ANNUAL CHANGES IN THE PRICES OF TABLE GRAPES AND PRICE MARGINS IN THE SUPPLY CHAIN

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Abstract

Price volatility is one of the main sources of risk in the production of fresh fruit, including table grapes. Sustainable functioning of the supply chain requires a detailed study of price fluctuations in the context of both - stable development of production and security and access to food for consumers. The movement and variation of producer, wholesale and retail prices of table grapes during the period 2000-2019 were studied. The changes in the relative price margins of the production prices in the wholesale and retail prices were identified. The producer prices have risen significantly in the period after Bulgaria accession to the EU until 2012. Variation in the quantity of production in the country explained 24.9% of the change in producer prices by years, as the quantity of imports, the unit price of imported products, the bargaining power of other contractors in the supply chain, changes in consumer demand also have an impact. Declining relative share of producer prices in the wholesale and the retail prices showed the weakening market positions of producers in recent years and the limited market power to negotiate a satisfactory level of purchase prices.

Key words: *table grapes, market, supply chain, prices, variability, price margins*

INTRODUCTION

From the point of view of economic theory, the price has been a complex economic category, in the value of which the divergent interests of producers, traders and consumers were refracted [11]. The prices, through the information function they perform, have been an important factor influencing the dynamics of the macroeconomic environment, determining on the one hand to a large extent the investment decisions of producers, and on the other - the decisions for distribution of income from consumers [24]. In the globalized environment of production and trade, price instability was established as one of the most serious problems arising from and largely determining the functioning of the market mechanism [9, 10].

The specificity of the production process in agriculture, based on natural processes, outside the control of producers, causing significant changes in production and supply of agricultural products, along with volatile price levels, often lead to instability of farm incomes and uncertainty for the survival of farms [7, 8]. Price volatility is one of the main

sources of risk in the production of fresh fruit, including table grapes [9, 6]. The sustainable functioning of the food chain requires a detailed study of price fluctuations in the context of both the stable development of production and the security and access to food for consumers [4, 7, 24, 6, 10]. The movement of prices in the long and short term, as well as the variation by years and by stages of the supply chain, is an important indicator of the sustainability of fresh fruit production [4, 24, 9, 23, 6].

The aim of the study was to investigate the movement and variability of the prices of table grapes and price margins by stages of the supply chain (production-wholesale-retail) in the long run.

MATERIALS AND METHODS

The object of the research activity were the price fluctuations on the table grapes market. The analytical activity covered three levels of the supply chain: producer price, wholesale price and retail price. Long-term changes in price levels were assessed through a comparative analysis by the stages of the

supply chain. The study of price variability in the long run was based on the construction and processing of time series, which summarized information on average annual price levels. Sources of primary data were Eurostat, the Ministry of Agriculture, Food and Forestry (MAFF), the Agrostatistics Department, the National Statistical Institute (NSI), the Commodity Exchange and Wholesale Markets State Commission (DKSBT) and the Agricultural Market Information System (SAPI Ltd.). The data for the period 2000-2019 were studied. The methods of comparative, index and graphical analysis, descriptive statistics, analysis of variance, correlation analysis and regression analysis were applied [20, 3, 18, 24, 9]. For the purposes of variation analysis, the method of descriptive statistics was used [20, 3]. The following basic values are derived: minimum value, maximum value, arithmetic mean, standard deviation. The estimation of price fluctuations was based on the values of the coefficient of variation (CV, %), calculated as the ratio between the standard deviation of the prices and the average price for the studied period, using the following formula [7, 2, 21, 22, 25]:

$$CV(\%) = \frac{SD}{\bar{P}} * 100 = \frac{\sqrt{\frac{\sum_{i=1}^{n}(P-\bar{P})^2}{n}}}{\bar{P}} * 100,$$

where
SD – standard deviation,
$\bar{P}$ - average price for the studied period.

Due to the lack of statistical information, the dynamic time series of wholesale prices did not include the years 2002, 2004 and 2005, and of retail prices - 2004, 2005, 2010, 2017. For the purpose of comparability of the data, the analysis of the variation of producer prices was performed in two variants: for the entire twenty-year period 2000-2019 and for sixteen years - excluding the data for 2000 due to the large deviation from the average price level as well as for 2004 and 2005.
The presence and parameters of price asymmetry between the stages of the supply chain were studied by calculating a relative price margin - the producer price, expressed as a percentage of the wholesale price and of the retail price [4]. Statistical data processing was performed with MS Excel and SPSS 19.0.

