THE INFLUENCE OF THE FACTOR OF SEASONALITY ON THE REAL GDP OF BULGARIA

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ABSTRACT

The main purpose of the present study is to analyze and forecast the dynamics of the real GDP of Bulgaria and to estimate the influence of the factor of seasonality. The dynamics and the seasonal fluctuations of the real GDP of Bulgaria have been studied by means of statistical models. A comparative analysis between Bulgaria and the European Union (EU-28) has been made. A conclusion has been reached that the factor of seasonality exerts a greater influence on the dynamics of the GDP in Bulgaria in comparison with the economy of the European Union as a whole.

Introduction. One of the main goals of every macroeconomic policy is to achieve the potential level of output and a steady economic growth. Understanding the factors which influence the dynamics of the real GDP is therefore crucially important from both practical and theoretical points of view. The factor of seasonality has a huge influence on the main parameters of the macroeconomic system, including the dynamics of the GDP.

It should be noted that a number of authors like Statev, Rangelova, Yotzov, Neycheva [3,4,5,6] did some research into the dynamics and major factors of the economic growth in Bulgaria, but they did not focus on the influence of the seasonality factor. Each economic system exists in a dynamic and complex environment. There is the well-grounded notion that economy does not develop under the same conditions and therefore managerial decisions should not be of the same type, regardless of the external conditions [1]. The identification of the major factors affecting the dynamics of the real GDP and the estimation of the exact quantitative effect of their impact will help make the right managerial decisions in developing and implementing macroeconomic policies.

Materials and Methods. The main objective of the present study is to analyze and forecast the dynamics of the real GDP of Bulgaria and to estimate the impact of the seasonality factor by making a comparison with the trends for the European Union.

The main tasks of the present paper are as follows:

1. To study the seasonal fluctuations of the real GDP of Bulgaria;
2. To make a comparative analysis between Bulgaria and the European Union (EU-28).
3. To present the main conclusions and results obtained in examining the economic indicators in the course of time.

Due to putting greater focus on the purpose of the present study, it has the following limitations:

1. The period on which information is presented is 2000Q1- 2017Q3;
2. Quarterly data are used at the level of both Bulgarian and EU (EU-28) economies;
3. The study is based on official and publically available information.

Eurostat's latest information has been used to conduct the study. The main methods applied are: comparative method, factor analysis, visual fit approach, the expert judgment method.

Seasonal dynamics of the GDP in Bulgaria and in the EU-28. Fig.1 presents the dynamics of the real GDP of Bulgaria for the period 2000Q1-2017Q3 (Chain linked volumes (2010), million euro- [2]).

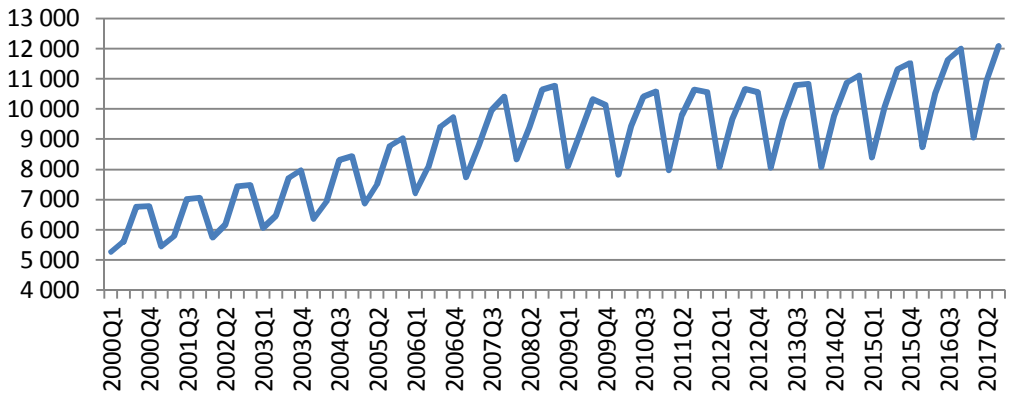

Fig. 1. The dynamics of the real GDP of Bulgaria, quarterly data
Source: Eurostat

This indicator reached its highest value in 2017Q3 (12080,8 million euro), and its lowest value - in 2000Q1 (5269,6 million euro). As can be seen in fig.1, the factor of seasonality had a huge impact on the real GDP in Bulgaria.

The results of the seasonal decomposition of the dynamics of the real GDP of Bulgaria are presented in fig. 2. The multiplicative model has been used.

