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THE EFFECT OF MAIZE PRODUCTION AND CONSUMPTION ON PRICES IN ROMANIA

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Abstract: *The present study seeks to answer the question: how does corn price influence production, consumption and foreign trade? In order to answer this question we will analyse the areas cultivated with corn, the total production and implicitly the average yield per hectare in the last years. These data, together with the average annual consumption of grain maize and the volume of imports and exports, will lead to the determination of supply and demand for maize on the market. With the help of price data collected on the website of the Ministry of Agriculture and Rural Development, which can be found in geographical areas and calendar months, we can observe the monthly differences in prices. Using these data and calculating the correlation coefficient, it will be possible to determine at the end of the project the effects of the demand and the supply on the price of this product.*

Keywords: *maize price, consumption, production, demand, supply.*

JEL classification: Q11

INTRODUCTION

In Romania, cereal production has grown in the last years to 21 million tons (grain cereals), of which on average (2013-2016), more than half (51.1%) is grain maize, with an average total production in the analysed period of 10.7 million tonnes, which again reveals the importance of this crop.

This agricultural product, along with wheat and rice, forms the food base of the vast majority of the world's population, either directly or by transforming it into food preparations.

Worldwide, maize is grown on extensive areas of over 185 million hectares, with a worldwide harvest of just over 1 billion tonnes. The largest areas cultivated with corn are in America and Asia, and among the first countries with the largest areas we can list: China, USA, Brazil, India and Mexico; Romania ranks 15th in the world, according to the area cultivated with maize (in 2014), with just over 2.5 million hectares and the first place in Europe.

The total production of maize has a decisive role in the livestock sector, especially in its development and modernization, especially in the meat producing sector. In this branch, the chemical composition of the product is particularly important, thus, by cumulating more maize hybrids from different areas, we can assume that the nutrients in the maize grain composition are arranged as follows: "protein 9.07-13.64%, starch 60-70%, fat 4.05-5.51%"².

This cereal product is used in animal feed as a very valuable but also in human food, not directly but in the form of cooked corn, bacon, popcorn, popcorn, corn flakes, etc. With regard to its industrialization, starch, alcohol, glucose and oil can be obtained, and as secondary products, borhot, bran, cakes.

Among the technical elements contributing to the importance of this crop can be mentioned: high and safe yields, corn is a good precursor, low harvest loss, low sowing, contribute to soil fertilization by harvesting chemical fertilizers.

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MATERIALS AND METHODS

In this study, we will analyse data on the maize market, with the help of statistical sites (INS, Eurostat, FAO State) will analyse Romania's total production, average, consumption and trade with this product. Corn prices will be collected from the website of the Minister of Agriculture and Rural Development, where prices are given for 2013-2016 on three areas of Romania (Banat, Muntenia and Oltenia).

These data will also be analysed from the point of view of the correlation and the link between them, by means of the correlation coefficient, which is thus determined:

$$r_{xy} = \frac{\sum(x_i - \bar{X})(y_i - \bar{Y})}{\sqrt{\sum(x_i - \bar{X})^2 \sum(y_i - \bar{Y})^2}}$$

RESULTS AND DISCUSSIONS

Carrying out a brief analysis of the maize market, the cultivated areas, total production, average production, consumption and based on them were aggregated demand and supply.

This market analysis was carried out for the period 2013-2016, the main reason being the availability of corn price data taken from the MADR.

Referring to the areas cultivated with maize during the period mentioned above and the total yields of the same period can also result in the average yields of this crop, they are summarized in the following table:

Table 1 Evolution of areas, total production and average production of maize

Specifications	2013	2014	2015	2016
Areas cultivated with maize (ha)	2518268	2512809	2605165	2580975
Production of grain corn (million t)	11305095	11988553	9021403	10746387
Average output (t/ha)	4,49	4,77	3,46	4,16

