Preliminary Communication

SHORT-TERM FORECASTING OF BELEXLINE AND BELEX15 MOVEMENTS

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Abstract. *At the onset of 2019, global economy has been facing a number of macroeconomic issues, which significantly multiplied in the course of the past ten-year period. Slow-moving rate of economic growth, increased fiscal deficits, enormous public and private debt – these are just some of the issues which led to the plunge of the leading stock market indices at the end of 2018. Bearing in mind that S&P 500, DJIA and NASDAQ Composite stopped the multiannual growth trend which started on March 22, 2009, new quakes on the global financial market may well be expected. Unlike developed global stock markets, which hugely recovered from the 2008 crash, the Belgrade Stock Exchange showed no significant growth trend in the observed period. In this respect, regardless of the detected declines of the world's best known stock market indices, it is not realistic to expect any significant change in the Belgrade Stock Exchange share market, which the conducted empirical research should confirm. The basic goal of the research is to establish the monthly tendencies of BELEXline and BELEX15 movements in the forthcoming one-year period. The basic hypothesis of the research is that there will be no significant changes in the movement of the values of selected stock market indicators in the Belgrade Stock Exchange share market during the one-year period to come.*

Key words: *Short-term forecasting, BELEXline, BELEX15, Winters' additive model, Winters' multiplicative method.*

JEL Classification: G17, G23, C22

INTRODUCTION

Depending on the method of establishing future share price movements, stock market analysts may be divided into two groups: fundamental analysts and technical analysts. The fundamental analysis advocates consider solely the basic market factors, whereas the technical analysis advocates use a number of graphic methods. In order to establish future share values, "fundamentalists" analyze the factors arising from economic and political background (a company's earnings, dividends, interest rate, etc.). Unlike them, technical analysts base their forecasts solely on market data analysis, assuming that all economic, financial, political and psychological factors are instilled in the market price of shares. They maintain their attempt to establish future short-term changes of share prices based on the past quotation analysis (in the period of at least 6 months) (Rusu & Rusu, 2003).

Economic forecasting has been underestimated for a long time. However, this field has become very popular in recent years. New researchers, such as Lawrence Klein, Wassily Leontief, Franco Modigliani and James Tobin, became Nobel prize winners for economics for their achievements in the field of forecasting (Lovrić et al., 2013, p. 132). Some of the leading scientific journals in this field are *International Journal of Forecasting* (*International Institute of Forecasters*) and *Journal of Forecasting* (*Wiley*). ~~Also~~ Moreover, the forecasting research may be found in some well-known journals in the field of statistics, management science, econometrics and operational research (*Journal of Business and Economic Statistics*, *Management Science* and *Journal of Econometrics*) (Chatfield, 2001, p. 10).

In this paper, the short term forecasting of future movements of BELEXline and BELEX15 indexes of the Belgrade stock exchange will be carried out. Regarding research objectives, the paper is organized in the following manner: The first part of the paper will deal with the analysis of the forecasting methods used in the similar researches. Winter's additive and Winter's multiplicative method will be used to perform the analysis and the forecasting of BELEXline and BELEX15 future values. In the second part, the model testing and the short term forecasting will be carried out, based on the model's goodness of fit with the historical values of stock indexes. In the final part of the paper, the discussion of the empirical results will be given along with the corresponding conclusions.

METHODOLOGY

The time series forecasting methods may be classified into qualitative and quantitative (Bovas & Ledolter, 2009, p. 2). The *qualitative methods* are applied in case time series data cannot be expressed quantitatively or are unavailable. These methods are based on the opinions of experts, which means the values of underlying economic phenomena are established based on an assessment of a group of economic experts. The *quantitative methods* may be used only if a piece of information about a phenomenon whose movement is subject to forecasting may be expressed numerically, i.e. quantified. In this regard, they are based on mathematical and statistical models. In order to apply the quantitative methods, one must use the data relative to the past time series values. The basic premise of the time series forecasting methods is that the series movement will be in the future as it was in the past. The quantitative methods include applicable methods of the statistical analysis of time series (project methods) and causal methods. The methods of the statistical analysis of time series forecast future movement of an economic

phenomenon solely on the basis of its values from the past, while the causal methods rest upon a premise that the phenomenon whose movement is subject to forecasting has a cause-and-effect relationship with another economic phenomenon or phenomena.