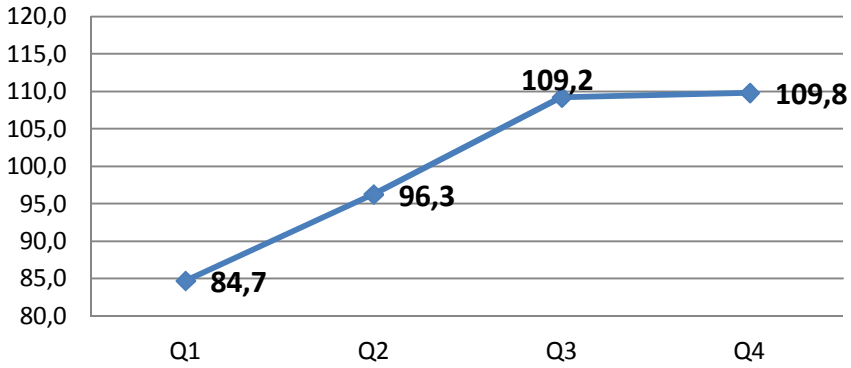

Fig. 2. Seasonal decomposition of the dynamics of the real GDP of Bulgaria
Source: Eurostat, the author's own calculations

As can be seen in fig. 2, the seasonal indices in Bulgaria reached their highest value in the fourth quarter (109.8%), and the lowest value – in the first quarter (84.7%). The seasonal indices show that in the time series studied there is pronounced seasonality – the deviation about the mean during the individual quarters is 25.1 percentage points (pp).

For the adjusted time series (i.e. the time series with removed seasonal or random fluctuations) the most suitable model for modeling the trend has been estimated by means of the procedure Curve Estimation of the software package IBM SPSS Statistics. The different models have been compared according to the value of the coefficient of determination (explanatory part).

According to the results obtained, the coefficient of determination has the greatest value with the cubic model (0.966) followed by the quadratic (0.962) and the linear (0.916) models. The F-statistic shows that the total variations explained by these models are significant (the significance levels are with values Sig. =0.00<0.05). As the difference between the values of the coefficient of determination for the cubic and linear models is equal to 0.05, i.e. less than 0.1, the linear model has been chosen as the most adequate one. The linear model is described by means of the following equation:

$$Y=6344,3136+69,1318t+\varepsilon, \quad (1)$$

where Y is the real GDP, t=1,2,3,…,71 (the number of quarters), ε-the error term (fig. 3).

Table 1. Estimation of the different models describing the variation in the level of the real GDP of Bulgaria

Model Summary and Parameter Estimates

Dependent Variable:Trend-cycle for Y from SEASON, MOD_1, MUL CEN 4

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	,916	751,245	1	69	,000	6344,314	69,132		
Logarithmic	,872	468,799	1	69	,000	3779,839	1528,657		
Inverse	,335	34,725	1	69	,000	9265,190	-6330,080		
Quadratic	,962	861,295	2	68	,000	5602,517	130,101	-,847	
Cubic	,966	629,292	3	67	,000	5343,144	171,877	-2,287	,013
Compound	,889	553,315	1	69	,000	6462,888	1,008		
Power	,897	602,800	1	69	,000	4674,140	,188		
S	,370	40,460	1	69	,000	9,126	-,806		
Growth	,889	553,315	1	69	,000	8,774	,008		
Exponential	,889	553,315	1	69	,000	6462,888	,008		
Logistic	,889	553,315	1	69	,000	,000	,992		

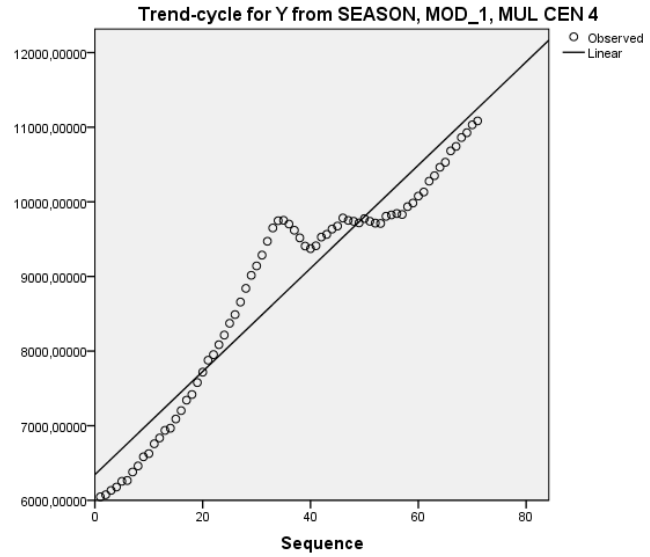

Fig. 3. Dynamics of the real GDP of Bulgaria with removed seasonality and random fluctuations (linear regression model)

Fig. 4 presents the dynamics of the real GDP of the EU-28, with quarterly data used on the European economy for the period 2000Q1-2017Q3 (Chain linked volumes (2010), million euro).