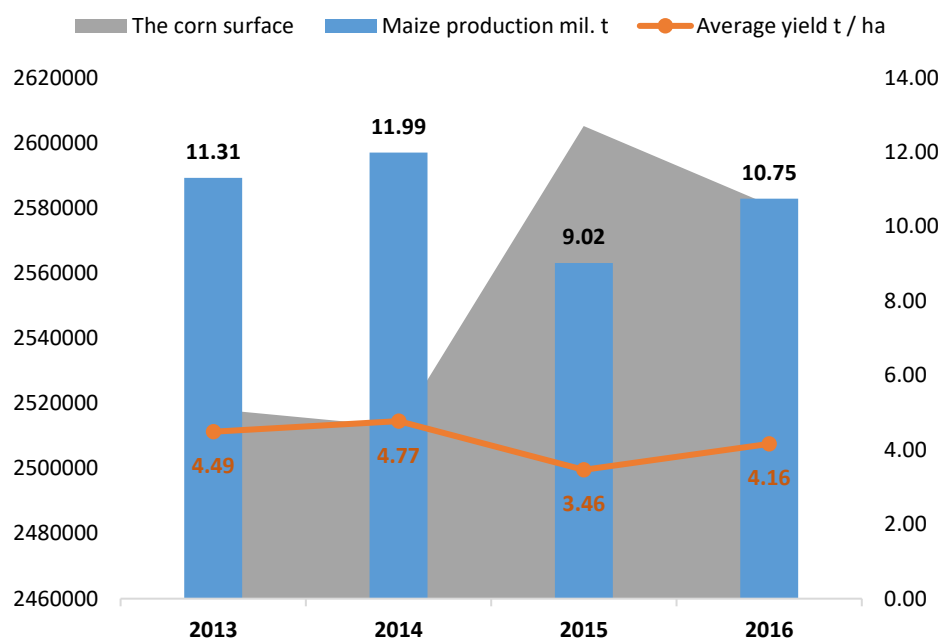
Source: <http://statistici.insse.ro>

As far as the area cultivated with maize is concerned, in the period 2013-2016 it grew very little on average by 0.84%, in 2015 the maximum of 2.6 million hectares cultivated with maize was reached and the minimum (in the last four years) of 2.51 million hectares a year earlier. On average, the area for maize crops was about 2.55 million hectares.

From these areas, on average, in the four years, 10.76 million tons of grain maize. In 2014, the largest quantity was harvested, of 11.98 million tonnes, and the next year the smallest harvested quantity of 9 million tonnes, inversely proportional to the situation of the areas.

On average, during the reference period, production increased insignificantly by 0.13%, but in 2016 it was lower than in the first years of the period, amounting to 10.74 million tonnes of maize. The decrease in 2015 compared to 2014 was 24.77%, the main cause being the drought in the year.

Figure 1. The evolution of the surface and the production of maize



Source: <http://statistici.insse.ro>

Figure 1 shows the previous table showing the surface and production evolutions, implicitly the average outputs, or in other words, the production yield. As can be seen from Figure 1, average production has decreased, on average, by 0.3%. Starting from an average yield of 4.49 tonnes per hectare (2013), the highest yield of 4.77 tonnes per hectare was recorded in the following year, due to the lowest level of the cultivated area, at the same time as the highest level high total production. In the following year, the situation was exactly the opposite, with the largest area of maize in the period under review and the lowest national production, therefore the average yield per hectare was the lowest in the whole period of only 3.46 tons /hectare. In the last year, the situation recovered, so the areas were lower and the production was higher than the previous year, recording an average yield per hectare of 4.16 tons.

Analysing consumption and external trade, aggregate demand and supply can be determined, and consumption and export and import data are presented in the following table. These were analysed for the period 2013-2015, not identifying data for 2016.

Table 2 Maize consumption and external trade

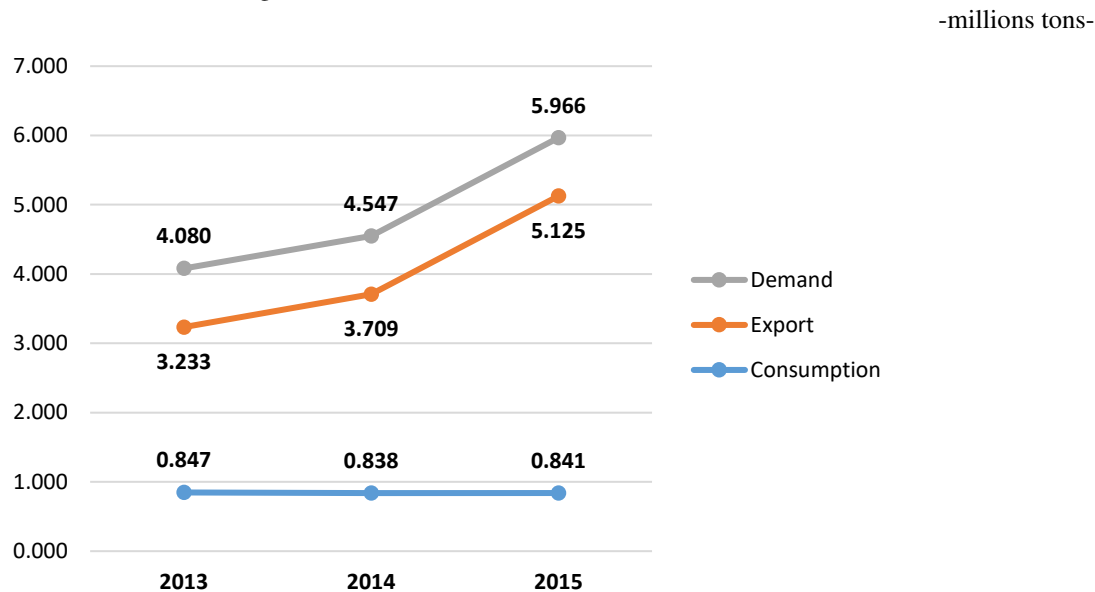
Specifications	2013	2014	2015
Annual per capita consumption of corn equivalent grain (kg / site / year)	42,3	42,0	42,3
Import (mil. t.)	0,284	0,471	1,622
Export (mil. t.)	3,233	3,709	5,125
Consumption of grain corn equivalent (mil. t)	0,847	0,838	0,841

