

Research And Statistical Analysis On Vegetable Production And Trade

Dalila G. STOICA

PhD Student, Bucharest University of Economic Studies, Romania
Email: stoicagabriela16@stud.ase.ro

Veronica T. BACIU

PhD Student, Bucharest University of Economic Studies, Romania
Email: tabaciuveronica@yahoo.ro

Mirela STOIAN

Prof. Univ. Dr., Bucharest University of Economic Studies, Romania
Email: mirela.stoian@eam.ase.ro

Marian MOTOFEANU

PhD Student, Bucharest University of Economic Studies, Romania
Email: marian.motofeanu@gmail.com

Cristina M. STERIE

PhD Student, Bucharest University of Economic Studies, Romania
Email: stერიemaria94@gmail.com

Correspondence should be addressed to: Dalila G. STOICA; stoicagabriela16@stud.ase.ro

* Presented at the 38th IBIMA International Conference, 23-24 November 2021, Seville, Spain

Copyright © 2021. Dalila G. STOICA, Veronica T. BACIU, Mirela STOIAN, Marian MOTOFEANU and Cristina M. STERIE

Abstract

Ensuring human health requires a balanced consumption of agri-food products, in which legumes and fruits have an important place. Vegetables are complex foods that contain many nutrients and vitamins essential for the proper and normal development of people. The paper analyzes the trends of vegetable production, consumption and trade in Romania. With regard to the consumption of vegetables, it is important to establish the link between the production obtained and their consumption. The aim of the paper is to investigate the connection between the two variables by applying statistical analysis methods using SPSS, the simple linear regression model. Romania is a country that is based on imports, and has exported goods 5 times less in value, 95.3 million euros. The analysis resulted in a correlation coefficient (R^2) of 46% which indicates average link between, consumption and vegetable production.

Keywords: Vegetable, Romania, Production, Trade..

Introduction

Romania's climate and soil offer favorable conditions for growing vegetables throughout the country, but nevertheless, the area cultivated with vegetables is in a continuous decline since 2010. This has generated dramatic decreases in the levels of production of local products and transforming Romania from a predominantly exporting country to a vegetable importing

Cite this Article as: Dalila G. STOICA, Veronica T. BACIU, Mirela STOIAN, Marian MOTOFEANU and Cristina M. STERIE, Vol. 2021 (35) "Research And Statistical Analysis on Vegetable Production and Trade", Communications of International Proceedings, Vol. 2021 (35), ISBN: 978-0-9998551-7-1, ISSN: 2767-9640. Article ID 38103121.

country. The value of vegetable imports exceeded 517 million euros in 2019, while exports were 95.3 million euros. The main countries from which Romania imports vegetables are Turkey, the Netherlands and Germany.

There are numerous studies that address the problems encountered in the vegetable sector, for example Soare E. (2016), in the paper "Economic analysis in vegetable sector of Romania" claim that only 60% of the total amount of vegetables consumed nationally is assured from domestic production and 40% is supported by vegetable imports. The same study argues that imported vegetables are more varied and that the diversification of the vegetable market does not significantly contribute to increasing domestic consumption. [6].

According to Rusali (2013), the post-accession period, Romania has shown interest in international markets in the period 2007-2012, thus showing an increase of up to 88% during this time, influenced by trade policies and exchange rates favored imports massive, covering exports. [4]

Popescu (2013) argues that the micro-regions with the largest areas of land cultivated with vegetables in 2011 are classified as follows: micro-region 2 which includes the North East and South East regions and has a share of 34.19% of the total land area, microregion 4 comprising the South West Oltenia and West regions with a share of 28.9%, microregion 3 comprising South Muntenia and Bucharest Ilfov with a share of 31.5%, on the last place being ranked microregion 1 comprising the northeast regions and center with 15.41 of the total area of the region.[3]

Constantin M. (2020), in his paper argues that in the period 2011-2018, priority is given to the export of vegetable products and fats, and in terms of imports, priority is given to the group of live animals, animal products, beverages and tobacco. [1]

Ion R. and Dobre I. in the study "Changes and trends of vegetables market in Romania", noted that the main reasons why domestic consumption is not covered by domestic vegetable production is due to large losses in this sector and the seasonality of supply. [2]

Soare E., Cofas E., Bălan A., and David L., in "The vegetables market in Romania", claim that the potential of the Romanian vegetable sector is not used to its maximum capacity due to factors such as the large number of farms. small size, low level of technology, high degree of perishability of vegetables, etc., which together contribute to obtaining negative results in this sector.[5]

Material and Method

This study presents the analysis of the main technical-economic indicators in Romania, including the establishment of links between the production obtained and the consumption of vegetables. The analyzed indicators refer to the area cultivated with vegetables, the production obtained, the value of imports and exports with vegetables as well as the presentation of the trends of the average annual consumption. For the analysis of the indicators, data provided by the National Institute of Statistics for the period 2010-2019 were used.

