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FOOD SELF-SUFFICIENCY IN EU COUNTRIES: AN ATTEMPTED PROJECTION TO 2080

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Annotation: Ensuring food security is a major problem of the contemporary world. The research problem analysed within this study was connected with a tentative answer to the question whether and to what extent agricultural production of individual EU-28 countries guarantees food self-sufficiency at present and may do so in the future. The aim of this study was to investigate the diverse agricultural production levels in EU countries in view of the potential permanent food self-sufficiency. The study was conducted using the deduction and comparative methods based on FAOSTAT, EUROSTAT and BFCN data as well as literature on the subject. The largest food producers in UE-28 are the countries belonging to the EU-15 group: Germany, Italy and Spain, and in the case of some products also Great Britain. Among the EU-13 countries only Polish agriculture has reached the volume of agricultural production comparable to the level in those countries. As a whole the EU-28 group as well as its "old" part, i.e. EU-15, and the "new" part (EU-13) presently are and until 2080 will continue to be self-sufficient in terms of food production. The only exception in this respect is fruit, the demand for which within the forecasted period is and will still be covered by internal EU production in approx. 2/3 in the EU-15, at the forecasted surplus in 2080 in the EU-13 countries. The degree of self-sufficiency varies in individual EU countries. Thus it is necessary to ensure effective mechanisms for surplus reallocation to regions suffering from shortages thanks to promotion of exchange of goods within the EU, while maintaining economic, social and natural sustainability of agricultural production.

Key words: agricultural production, food security, food self-sufficiency.

JEL classification: Q10, Q18.

1. Introduction

Assurance of food security is a major problem faced by the modern world. In simple terms we may assume that it consists in ensuring physical availability of food, economic availability of food and food safety (Mikuła, 2012). According to FAO (2014), food security is a situation when all people at all times are provided with physical, social and economic access to sufficient, safe and nutritional food, satisfying their nutritional needs and preferences required to conduct active and healthy lives. This paper focuses on the first pre-condition for food security, i.e. the potential assurance of physical availability of food. Physical availability may be attained by producing food within one's country or by imports. In the case when the needs of the country's population are satisfied, surplus production may be exported. It is one of the reasons why it is crucial to ensure food self-sufficiency. As it was reported by Pawołek (2015) after Małysz (2008): food self-sufficiency was simplified to an element of physical availability of food, i.e. provision of staple foodstuffs, based on international markets for raw materials and final food products. However, no attempts are made to achieve autarky in terms of providing all food products and nutrients. Thus potentially individual countries have at their disposal surpluses of certain food products, at the same time experiencing shortages of other food products.

Food production is mainly limited by land resources, followed by land productivity. Most countries around the world are incapable of ensuring self-sufficiency due to lack of natural resources. Therefore, even a self-sufficient country should not rely exclusively on domestic production (Gołębiewska and Stefańczyk, 2017). Although global food demand is going to increase in the next

decades, that process will vary from one region of the world to another and from one product to another. Apart from areas with a relatively stable population size there are countries and continents, in which the population is growing rapidly. Thus we face the need to ensure proper nutrition for the increasing population within individual countries, continents as well as the global scale. According to forecasts, in order to meet the global food requirements, the volume of food production must increase by 70% by 2025. Another issue is to ensure safety of food produced and devise a delivery method that makes food available to the population at different levels of development and income. Therefore, in addition to ensuring physical and economic availability of food, problems related to food distribution and safety need to be identified (Marvin et al., 2009, Gołębiewska and Stefańczyk, 2017).

The research problem investigated in this study was connected with the attempt to determine whether and to what extent agricultural production in individual EU-28 countries currently ensures their food self-sufficiency and whether it will do so in the future. The European Union produces food for its own needs and for exports. After satisfying the food demand of its population the EU may become in the future a leading exporter of food to the regions of the world suffering from malnutrition or famine. The aim of this study is to investigate the varied levels of agricultural production in EU countries in view of the potential to ensure sustainable food self-sufficiency.

