

# Balance sheet of pork production and consumption in Croatia

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## SUMMARY

The production and consumption of pork make up a significant share of many countries' total production and consumption of food products. The demand for pork is determined by income and population growth, while besides being influenced by these same factors, pork production is also determined by the price of animal feed, primarily corn. Most pork is produced in Asia (57.4%), followed by Europe (23.6%) and the Americas (17.4%). The most important world producers of pork are China (51%), United States of America (USA) (9%) and Germany (4%).

In the period from 2000 to 2012, the number of pigs in Croatia was constantly decreasing, although with some annual fluctuations, and this trend is expected to continue until 2016. The same goes for the degree of self-sufficiency which in 2016 should be slightly above 50%. The lack of domestic production would be compensated by the import of pigs for slaughter and the import of pork and pork products mostly from other EU countries. The insufficient production of pork is to a large extent a consequence of low competitiveness of domestic production by reason of the relatively small number of pigs per producer, inadequate technology and high corn prices in the world market. A significant step forward for a large part of small producers is the change of breed composition and the production of products with higher added value such as kulen (paprika-flavoured sausage), ham, prosciutto and the like.

**Key words:** pork, production-consumption balance, self-sufficiency, Croatia

## INTRODUCTION

The state of livestock production is one of the indicators of the state of agriculture, and the trends in livestock production are indicators of agricultural development. Livestock production impacts the development of a major part of crop production, especially of grain and forage crops, and livestock products such as meat and milk are the main inputs of food industry.

According to FAO (2011) the world consumption of animal protein is expected to increase by about 2/3 by 2050. It will be possible to meet this future demand only by increasing productivity in livestock production. The increase of productivity will be limited by animal health and welfare, quality and food safety, and welfare of consumers.

Owing to its many production characteristics, pork production has and will have even greater significance in the population's future diet while the overall level of the demand will be determined by population growth and an

increase in their income, though to a certain limit, after which, especially due to income growth, there will be a substitution of pork consumption by other types of meat.

Pig farming has a very important place in Croatian livestock production (Kralik et al., 2012). Pig production is a major consumer of agricultural crops and fodder is the most expensive input in pig production representing on average 60-70% of production costs (van Milgen et al., 2012).

One of the objectives of Croatia's agricultural policy is to achieve self-sufficiency (Grgić et al., 2011) in those products for the production of which conditions are in place in a specific area. Pork is one such product.

Domestic pork production does not meet domestic consumption, which leads to a significant import of pork (about 46% of net production and import of live animals for fattening). In Croatia two processes are simultaneously present: a relatively high demand for pork and a reduction in the number of pig produ-

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cers. The decrease in the number of producers logically follows the concentration of production in response to the growing competition in the domestic market, while the relatively high demand is due to a smaller consumption of other types of meat such as beef, fish, etc.

One of the key elements in decision-making, both for producers and for agricultural policy-makers, is the degree of self-sufficiency in certain productions. The study of self-sufficiency by method of production-consumer balance sheets has proven to be a useful tool in the design of agricultural policy and it is applicable in Croatia as well (Ministry of Agriculture 2014).

After analysing the major trends of pig production in the world, the paper gives an overview of changes in the number of pigs and pork production in Croatia for the period from 2000 to 2014 and the projection for 2016. The aim is to calculate the degree of Croatia's self-sufficiency in pork in the period from 2000 to 2012 and on the basis thereof project the country's self-sufficiency in 2016.

## MATERIAL AND METHODS

The paper uses data from the National Bureau of Statistics of the Republic of Croatia, EUROSTAT and FAO. The method of polynomial trend of first and second degree was used for time series analysis and projection to 2016.

The balance sheet method was used to calculate the degree of self-sufficiency. Production and consumption balance sheets are standardized in such a way that the processed products have been reduced to their primary equivalent (raw material) by the so-called vertical standardization procedure. Rates of extraction or technical coefficients used in preparing the balance sheet are used for backward conversion to the primary level by multiplying the quantity of processed products and the reciprocal technical coefficient. For example, quantities of pork and products containing it (imported, exported, produced, consumed) are expressed in the equivalent of pork<sup>4</sup>.

