL	$Y = 1.0527+0.0178x+0.0312x^2$	0.9802	<0.00000

Source: autors (program Statistica)

Figure 6 presents intensity of poultry production - number of poultry heads per capita. In 2013, the highest stock density is observed in Hungary (3.8 heads p. c.), followed by Poland (3.4 heads p. c.). Although development over last decade was relatively volatile, stocking density has negative trend and its further reduction in pieces could be expected, while amount of population remains more or less constant. Fast growth of production in Poland (almost doubled) is not reflected in amount of heads per capita. Therefore authors can assume, that weight of average animal increased as well. Situation in the Czech Republic and Slovakia is alike. Both countries experienced decline, in 2013 they both approached 2 heads per capita. But while amount of bred pieces falls, consumption is relatively constant.

Values of slaughter production per capita are presented in Table 10. Hungary has remained relatively stable over the analysed period. Values remained within the 37 - 45 kg. p. c. range, even though total production of poultry meat dropped. But Hungary was the only country that experienced negative change in population

(-300 ths.). This decline, together with growth in imports of live animals, stands behind the stability of slaughter production, which is more or less stable without observed decreasing trend. In 2003, Hungary did not import almost any live heads, but until 2013 it grew up to 17 ths. tons. Slaughter production of poultry meat evince downward sloping trend in the Czech Republic and Slovakia, it felt by 7 kg p. c. and by 4 kg p. c. respectively. Decrease in slaughter production is caused by decline of kept live animals and population growth. In the case of the Czech Republic, total poultry production felt by 70 ths. tons between 2003 and 2013, while number of inhibitors increased by 250 ths. In Slovakia, the situation is very similar, the total production of poultry meat has dropped by about 23 ths. tons and the number of population increased by 36 ths. Reduction of slaughter production leads to an increase of export of live animals from both countries. Between 2003 and 2013 it increased 6 times in the Czech Republic and 25 times in the case of Slovakia.



Source: The authors based on data from EUROSTAT

Figure 6. The number of poultry heads per capita (average pieces)

Graf 6. Množství drůbeže na osobu (kusů průměrně)

Table 10. Slaughtering of poultry meat per capita and year (carcass weight, kg)

Tabulka 10. Porážka drůbeže na osobu za rok (JUT, kg)

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	29.8	30.4	31.5	29.9	28.2	27.3	25.9	25.1	22.6	22.4	22.4
SVK	17.4	15.9	17.6	17.8	15.5	14.0	14.7	16.3	13.4	14.1	13.0
HUN	45.3	44.2	37.1	38.2	37.4	38.6	38.6	37.5	40.3	43.1	x
PL	23.6	25.2	28.1	29.1	31.3	32.6	34.8	38.4	39.7	43.7	46.1

Source: authors based on data from statistical authorities

Note: calculations according to the Formula 3

Poznámka: výpočet byl proveden podle vzorce 3

Opposite trend is observed in Poland. During the decade, slaughter production almost doubled and in 2013 reached 46 kg per capita. Such a rise can be explained by 2 factors - consumption and competitiveness. Beef meat has been substituted mainly by poultry products, therefore per capita consumption of poultry meat increased from 19.7 kg in 2003 to 26.5 kg in 2013 (+34%). But increase in poultry consumption cannot fully explain increase in national production that has nearly doubled (+97%). Therefore second factor - competitiveness - needs to be examined. The trade coverage analyses prove high competitiveness of poultry production and processing industry. This fact can be also supported by increase in volume of imported live animals, it increased from 3.3 ths. to 71.1 ths. tons, the highest increase was observed in imports of matured animals, i. e. animals that are almost ready for slaughter operations.

Table 11 - Trade coverage of poultry (%, based on EUR values)

Tabulka 11. Krytí dovozu vývozem drůbeže (%, na základě hodnoty v EUR)

TC	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	68.5	82.8	67.5	61.4	81.5	79.6	65.2	67.6	62.6	60.6	68.7
SVK	39.2	55.2	79.7	72.0	77.1	61.5	62.1	80.3	73.2	91.4	90.9
HUN	2057.5	1085.8	831.8	741.6	714.8	609.1	667.8	713.9	667.9	668.1	581.6
PL	n/a	278.3	403.7	446.1	503.9	671.1	651.5	750.1	776.6	875.6	786.3

Source: authors based on data from statistical authorities

Note: calculations according to the Formula 4

Poznámka: výpočet byl proveden podle vzorce 4

Table 12 - Trade coverage of poultry (%, based on weight values)

Tabulka 12. Krytí dovozu vývozem drůbeže (%, na základě údajů o váze)

Trade coverage	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
CZE	40	45	49	35	40	35	33	34	28	29	32
SVK	30	47	58	51	51	51	50	86	64	90	76
HUN	752	493	273	298	332	326	364	414	405	475	n/a
PL	543	152	259	316	406	748	848	1300	1362	1274	1517