At the end of the study, a linear regression model was developed to show the link between the production obtained and the consumption of vegetables. The linear regression model is a statistical-econometric tool that is used to establish the dependency relationships between two variables, using the SPSS program.

Results and Discussions

As a general trend, the consumption of vegetables is increasing, highlighting an increase in the share of fruits in the zinc diet of the population. The link between vegetable consumption and vegetable production is of medium intensity, according to the result obtained in SPSS.

The area cultivated with vegetables in Romania is in a continuous decrease. This is mainly due to the existence of a large number of small farms as well as the existence of a high degree of landslides. Also, high technological costs have contributed to this downward trend, especially for vegetables grown in protected areas. Thus, the total area with vegetables decreased by 13% in 2019 compared to 2010. (Table 1)

Table 1 - The surface cultivated with vegetables, in Romania (2010-2019) (thousand hectares)

Category	Year										Growth rate %	2019/2010
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
Vegetables - total	262.7	263.4	258.9	259.0	239.5	239.5	228.1	224.6	226.3	227.7	-1.57	-13%
White cabbage	47.0	47.0	49.1	54.9	47.8	48.7	46.2	46.2	47.3	47.2	0.03	0%
tomato	49.8	51.8	49.7	48.4	43.9	44.3	41.0	40.0	40.7	40.8	-2.17	-18%
Dried onions	33.8	33.1	33.1	32.2	30.3	31.2	30.3	30.0	30.3	30.3	-1.20	-10%
Pepper	21.0	20.0	19.9	19.5	18.2	18.4	18.0	17.7	18.0	18.7	-1.30	-11%
Dried garlic	12.8	12.1	11.4	10.6	10.7	10.8	10.2	10.0	10.2	10.0	-2.68	-22%
Eggplants	10.3	10.0	9.6	9.4	9.2	9.2	8.8	8.7	9.0	9.0	-1.52	-13%

Source: insse.ro (accessed on june 3, 2021)

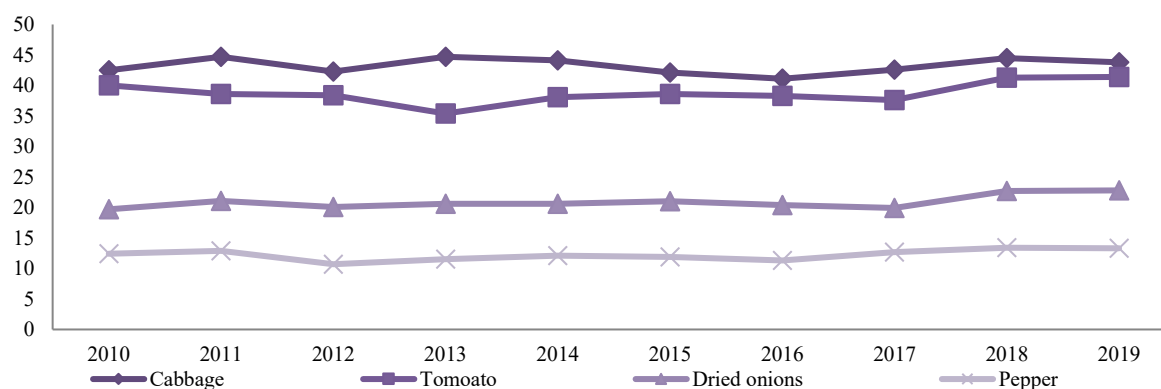
Currently, the main varieties of vegetables grown are cabbage, tomatoes and onions, with a percentage of 21%, 18% and 13% of the total area cultivated with vegetables.