Elements of the production-consumption balance sheet and calculation of the self-sufficiency degree are the following:

**1. SLAUGHTER:** total number of slaughtered livestock in slaughterhouses and on family farms

$$Y_c = -15,938X^2 + 188,37X + 1946,2$$

**2. NET WEIGHT OF SLAUGHTERED ANIMALS:** dressed carcass weight without hide, blood, head, viscera, fore legs to the knee and hind legs to the hock

$$Y_c = -0,4845X^2 + 7,8907X + 116,78$$

**3. DOMESTIC MEAT PRODUCTION:** the sum of the slaughter balance and foreign trade of livestock intended for slaughter, i.e. slaughter plus exports and minus imports

**4. FOREIGN TRADE** (exchange with EU and non-EU countries)

- live animal import

$$Y_c = 1,0145X + 1,178$$

- live animal import from EU

$$Y_c = -0,1022X^2 + 2,6805X - 4,7102$$

- live animal export

$$Y_c = 0,0785X^2 - 0,7292X + 1,2308$$

- meat import

$$Y_c = 3,809X + 20,623$$

- meat import from EU

$$Y_c = 4,0502X + 14,018$$

- meat export

$$Y_c = 0,5058X + 0,0638$$

- meat export from EU

$$Y_c = 0,0278X - 0,0101$$

**5. NET MEAT PRODUCTION:** domestic production plus imports of live animals and minus exports of live animals

**6. AVAILABLE RESOURCES:** net production plus meat imports

**7. INITIAL STOCKS:** quantities stocked on the first day of the reference period

**8. FINAL STOCKS:** quantities stocked on the last day of the reference period, and simultaneously the initial stocks of the subsequent reference period

**9. CHANGES IN STOCKS:** the difference between final and initial stocks

**10. DOMESTIC CONSUMPTION:** production plus imports and minus exports and changes in stocks

**11. HUMAN CONSUMPTION:** quantities entering the market either in their original state or processed and available to the population for consumption during the reference period

**12. SELF-SUFFICIENCY DEGREE:** the ratio between domestic production and domestic consumption. If the amount is below 100, then production does not cover consumption, while the amount above 100 indicates that production exceeds domestic demand so certain amount of products is either stored or exported

<sup>4</sup> The reduction in the number of producers is closely connected with the overall reduction in the number of family farms. ([http://faostat3.fao.org/download/FB/\\*/E](http://faostat3.fao.org/download/FB/*/E))

The applied methodology is the same as for drafting balance sheets of any other meat. The same methodology was applied in Grgić, Zrakić 2015.

## RESULTS

### Pork production in the world and in the EU

More than 300 million tons of meat is produced worldwide (FAOSTAT), a large part of which is pork (about 112 million tons or 37%).

The production of pork depends on the potential for producing sufficient quantities of animal feed, primarily corn, on climate and religious restrictions. Thus, most pork is produced in Asia (57.4%), followed by Europe (23.6%) and the Americas (17.4%). Pork production in the area of Oceania and Africa is negligible.

The world's biggest pork producers are China (51%), United States of America (USA) (10%) and Germany (4%).

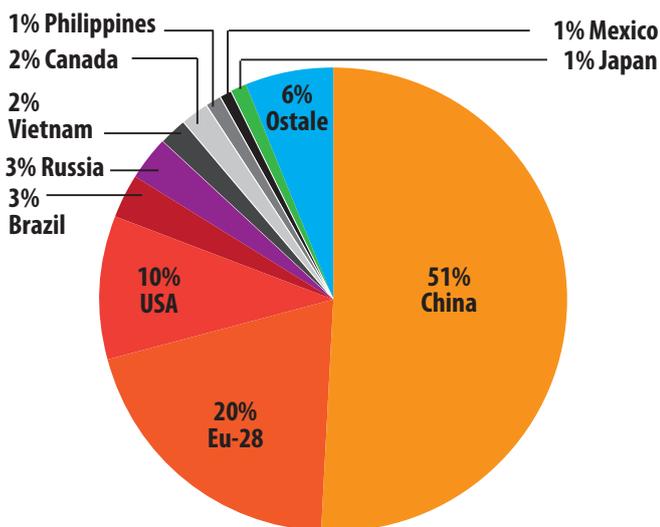


Chart 1. Structure of the world pork production in 2014  
Source: <http://www.indexmundi.com/agriculture/?commodity=swine-meat&graph=production>, according to USDA (2.3.2015).