RESULTS AND DISCUSSIONS

For the twenty-year period covered in Figure 1, the production of table grapes in Bulgaria registered a significant decrease compared to the level of 2000 and 2001, which amounted to 49.4 thousand tons and 30.4 thousand tons, respectively. In the last three years, the quantity of production was between 10.1 thousand tons and 14.3 thousand tons, which was a decrease of over 75% based on production in 2000. Fluctuations in annual production levels reflected the combined impact of production and market risk in the subsector. It should be noted that during the period 2015-2019 the variation in the volume of production had been weaker compared to the previous five years. The quantity of table grapes produced in the country did not fall below 10 thousand tons per year, which is largely due to the possibility of supporting the income of farmers under the coupled subsidy scheme applied under the first pillar of the CAP 2014-2020.
Considered in the long run (Fig. 1), the level of the producer prices of table grapes showed an increasing trend, which was confirmed by the high value of the coefficient of determination (R^2=0.6162).
The price levels were the lowest in the pre-accession period - between 0.14-0.50 BGN/kg. Since 2007, when Bulgaria ranked among the full EU member states, producer prices have been gradually rising, with the highest average annual prices reported in 2012, corresponding to the extremely small quantity of table grapes produced - only 7.1 thousand tons.
The average level of the annual producer prices of table grapes during the period 2000-2019 was 0.55 BGN/kg, as the difference between the minimum and the maximum price level amounted to 0.85 BGN/kg (Table 1).
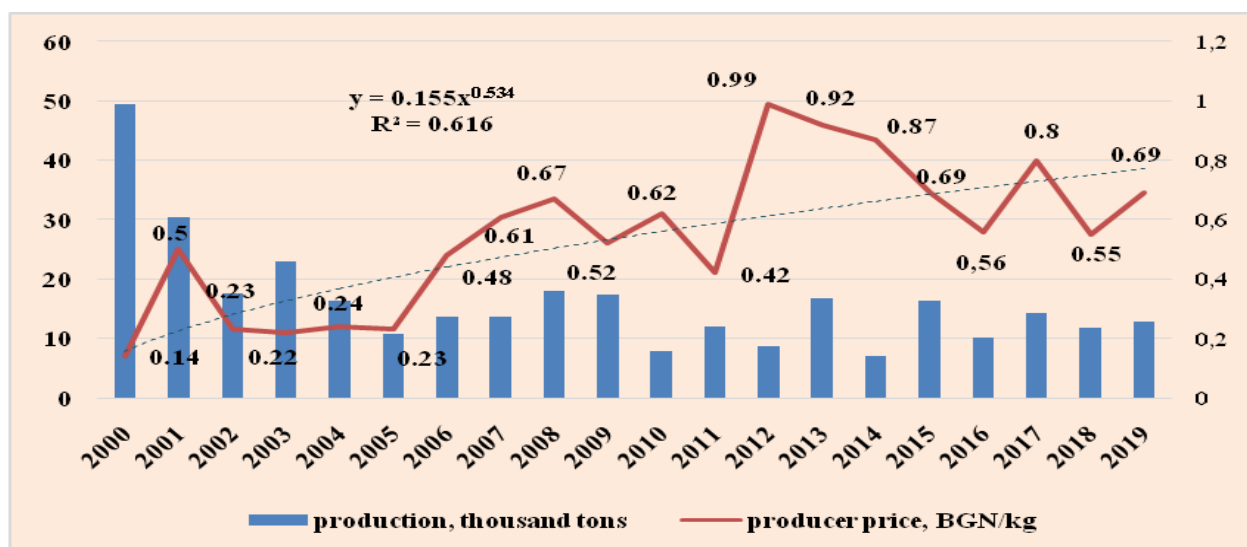
Fig. 1. Dynamics of the level of production and producer prices in Bulgaria during the period 2000-2019
Source: MAFF, Agrostatistics Department (https://www.mzh.government.bg/bg/statistika-i-analizi/izsledvane-rastenievadstvo/danni/) [12] and Eurostat (https://ec.europa.eu/eurostat/web/agriculture/data/database) [5].