Source: <http://statistici.insse.ro> , trademap.org

According to the NIS, the average annual per capita consumption of grain maize was on average (2013-2015) of 42.2 kilograms per capita. By reporting this value to the total population, each year, it was possible to calculate the total grain maize consumption, expressed in millions of tonnes, averaging 0.842 million tonnes.

Both imports and exports increased during the reference period, from 0.284 million tonnes imported in 2013, to 5.7 times more imports and 1.6 million tonnes in 2015. In the first year, the export was 3.233 million tonnes, and in two years it increased to 5.125 million tonnes and 58.52% respectively. Throughout the period, the trade balance was surplus; on average, the export of maize was higher than the import of 5.07 times.

Figure 2. Demand of corn on the market

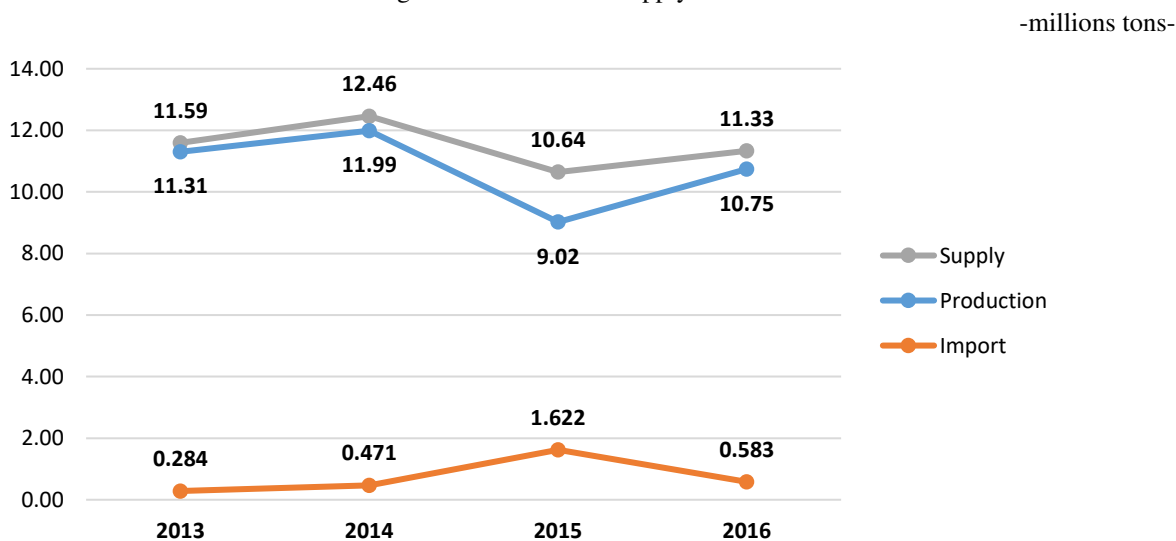


Source: own calculations

As defined as aggregate demand, as a sum between consumption and export, figure 2 was presented as a sum for the period 2013-2015. As can be seen, domestic consumption has a rather low contribution to demand, at a somewhat constant level of 842 thousand tons on average. In addition, the volume of exports made by Romania in this period, respectively, averages 4 million tons.

Romania's demand for grain maize amounts to an average of 4.864 million tonnes. During the analysed period, its trend was increasing, following the same trend as exports due to their high volume. In 2015, total demand grew by 46.22% compared to the first year, reaching 5,966 million tonnes.

