

## POTATO MARKET CHANGES - EU OVERVIEW FOR THE 2010-2019 PERIOD

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**Abstract:** *The EU potato sector is analysed regarding production quantities, harvested area, yields, consumption, price indices, import and export intra and extra EU. The present paper was intended as an empirical secondary data analysis of the EU potato sector for the period 2010-2019. The methods used are the direct comparison, the method of indices, relative and absolute changes, Gini coefficients. Romania was the 4<sup>th</sup> producer of potatoes in the EU by harvested area and the 7<sup>th</sup> by potato production quantity in 2019. The yield in EU standard humidity decreased to 14.79 tonne/ha, pushing next to last place near Bulgaria.*

**Key words:** *Potato sector, food balance and security, potato market concentration, market decrease, time series*

### 1. Introduction

European Union's potato sector is a high value agriculture sector, in 2019 it produced 56.62 million tonnes of potatoes worth over 13 billion euros.

The potato sector was in decrease in the 2000-2010 period due to massive potato crop area decrement. The potato is an expensive culture, investment costs per ha can reach more than 5000 Euros.

In this article the approach from six directions was considered to give an overview of the potato market in the 2010-2019 period. At the time of writing this article, only raw data was available, with no articles for this period.

The six directions of approach considered are: (1) Harvested area and land concentration within EU28 member states regarding production, (2) Harvested potato production including seed potatoes and the development potential of potato production, (3) Yield of potato production – connections between yield and production, (4) Potato Consumption and hypothetical Potato Balance for all EU-28 countries, (5) Potato trade inside and outside of EU, export, import and balance (Quantitative approach), and (6) Potato producer price analysis by export/import balance of the EU28 members.

## **2. Data and Methods**

### **2.1. Data**

The data used in this paper was collected from the Eurostat Database for the 2010-2019 period regarding potato production quantities, harvested areas, yields, producer prices, population number, export and import quantities and prices intra and extra EU for Romania and the other EU28 countries.

Data regarding potato consumption for the 2014-2017 period was gathered from FAOSTAT.

### **2.2. Methods and indicators**

The following indicators of the potato sector were taken into consideration in order to show a wider field of the Romanian potato market as part of European single market: (i) Cultivated /Harvested Area with Potatoes (Area) analysed in dynamics with indices, absolute value and the share of potato cultivated area compared to EU28, (i1) Gini index to determine and study the harvested area concentration and fluctuations as (Gini Index is equal to 1 minus twice area (Z) under the Lorenz Curve  $G=1-2Z$  (8)); (ii) Harvested potato production dynamics including seed potatoes in absolute values and indices, and the share of production compared to EU28; (iii) Potato yields dynamics in absolute values and indices; (iv) Potato consumption dynamics in absolute values; (v) Potato import and export balance dynamics of EU-28 in absolute quantity and indices; (vi) Potato selling prices in absolute value and weighted averages.

## **3. Results**

### **3.1. Harvested area**

The ranking of the EU28 member states by harvested area with potatoes hasn't changed in the 2010-2019 period, and Romania like all the other countries in the EU28 maintained its rank (Romania is in the 4<sup>th</sup> place). (Source: Eurostat, *apro\_cpsh1*).

The areas in the EU28 are highly concentrated, the countries within the top seven by area of harvested potatoes represented 78% of the areas harvested in EU28 in 2019.

In figure 1 the distribution of harvested potato area in the EU28 countries for 2019 can be observed (only the top seven for better visibility); Romania's potato harvested area represented 10.36% of the total 1.772 million ha harvested in the EU28.