Table 1. Analysis of the variation of producer prices of table grapes during the period 2000-2019

Indicator	n	R	Pmin	Pmax	$\bar{P}$	SD	CV (%)
Producer price, BGN/kg	20	0.85	0.14	0.99	0.5475	0.24715	45.14
Producer price, BGN/kg	16	0.77	0.22	0.99	0.6319	0.19739	31.24

Source: own calculations with SPSS.19
R – range of variance, Pmin – minimum price, Pmax – maximum price

The deviations of the prices by years compared to the average value for the period were within ± 0.25 BGN/kg. The value of the coefficient of variation was high and indicated a large annual variation in price levels, which implied a significant market risk in terms of income of producers.
To study the strength of the relationship between the quantity of production and the level of the producer price, the method of correlation analysis was applied (Table 2).

Table 2. Correlation between the quantity of production and the level of producer price

	Production, thousand tons	Producer price, BGN/kg
Production (thousand tons)	1	
Producer price (BGN/kg)	-0.4988	1

Source: own calculations with MS Excel.

The value of the correlation coefficient given in Table 2 showed that there was a significant inverse relationship between the volume of production and the producer price formed by years.
With an increase in the quantity produced, the price decreased and vice versa - with a reduced production volume, the price increased. To measure the specific quantitative ratios, i.e. the quantitative influence of the factor on the result, a one-factor linear regression analysis performed using the SPSS 19.0 program was applied.
The empirical value of the F-criterion was 5.960, which means that the estimate of the explained variance was more than 5 times higher than the estimate of the residual variance at a significance level of 0.025, which defines the model as adequate (Table 3).

Table 3. Assessment of the adequacy of the linear regression model

	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.289	1	0.289	5.960	0.025
Residual	0.872	18	0.048		
Total	1.161	19			

Source: own calculations with SPSS 19.0.

With a risk of error of 5% (Sig = 0.025 <0.05 = α), there was reason to reject the null hypothesis and to assumed that there was a regular relationship between production volume and producer price.
As already mentioned, the correlation coefficient had a value of 0.499 with a negative sign (given the negative value of the

regression coefficient given in Table 5 - 0.013), confirming the significant inverse relationship between production and producer price. The value of the coefficient of determination (0.249) showed that only 24.9% of the variation in the production price can be explained by the change in the quantity of production (Table 4).

Table 4. Values of measures of dependence

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.499	0.249	0.207	0.220

The independent variable is production, thousand tons.
Source: own calculations with SPSS 19.0

The values of the coefficients given in Table 5 were statistically significant at a risk of error of 5%.

Table 5. Values of the coefficients

Indicator	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
Production, thousand tons	-0.013	0.005	-0.499	-2.441	0.025
(Constant)	0.761	0.100		7.570	0.000

Source: own calculations with SPSS 19.0.

The movement of wholesale prices of table grapes in the period 2001-2019 was presented in Fig. 2. The low value of the coefficient of determination ($R^2 = 0.3477$) did not give grounds for determining a specific trend in the development of the price level under the influence of the studied time period. The lowest price levels were noted in the initial years 2001-2003, before the accession of our country to the EU.
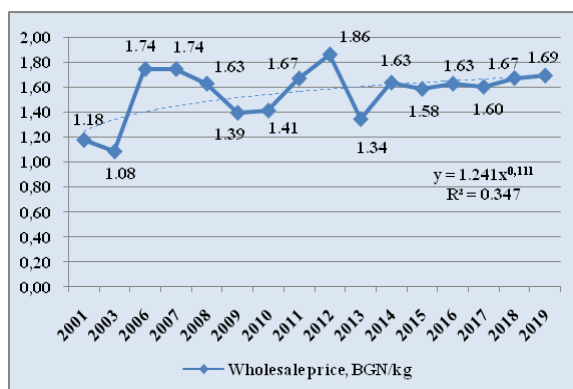

Fig. 2. Dynamics of wholesale prices of table grapes by years during the period 2001-2019, BGN/kg
Source: MAFF, DKSBT and SAPI Ltd. (prices do not include VAT) [13, 14, 15, 16, 17, 26]

In the years of the pre-accession period and beyond, wholesale prices showed some stability, moving in most cases between 1.90 BGN/kg and 2.23 BGN/kg with VAT. Only in 2009 and 2013 there were more significant deviations, as the situation in the last year could be explained by the higher volume of production - 16.7 thousand tons, exceeding by 73.4% the average level of production for the previous three years, as well as with the larger volume of imports.