2. Materials and Methods

The study was conducted using the deduction and comparative methods based on data provided by FAOSTAT, EUROSTAT and BFCN as well as literature on the subject. Values of the index of food self-sufficiency were estimated based on the mean food production food in the years 2011-2013 and mean consumption in that period corrected by the change in the population size, which took place by 2016. Moreover, the paper presents also values of this index calculated for the year of 2080 following the population forecast showed by EUROSTAT. The EUROSTAT forecast includes foreseeable changes in the scope of natural movement of population, migration and other socio-economic variables. Due to the very long, more than 60-year time frame of the forecast, it can be treated only as an approximation of the future real state, and thus, the food self-sufficiency indicators calculated on this basis are only a possible but not a certain picture of the future reality. However, it is difficult to look for more reliable projections, because in such a long period the impact of variables, for which it is not possible to estimate the statistical probability, can be decisive (as the time horizon increases, the random factor affects the forecast results more)[10]. For the same reason, the simplifying assumption was made that the volume of agricultural production in 2080 and consumption per capita will be identical to those means in the years 2011-2013[11].

3. Results and Discussion

The potential to ensure self-sufficiency depends first of all on the volume of agricultural production as well as the level of food demand. The volume of production is dependent on the agriculturally utilised area, intensity of land use and productivity. The level of demand depends on the volume and structure of consumption resulting from the number of inhabitants and their food preferences, as well as the level of food waste. In 2013 in the entire EU approx. 40% total land area was utilised

[10] Adopting of the simplifying assumptions is necessary in this study, just like in almost every case of attempting to predict a distant future. For example, the authors of the report "The Limits to growth" (Meadows et. al 1972), went this way, recognizing properly that the more specific analysis is not justified in this case.

[11] This is only an assumption adopted for the purpose of the projection. The possibility of increasing the agricultural production is positively influenced by agrotechnical progress, but at the same time there is a loss of land related to the industrialization and suburbanisation. Production capacity is also institutionally restricted by the CAP regulations. Similarly, the size and structure of individual consumption is influenced by biological and cultural factors, non-quantifiable in the long-term perspective. Therefore, in the absence of reliable estimators, it was assumed that the food production and per capita consumption are constant.

agriculturally. Land and labour productivity are increasing systematically, particularly within the EU-13; however, the level of efficiency is still lower in those countries than in the EU-15 (Nowak, 2011). Considerable differences are also found in terms of food waste. It is estimated that within the entire EU-28 in 2012 approx. 20% total food produced was wasted, amounting to 88 million ton (173 kg per capita)[12]. Sources of food losses and waste in the European Union are connected with all the stages in the food production and distribution chains. Households waste 53%, the processing industry 19%, the catering industry 12%, food production 11%, while wholesale/retail and distribution channels account for 5% food waste (BFCN, 2016). The European Union is a diverse entity. It comprises countries differing in their history, cultural patterns, economy and natural conditions. Among other things these factors affect the potential for development in food production as well as the volume and structure of food demand. It is impossible to eliminate differences concerning productivity of agriculture in individual countries, similarly as it is not feasible to unify the volume and structure of consumption for individual food products. However, the co-existence within the EU facilitates exchange of agri-food products between individual member countries within the common EU market. Thus it may be assumed that despite the above-mentioned differences the problem of food security, or in a narrow sense, food self-sufficiency may be investigated at the level of the entire EU, even when the situation in some of the member countries varies.

Table 1 presents the mean volume of agricultural production in individual EU-28 countries in the years 2011-2013. It clearly shows that the EU-15 countries produced much bigger volumes of food than the EU-13 countries. France and Germany were the largest cereal producers, while among the EU-13 countries the greatest quantities were produced in Poland. The largest amounts of fruit were produced in Italy, Spain, France and in Poland. Similarly as in the case of fruit, leaders in the production of vegetables included Italy and Spain as well as Poland and France. France was the largest potato producer, followed by Germany, Spain, Italy and Poland. In the case of meat Germany ranked first, followed by France, Spain, Poland and Great Britain. The largest amounts of milk were produced in Germany and France, followed by Great Britain, Poland, Holland and Italy. France was the largest producer of eggs, followed by Germany, Italy, Spain, Holland, Great Britain and Poland. In this way we may identify the leaders in agricultural production within the EU-27. They are primarily countries belonging to the EU-15, i.e. France, Germany, Italy and Spain, while in the case of some products it is also Great Britain. Among the EU-13 countries only Polish agriculture reached the volume of agricultural production comparable to that of the above-mentioned countries.