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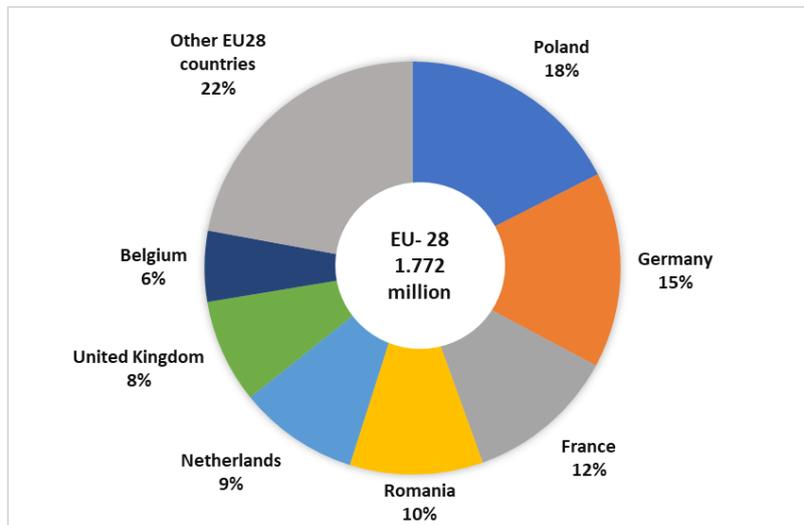


Fig.1. Area harvested of potatoes, including seed potatoes, by main producing EU Member States, 2019

(own representation, data source Eurostat apro\_cpsh1)

Romania’s position hasn’t changed in this period, but its share of EU28 total harvested area has decreased from 13.82% in 2010 to 10.36% in 2019. The lowest share percentage can be found in 2017: 9.82%. From 2010 till 2019, from the top seven countries by area of potato production only Poland and Romania have decreased their areas harvested with potatoes, the biggest gains being registered by France and Belgium in this nine year period.

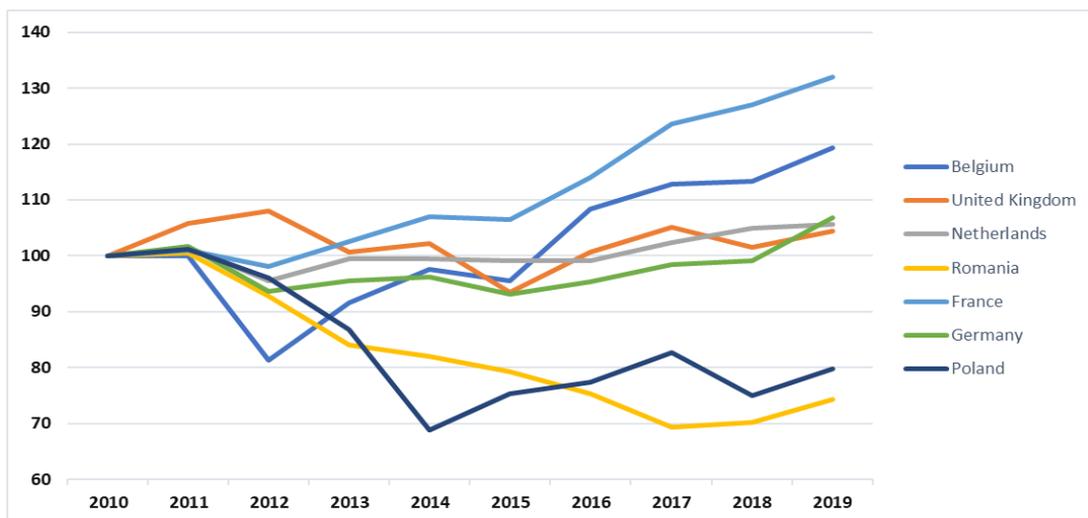


Fig.2. Index of the area of potatoes harvested, main producing Member States of EU28 2010=100

(source: author’s own calculation and representation based on Eurostat, apro\_cpsh1).

For studying the changes of concentration of potato harvested areas, the Gini coefficient for the 2010-2019 period has been calculated (Table 1). Because of missing data for Belgium and Latvia for 2010, the 2011 data was used. The calculated Gini ratio had a minimum of 0.592 in 2011 and a maximum of 0.652 in 2018 (Table 1.)

Table 1

*Potato harvested area Gini ratios*

Time	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EU28 potato harvested area calculated Gini ratio	0.603	0.592	0.623	0.632	0.641	0.652	0.650	0.638	0.652	0.647

(Source: *author's own calculation and representation based on Eurostat, apro\_cpsh1*).