Source: authors based on data from statistical authorities

Note: calculations according to the formula 4

Poznámka: výpočet byl proveden podle vzorce 4

The trade coverage analyses undoubtedly demonstrates that Hungary and Poland gained competitive advantage over the Czech Republic and Slovakia (see Table 11 and 12), as they reach positive trade balance both in volume and value terms. Both countries are characterised by high export, which considerably exceeded imports. Products flow most commonly into neighbouring countries. Poland exports mainly chilled or frozen cuts and offal of species *Gallus domesticus* (HS 020713, 020714) and turkeys (HS 020726), those categories generated almost 70% of total export

values in EUR (2013). Its competitive advantage is also underlined by offered prices; in majority of groups (HS6), Poland exported for the lowest prices out of all Visegrad countries. Export of processed poultry products from Hungary is diversified into more product groups. Positive trade balance is not only based on trade in products of *Gallus domesticus* species (27% of export value), but includes also products from turkeys (21%), ducks (22%) and geese (17%). Here it needs to be added, that Hungary belongs among the largest producers of foie gras (duck and goose liver). Different situation occurs in the Czech Republic and Slovakia. Import of poultry substitutes local production that is not sufficient. Trade deficit prevails in almost all HS6 categories both in volume and value terms. Export of live animals is the only category that records positive trade balance. In the case of the Czech Republic, live animals created 52% of exported value, species of *Gallus domesticus* prevailed. Interesting situation is observed in exports of ducks, geese and turkeys. Value of exports of live animals from those groups (19 million EUR) was almost 3 time larger than value of exports of processed products thereof (6.9 million EUR). This only indicates, that there exist problem in processing industry of animals other than *Gallus domesticus* species.

Conclusions

Results of this article assessed the level of self-sufficiency in four Visegrad countries, as well as analysed other additional indicators and information available from national statistical authorities and Eurostat - production intensity, slaughter production per capita and trade coverage. The results indicate how different can be situation in neighbouring countries with comparable historical development. The Czech Republic reached self-sufficiency only in beef; rate of self-sufficiency was above 100% for all monitored years. Increasing tendency has been described after 2010. The situation has changed rapidly after the EU accession with respect to pork and poultry meat. Self-sufficiency in pork was determined by reduction in animal husbandry which led to rising position of poultry imports (both in volume and values). Consumption of pork is stabilised and fluctuated between 555 - 599 thousand tones annually. However, production for the period decreased to 282 thousand tones. It resulted in self-sufficiency of 57%. To cover domestic consumption, pork industry would need to increase production by approximately 1.5 million pig heads. With existing capacity and infrastructure, such increase seems to be unreachable. Poultry industry can be found in very similar situation. In 2003, Czech poultry consumption could be covered from national resources. Over the decade this indicator fell down to 73%. Domestic production is down by 70 ths. tons, while domestic consumption ranged from 329 and 340 ths. tones. The main factor, as in the case of pork meat, is a sharp decline in processing capacity, which leads to the need to export live animals instead carcases or processed products. Whereas the average Czech eats the largest amount of meat in the Visegrad group, lack of processing capacities for poultry and pork products may result in future strategic problems.

In Slovakia, beef production is on sufficient level that can cover local consumption. The situation is more critical in pork and poultry. Production of pork covers only one half of consumption; to cover the gap, pork industry would need to increase production by approximately 650 ths. pigs. Between 2003 and 2013, production

decreased from 181 ths. tons to 75 ths. tons, while consumption fell only from 195 ths. tons to 134 ths. Slovakia also belongs among net importers of processed pork products. On contrary, in 2013 Slovakia was a net exporter of live animals. This fact corresponds with decrease of slaughter industry, its per capita production fell by 70% between 2003 and 2013. Therefore it can be concluded, that live animals are exported and processed pork meat imported. Even before Slovakia became member of the EU, rate of self-sufficiency was below 100%. EU accession only opened the market, poultry industry was endangered by international competition and rate of self-sufficiency decreased further on. Between 2003 and 2009, domestic production was reduced by 18 ths. tones, while domestic consumption remained relatively constant. After 2009, self-sufficiency fluctuates between 69 and 92%. In 2013 poultry production would need to be increased by more than 11 million chickens in carcasses weight, to cover national consumption.