Countries participating to a somewhat lesser degree in the world's pork production are Brazil (3%), Russia (3%), Vietnam and Canada with 2% each, and Mexico, the Philippines and Japan with 1% each. All other countries account for about 6% of world production of pork. It is noticeable that the world's main producers of pork are heavily populated countries and that they will be the ones dictating future trends in changing production and consumption. This is especially true for China,

which due to its 1.3 billion inhabitants and the potential of its economic growth rates, has a dominant influence on pork global production and market.

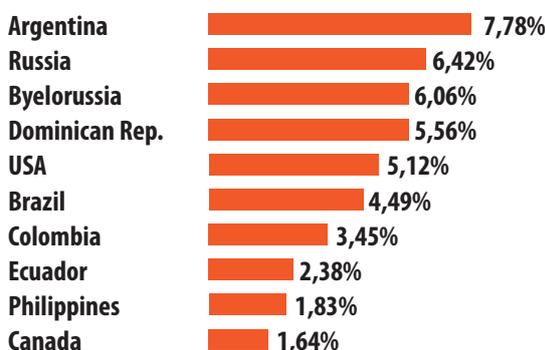


Chart 2. Top ten countries in the world in terms of pork production growth rate, estimates for 2015

Source: <http://www.indexmundi.com/agriculture/?commodity=swine-meat&graph=production-growth-rate>, according to USDA (3.3.2015.)

This is especially important when we see that China is not among the countries with higher growth rates in pork production. It is estimated that Argentina, the Russian Federation and Belarus will have the highest growth rate of pork production in the world in 2015.

Slightly lower, but still significant, growth rates are expected in the Dominican Republic, the USA, Brazil and Colombia. However, it should be noted that the expected growth rates will significantly depend on the global corn production and price. They will be less affected by changes in demand or by other unexpected events.<sup>5</sup>

The price of pork has been growing in the last 10 years as a result of the increase in prices of animal feed which have more than doubled. A particularly significant increase in the price of animal feed happened in 2012 due to a decrease in grain production as a result of drought in the United States, the Black Sea region and Eastern Europe. However, the price of animal feed declined in 2013 which did not lead to an increase in the world's supply of pork since in the meantime sanitation and environmental conditions had been rendered more severe and there had been an increase in the cost of energy, water and labour. At the same time the demand on the world market increased due to the growing demand in the countries with rising incomes, increasing population and a higher degree of urbanization (OECD-FAO, 2014).

Pork is produced in all EU Member States but there are significant differences in the structure of the pro-

<sup>5</sup> Losses and other impacts of the trade embargo imposed on Russia because of the crisis in Ukraine have not yet been quantified.

ducers with respect to the number of pigs per holding. As much as three-quarters of the total number of pigs is raised on a small number of production-intensive farms (1.5% of farms). This primarily refers to the "old" EU members, while "small" pig farmers are mainly based in the new Member States. The accession of new members to the EU is one of the reasons for the reduction of the average drove size in the EU (Marquer, 2010).

The European Union (EU) is the world's second largest pork producer (Chart 1) and one of the largest exporters. The Union produces around 22 million tons<sup>6</sup>, which is 19.5% of total world production, and exports approximately 12% of its own production (Sheldon, 2013). The main export destinations are Russia (800,000 tonnes per year) and East Asia (Japan, China), the largest exporters being Germany, Denmark, Spain, France, the Netherlands and Poland.

The main producers of pork in the EU are Germany, Spain and France, which together account for half of the production of the Union's pig live weight.