According to the results of the descriptive statistical analysis (Table 6), the average level of the wholesale price during the period 2001-2019 was 1.55 BGN/kg without VAT. The minimum value - 1.08 BGN/kg was noted in 2003, and the maximum - 1.86 BGN/kg was reached in 2012. The difference between the maximum and the minimum value was 0.78 BGN/kg, and the annual deviations around the average price for the studied period were within ± 0.21 BGN/kg. The coefficient of variation was 13.78 %, which mean that the studied population was characterized by a relatively high degree of homogeneity, i.e. wholesale prices were relatively stable, which was more pronounced during the period 2014-2019.

Table 6. Analysis of the variation of wholesale prices of table grapes during the period 2001-2019

Indicator	n	R	Pmin	Pmax	$\bar{P}$	SD	CV (%)
Wholesale price, BGN/kg	16	0.78	1.08	1.86	1.55	0.21390	13.78

R – range, Pmin – minimum price, Pmax – maximum price
Source: own calculation with SPSS 19.0.

The data from the performed analysis showed a certain stability and a smaller degree of variation in the annual wholesale prices of table grapes compared to the producer prices. Based on the average annual price level, it can be concluded that the variation in the quantity produced, under the influence of the climatic conditions of the year, did not create serious deviations in wholesale prices over the last five years. They remain relatively stable, with more significant deviations observed by months and weeks of sales, when (depending on the period) the impact of the volume of production in the country and imports and the

accordance with consumer demand may affected more significantly.

While producer and wholesale prices were used as an indicator of the sustainability of production, retail prices rather determined the sustainability of the whole supply chain and were more important in the analysis of consumer behavior. The change in their level could be considered as a direct and indirect indicator of market security and consumer access to final products.

The high value of the coefficient of determination ($R^2 = 0.8129$) confirmed the positive change in the price level, as the upward trend was more pronounced during the period 2012-2019, when prices ranged between 2.26 and 2.97 BGN/kg without VAT (Figure 3). The only exception was observed in 2013, when the average annual price decreased, as one of the influencing factors is the increased amount of production in the country.

Fig. 3. Dynamics of retail prices of table grapes during the period 2000-2019, BGN/kg
Source: MAFF, SAPI Ltd. (prices do not include VAT) [13, 14, 15, 16, 17, 1].

Noting the upward trend in prices, it should be pointed that the current study did not rule out the impact of inflation, and the quantity of production in the country was significantly less than in the early years of the period.

The average level of the retail price without VAT for the sixteen surveyed years was 2.05 BGN/kg (Table 7). The highest level was noted in 2015 - 2.97 BGN/kg, and the lowest - 1.18 BGN/kg in 2003. The range of variation between the two values was 1.79 BGN/kg. The value of the standard deviation showed that the annual changes were within ± 0.56 BGN/kg.

Table 7. Analysis of the variation of retail prices of table grapes during the period 2000-2019

Indicator	n	R	Pmin	Pmax	$\bar{P}$	SD	CV (%)
Retail price, BGN/kg	16	1.79	1.18	2.97	2.05	0.56037	27.28

Source: own calculation with SPSS 19.0.
R – range, Pmin – minimum price, Pmax – maximum price

To compare the average levels and the annual variation of producer, wholesale and retail prices of table grapes, an analysis was performed by the method of descriptive statistics with a scope of sixteen years between 2000 and 2019, in accordance with the available information mostly due to the gaps in wholesale and retail price data.