The changes are small on yearly bases, but the increasing trend of the ratios can be observed specially in the 2011-2015 period. The Gini indices are approximately constant, and there is a fairly high and constant concentration of the area cultivated with potatoes in the same few EU countries.

### 3.2. Production of potatoes

The harvested potato production including seed potatoes in the EU28 for the year 2019 exceeded 56.6 million tonnes. This was a 9.28% increase from 2018. The top seven production quantities of potatoes (including seed potatoes) represented 79.5% of the total production. The countries are the same as in the top of the harvested area discussed before, but the rankings are different as shown in figure 3.

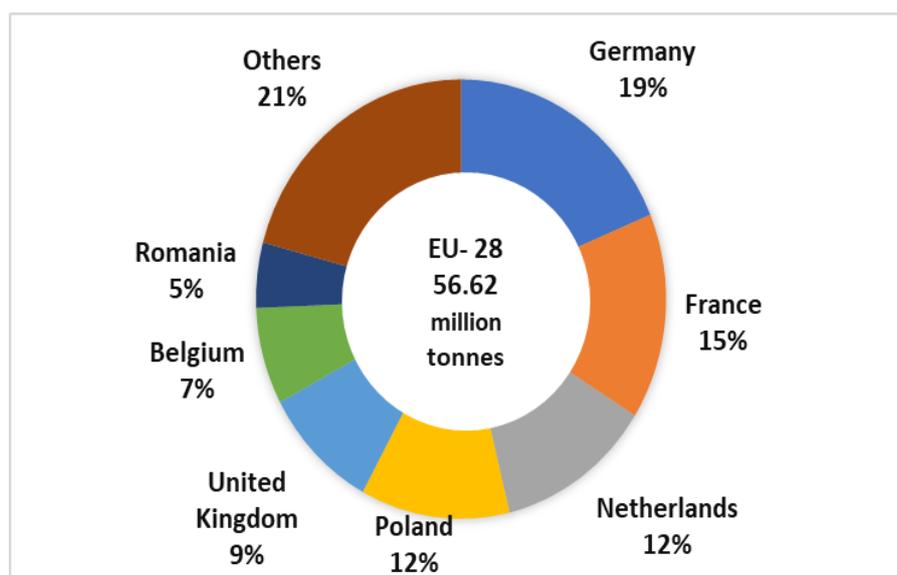


Fig. 3. *Production of potatoes, by main producing EU Member States, 2019*

(Source: *author's own calculation and representation based on Eurostat, apro\_cpsh1*)

The scatterplot representation of the analysed nine years average growth rate on the Ox axis, and potato production quantities in 2019, expressed in tonnes, on the Oy (figure 4), reveals that Germany, France, Netherlands, Belgium, and Denmark are the leading countries in the EU28 as of 2019 regarding potato production, including seeds. Denmark has the biggest average growth rate of potato production during the 2010-2019 period, 6.58%.

Romania is in the second quadrant along with Spain, UK, and Poland. The average growth rates were negative, these countries' production has been shrinking from 2010, Poland and Romania lost more than 2% of their production every year from 2010 to 2019. Their production quantity was above EU28's average of 2,022 million tonnes.