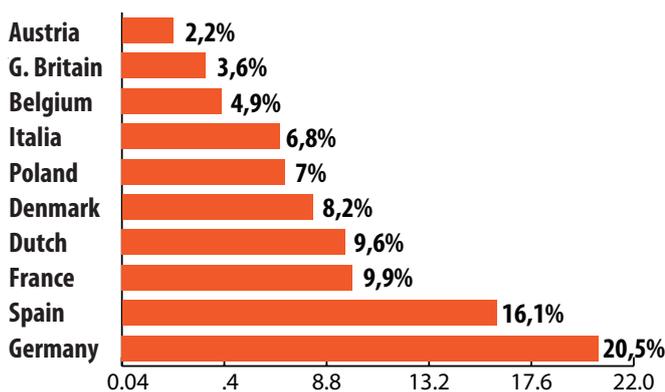


Chart 3. Top 10 EU countries in pork production in 2013

Source: FAOSTAT, 2015

The Netherlands, Denmark, Poland, Italy, Belgium, the UK and Austria account for a somewhat smaller share in the European pork production. The underdeveloped countries of the Union, such as Croatia, Romania, Bulgaria or Slovenia, are not among the leading countries.

The number of pigs in the EU has declined since 2007 by about 9% and today the EU-28 has about 146 million pigs while the largest decrease was recorded in the number of sows and that by almost three million heads, or by 19%. This trend is a result of restructuring

processes in some of the major meat-producing countries, such as measures to increase productivity, higher prices of animal feed, adaptation to new standards of animal keeping and welfare.

The expected new standards on animal welfare will lead to the disappearance of small producers, and at the same time meat production on the already highly productive farms will increase. Denmark is an example of successful pig production. Over the last few decades, Danish production of pigs and pork has become a recognized product on the European and world market. The high production standards in food quality and safety, rich genetic potential and selection, and the respect of animal welfare have resulted in a high rate of exports to 140 countries of the world (EU 70%) and in high productivity (about 5000 farms produce 28 million pigs per year). Danish export, however, is not among the largest in the world, due to limited land resources and the consequent limited potential to produce their own animal feed.

EU meets its own needs for pork and the expected level of self-sufficiency is 110% (EC, 2015)<sup>7</sup>.

Table 1 Balance sheet of pork production and consumption in EU – estimates for 2015

Balance sheet elements	
Production – t	22.365.000
Import – t	10.000
Export – t	2.200.000
Initial stocks – t	0
Final stocks – t	0
Available quantities – t	22.375.000
Domestic consumption – t	20.175.000
Consumption per capita* - kg	39,78
Self-sufficiency degree* - %	110,86

Source: <http://www.indexmundi.com>, according to USDA, (3.3.2015.); \*authors' own calculation

The estimated average consumption of pork per capita in the EU-28 in 2015 is 39.78 kg (Table 2.)<sup>8</sup>.

Within the EU, pork consumption significantly differs across the member states. Denmark, as one of the world's largest exporter of pork, has a per capita consumption of about 80 kg of pork, followed by Cyprus (72 kg), Spain (62 kg), Austria (57 kg) and Germany (54 kg).

<sup>6</sup> European pork production decreased in the last few years from 22.9 million tonnes (2011) to 22.3 million tonnes (2013) due to production restrictions in the EU. Production of pork is influenced by geopolitical measures – the Russian ban on the import of pigs and pork products from the whole of the EU (Croatian Chamber of Agriculture, 2015).

<sup>7</sup> It may be higher, which would be bad, because of lower exports to Russia.

<sup>8</sup> According to estimates by the European Commission, meat consumption at EU level decreased from 2012 to 2013 by about 1.5% and is now about 65 kg per capita.

### Tendencies in pork production in the Republic of Croatia

Over the entire period considered there was a reduction in the number of pigs in Croatia and this trend is expected to continue until 2016. At the same time the domestic demand for pork will be met by further import of pigs.

By about 50% of Croatia's demand for pork is met by imports, which makes it in one of the major pork-importing countries in the EU. As before, the import will be mostly from the EU member states, notably the Netherlands and Germany.