Table 2 - The production obtained from vegetables, in Romania (2010-2019) (thousand tons)

Category	Year										Growth rate %	2019/2010
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		
Vegetables - total	3,864	4,176	3,535	3,961	3,802	3,674	3,358	3,638	3,797	3,530	-1.00	-9%
White cabbage	981	1,025	988	1,156	1,123	1,078	992	1,027	1,066	986	0.05	0%
Tomato	769	911	683	749	706	702	627	680	743	689	-1.20	-10%
Dried onions	369	394	345	392	387	361	325	352	350	341	-0.89	-8%
Pepper	243	254	207	228	229	226	202	226	230	223	-0.96	-8%
Eggplants	144	160	126	123	128	128	116	128	138	129	-1.24	-11%
Dried garlic	67	67	59	62	63	64	54	56	58	55	-2.23	-18%

Source: insse.ro (accessed on june 3, 2021)

Regarding the production obtained, as in the case of cultivated area, there is a decrease of 8.64% in 2019 compared to 2010, although Romania has a high potential for growing vegetables, especially in the field, due to the high degree of soil fertility as well as climate diversity. In addition, an element that influences the production of vegetables is related to the requirements and facilities representative of the market economy, which, at the moment, Romania does not yet have in its agricultural activity. (Table 2)

**FIG. 3 - Consumption of vegetables, in Romania, in the period 2010-2019**

Source: insse.ro (accessed on june 3, 2021)

According to the National Institute of Statistics, on average, during the analyzed period, approximately 150 kg of vegetables per year per capita were consumed. The consumption of vegetables, for all categories, followed an upward trend, this being primarily due to the trend of human consumption, the population moving towards a healthier diet based on fresh vegetables and fruits, but also to the increase of living standards. Factors that are associated with the consumption of vegetables, especially fruits, refer to the age but also the financial strength of the population. (Fig.3)

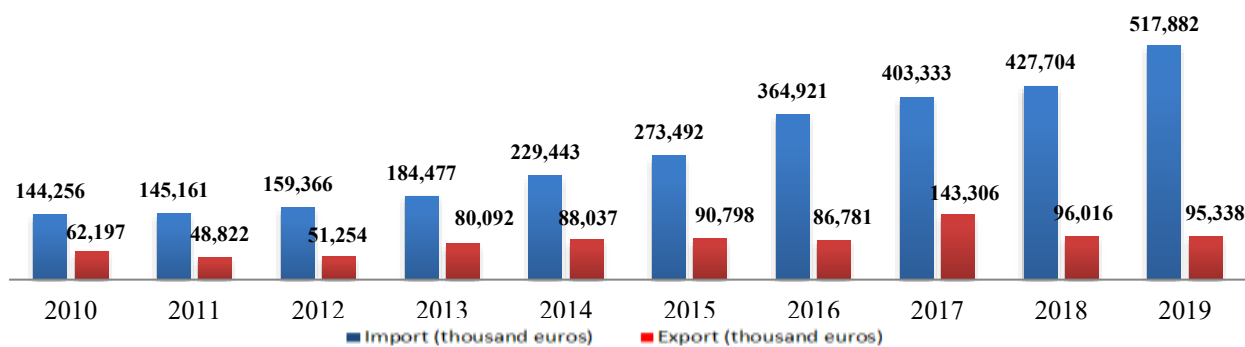


FIG. 4 - The evolution of the import and export of vegetables in Romania in the period 2010-2019 (thousand euros)

Source: Trade Map (accessed on June 3, 2021)

The value of vegetable imports shows an upward trend throughout the period, so in 2019 it exceeded 517 million euros, about 3.5 times higher than in 2010 (Fig 4).

Among the main exporting countries is Turkey (76 million euros), Netherlands (73 million euro) and Germany (62 million euro).

Exports fluctuate, due to fluctuations in production, which contributed to the formation of the selling price of vegetables for export.

The main importing countries are: Italy (4.5 million euros), Spain (1.3 million euros), and Germany (1.06 million euros).

Table.3 Indicators used for statistical analysis

Indicator		Total production	Consumption
UM		thousand tons	kg/loc
Year	2000	2,528	115
	2001	2,877	126
	2002	2,864	122
	2003	3,358	149
	2004	4,774	155
	2005	3,625	136
	2006	4,139	159
	2007	3,117	150
	2008	3,820	159
	2010	3,864	156
	2011	4,176	163
	2012	3,535	151
	2013	3,961	152
	2014	3,802	158
	2015	3,674	159
	2016	3,358	156
	2017	3,638	162
	2018	3,797	173
2019	3,530	170	

Source: insse.ro (accessed on June 3, 2021)

In order to establish the link between vegetable consumption and total vegetable production obtained in Romania, in the period 2000-2019, statistical analysis methods were applied using the SPSS application, the simple linear regression model.

To verify the existence and nature of the link between the dependent variable "Consumption" and the independent variable "Total production", the corresponding correlogram was constructed and the degree of influence of the variables was measured resulting in a coefficient of determination R^2 of 46%, indicating an average link. The correlation coefficient

R^2 (Pearson's coefficient) indicates how strong the connection between the two variables is, as well as its intensity. In our case, the Pearson correlation coefficient R^2 indicates a direct, average link with a determination ratio $R^2 = 0.463$, (46%), meaning $R^2 = |R^2|$ we can argue that there is an average link between the two variables.

