

UDC 634.8:519.246.8(497.6)  
Original scientific paper  
Received: March 21, 2022  
Accepted: April 27, 2022  
Corresponding author: larix.bm@gmail.com

## STATISTICAL ANALYSIS OF THE VITICULTURE SECTOR OF BIH WITH REFERENCE TO FAMILY HOUSEHOLDS

**Branka Marković**

Nezavisni Univerzitet Banja Luka, Banja Luka, Bosnia and Herzegovina  
e-mail: larix.bm@gmail.com

**Ružica Đervida**

Nezavisni Univerzitet Banja Luka, Banja Luka, Bosnia and Herzegovina  
e-mail: ruzica.djervida@unbl.org

**Abstract:** *Observing the historical genesis of grapevine cultivation on the territory of Bosnia and Herzegovina, it is important to emphasise that the tradition of grapevine cultivation is over 2.000 years old. In whole area, the vine was brought by the ancient Greeks. Today's production of wine grapes, in 2021, is carried out on an area of approximately 3.700 ha, which is significantly less than in 1989, when production took place on an area of 5.722 ha. As a result of the war, the area has been reduced to today's figures. Approximately 10.200 agricultural households are engaged in grapevine cultivation and wine production, which represents 96,21% of the total area under vines, only 3,79% of the area is owned by registered companies.*

*The main goal is to increase the area under vineyards, to modernize existing capacities, which ultimately results in increased wine production. In order to achieve all the stated goals, it is necessary to provide certain funds. Transition countries, to which Bosnia and Herzegovina also belongs, are based on further growth and development on the arrival of foreign investment. In countries in transition, foreign investment is the only possible factor in economic development. However, due to a number of factors that influenced poor organization and poor access, which is especially pronounced in family farms, a large number of foreign investment do not come to BiH.*

*The basis of the paper is related to the analysis of the actual state of the viticulture and wine production sector in BiH and the amount of wine exported to EU markets. Since the majority, which consists of agricultural households do not their own capital, i.e. they do not have their own sources of financing. By using certain statistical methods one can get an insight into the real situation that exists in the field of viticulture in BiH, with reference to family farms. According to the data obtained from the analysis, the place and position*

*of the viticulture sector, which is the most important part of the food and agricultural area in Herzegovina, can be predicted.*

*Due to its great diversification, this area is very interesting for foreign investments. By applying various statistical tools, the situation in the field of viticulture can be determined and in that way it is possible to attract all interested investors.*

**Keywords:** *statistical analysis, investments, viticulture sector, statistical analysis, correlation, regression*

## INTRODUCTION

The cultivation of vines in the territory of present-day Herzegovina has a tradition that is very long, even over 2000 years. Ottoman Empire, where the production of wine and the cultivation of vines is extinguished. When we look at the historical development of the cultivation of vines and the production of wine, it can be stated that there were terrible ups and downs. At that time, and even recent production, it is influenced by various factors. When we talk about recent production, we must look back at the last thirty years. At the beginning of the 90's of the last century, the area under vineyards was approximately 5,722 ha. Due to the war that was fought in the period 1992-1995, in the territory of Herzegovina, agricultural production was destroyed and vineyards were neglected. Today, according to the data, grape production takes place on an area of approximately 3700 ha, with grape production increasing from 5000 kg / ha at the beginning of the 21st century to 9000 kg / ha in the 1920s.

The largest part of the area under vineyards, about 96%, is owned by family farms, more precisely, about 10,200 agricultural farms are engaged in vine growing. Apart from the war, one of the reasons for the small production of grapes is the large fragmentation of the property. So the entire area under the vineyards is divided into 14,200 plots whose average area is about 0.25 ha.

**Table 1.** Overview of areas under vines and production (2016-2020)

Year of production	Area (ha)	Grape production (kg)	Wine production (l)	Grape quantity (kg/ha)
2016.	3.580	25.776.000	16.754.400	7.200
2017.	3.600	26.280.000	17.082.000	7.300
2018.	3.620	27.150.000	17.647.500	7.500
2019.	3.667	27.500.000	17.875.000	7.500
2020.	3,700	28.120.000	18.278.000	7,600

(Source: BHAS, FAZ Mostar)

It should be pointed out that in Herzegovina, as a region in BiH, grape growing, production and processing is one of the most important segments of the agri-food sector and that this sector cultivates approximately 62% of pre-war areas that were under vines, and that the viticulture sector employs approximately 11,000 people, which is a significant factor for the region of Herzegovina.