The structure of pig production is dominated by farms and large production systems that operate according to mixed programs, while the production on family farms is decreasing. The main problem hampering domestic producers' competitiveness is that the cost of construction of modern farms in Croatia is by 15-20% higher than for instance in Denmark or the Netherlands (Kralik et al., 2013).

The "small" producers are faced with particularly difficult economic conditions. According to Kralik et al. (2013), small producers do not succeed by reason of unsuitable agricultural policy, the lack of infrastructure (slaughterhouses, meat processing facilities) and their own disorganization and disorientation in market economy.

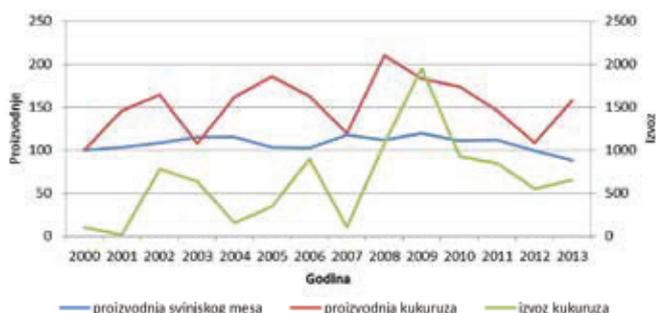
**Tablica 3.** Balance sheet of pork production and consumption in Croatia from 2000 to 2012 and projections for 2016

Year	Number of head at the beginning of the year	Pigs born during the year	Import	Export	Slaughtered	Died	Number of head at the end of the year
2000/06	1318	2538	276	0	2393	385	1353
2007	1489	2317	497	1	2654	309	1348
2008	1348	1979	537	12	2492	256	1104
2009	1104	2023	656	14	2289	230	1250
2010	1250	1784	626	24	2158	247	1231
2011	1231	1417	611	49	1775	202	1233
2012	1233	1340	558	74	1684	191	1182
2013	1182	1268	370	73	1477	160	1110
2016	1211	1083	517	92	1429	146	1144

Source: Croatian Bureau of Statistics and authors' own calculation

Therefore, family farms are advised to focus on the production of selected breeds of pigs (e.g. Black Slavonian Pig), and to group together into associations or cooperatives. In some European countries, the typical products of native species of pigs are a good example of strong cooperation between public institutions, producers and scientists. Thanks to this synergy, products made from domestic pigs are competitive in the market (Pugliese and Sirtori, 2012).

The projection for 2016 indicates a slight increase in the number of pigs at the beginning and at the end of the year but also points toward a significant reduction in the number of born pigs. At the same time there will be an increase in imports of live animals that will not be sufficient to maintain the level of domestic meat production, which too will be met by import, while main-