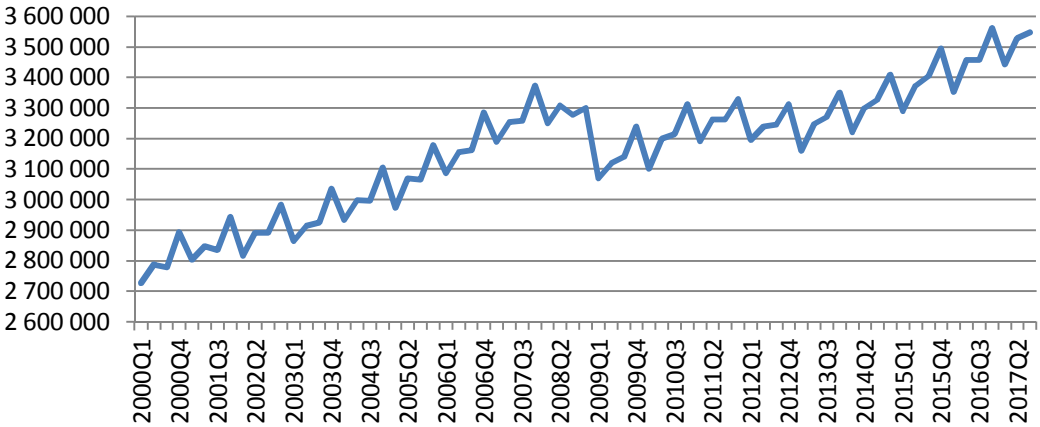

Fig. 4. Dynamics of the real GDP of the EU-28, quarterly data
Source: Eurostat

As can be seen in fig. 4, in the periods 1995-2007 and 2013-2017 there was a strongly marked upward trend in the real GDP of the European Union. In the period 2008-2012 a considerable fall in real output was observed as a result of the negative impact of the global financial and economic crisis. The most considerable fall was in the first quarter of 2009 compared to the fourth quarter of 2008 (6.94%).

There is pronounced seasonality in the time series examined. The results from the seasonal decomposition of the dynamics of the real GDP of the EU-28 are presented in fig. 5.

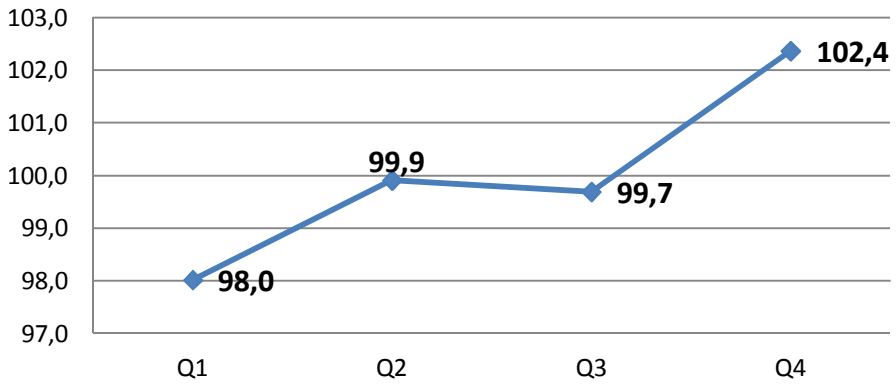

Fig. 5. Seasonal decomposition of the dynamics of the real GDP of the EU-28, quarterly data
Source: Eurostat, the author's own calculations.

As can be seen in fig. 5, just like in Bulgaria, the seasonal indices in the EU-28 reached their highest value during the fourth quarter (102.4%), and their lowest value – in the first quarter (98.0%). The factor of seasonality exerted a comparatively greater influence on the Bulgarian economy in comparison with the mean values for the European Union. The deviation about the mean during the individual quarters is 4.4 pp.

For the adjusted time series (i.e. the time series with removed seasonal or random fluctuations) the most suitable model for modeling the trend has been estimated by means of the procedure Curve Estimation of the software package IBM SPSS Statistics. The different models have been compared according to the value of the coefficient of determination (explanatory part).