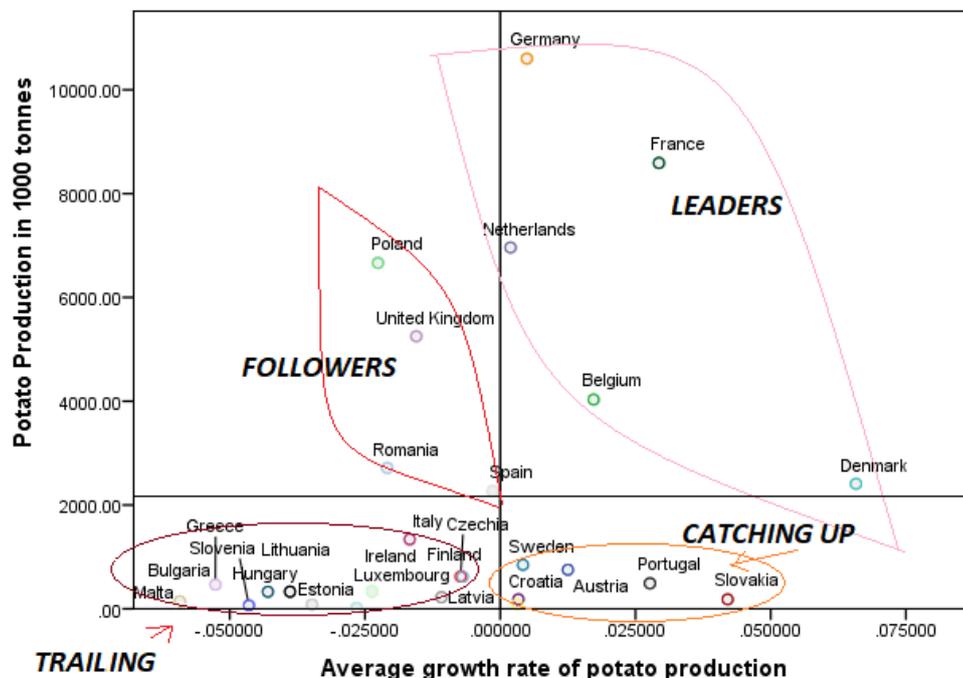


Fig. 4. Development potential of potato production, including seed potatoes within EU28 by 2010-2019 production quantities

(Source: author's own calculation and representation based on Eurostat apro\_cpsh1)

The countries in the third quadrant are trailing with negative growth rates and potato production below EU28 average. Italy has the biggest production in this group with a 66% of the EU28 production of potatoes.

The countries in the 4<sup>th</sup> quadrant are catching up in the long run with positive average growth rates of potato production but under the EU28 average. Sweden is in the best position in this group regarding production quantity and Slovakia exhibits the biggest average growth rate of potato production.

### 3.3. Potato Yield in EU28

The Eurostat online database contains information about yield per hectares of potato production including seed potatoes, there are 25 missing values for the 2010-2019 period, no data for Malta – all ten values are missing for the studied period. For the potato yield studying the values were calculated as Produced Potatoes (in 1000 t) / Harvested Area (in 1000 Ha), the results were expressed as in Eurostat *apro\_cpsh1* in t/ha. This was necessary not only because of missing values, for Italy the values in 2011, 2012 and 2014 were not realistic, 2.56, 2,56, 2.62 t/ha. The calculated yields are 24.95, 25.43, and 26.08 t/ha. For Belgium and Latvia, the yields for 2010 were not possible to be calculated due to lack of data, thus the 2011 yields were used instead. The EU28 average yield of potato production was situated in the interval 26.12-29.55 t/ha with an average of 27.70 t/ha in the 2010-2019 period. In 2019, the countries with the best yields (t/ha) were Denmark, Netherlands, France, Belgium and Germany; the lowest yields were obtained in Malta, Romania, Bulgaria, Lithuania, and Croatia.