Generally speaking, the time series models may be used in case there is a small amount of information regarding the factors which affect the variable value, there is a huge amount of data or the analysis goal is to make a short-term forecast (Rusu & Rusu, 2003). In this respect, the time series analyses relative to the share prices and stock market index values from the past are suitable for use along with the technical analysis. Like the technical analysis, the time series analysis along with the past share price analysis uses different statistical methods to forecast their movement in the future. A majority of research of this kind applies the following methods: time series decomposition, Box-Jenkins (ARIMA) methodology, neural networks and Holt-Winters' exponential smoothing (Tseng et al., 2012). Nevertheless, in addition to this, the *Box-Jenkins (ARIMA) methodology* is predominantly used for short-term forecasting purposes (Rusu & Rusu, 2003). Some of the authors who explained the application of this methodology more closely by means of a stock market index example were Varghese et al. (2016). Tolosa et al. (2015) used the ARIMA methodology to analyze and forecast the Philippine Stock Exchange indices. Seeking to predict the future values of stock market indices they often use the *moving average methods* in their research. These methods were used by numerous researchers for the analysis and forecasting of daily values of the best-known stock market indicator, the Dow Jones Industrial Average (Brock et al., 1992; Sullivan et al., 1999; Siegel, 2008). The moving average methods take the latest dynamic series data into account. The effect of the latest observations wanes with the rise of the number of values (periods) used. If a dynamic series experiences random changes in longer time intervals, a larger amount of data is used, and if random changes occur frequently, i.e. in shorter time intervals, a considerably smaller amount of data is used (Rusu & Rusu, 2003). Although quite complex as well, the *neural networks model* is frequently used to analyze and forecast the stock market indicator values. Leigh et al. (2005) used this model to analyze the NYSE Composite Index and forecast its future movement. The neural networks model was also used by Yumlu et al. (2005) while testing the Istanbul Stock Exchange performance, whereas Mostafa (2010) used it to forecast the stock market movements in Kuwait. The *exponential smoothing methods* are also often used to make short-term forecasts of time series. This group of methods is suitable for short-term prediction, step by step. In addition to this, a smoothed value of time series represents a combination of exponentially weighted values, whose movement is represented up to a certain observed period, and specific observed smoothed values during such period. A smoothed time series indicates the basic tendency and principle present in the data. Simple exponential smoothing does not recognize the trend in time series, whereas the value forecast by means of the Holt-Winters' method includes both the exponentially smoothed component and trend component (Rusu & Rusu, 2003). Besides, time series often feature seasonal variations. In this context, the Holt-Winters' forecasting methods were developed and they include the seasonal component; there are additive and multiplicative methods (Kalekar, 2004). The goal of time series exponential smoothing is to eliminate the effects of random variations (fluctuations) and discover the basic characteristics of the phenomenon development. By applying the procedure of exponential smoothing to the available data, a smoothed series is obtained by means of suppressed random fluctuations. The resulting smoothed value series is a starting point used to forecast future values.

Two methods were selected from a vast group of exponential smoothing methods to analyze and forecast the future movement of BELEX15 and BELEXline indices: *Winters'* additive and *Winters'* multiplicative methods. The application of the above methods to the time series of these indices (separately) resulted in two models per each series. A better adjusted model was selected based on the forecast root-mean-square error as a criterion for the model evaluation. The better model is the one with less forecast error (root-mean-square error (RMSE) in this case). All calculations were made in *IBM SPSS* software.

Even though the first organized share trade at the Belgrade Stock Exchange began by the middle of 2001, the Stock Exchange made its first index, BELEXfm, on May 1st, 2004. It was the so-called *all-share* index, which means it comprised all shares included in the free stock market (fm - free market). The enormous rise of share prices and market activities in general in the period before the global financial crisis was improperly illustrated by the general market movement indicator. For this reason, on May 3rd, 2007 BELEXfm was replaced by BELEXline, which provided a much more precise representation of the general performance of the shares traded on the Stock Exchange. BELEXline represents all shares traded on a regular basis, i.e. actual market capitalization is indexed. On October 1st, 2015 the Belgrade Stock Exchange made its second index, BELEX15, which included only shares traded by continuous trading which met the criteria for inclusion into the index basket. The base values of both indices were 1,000 index points. The monthly value data of BELEX15 and BELEXline indices between October 2005 and February 2019 were taken from the Belgrade Stock Exchange website and shown in Figure 1 and Figure 2.