The average level of the producer price for the studied period (excluding the prices for 2000, 2004 and 2005) was 0.63 BGN/kg and was lower by 0.92 BGN/kg (-59.4%) compared to the average value of the wholesale prices and by 1.42 BGN/kg (-69.3%) compared to the average value of the retail prices. The limits of the annual deviations from the average level were the widest at retail prices ± 0.56 BGN/kg. They were narrowest at the producer prices, where the fluctuations of the average annual levels were within ± 0.20 BGN/kg. Wholesale prices deviated on average by ± 0.21 BGN/kg during the years indicated in the study. The coefficient of variation had the highest value at producer prices, which determines the significant impact of market risk on production.

The analysis of the data showed the maintenance of a relatively low average level of producer prices - 0.63 BGN/kg compared to the other two stages of the supply chain. Viewed in the long run through the prism of investor interest, such a price with a constant increase in the average level of direct production costs for growing vineyards for table grapes production, reaching about 7,500 BGN/ha according to Institute of Viticulture and Enology calculations for 2019, could not provide incentives for starting and/or developing the production activity. In this case it was necessary to assess the potential

markets and opportunities for a more rational organization of sales channels in order to achieve a higher price level and limit market risk.
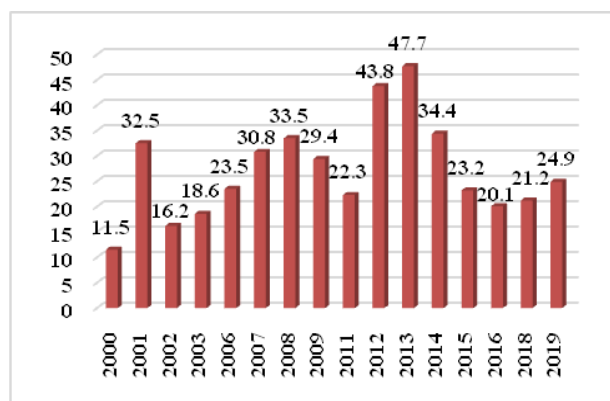
The relative share of the producer price in the wholesale and retail price was an indicator of the market positions and bargaining power of each of the counterparties in the supply chain. From the data shown in Figure 4 a) it was evident that the share of the production price in the wholesale price of table grapes in Bulgaria varied between 20.4% and 68.7% during the sixteen-year study period. Higher

levels were reported during the period 2012-2014, after which the relative share of the producer in the wholesale price decreased sharply. In 2018 and 2019, it was 32.9% and 40.8%, respectively. The big difference could be explained by the higher post-harvest costs incurred by wholesalers. The reduced contribution of producer prices showed that the activities of transport, sorting, packaging, storage of products and others were carried out mainly by wholesalers, who in the most cases had the necessary equipment and labor.
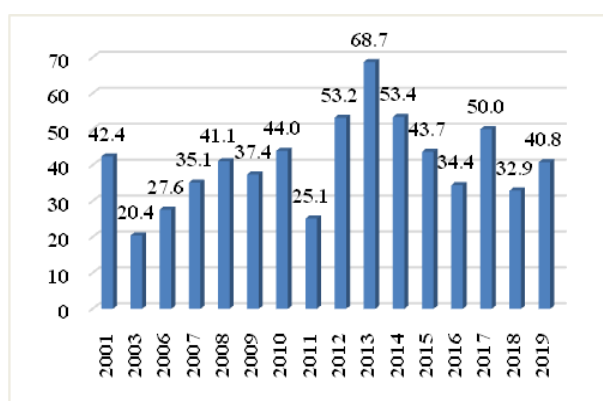
Source: NSI, MAFF, DKSBT [19, 13, 14, 15, 16, 17, 26] and own calculations.
a) in the wholesale price, %

Source: NSI, MAFF, SAPI Ltd. [19, 13, 14, 15, 16, 17, 1] and own calculations.
b) in the retail price, %

Fig. 4. Relative share of producer price in the wholesale price and in the retail price during the period 2000-2019, %

The relative share of the producer price in the retail price was even smaller and varied between 11.5% and 47.7% (Fig. 4 b). A significant decrease in the percentage share of the producer was observed after 2014 and with each passing year the share of producer prices in retail prices decreased. Increasingly high requirements of consumers in terms of appearance, cuts, security guarantees and more attributes of the goods displayed in the trade network, required the realization of additional investments in order to increase the added value. These costs should be borne mainly by traders, which, excluding the influence of the speculative element, determined the declining market share of the producer.