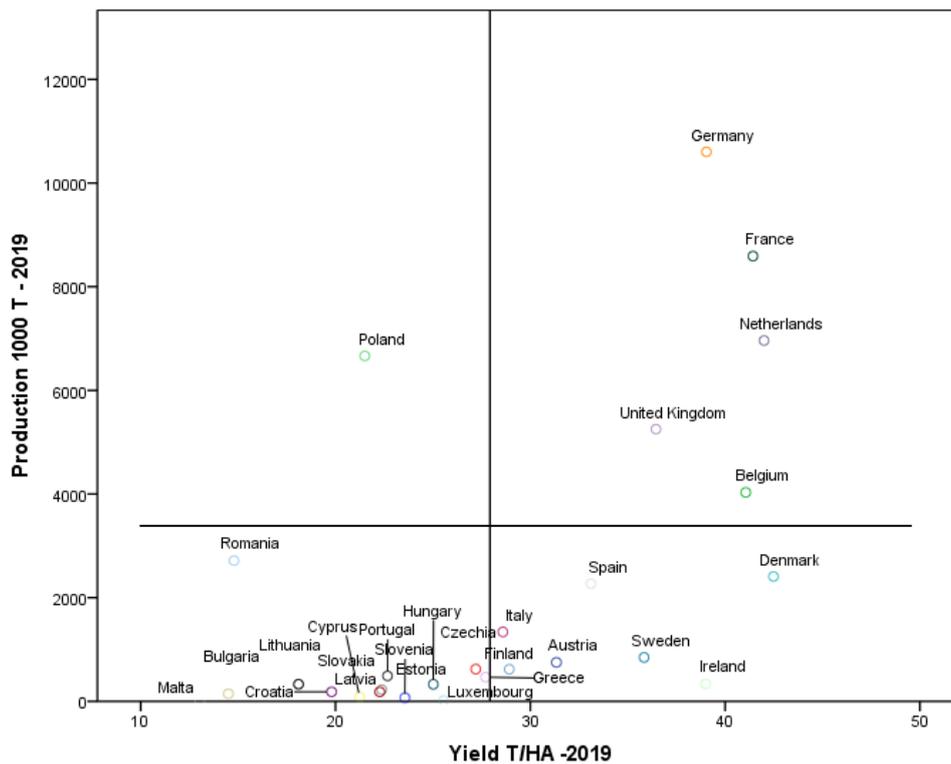


Fig.5. *Potato Yield and Production in 2019 / all EU28 countries*

### 3.4. Potato Consumption in the EU-28

The most recent data regarding potato consumption was collected from FAOSTAT, it was for the year 2017. The data regarding consumption is available on yearly bases for

the 2014-2017 period. Studying the potato consumption data, the following can be observed: the average potato consumption in the 2015-2017 period had low volatility, the average consumption was in the [61, 62] kg/capita/year interval. The whole list can be consulted in the bellow bar chart, the top consumers in 2017 were Latvia, Poland, Romania, UK, Belgium, Netherlands, Germany, and Estonia; the lowest consumers in the EU-28 potato wise were Cyprus, Bulgaria, Italy, and Malta. A relationship between GDP/capita, Potatoes production/capita, Meat consumption/capita and Wheat consumption/capita over Potatoes consumption/capita has been studied but without observable pattern.

The values of potatoes consumption as of year 2017 are represented in figure 6. These values were used to calculate the necessary amount of potato for the EU-28 countries, by multiplying the EU-28 countries population (2017) with their average potato consumption kg/capita/year and multiplied with a correction factor for weight loss (1.195) plus potato seed quantity for the countries area.

The correction factor was determined as  $(1.03\% \wedge 6)$ , 3% weight loss per 30-day period, with an average period of 180 days. The need for potato seed was appreciated as 3t/ha. The harvested area for 2020 was estimated as equal with 2019 potato harvested area due to lack of data regarding seeded areas as of 2020. The data was compared to the countries' harvested production for year 2017 and 2019 to calculate the Balance for 2017 and 2019 as in figure 6.