The correlogram gives us the possibility to establish the existence of the connection between the dependent variable and the independent variable, of the meaning, form and intensity. (Fig 5)

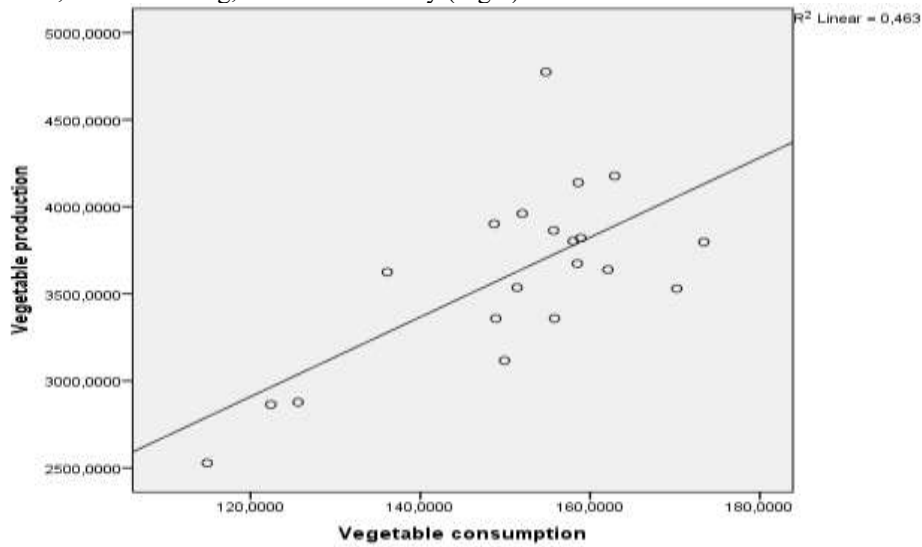


FIG. 5: Correlogram and graphical approximation of the link between vegetable consumption and total vegetable production in Romania

Source: SPSS own representation

Table 4 presents the descriptive statistics of the model. According to variables listed in the table, the average consumption of vegetables in the period 2000-2019 is 150.9 kg / inhabitant, with a standard deviation of 15.25 kg. For the production of vegetables resulted an average of 3616.9 thousand tons and a standard deviation of 512.7 tons.

Table 4: Descriptive statistics

	Mean	Std. Deviation	N
Vegetable consumption	150.940000	15.2532102	20
Vegetable production	3616.954100	512.7439397	20

Source: SPSS own representation based on data provided by INSSE

Next, the correlation table was obtained, in our case the Pearson correlation, because scale variables were used. Thus, a correlation of 68% is observed, being a strong correlation and showing the correctness of the choice of variables.

Table 5: Correlation table - Pearson correlation

		Vegetable consumption	Vegetable production
Pearson Correlation	Vegetable consumption	1.000	.681
	Vegetable production	.681	1.000
Sig. (1-tailed)	Vegetable consumption	.	.000
	Vegetable production	.000	.
N	Vegetable consumption	20	20
	Vegetable production	20	20

Source: SPSS own representation

The table presents elements such as the regression coefficient (R), the coefficient of determination for regression R^2 , the correlation of R^2 and the standard error of prediction.

Table 6 - Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.681 ^a	0.463	0.434	11.4795913
a. Predictors: (Constant), Vegetable Production				
b. Dependent Variable: Vegetable consumption				

Source: SPSS own representation

The regression coefficient (R) is, in fact, the standardized regression coefficient - Beta, being the same as the Pearson linear correlation coefficient, in our case it has the value 0.681, which indicates that the link between vegetable consumption and vegetable production is medium intensity. The value of the coefficient of determination for regression is 0.463, which indicates that approximately 46% of the variation in vegetable consumption is affected by the variation in vegetable production. This link can be described by the following linear regression model:

$$Y = 77,694 + 0.020 \text{ vegetable consumption} + e$$

Table 7 - ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2048.490	1	2048.490	15.545	.001 ^b
	Residual	2372.058	18	131.781		
	Total	4420.548	19			
a. Dependent Variable: Consumul de legume						
b. Predictors: (Constant), Productia de legume						

Source: SPSS own representation

The ANOVA table shows the sources of variation on vegetable consumption. There are two sources: predictor influence (Regression) and residual influence (Residual).