In Poland, the rate of self-sufficiency in beef is very high, in 2013 it reached 416%. Main growth of self-sufficiency occurred after 2009 and was mainly driven by fall in domestic consumption (consumption in 2013 reached 30% of consumption in 2003). Poland achieved a positive trade balance both in value and volume terms. Exports of beef exceeds imports more than 10 times in volume, while in some years exports exceeded imports more than 20 times in value. This suggests that Poland exports rather processed beef meat. Pork production covers Polish consumption, with the only exception in 2009, when self-sufficiency fell slightly below 100%. Self-sufficiency in poultry has evinced increasing trend. During the reporting period, production almost doubled, consumption was influenced by fall in beef consumption and poultry became a substitute. Poland also recorded a significant increase in imports of live animals and exports of chilled or frozen meat or meat products. Poland is price competitive, its average annual export prices (HS6) were the lowest among other Visegrad countries. Competitiveness of poultry processing is obvious.

Hungary is self-sufficient in all analysed meat types. Production covered 106 - 130% of beef consumption, but for the last decade, the sufficiency has downward sloping direction. Therefore it is not clear, whether Hungary will remain sufficient also in the future. But observed oscillation is caused by fluctuation in consumption and production over the years. Self-sufficiency in pork meat also evince oscillation between 105 and 130%. From all Visegrad countries, only Hungary experienced positive foreign trade balance in pork, both in value and volume terms. Although trade coverage sharply decreased after EU accession, Hungary still report positive trade balance, mostly generated by exports of other frozen products. Self-sufficiency in the case of poultry meat has upward sloping character, even thou production is on decline. But fall in domestic consumption is faster than fall in domestic production, so it results in rise of sufficiency. Compared to other countries, Hungary diversify its poultry production as producers not only breed *Gallus domesticus* species, but value of processed meat exports is also created by trade with turkey, ducks or geese.

References

Azani, H., Schoonbeek, S., Mahmoudi, H., Derudder, B., De Maeyer, P., Witlox, F. (2011) Organic agriculture and sustainable food production system. Agriculture, Ecosystems & Environment, 144 (1), 92-94.

Barker, R. (1976) Price Support versus Input Subsidy for Food Self-Sufficiency in Developing Countries. American Journal of Agricultural Economics, 58 (4), 617-628. DOI: 10.2307/1238804

Basek, V. (2010) Czech agriculture six years after EU accession. Praha: Ústav zemědělské ekonomiky a informací.

Basek, V., Doucha, T. (2010) Český potravinářský průmysl – jeho šance a rizika do budoucnosti. Potravinářská Revue, 6, 7-14.

Belova, A., Smutka, L., Rosochatecka, E., Bazina, A. (2012) Competitiveness of Domestic Production of Poultry Meat on the EU Market and on the World Market. AGRIS on-line Papers in Economics and Informatics, 4 (4), 11-25.

Bielik, P., Smutka, L., Horska, E., Selby, R. (2014) Agricultural development and government expenditures in the new EU countries. APSTRACT: Applied Studies in Agribusiness and Commerce, 8 (1), 21-35.

Delgado, C. L. (2003) Rising consumption of meat and milk in developing countries has created a new food revolution. The Journal of Nutrition, 133 (11), 3907-3910.

Demekas, D. G., Barthholdy, K., Gupta S., Lipschits, L., Mayer, M. (1988) The effects of the common agricultural policy of the European community: a survey of the literature. Journal of Common Market Studies, 27 (2), 113-145. DOI: 10.1111/j.1468-5965.1988.tb00334.x

Dyson, T. (1999) Prospects for feeding the world. British Medical Journal, 319 (7215), 988-991. DOI: 10.1136/bmj.319.7215.988

Evans, A. (2009) The Feeding of the Nine Billion: Global Food Security. London: Royal Institute of International Affairs.

Food and Agriculture Organisation, FAO (2006) Working paper series. Report on food deprivation towards the MDG on hunger reduction. [Online] Available at:http://www.fao.org/fileadmin/templates/ess/documents/food_security_statistics/working_paper_series/WP008e.pdf [Accessed 15 December 2014].

Gebeltova, Z. (2012) Czech Republic's self-sufficiency in case of pork meat and its impact on trade balance development. AGRIS on-line Papers in Economics and Informatics, 4 (2), 1-12.

Grofova, S., Srnec, K. (2012) Food crisis, food production and poverty. Agricultural Economics – Czech, 58 (3), 119-126.

Kazuo, S. (2008) For National Cooperation in Increasing Food Self-Sufficiency Rate, Speeches at symposium for revitalization of agriculture. [Online] Available at: http://www.japan-press.co.jp/pdf/special_june_2008.pdf [Accessed 15 January 2015].

Kearney, J. (2010) Food consumption trends and drivers. Philosophical transactions of the royal society B, 365 (1554), 2793-2807. DOI: 10.1098/rstb.2010.0149

Konarska, M., Sakowska, A., Glabska, D., Wierzbicka, A. (2014) Czynniki determinujące spozycie miesa wolowego na Swiecie i w Polsce w latach 2000-2012. Zeszyty Naukowe SGGW w Warszawie - Problemy Rolnictwa Swiatowego, 14 (29), 98-106.