Agricultural production through respective distribution channels reaches consumers in individual countries. The volume of food demand depends on the population size, nutritional needs and the structure of preferences for individual agri-food products. In 2016 the EU-28 population was 510.3 million, of which 239.9 million people lived in the UE-15 countries and 270.4 million in the UE-13. In 2080 it will be 572.6 million, 297.2 million and 275.3 million people, respectively (EUROSTAT, 2017). Thus the total EU-28 population will increase by 12.2% (Table 2). However, it may be stated here that this increase will concern first of all the EU-15 countries, in which the population will increase on average by 23.9%. At the same time, the population size in the EU-13 will increase by as little as 1.8%. The highest population growth rate is forecasted for Luxemburg Sweden, Ireland, Great Britain and Belgium. In turn, the greatest population losses will affect Lithuania, Bulgaria, Latvia and Greece. Slightly smaller, but still high reduction in the population size is forecasted for Portugal, Romania, Poland and Croatia. Such large losses may be termed

[12] This estimate refers to the year 2012 and covers both edible food and inedible food by-products.

as demographic disaster for these countries. As the data clearly show, this phenomenon will affect mainly the EU-13 countries.

Table 1. Agricultural production in EU countries, means in the years 2011-2013 (thousand tons)

Country	Cereals	Fruits	Vegetables	Potatoes	Meat	Milk	Eggs
EU-28	296425	60416	66735	141192	45059	156205	6816
EU-15	208829	51501	53947	85937	37779	126702	5353
EU-13	87596	8915	12787	55255	7280	29504	1462
Austria	5354	1096	640	2363	908	3392	106
Belgium	2998	551	2331	1960	1784	3225	166
Bulgaria	7869	454	487	2937	218	1278	73
Croatia	2903	399	211	1171	199	789	38
Cyprus	72	164	110	116	89	207	10
Czech Republic	7469	238	196	2635	528	2811	123
Denmark	9138	69	294	3167	1980	4994	80
Estonia	913	6	78	332	71	729	11
Finland	3801	21	265	1362	389	2309	64
France	67440	8522	5440	27134	5709	24916	886
Germany	45025	2492	3610	17042	8264	30797	774
Greece	4789	3516	3745	4017	437	1971	96
Hungary	12550	1188	1428	5056	853	1771	140
Ireland	2348	56	233	879	927	5503	47
Italy	18274	16227	13870	16124	4169	11114	765
Latvia	1828	16	157	667	80	878	41
Lithuania	4119	73	300	1497	208	1762	48
Luxembourg	159	16	1	59	21	296	2
Malta	14	10	80	35	14	45	4
Netherlands	1699	693	4937	2443	2683	12054	689
Poland	27744	3844	5618	12402	3766	12618	555
Portugal	1171	1692	2664	1842	762	1949	123
Romania	18175	2195	3899	8090	969	5052	318
Slovakia	3388	117	148	1218	156	955	80
Slovenia	551	210	73	278	129	608	21
Spain	21373	16104	12898	16792	5619	7407	761
Sweden	4899	49	395	1781	508	2900	122
United Kingdom	20361	397	2624	7794	3618	13876	672

Source: the author's calculations based on FAOSTAT data (2018)