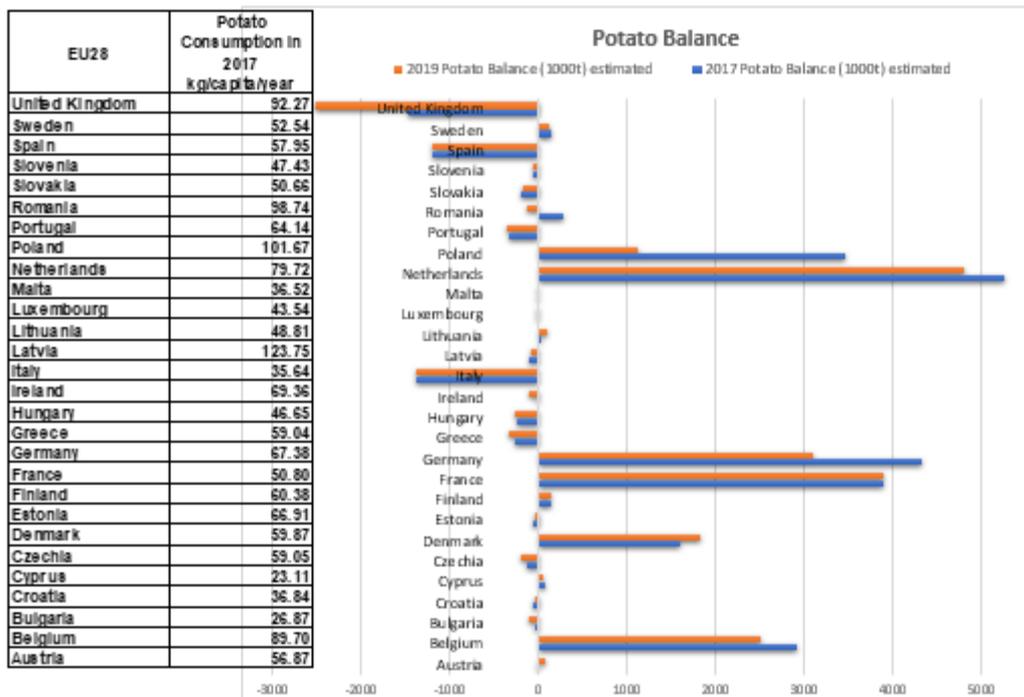


Fig. 6. Potato Consumption and hypothetical Potato Balance in 2017 – EU-28 – kg/capita/year

(source: fao.org and Eurostat demo\_gind, apro\_cpsh1)

### 3.5. Potato import and export intra EU-28 and extra EU-28

Data regarding import and export for 2017 and 2019 regarding potato was available at the time of the study.

In 2019, the total potato export quantities exceeded the total import quantities. It is challenging that imports overtook exports between EU-28 member states, imports were bigger with 16,293.6 tonnes than exports, having a negative balance. The most probable cause was that some of the imports from outside EU-28 were wrongly classified as exports. As regarding the balance trade of potatoes outside of EU-28 the balance is positive with 559,789 thousand tonnes.

The top exporters and importers inside and outside of the European Union can be observed in figure 7.

The concentration is visible regarding the potato export quantities intra and extra EU, 85% of the exports inside EU-28 were due by four countries and 80% of the exports outside EU-28 were due by three countries. Germany, France, and Netherlands had the biggest exports in 2019 regarding potato trade.