Table 2. Estimation of the different models describing the dynamics of the real GDP of the EU-28

Model Summary and Parameter Estimates

Dependent Variable:Trend-cycle for Y from SEASON, MOD_1, MUL CEN 4

	Model Summary					Parameter Estimates			
Equation	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	,896	592,561	1	69	,000	2836198,626	9185,788		
Logarithmic	,832	340,813	1	69	,000	2503715,284	200617,157		
Inverse	,332	34,240	1	69	,000	3224677,695	-846545,377		
Quadratic	,909	340,146	2	68	,000	2782438,660	13604,416	-61,370	
Cubic	,943	369,768	3	67	,000	2676969,897	30591,399	-647,090	5,423
Compound	,892	567,529	1	69	,000	2844255,479	1,003		
Power	,850	389,482	1	69	,000	2551123,712	,065		
S	,349	37,035	1	69	,000	14,985	-,278		
Growth	,892	567,529	1	69	,000	14,861	,003		
Exponential	,892	567,529	1	69	,000	2844255,479	,003		
Logistic	,892	567,529	1	69	,000	3,516E-7	,997		

According to the data in table 2, the cubic model is the most adequate one (0.943), followed by the quadratic (0.909) and the linear (0.896) models. The models shown are statistically significant. As the difference between the values of the coefficient of determination for the cubic and linear models is less than 0.1, the linear model has been chosen as the most adequate one:

$$Y=2836198,6258+9185,7884t+\varepsilon, \quad (2)$$

where където Y is the real GDP, t=1,2,3,…,71 (the number of quarters), ε-the error term (fig. 6).

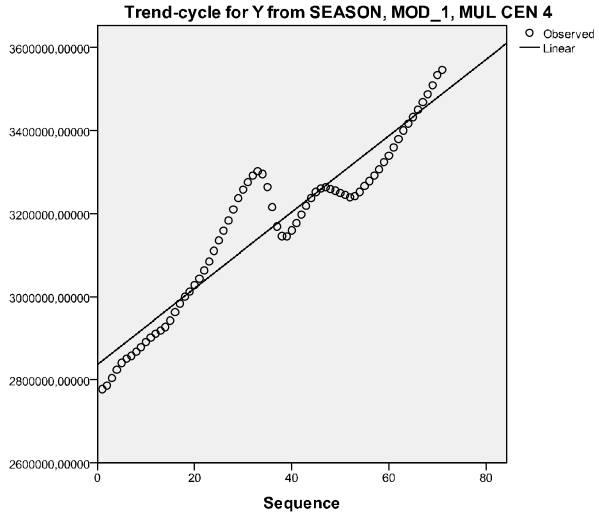

Fig. 6. Dynamics of the real GDP of the EU-28, with removed seasonal and random fluctuations (linear regression model)

On the basis of the model thus obtained a forecast could be made for the quarterly values of the real GDP in Bulgaria and the EU-28 for the next period. The time horizon of the forecast is 13 quarters, i.e. about 18% of the length of the time series.

Table 3. Quarterly forecast values of the real GDP of Bulgaria and the EU-28 (million euro)

Quarter	Real GDP- Bulgaria	Real GDP - EU-28
Q4 2017	12431,4	3580408,0
Q1 2018	9652,8	3437369,2
Q2 2018	11030,9	3512919,3
Q3 2018	12590,3	3514438,5
Q4 2018	12735,0	3618021,4
Q1 2019	9887,1	3473385,3
Q2 2019	11297,1	3549630,8
Q3 2019	12892,3	3551070,2
Q4 2019	13038,6	3655634,7
Q1 2020	10121,4	3509401,4
Q2 2020	11563,3	3586342,3
Q3 2020	13194,3	3587701,9
Q4 2020	13342,2	3693248,1

Therefore, if we assume that the patterns found will hold steady during the forecast period as well, then the level of the real GDP of Bulgaria will grow and during the fourth quarter of 2020 it will reach a value of 13342,2 million euro, i.e. it will be larger by 7.32% in comparison with the fourth quarter of 2017. The real GDP of the EU-28 will also grow and during the fourth quarter of 2020 it will reach 3693248,1 million euro. The forecast growth rates of the GDP of Bulgaria are considerably higher than the growth rates of the real GDP of the EU-28. For example, Bulgaria's real GDP growth in 2020Q4 and 2019Q4 compared to 2017Q4 is 7.32% and 4.88% respectively, and for the EU-28 – 3.15% and 2.10% respectively.

Conclusions and closing. The following conclusions can be made from the analysis of the data presented:

– The global financial and economic crisis had a strong negative impact on the Bulgarian and European economies.

– The factor of seasonality has a huge influence on the dynamics of the real GDP. The influence of the seasonality factor is considerably stronger in Bulgaria in comparison with the European Union.

– If we assume that the patterns found will hold steady during the forecast period as well, then the real GDP of Bulgaria will grow and during the fourth quarter of 2020 it will reach a value of 13342,2 million euro.

– The forecast growth rates of the GDP of Bulgaria are considerably higher than the growth rates of the real GDP of the EU-28.

In closing, it can be noted that the factor of seasonality exerts a greater influence on the dynamics of the GDP in Bulgaria in comparison with the economy of the European Union as a whole. In the short run the positive upward trend in the real GDP of both Bulgaria and the European Union will most likely hold steady, with higher growth rates of this indicator in Bulgaria compared to the average values for the EU-28.

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