Table 3 presents values of the index of food self-sufficiency estimated based on the mean food production in the years 2011-2013 and the mean consumption in that period, corrected by the change in population size recorded by 2016. The values of this coefficient calculated for the year of 2080 following the EUROSTAT population forecast were also presented. In this case the analysis does not take into consideration agrotechnical change or the loss of land excluded from agricultural production and allocated for residential, industrial and infrastructure development. Other factors may not be considered over such a long timeframe, as they are unpredictable, such as e.g. climate change, natural disasters, wars, etc. Analysis of data contained in Table 3 indicates that the EU-28 as a whole as well as its "old" part (EU-15) and the "new" part (EU-13) currently are and to a large extent will continue to be self-sufficient in terms of food supply. The only exception is fruit, the demand for which is now

covered and in the period of this forecast will be satisfied by the production within the EU in approx. ¾ in the EU-15, at the predicted surplus in 2080 in the EU-13 countries. Apart from countries with a relatively small area and a considerable increase in population size the situation in terms of food self-sufficiency will not change markedly. Luxemburg and Malta will experience shortages in practically almost all agricultural products. Thus shortage will appear in the countries, in which the population will increase considerably. These shortages may be compensated for within the EU by excess food production in the countries suffering from depopulation.

Table 2. Projected population change, 2016-2080

Country	Change (%)	Country	Change (%)	Country	Change (%)
EU-28	12.2	Finland	1.6	Netherlands	16.2
EU-15	23.9	France	17.9	Poland	-23.5
EU-13	1.8	Germany	-5.3	Portugal	-26.7
Austria	15.9	Greece	-32.6	Romania	-26.5
Belgium	25.4	Hungary	-11.6	Slovakia	-13.1
Bulgaria	-35.8	Ireland	31.7	Slovenia	-6.1
Croatia	-21.8	Italy	-11.3	Spain	9.8
Cyprus	18.5	Latvia	-34.8	Sweden	46.1
Czech Republic	-7.4	Lithuania	-42.6	United Kingdom	26.1
Denmark	20.2	Luxembourg	85.1		
Estonia	-13.3	Malta	19.1		

Source: EUROSTAT (2017)

Thus it may be stated that while the level of food self-sufficiency varies in individual countries, the EU as a whole is relatively safe in this respect. The extent of stability in the case of food security depends on the provision of efficient mechanisms for surplus reallocation to the areas suffering from shortages. This is not equivalent to any proposal for to introduce any institutional reallocation mechanisms. Such ideas were implemented in many communist countries and inevitably ended with a decline of agriculture and in extreme cases - in famine and civil war. However, at the level of the EU institutions it is recommended to promote internal exchange of goods, while maintaining economic, social and natural sustainability of agricultural production. Assuming that, in the long term, the European Union is committed to convergence of many operational areas and makes efforts to ensure similar conditions for the functioning of economic operators and households in all member countries, it does not seem justified for each separate country to pursue the objectives of food self-sufficiency. Under some circumstances, it may be reasonable for certain products on a transitional basis (Woś, 1998; Baer-Nawrocka, 2014). However, because of various reasons including the specificities of different countries (mainly in terms of natural conditions) and in view of various comparative costs of production, national self-sufficiency is not justified in the long term, especially if food may be traded with other countries on a relatively unrestricted basis. Thus, without prejudice to the economic separateness and autonomy of Community countries, focus should rather be placed on self-sufficiency within the EU, having in mind its production potential and competitive position against non-member countries. Also, potential reserves should be identified which may be used provided that greater rationalisation efforts are made in the course of food production, processing, distribution and consumption. If in accordance with the proposals contained in the report by the MEP Biljana Borzan (S&D, Croatia), presented in April 2017 at the European Parliament[13] the level of food

[13] For more detail see: Initiative on resource efficiency: reducing food waste, improving food safety (2016) and Borzan (2017).

waste was reduced by half (i.e. from 20% to 10%), the European Union could become a significant net food exporter, with no need to increase cropped area or production intensity.