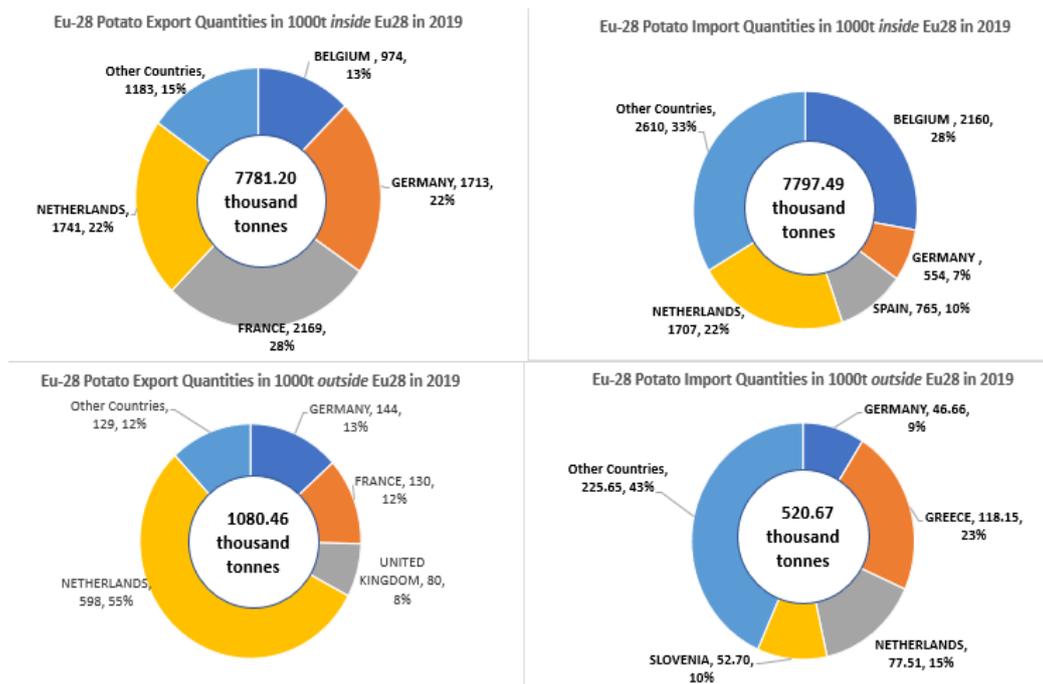


Fig. 7. Potato trade in the EU-28 as of 2019

(source: author's own representation of data from Eurostat DS-016890)

The Export-Import Balance for 2017 year regarding potato quantities was calculated.

The balance based on Eurostat DS-016890 was compared to Fig. 6 hypothetical balance. The results were shocking at most of the countries, the differences were

positive at 15 countries and negative at 13 countries. The table containing Balance of potato exchanges by countries inside and outside of EU-28 can be observed in Table 2.

Table 2

## EU 28 Potato Balance for years 2017 and 2019

Eu 28	Hypothetical Potato Balance 2017 (All Export- All Import in 1000t)	Potato Balance 2017 (All Export- All Import in 1000t)	Difference in 1000t	Hypothetical Potato Balance 2019 (All Export- All Import in 1000t)	Potato Balance 2019 (All Export- All Import in 1000t)	Difference in 1000t
Austria	-13.61	-139.85	-126.24	77.79	-131.06	-208.85
Belgium	2920.84	-1198.46	-4119.29	2510.01	-1195.63	-3705.63
Bulgaria	-42.45	-38.57	3.88	-109.59	-40.09	69.51
Croatia	-54.46	-11.08	43.38	-23.11	-18.42	4.69
Cyprus	73.67	90.33	16.65	48.25	61.48	13.23
Czechia	-125.60	-147.11	-21.51	-196.97	-160.98	35.99
Denmark	1604.03	38.32	-1565.72	1823.54	55.96	-1767.58
Estonia	-51.68	-7.14	44.54	-35.92	-1.09	34.83
Finland	150.93	-5.85	-156.78	156.88	8.53	-148.35
France	3896.13	1606.94	-2289.19	3903.77	1866.63	-2037.14
Germany	4324.10	1387.54	-2936.56	3108.07	1256.41	-1851.66
Greece	-272.92	-140.93	131.99	-340.16	-166.07	174.09
Hungary	-245.23	-19.91	225.32	-254.82	-20.41	234.41
Ireland	-8.50	-65.81	-57.31	-94.01	-502.53	-408.53
Italy	-1370.80	-502.53	868.27	-1370.66	-64.55	1306.11
Latvia	-108.56	-13.44	95.12	-90.00	-5.15	84.86
Lithuania	9.64	5.30	-4.34	112.27	10.16	-102.11
Luxembourg	-11.32	-3.06	8.26	-18.39	-2.86	15.52
Malta	-13.39	-1.00	12.40	-14.60	-3.04	11.56
Netherlands	5272.09	48.13	-5223.96	4818.95	544.60	-4274.35
Poland	3473.24	-83.83	-3557.07	1125.13	-93.31	-1218.44
Portugal	-336.94	-299.26	37.68	-361.28	-290.15	71.13
Romania	280.97	-116.92	-397.89	-124.26	-126.59	-2.33
Slovakia	-202.36	-49.48	152.88	-171.85	-55.09	116.76
Slovenia	-48.35	-30.67	17.68	-60.29	-19.97	40.32
Spain	-1182.52	-483.99	698.53	-1184.33	-495.14	689.18
Sweden	153.72	-38.27	-191.99	134.95	-41.43	-176.39
United Kingdom	-1456.39	93.04	1549.43	-2523.16	99.70	2622.86

(source: author's own calculations, based on Eurostat DS-01689)

### 3.6. Potato selling prices

The selling prices of main potatoes crops producers without VAT have fluctuated significantly between EU member states from 14.29 euro/100 kg to 58.2 euro/100 kg in 2019. The producer selling prices in Ireland are confidential; the prices from Estonia, Cyprus, and France are missing from the Eurostat TAG00063 data table (Figure 8).