The F test has a value of 15.54 which indicates that the influence of regression is higher compared to the residual influence, and the probability of F (sig.) is 0.001, being less than 0.05 (5%), resulting that model access is valid because the calculated value of test F is greater than the theoretical value.(Table 7)

Table 8: Coefficients of variables

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B		
	B	Std. Error	Beta			Lower Bound	Upper Bound	
1	(Constant)	77.694	18.754		4.143	0.001	38.293	117.095
	Vegetable production	0.020	.005	0.681	3.943	0.001	0.009	0.031
a. Dependent Variable: Vegetable Consumption								

Source: SPSS own representation

In the table are presented the coefficients of the variables, so we estimated a model with constant, with a value of 77.69 with a probability of 0.01 which means that this variable is constant model, because it is below 5% threshold. Moreover, analyzing the confidence interval, it is observed that it does not include the value 0 (being between 38.29 and 117.09) which shows that the variable is statistically significant.

At the same time, the estimate for the Beta parameter, regarding the independent variable, vegetable production, is also statistically significant because it has the value of Sig. Under 5% (0.001). The value of the parameter attached to the factorial variable is greater than zero, indicating that there is a direct relationship between vegetable consumption and vegetable production. Thus, for an increase in vegetable production by 1000 kg, vegetable consumption increases by 20 kg.

Conclusions

Following the analysis of the indicators, it is found that the total area provided with vegetables is in a continuous decrease, being lower by 13% in 2019 compared to the base year. The small size of the farms, the high degree of fragmentation of the vegetable surfaces but also the high technological costs have left their mark on the cultivated areas and implicitly on the obtained production. Thus, the total production of vegetables decreased by 8.64% in 2019 compared to 2010, although, on average, the consumption of vegetables is increasing, the main species of world cultivated in Romania being cabbage, tomatoes and onions.

Romania is a country that is based on imports, so during 2019, our country imported vegetables with a total value of approximately 517 million euros and exported 5 times less in value, 95.3 million euros. The main countries from which we import vegetables are: Italy, in 2019 were imported vegetables worth 4.5 million euros, and Spain from where vegetables worth 1.3 million euros were imported.

However, the link between vegetable consumption and total vegetable production was established, so that the Pearson correlation coefficient indicated a directly proportional link of medium intensity. In addition, the value of the regression

coefficient is $(R^2) 0,463$, which indicates that approximately 46% of the variation in vegetable consumption is affected by the variation in vegetable production.

Acknowledgment

„This paper was co-financed by The Bucharest University of Economic Studies during the PhD program”

References

- Constantin M., Drăghici I., Necula R. (2020) ‘Levels and trends in international agro-food trade of Romania in the 2011-2018 period,’ *Annals of the Academy of Romanian Scientists Series Agriculture, Silviculture and Veterinary Medicine* 9 (1), 49-61
- Dumitru, E.A., Ursu A., Tudor V.C. and Micu M.M. (2021) ‘Sustainable Development of the Rural Areas from Romania: Development of a Digital Tool to Generate Adapted Solutions at Local Level,’ Euromontana, Contribution to the impact assessment on Products of Mountain Farming. Available from <http://bit.ly/2ib4R0E>.
- International Trade Centre, [Online], [Retrieved June 03, 2021] https://www.trademap.org/Product_SelCountry_TS.aspx?nvpm=1%7c642%7c%7c%7cTOTAL%7c%7c%7c2%7c1%7c1%7c1%7c2%7c1%7c1%7c1%7c%7c1
- Ion R. and Dobre I. (2015) ‘Changes and trends of vegetables market in Romania, Sustainable agriculture and rural development in terms of the Republic of Serbia strategic goals realization within the Danube Region,’ International Scientific Conference, Institute of Agricultural Economics, ISBN 978-86-6269-046-3, 10-11 December 2015, Belgrade, Serbia, 54-69
- Popescu A. (2013) ‘Consideration on Romanians vegetable market,’ *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*, 13(4), 227-234
- Romanian National Institute of Statistics, [Online], [Retrieved June 03, 2021], <http://statistici.insse.ro:8077/tempo-online/>
- Rusali M.A. (2013) ‘Agrifood competitive performances within Romania’s foreign tradepattern: evaluation and alerts,’ 1st International Conference 'Economic Scientific Research - Theoretical, Empirical and Practical Approaches', 8(1), 632-639
- Soare E., Cofas E., Bălan A., David L. (2012) ‘The vegetables market in Romania,’ *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development* 12(2), 161-166
- Soare E., Dobre I și David L. (2016) ‘Economic analysis in vegetable sector of Romania,’ *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development* 16(4), 333-338