Kosicka-Gebska M., Pazdziecka N., Gebski J. (2010) Tendencje zmian w spozyciu miesa wolowego w Polsce w latach 2000-2009. Zeszyty Naukowe SGGW w Warszawie - Problemy Rolnictwa Swiatowego, 10 (25), 49-59.

Kotyza, P., Slaboch, J. (2014) Food Self Sufficiency in Selected Crops in the Czech Republic and Poland, Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 62 (6), 1329-1341. DOI: 10.11118/actaun201462061329

Kydd, J., Buckwell, A., Morrison, J. (1997) The role of the agricultural sector in the transition to a market economy in Central and Eastern Europe: an analytical framework. In: Kydd, J., Davidova, S., Mackay, M., Mech, T., The Role of Agriculture in the Transition Process towards a Market Economy. New York: United Nations.

Lohoar, J. S. (1981) Analysis of Food Self-sufficiency in Barbados. Bridgetown: Inter-American Institute for Co-operation in Agriculture.

Lyuri, D. (2008) Agriculture. In: Jorgensen, S. E., Fath, B., Encyclopedia of Ecology, 1 (A-C), 76-84. DOI: 10.1016/b978-008045405-4.00838-7

Maly, M. (2013) Partial equilibrium model – Pork. Journal of Central European Agriculture, 14 (1), 208-305. DOI: 10.5513/JCEA01/14.1.1197

Minot, N., Pelijor, N. (2010) Food security and food self sufficiency in Bhutan. Washington: International Food Policy Research Institute.

Morrison, K. T., Nelson, T. A., Nathoo F. S, Ostry A. S. (2012) Application of Bayesian spatial smoothing models to assess agricultural self-sufficiency. International journal of geographical information science, 26 (7), 1213-1229. DOI: 10.1080/13658816.2011.633491

Mroczek, R. (2009) Sektor miesa czerwonego w Polsce po przystąpieniu do UE. Zeszyty Naukowe SGGW w Warszawie - Problemy Rolnictwa Swiatowego, 7 (22), 89-98.

Nasko, G. (1989) Food Self-sufficiency in Nigeria: A Review of Federal Government Programme. Victoria Island Lagos: Federal Civil Service Forum.

Organisation for Economic Co-operation and Development, OECD (2005) International Indicators of Trade and Economic Linkages. [Online] Available at:http://www.oecd.org/std/internationaltradeandbalanceofpaymentsstatistics/35452748.pdf [Accessed 10 March 2013].

Orsilo, N. (2008) The environmental impact and economic consequences of agricultural land drainage in Czechia: 1960 – 1989. Klaudyán: Internet Journal of Historical Geography and Environmental History, 5 (1), 14-29.

Pingali, P. (2006) Westernization of Asian diets and transformation of food systems: implications for research and policy. Food Policy, 32 (3), 281-298. DOI: 10.1016/j.foodpol.2006.08.001

Rask, N. (1991) Dynamics of self-sufficiency and income growth. In: Ruppel, F. J., Kellogg, E. D., National and Regional Self-Sufficiency Goals: Implications for International Agriculture. Boulder: Lynne Rienner Publishers.

Smeets Kristkova, Z., Garcia Alvarez Coque, J. M. (2015) Competitiveness of the EU beef sector – a case study. AGRIS on-line Papers in Economics and Informatics, 7 (2), 77-92.

Staatz, J. M. (1991) Designing Social Science Research to Inform Agricultural Market Reforms and Structural Adjustments in Developing Countries. In: Johnson G. L., Bonnen, J. T., Fienup, D., Quance, C. L., Schaller, N., Social Science Agricultural Agendas and Strategies. East Lansing: Michigan State University Press.

Stachowiak, Z. (1999) Teoretické vymezení potravinové bezpečnosti státu. Aplikované společenské a ekonomické vědy, 3, 135-150.

Svatos, M., Smutka, L., Elshibani, B. A. M., Mousbah, S. A. A. (2013) Development of Visegrad Countries' Agricultural Trade in Relation to Agricultural Production Development. AGRIS on-line Papers in Economics and Informatics, 5 (1), 61-71.

Svobodova, H. (2014) Changes on Foreign Trade in Agricultural Commodities in the Czech Republic. Journal of Central European Agriculture, 15 (2), 62-72. DOI: 10.5513/JCEA01/15.2.1453

Tiraspolsky, A. (1980) Food Self-Sufficiency in Eastern Europe. Eastern European Economics, 19 (1), 3-27. DOI: 10.1080/00128775.1980.11648217

von Braun, J. (2007) The world food situation: new driving forces and required actions. Washington: International Food Policy Research Institute.

Warr, P. G. (2011) Food Security vs. Food Self-Sufficiency: The Indonesian Case. Working papers in trade and development, 4, 2-16. DOI: 10.2139/ssrn.1910356