Table 3. Indexes of food self-sufficiency for EU countries, the current status and forecast for 2080 (%)

Country	Cereals		Fruits		Vegetables		Potatoes		Meat		Milk		Eggs	
	2016	2080	2016	2080	2016	2080	2016	2080	2016	2080	2016	2080	2016	2080
EU-28	108	106	77	74	101	101	104	102	106	103	111	108	101	98
EU-15	99	92	74	70	102	97	105	95	107	99	110	102	98	90
EU-13	135	173	95	120	97	125	99	129	101	127	114	146	116	147
Austria	102	88	60	52	62	53	91	79	114	99	129	112	82	71
Belgium	39	31	62	49	127	101	183	146	225	179	101	81	98	78
Bulgaria	221	344	67	105	82	127	72	113	55	85	94	146	110	171
Croatia	114	146	75	95	60	77	80	102	73	93	81	104	98	125
Cyprus	22	19	190	161	109	92	298	251	107	91	122	103	117	99
Czech Republic	146	158	30	33	25	27	83	89	66	71	123	133	86	92
Denmark	110	91	10	8	44	36	103	86	352	293	231	192	82	68
Estonia	135	156	6	7	51	59	81	94	77	89	152	175	65	75
Finland	116	114	4	4	53	52	92	90	91	90	97	96	114	112
France	180	153	57	49	71	60	114	97	95	81	134	113	94	79
Germany	113	120	28	30	42	44	126	134	114	121	130	138	71	75
Greece	88	131	165	245	113	168	80	119	51	76	63	94	91	134
Hungary	182	206	120	136	143	162	84	95	123	140	99	112	98	111
Ireland	67	51	7	5	44	34	52	40	238	181	222	169	89	67
Italy	71	80	113	128	139	157	51	58	80	90	68	77	96	108
Latvia	209	321	15	23	67	102	102	156	62	96	168	257	144	221
Lithuania	197	343	42	73	80	139	95	166	94	165	143	249	115	201
Luxembourg	75	40	12	6	2	1	48	26	37	20	168	91	26	14
Malta	9	7	23	20	79	66	54	45	33	28	42	35	79	66
Netherlands	15	13	24	20	296	255	205	176	182	157	185	159	225	193
Poland	105	137	136	177	111	144	103	135	127	166	119	155	148	194
Portugal	25	34	81	111	134	183	50	68	80	110	84	114	108	147
Romania	148	201	91	124	101	138	107	146	93	126	103	140	109	148
Slovakia	116	134	32	36	35	41	58	67	52	60	102	117	99	114
Slovenia	65	69	67	72	40	43	58	62	80	86	112	119	93	99
Spain	70	64	168	153	179	163	62	56	127	116	71	65	111	101
Sweden	108	74	4	3	37	25	73	50	63	43	85	58	90	62
United Kingdom	89	71	5	4	38	30	73	58	66	52	79	63	85	67

Source: the author's calculations based on data of EUROSTAT (2017) and FAOSTAT (2018)

4. Conclusion

The discussion presented in this paper leads to the formulation of the following observations:

1. The largest food producers in the EU-28 are countries of the EU-15, i.e. France, Germany, Italy and Spain, and in the case of some products also Great Britain. Among the EU-13 countries only Polish agriculture has reached the volume of agricultural production comparable to that in the above-mentioned countries. The EU-28 as a whole as well as its "old" part (EU-15) and the "new" part (EU-

13) currently are and by 2080 will remain self-sufficient in terms of food supply. Fruit production is the only exception in this respect, as the demand is covered and in the timeframe of this forecast will continue to be covered by the EU production in approx. ¾ in the EU-15, at the forecasted surplus in 2080 in the EU-13 countries.

2. While the level of food self-sufficiency varies in individual EU-28 countries, the problem of food self-sufficiency should be considered at Union-wide level. Under some circumstances, the commitment to food self-sufficiency at national level may be reasonable for certain products on a transitional basis. However, because of agricultural specificities of different countries and in view of various comparative costs of production, national self-sufficiency is not justified in the long term, especially if food may be traded with other countries on a relatively unrestricted basis. Thus it is necessary to provide efficient mechanisms for surplus reallocation to areas suffering from shortages by facilitating exchange of goods within the EU, while maintaining the economic, social and natural sustainability of agricultural production.

3. Also, the high level of food waste in the European Union (reaching 20%) suggests there is an opportunity to address more fully the population's food requirements and to increase exports to non-member countries, provided that greater rationalisation efforts are made in the course of food production, processing, distribution and consumption processes.

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