It is necessary to determine the current situation in the sector of cultivation, grape processing and wine production. New vineyards that are being raised are concentrated in a couple of municipalities in the region of Herzegovina, approx. € 10,000, while complete investments in order to achieve and develop competitive production are approx. € 25,000. According to the existing data, in general, the agricultural sector in BiH does not have its own financial resources for the development of the viticulture sector, they need some financial support. As for the support from the state, it is realized through the credit lines of the Development Bank of the Federation, where the structure is: own funds (participation) 25%, grant funds 25% and credit with a loan 50%. The main goal of this paper is to research, define and explain the situation in the viticulture sector, respecting that this sector is the most important part in the food and agricultural area of Herzegovina, and diversification of the sector must be taken into account, which is very important in attracting investment.

## 1. STATE OF THE VITICULTURAL SECTOR

When it comes to the viticulture sector in BiH, we must emphasize that it is a small sector that concentrates on a couple of municipalities in the Herzegovina region, 92.5% of Herzegovina-Neretva and West Herzegovina cantons, and about 7.5% in the municipality of Trebinje. Damage caused in that sector during the war and after thirty years is visible. According to the data of the FTC BiH in 2021, the area under which vineyards are planted is approximately 3,700 ha, which is about 62% of the area under vineyards compared to the pre-war period. The European Union controls the price and quality of wine through legislation. The regulation was revised in 2006, so that then it experienced major changes in terms of subsidies. was removed that year. So from that period the financial resources for viticulture increase, and this aims to increase competitiveness in the international market. Recovery of agriculture, and thus the vineyard It is very slow, in the post-war period it was bypassed when it comes to donations, and investments lasted less than four years until 2010. All this results in the status of the viticulture sector in relation to the same in the neighborhood, especially in Europe and the world level.

**Table 2.** Overview of European countries by area under vineyards (000 ha)

No.	Country	2006.	2010	Index
1.	Špain	1174	1113	-5,20%
2.	France	882	840	-4,76%
3.	Italy	835	818	-2,04%
4.	Turkey	570	505	-11,40%
5.	Portugal	246	243	-1,22%
6.	Romania	213	206	-3,29%

(Source: VTK BiH)

From the above table it can be concluded that the wine sector in BiH, with its plantations of 3,700 ha, is far below the European average. According to the Agency for Statistics of BiH, the total number of family farms in 2021 was about 10,200, with a larger number of small winegrowers who in most cases produce for their own needs and for the local market, only about 2% of farms are engaged in viticulture on areas greater than 2.0 ha.

**Table 3.** Areas under vines

Area in ha	Number of households in GU	Number of ha per GU	Estimated number of household	Percentage (%)	Total number of ha	Percentage (%)
0,001-0,50	529	66	10.216	92,97	1.268	36,56
0,51-1,00	19	10,9	367	3,34	211	6,08
1,10-2,0	11	10,5	212	1,93	203	5,85
2,01-5,00	7	17,5	135	1,23	338	9,75
5,10-10,00	1	5	19	0,17	97	2,80
> 10,10	2	70	39	0,35	1352	38,99
TOTAL	567	179,6	10.989	100,00	3.468	100,00

(Source: FAZ Mostar)

In order to better understand the values, we must mention that with 1,045,600 ha under vineyards, Spain ranks first in the world, which would mean that only 0.03% of this total area would belong to the wine sector in BiH.

As already mentioned in the introduction, the total area under vines of approximately 3700 ha is divided into 14,200 plots, which would mean that the average size of the plot under vines is 0.24 ha. It is from these indicators that it can be concluded that the viticulture sector is in a very unfavorable, non-functional position in relation to the entire agricultural production.

The strategy for the development of agriculture until 2025 sets a certain goal regarding the development of viticulture, which is to reach 10,000 ha under vineyards by 2025. However, the current situation and the current dynamics tell us the opposite, so the question can be asked that Is it possible to achieve the set goal under such conditions? The only solution to achieve the set goal is new investments. Certain combinations of state subsidies with certain favorable loans must be the key to a solution that can reach the target of 10,000 ha by 2025, which meant accelerating the dynamics of planting vines.

Investments are very important for the development of the entire agricultural sector. In order to reach new investments, it is necessary to determine the complete situation in the entire sector, emphasizing viticulture. It is necessary to determine the costs of the entire planting of vines, which includes the preparation of the planting area and the raising of plantations in the first three years.

**Table 4.** Costs (KM) of raising plantations in Herzegovina

Description	Material costs	Machine services	Manual labor	Total
Preparation	837	3.135	176	4.147
First year	10.926	2.302	1.221	14.448
Second year	1.054	910	1.325	3.289
Third year	827	853	1.586	3.266
Metal framework	16.288	2.356	1.178	19.821
UKUPNO	29.931	9.555	5.458	44.972

(Source: FAZ Mostar)

Since the beginning of this century, grape production has been constantly increasing, so the yield in 2005 was approximately 5,000 kg / ha<sup>1</sup>, and in 2011 it was approximately 7,000 kg / ha. In 2016, the total production of grapes amounted to approximately 25 million kg, while in 2020 this amount amounted to approximately 28 million kg, and the average amount was approximately 7,600 kg / ha.