These data determined the weakening market positions of producers in recent years, which had a downward effect on producer prices. The weak market power of this stage of the

supply chain did not allowed to defend the interests and to achieved a stable return. Improving the situation in this aspect should be a matter not only of intervention and protection of domestic production, but also of the perceived need for cooperation and building groups and organizations of producers that could help increase the added value of the final product and its realization at the more price-attractive markets.

The findings made so far were also confirmed by the long-term dynamics in the movement of the producer, wholesale and retail prices outlined in Figure 5.

The comparison between the three curves, describing the movement of prices in the supply chain, showed that not every change in the producer price affected the level of the wholesale prices and of the retail prices. The increase in the producer price in 2007 did not lead to a higher wholesale price, and the retail

price even decreased very slightly. At the same time, the decrease in producer prices in 2011 did not provoke a similar reaction in the other two stages of the supply chain, as retail prices even marked a slight increase compared to the previous year. Lower producer prices after 2014 did not lead to a decrease in wholesale and retail prices, with a significant increase in retail prices. The gap between producer prices and wholesale and retail prices increased. This could be explained by the higher costs that retailers incur to store and present the product in the form sought by consumers. Another question was to what extent, under these conditions, the producer managed to receive adequate payment for his investments and efforts. The big loser in this case remained the consumer, as high prices, limited production and growing imports did not stimulate the growth of consumption and it stayed extremely low - about 2.6 kg per capita in 2019 according to NSI data.
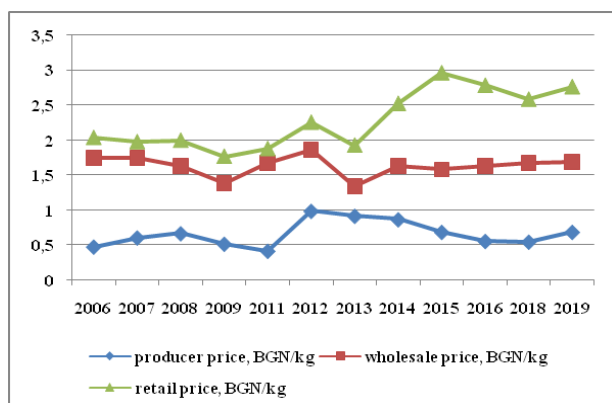

Fig. 5. Dynamics of producer, wholesale and retail prices during the period 2006-2019, BGN/kg
Source: NSI, MAFF, DKSBT and SAPI Ltd. [19, 13, 14, 15, 16, 17, 26, 1]

The results of the analysis showed that producers remained the weakest stage in the supply chain. Stabilizing their market positions and increasing their bargaining power would require both state support, not only to stabilize profitability, but especially to protect Bulgarian production, and awareness of the need to join forces and expand investment in increase the added value of production.

CONCLUSIONS

In the long run, there was an increase in producer prices, given that the current study did not rule out the impact of inflation. The price levels had increased significantly since the accession of our country to the EU, reaching 0.99 BGN/kg in 2012, which is the highest level for the entire surveyed twenty-year period. Since 2013, there had been a gradual decrease in producer prices with significant annual fluctuations, and for the last three years they ranged between 0.55 BGN/kg and 0.80 BGN/kg.

There was a significant inverse relationship between the variation of production in the country and the change in the price level of a producer. The annual changes in the volume of production explained only 24.9% of the change in producer prices. Their dynamics were influenced by a number of other factors, such as the volume of imports, the unit price of imported products, the bargaining power of other counterparties in the supply chain, changes in consumer demand.

The results of the analysis showed some stability and weaker variation in the annual wholesale and retail prices of table grapes compared to producer prices, which is most valid for the period 2014-2018. The largest annual fluctuations were observed in producer prices, which outlined the application of short distribution channels and direct sales as an extremely important option for increasing profitability in the subsector.

The declining relative share of producer prices in the wholesale and the retail prices showed the weakening market positions of producers in recent years. Improving the situation in this aspect is a matter not only of intervention and protection of domestic production, but also of the perceived need for cooperation and building groups and organizations of producers that could provide conditions for increasing the added value of the final product and sales its at a more attractive in price aspect markets.

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