If looking at the traditional countries with high negative balance – the import dependents should have higher prices compared to the countries with positive potato balance. By calculating the average potato producers' selling prices for positive and negative potato balances in 2019, the results were 23.1 euro/100 kg average selling price in case of positive balance and 31.4 euro/100 kg in the opposite case (found in Table 2). Calculating as described the average prices but comparing the prices to the Hypothetical Potato Balance of 2019 presented in Table 2, the results were fairly the same: 23.1 euro/100 kg for positive balance and 33.02 euro/100kg for negative balance.



Fig. 8. *Potato selling prices*

(Source: Eurostat TAG00063)

#### 4. Conclusions

Potatoes were cultivated on 1.772 million hectares (ha) in the EU-28 in 2019 (Fig. 1), this was the biggest cultivated area with potatoes in the last seven years, almost reaching the value from 2012, of 1.792 million ha, but lower compared to the studies regarding the first period, 2010 (by 6.03%). The production of potatoes was mainly concentrated in 2019 in the seven countries presented as they accounted for harvesting of 78% of EU-28 potato harvested area. The proof of concentration are the values of the Gini index calculated for the studied 2010-2019 period presented in Table 1.

The cultivated area has sharply declined in 2019 compared to 2010, in Poland (20%) and Romania (25%), but with a slight increase compared to 2018. France (32%) and Belgium (19%) increased their harvested areas the most; United Kingdom (4.4%), Netherlands (5.6%) and Germany (6.8%) in this nine-year period slightly increased, but insignificantly due to their harvested area sizes.

The harvested potato production in the EU-28 in 2019 was 56.62 million tonnes, marginally better than 2010 harvested production quantity (0.64%). In this period, the production was fluctuating annually, influenced by weather conditions. Germany maintained the position as the biggest potato producer of Europe with a slow increase in production. The biggest growth in term of production increase was registered in Denmark (77%) with an average growth rate of 6.5% (Fig. 4).

The EU-28 average yield of potato production was situated in the 26.12-29.55 t/ha interval with an average of 27.70 t/ha in the 2010-2019 period. In 2019 the countries with best yield (t/ha) were Denmark, Netherlands, France, Belgium and Germany, the lowest yields were obtained in Malta, Romania, Bulgaria, Lithuania, and Croatia. (Fig. 5)

The average potato consumption in the European Union (FAOSTAT database) for the 2013-2017 period has low fluctuation, the rankings and consumption changes are small. A pattern regarding production, area or yield of potato production, potato production /capita /year and consumption /capita /year could not be identified. The consumer

habits of population didn't change either direct or indirectly regarding GDP/capita/year either. For further investigation as of consumption in the EU-28 countries, using population, and potato harvested area a hypothetical potato balance quantities table for 2017 and 2019 were generated and represented in Fig. 6.

The import and export balances of the EU-28 countries confirm that the biggest producers in the EU are capable of achieving quantitative exports in the potato trade inside and outside of the EU. It is interesting that a producer country from the Leader group (Fig. 4 and Fig. 5) – Belgium - import quantities surpass its exports inside EU trade with more than 221% (Fig. 6.), backed up by an average production balance surplus of 219 kg /capita /year for 2019. EU-28 changed from the status of a net importer in 2017 (1.2753 million tonnes negative balance) to a net exporter status in 2019 (4.699 million tonnes positive balance) (Table 2).

Regarding producer selling prices of potato without VAT a linkage can be verified between potato quantity export/import balance of each EU-28 country and the average price index – a country with positive export/import balance has, on average, lower producer prices than a country with negative balance. Further studies are necessary for other agricultural crops EU wide to verify these results.

### Acknowledgements

I am particularly grateful for the assistance given by main supervisor prof. dr. Liliana Duguleană regarding the technical and empirical approach of the article.

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