U posljednje vrijeme teži se proizvodnji što kvalitetnijih vina uz uvođenje ISO i HACCP standarda.

As already mentioned in the previous section, the production of grapes, and thus wine, is located in the area of Herzegovina, where approximately 4,200 are under vines. Of the total amount of grapes produced, 65% is processed into wine. If we look at the structure, it must be emphasized that 55% is white wine while 45% is the rest, of which domestic indigenous varieties are represented for red wine, namely Blatina, while for white wine we have Žilavka.

Produced grapes are processed in 23 registered wine producers, which represents 40% of the total area under vineyards, while 60% is with unregistered producers.

When analyzing the export of wine from BiH, it can be seen that in 2018, approximately 6.9 million KM were exported, in 2019 7 million KM, and due to the COVID 19 pandemic in 2020, the export of wine was reduced to approximately 5 million KM.

<sup>1</sup> Federal Agromediterranean Institute Mostar

**Table 5.** Export of wine from BiH (2016-2020)

Year	Wine export (quantity 000 l)	Export of wine per prices (KM)
2016	2.009,14	4.818.045
2017	1.709,47	5.362.345
2018	3.472,34	6.901.468
2019	3.575,05	7.167.583
2020	2.875,81	5.449.838

(Source: FAI Mostar)

The largest importers of wine from BiH are: R. Croatia; R. Republic of Serbia; Germany.

## 2. STATISTICAL ANALYSIS

Looking at the collected data on grape production in BiH and the amount of wine exported by BiH, it can be concluded that: in the last five years there has been a slight increase in grape production, while wine exports in that period vary significantly, especially in 2020, which can be explained by lower consumption of wine due to measures introduced due to the COVID 19 pandemic. financial support to the viticulture sector. When analyzing the collected data on wine exports to the EU, it can be concluded that these exports are small compared to other exporters from EU countries. This situation is not a consequence of the poor quality of wine produced, but mostly of fragmented production and poor promotion of wine from BiH.

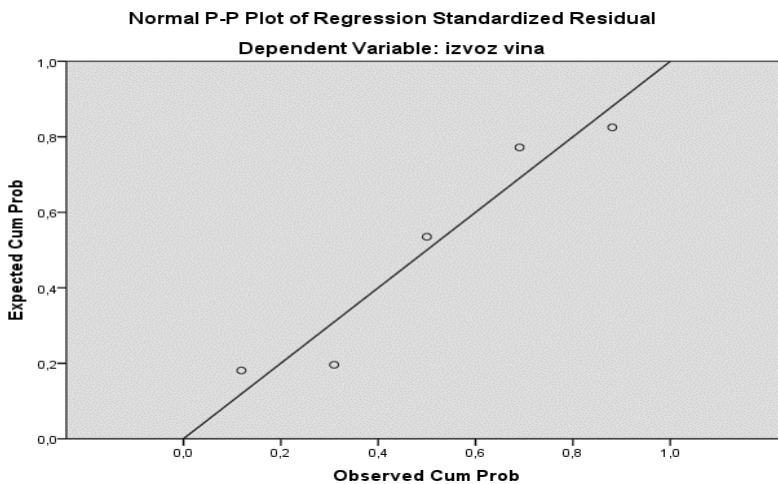
In the research part of this paper, data from FAI Mostar were used which present itself as a function with parameters on the basis of which it will be concluded about the influence of the independent variable on the dependent variable.

**Table 6.** Grape production and wine export (2016-2020)

Year	Grape production (000 kg)	Wine export (quantity 000 l)
2016	25.776.000	2.009,14
2017	26.280.000	1.709,47
2018	27.150.000	3.472,34
2019	27.500.000	3.575,05
2020	28.120.000	2.875,81

(Source: FAI Mostar)

Based on the collected data, we can determine and thus arrive at the answer to the question, what is the relationship between the amount of grapes produced and the amount of wine exported to the EU market. The relationship between the observed phenomena can be described using a statistical model: correlation and regression. Regression is an analytical expression that analyzes in detail the parameters that are in the correlation relationship. The strength of the connection between the analyzed phenomena is determined by correlation. Models of linear, curvilinear, multiple correlation can be used to investigate phenomena. The first step in the analysis is to determine, based on the scatter diagram, whether there is a relationship between the phenomena and what it is like.