Figure 3. Corn market supply



Source: own calculations

The aggregate offer is presented in the literature as an amount of two components, namely production and import. Analysing these data for the period 2013-2016, it was calculated and presented in Figure 3, the offer of corn grain product. As can be seen in the figure, the evolution of imports shows an increasing trend, with an average volume of 0.74 million tonnes, this average being "encouraged" by the import volume of maize from 2015, when it was highest of 1.622 million tonnes, amid a low production in that year.

Average production for the reference period was 10.77 million tonnes, its trend over the four-year period oscillated, with a significant decline in 2015.

Cumulatively, the two indicators set the level of corn supply on the Romanian market, so in the period 2013-2016, the supply level averaged 11.51 million tons of corn, 2.36 times higher than demand level. The tendency of supply evolution, experienced slight fluctuations, following the trend of production, and where the latter underwent drastic changes (2015), was neutralized by the volume of imports that tried to cover the production deficit.

Table 3 Corn prices by geographical area

-lei/tonne-

Luna	Banat				Muntenia				Oltenia			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
Jan.	980.06	586.88	492.11	606.89	1003.91	647.97	601.22	658.46	1017.81	588.94	502.60	574.23
Feb.	960.27	563.57	511.89	604.53	985.47	632.43	637.32	653.24	1001.29	560.24	600.00	609.72
Mar.	914.82	576.30	531.26	598.24	976.89	673.12	607.82	644.68	966.09	663.15	598.93	598.74
Apr.	897.25	591.98	537.66	590.15	978.70	723.18	647.42	598.42	987.49	693.86	649.12	618.31
Mai	868.90	654.58	558.75	603.44	998.58	683.48	661.56	648.17	936.88	710.00	627.82	634.55
Jun.	987.37	692.46	560.36	665.56	985.84	656.89	663.80	704.67	933.18	723.23	596.15	637.04
Jul.	890.00	683.26	631.73	661.00	917.90	658.56	651.33	739.61	915.69	689.49	-	626.30
Aug.	658.61	691.86	765.50	690.19	686.50	655.00	725.76	677.59	503.22	766.00	554.26	578.91
Sep.	-	571.91	565.44	564.70	-	549.29	629.08	594.37	-	581.66	592.02	601.75
Oct.	505.13	441.77	554.32	535.19	628.97	537.35	600.27	592.74	515.77	522.46	578.26	611.78
Nov.	520.48	426.04	556.73	550.55	594.34	547.36	610.74	597.53	527.77	509.78	605.56	603.01
Dec.	537.98	438.81	598.29	565.71	631.69	545.13	618.94	587.21	537.17	503.87	632.32	639.02