**Chart 4** Indices of pork and corn production and of corn export in Croatia 2000=100

Source: authors' own calculation

**Tablica 3.** Balance sheet of pork production and consumption in Croatia from 2000 to 2012 and projections for 2016

	2000/07	2008	2009	2010	2011	2012	2016
<b>PRODUCTION BASE</b>							
Slaughter (000 head)	2,374	2,492	2,289	2,159	1,775	1,684	1,913
Average carcass weight (kg)	58,48	59,40	69,80	68,35	82,50	75,33	58,02
Net weight of slaughtered animals (1000 t)	138,84	148,04	159,75	147,54	146,46	126,85	111,00
<b>BALANCE (1000 t)</b>							
<b>DOMESTIC MEAT PRODUCTION (GIP)</b>	133,23	137,12	146,63	136,39	137,70	121,98	104,10
<b>LIVE ANIMALS IMPORT</b>	5,64	11,97	14,28	13,05	12,41	10,85	18,42
- from EU	4,55	11,97	14,28	13,05	12,41	10,85	11,32
<b>LIVE ANIMALS EXPORT</b>	0,02	1,05	1,16	1,90	3,65	5,98	11,52
- in EU	0,00	0,00	0,00	0,00	0,00	0,00	0
<b>NET MEAT PRODUCTION</b>	138,84	148,04	159,75	147,54	146,46	126,85	111,00
<b>MEAT IMPORT</b>	37,87	54,19	64,50	60,91	63,34	68,82	85,38
- from EU	33,11	50,62	54,24	54,13	61,05	65,85	82,87
<b>AVAILABLE RESOURCES</b>	176,71	202,23	224,24	208,45	209,79	195,67	196,38
<b>MEAT EXPORT</b>	2,24	4,79	5,58	5,72	5,65	7,20	8,66
- in EU	0,12	0,18	0,25	0,23	0,38	0,39	0,46
<b>INITIAL STOCKS</b>	5,63	7,92	6,53	0,87	7,62	4,87	5,11
<b>FINAL STOCKS</b>	5,83	6,53	0,87	7,62	4,87	5,35	4,88
<b>CHANGES IN STOCKS</b>	0,20	-1,40	-5,66	6,75	-2,74	0,48	-0,23
<b>DOMESTIC CONSUMPTION</b>	174,27	198,84	224,32	195,98	206,88	188,00	187,95
<b>LOSSES</b>	0,00	0,00	0,00	0,00	0,00	0,00	0,00
<b>ANIMAL FEED</b>	0,00	0,00	0,00	0,00	0,00	0,00	0,00
<b>HUMAN CONSUMPTION</b>	174,27	198,84	224,32	195,98	206,88	188,00	187,95
- per capita/kg	39,33	44,84	50,65	44,36	48,28	43,87	44,01
<b>SELF-SUFFICIENCY DEGREE</b>	76,82	68,96	65,37	69,60	66,56	64,88	55,39

Source: Ministry of Agriculture 2014, projection calculated by the authors

taining or slightly increasing consumption per capita. Such tendencies were observed in the second half of 2014, when the supply of imported pork significantly increased in the domestic market.

Although pork production is strongly connected to the production and price of corn, this was not observed in Croatia during the analysed period.

In the period from 2000 to 2013, there were significant fluctuations in the production of corn, the impact being primarily evident in exports of corn, most commonly with one-year lag. Increased corn production did not translate, through its lower prices, into an increase in the number of pigs and pork production<sup>8</sup>.

### Balance of pork in the Republic of Croatia from 2000 to 2012 and projections for 2016

Domestic production of pork during the analysed period fluctuated between 121 and 146 thousand tonnes, whereby neither the population's demand for fresh meat nor the meat-processing industry's need for high quality raw material were met.

In 2016, we expect a slight increase in the number of slaughtered animals and a reduction in the average carcass weight, which will be due to increased imports of live animals that will still be mostly imported from EU countries. These trends will lead to a reduction in net meat production which will in turn lead to increased imports of meat by 25%. We also expect a slight increase in the consumption of pork *per capita*<sup>9</sup>, as well as a significant reduction in the degree of self-sufficiency from 64.88% in 2012 to 55.39% in 2016.

### CONCLUSION

Future world pork production will be influenced by economic and non-economic factors. Among the most important economic factors are the changes in the animal feed market i.e. corn prices and an increase in the demand as a result of income and population growth. One of the non-economic factors is the influence of eating habits i.e. the increase of the population that does not consume pork for religious reasons. Due to the relatively short reproductive cycle and large meat production per sow, it is expected that pork production will continue to increase in the countries with higher rates of population growth, primarily the countries of Asia.

In Croatia, the number of pork producers is reducing but the number of pigs they grow is increasing, so they can compete pricewise with the increasing pressure from imports. Smaller producers become uncompetitive and disappear. At the same time, due to the high global demand, the production of corn is for the most

part exported thereby raising the price of animal feed. The reduction of the main drove leads to a reduction in the number of pigs for slaughter which Croatia compensates by higher imports of pigs and pork from other countries of the Union. This negative trend is expected to continue in the coming period.

For all the above reasons, Croatia's degree of self-sufficiency in pork is low and in 2016 it is expected to be around 55%, which means that as much as 45% of the needs will be met from imports. These forecasts are a warning to Croatia's policy-makers in the field of both agriculture and economy, because besides affecting the agricultural sector, the forecasted trends will directly influence the state of food industry as well.

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<sup>9</sup> Obviously the problems in Croatia's pig production stem from the production structure of the producers and from other non-economic factors associated with this production.