**Graph 1.** Scattering diagram  
(Source: author's calculation in SPSS)

From the scatter diagram it can be stated that there is a linear relationship between the variables, the points on the graph are grouped approximately linearly around the direction, so we can proceed to further analysis of the strength of the relationship between the observed phenomena

All collected data are processed using SPSS, where linear regression and correlation will be analyzed.



**Table 7.** Descriptive analysis

	Mean	Std. Deviation	N
Wine export	2728,3620	843,73366	5
Grape production	26965200,0000	940401,61633	5

(Source: author's calculation in SPSS)

**Table 8.** Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,729a	0,532	0,375	666.79059

(Source: author's calculation in SPSS)

Table 8 Model Summary can be used to read the explanatory relations between the phenomena we analyze, so that, as we have already stated, this is a linear model, Pearson's correlation coefficient (R) determines the strength of the connection and it is  $R = 0.729$ , which can be stated that it is a solid correlation. In order to be able to determine the representativeness of the model we have chosen, the Determination Coefficient R Square is used. Based on it, the share of variability is determined, ie. how many variables Y can be explained with variable X. The coefficient of determination ranges from  $0 \leq r^2 \leq 1$ . The coefficient of determination is 0.532, so the variable grape production explains 0.532% variability in wine exports.

**Table 9.** ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	1.513.716,863	1	1.513.716,863	3,405	0,162a
	Residual	1.333.829,076	3	444.609,692		
	Total	2.847.545,939	4			

(Source: author's calculation in SPSS)

Table 8 ANOVA shows the results obtained when testing the null hypothesis, if the coefficient of determination R square = 0, there can be no linearity. From the table it can be read that the F statistic is 3.405 at the significance level of 0.162

After the analysis, it is possible to start determining the parameters of the impact of wine exports and its dependence on grape production in BiH. The parameters will serve us to determine the model of simple linear regression, where the influence of the independent variable on the dependent variable is seen.

**Table 9. Coefficients**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95,0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	-14.910,989	9.564,470		-1,559	0,217	-45349,40	15.527,42
	proizvodnja grožđa	0,001	0,000	0,729	1,845	0,162	0,000	0,002

(Source: author's calculation in SPSS)

## CONCLUSION

The application of certain statistical models significantly affects the uncertainty that prevails in decision-making in the business world. Based on the parameters that are calculated, certain indicators are obtained that enable, in addition to experience, information, for the company's management to make strategic decisions, which will significantly affect the functioning of the company.

In this case, we used a model that determines the relationship, ie. connection between the two observed phenomena. The analytical model by which this mutual influence is determined is the regression model, while the strength of this correlation is shown using the correlation coefficient-Pears coefficient. In the analyzed case, the Pearson coefficient is not the maximum, but according to the obtained data, it can be concluded that the connection is strong. In this case, and based on the current situation

in the viticulture sector, it is necessary to make a decision on whether and to what extent production capacities can be expanded in relation to wine exports and whether they can rely on revenues from exports. As it is already known, in the strategy of development of the viticulture sector until 2025, increasing the number of vineyards from the current 3,700 ha to 10,000 ha would require new investments that cannot be financed with own funds from wine sales on domestic and foreign markets. We must also mention that it is very difficult to achieve this goal, if it is known that in 2020 there was a big drop in wine exports which amounted to cca 24% compared to 2019 due to the COVID 19 pandemic. The consumption of wine on the domestic market per capita amounts to 5.4 liters, placing BiH is at the very bottom of wine consumption in Europe.

#### **REFERENCES:**

1. Bahovec, V. i Erjavec N.: Uvod u ekonometrijsku analizu, Element, Zagreb, 2009.
2. Berenson, M. L.: Basic business statistic, New Jersey: Prentice Hall, 2012
3. H. Anton and C. Rorres, Elementary Linear Algebra. John Wiley & Sons, 2013.
4. Hamilton, D. J. Time Series Analysis. Princeton NJ: Princeton University Press, 1994
5. Sampath S, Sampling Theory and Methods, Alpha Science International Ltd, Harrow, U.K, 2005
6. Šošić, I.: Primijenjena statistika, Školska knjiga, Zagreb, 2006.

#### **Internet sources:**

1. <http://www.mvteo.gov.ba/Content/Read/poljiprivreda-i-ruralni-razvoj-stocarska-proizvodnja-vino>
2. <https://www.komorabih.ba/wp-content/uploads/2021/01/Vinska-industrija-BHS.pdf>
3. <https://www.faz.ba/sites/default/files/publikacije/MONOGRAFIJA>
4. <https://www.faz.ba/hr/vinogradstvoivocarstvo>