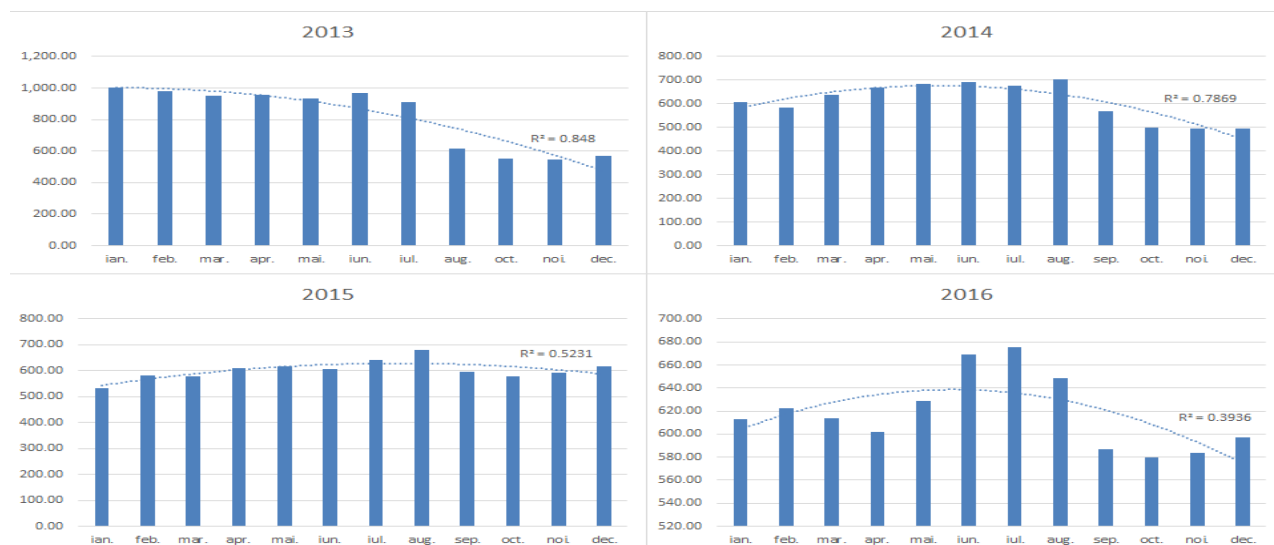
Source: *madr.ro*

In Table 3 are presented the prices recorded in different regions (Banat, Muntenia and Oltenia), maize, per calendar month. Thus, it can be noticed that the lowest prices were recorded in the Banat area for 9 out of the 12 months of the year, and the highest prices are found in the Muntenia area, with maximum values for 6 of the 12 months. However, the highest price of a ton of corn was recorded in 2013, in the Oltenia region being 1017.81 lei. From the same table it can be noticed that in 2013 the highest prices of one tons of corn oscillating between 505.13 lei and 1017.81 lei were recorded, and in the year 2015 the lowest they oscillated between 492.11 lei and 765.5 lei.

Achieving a price average for each year, regardless of the region, so a national average, but taking into account each month we can see the trend and price changes from month to month. These values are shown in Figure 4.

As mentioned above, the highest corn price was recorded in 2013, on average at 816.73 lei per tonne. As can be seen from the previous figure, in the winter months the price was high, as expected, due to the low (current) market supply combined with the low stock of farmers and the costs of producers or sellers with storage and storage, so these prices remain high until the summer, close to the new harvest period. In the post-harvest months, corn prices fall in October with the lowest price of 549.95 lei per tonne as the offer is generous and the demand lower.

Figure 4 National average monthly calendar prices



Source: *madr.ro*

The average price in 2014 was 609.5 lei per ton of grain corn. Even if the average annual price is lower than in the previous year, the trend of the month-to-month trend is similar in the months and again the price has increased, it has grown even more in the months before harvest, amid a stock of the lowest farmer and a high demand, respectively, reaching the peak in August, the last before the new production, the price of a tons of corn being 704.29 lei.

In 2015 the lowest price per tonne of corn was recorded, on average, of 602.72 lei, in contradiction with the offer (ie production) of the reference year. However, two aspects have to be mentioned: the first refers to the import made by Romania during that period, which was very high compared to the other years (three times higher) to "support" the supply of corn, thus neutralizing the price, and the second aspect relates to the fact that, although the offer was small, it was dispersed to a greater extent because the area cultivated in that year was the largest, in other words, there were several farmers who had maize production in 2015. These aspects can also be seen from the evolution of prices on Monday, as there are no such big differences from one month to the next, it is observed that in the critical period (August) the price of one ton was the highest of 681.84 lei, and the cheapest ton of corn could have been bought in January with 531.98 lei.

In 2016, the average price per ton of corn was 618.51 lei. This year due to higher production than in the previous year, but also due to the relatively high imports, prices were not very high in the winter months, but they increased in the pre-harvest months to a maximum of 675.64 lei in July.

Table 4 Coefficients of price correlation

Coefficientul de corelație	Suprafața cultivată	Producția totală	Producția medie	Consumul anual	Import	Export
Preț	-0.5317	0.3137	0.3435	0.9454	-0.5466	-0.5493

Source: *own calculations*

In order to be able to determine exactly which indicator influences most the price setting on the maize market, we have determined the correlation coefficient among the average annual price for the period 2013-2016 and the eight indicators previously analysed, so we can see the close links (as close as possible to 1 or -1) or the weakest (close to 0) in Table 4.

CONCLUSIONS

Analysing the correlation between the price and the cultivated area, it can be seen that it is a close relationship, but inversely proportional, as could be expected, when the area cultivated with maize grows, its price decreases due to the increasing supply (the degree of access of farmers), and when the surface is reduced, the corn supply is reduced and therefore the prices increase.

The price is not greatly influenced by production, either the total or the average, the correlation coefficients being 0.31 and 0.34.

Between the price and the annual consumption there is, as can be seen from Table 4, the strongest link with a coefficient of 0.9454, this consumption determines the demand so when it is high the prices rise, and vice versa.

As can be seen, both the link between price and import and between price and export is inversely proportional, so when one of the components of the trade balance grows, the price decreases, and vice versa. Import has the supply characteristic, so it has a correlation coefficient in relation to the price of -0.5466, but surprising is that the export has a similar coefficient of -0.5493.

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