Based on the shown values of the main Belgrade Stock Exchange indices the impact of the 2008 global financial crisis is clearly observed. This shock is one of the most influential factors which may affect successful forecasting of the BELEX15 and BELEXline time series.
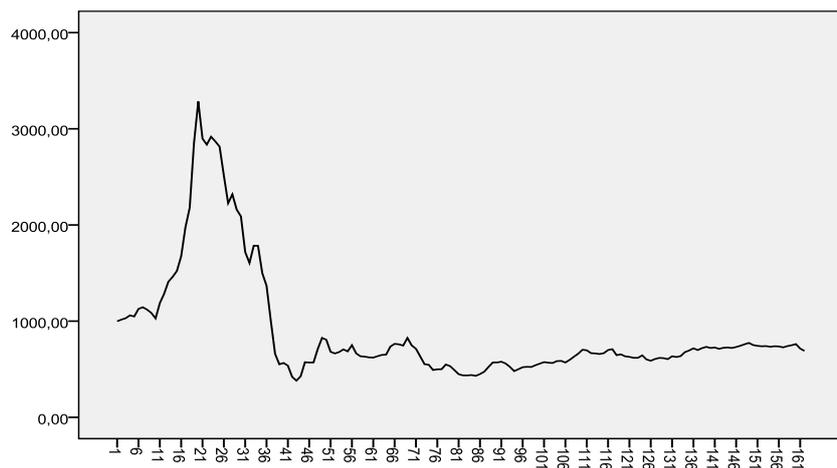
Fig. 1 Original values of BELEX15 index between October 2005 and February 2019
Source: Belgrade Stock Exchange
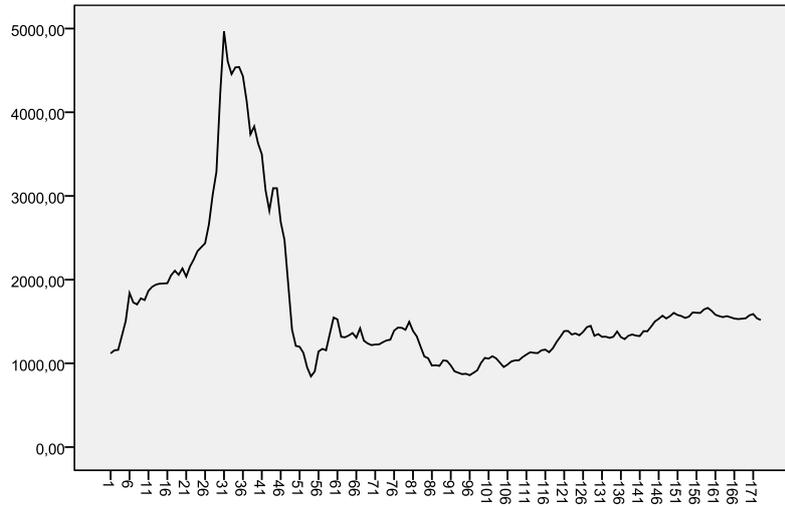
Fig. 2 Original values of BELEXline index between October 2005 and February 2019
Source: Belgrade Stock Exchange

RESULTS OF THE RESEARCH

Before making a short-term forecast of the future movement of BELEX15 and BELEXline indices of the Belgrade Stock Exchange, it is required to marginalize the impact of the shock incurred by the 2008 crash. In this regard, two time series will be represented in the period between January 2009 and February 2019, which will serve as a basis for the attempted short-term forecasting (Figure 3 and Figure 4).

Fig. 3 Original values of BELEX 15 index between January 2009 and February 2019
Source: Belgrade Stock Exchange

Application of the *Winters'* additive and multiplicative models to the BELEX15 time series will help establish the forecast error during the use of these models.

Table 1 BELEX15 index forecast error by the *Winters'* additive and multiplicative models

Type of model	Forecast error
Winters' additive model	37.543
Winters' multiplicative model	41.200

Source: Authors

Based on the shown data it may be concluded that a better adjusted model was obtained for the observed time series by applying the *Winters'* additive model.

Fig. 4 Original values of BELEXline index between January 2009 and February 2019
Source: Belgrade Stock Exchange

As in the previous case, the *Winters'* additive and multiplicative models were used on the observed time series to establish the forecast error.

Table 2 BELEXline index forecast error by the *Winters'* additive and multiplicative models

Type of model	Forecast error
Winters' additive model	60.232
Winters' multiplicative model	66.517

Source: Authors

It was observed that the Winters' additive method model was better adjusted to the BELEXline and BELEX15 time series. Accordingly, the *Winters'* additive model will be used for short-term forecasting of the movement of both indices between March 2019 and February 2020.

Figures 5 and 6 illustrate how the *Winters'* additive model matches the original values of BELEX15 and BELEXline indices and their forecast values for the one-year period.
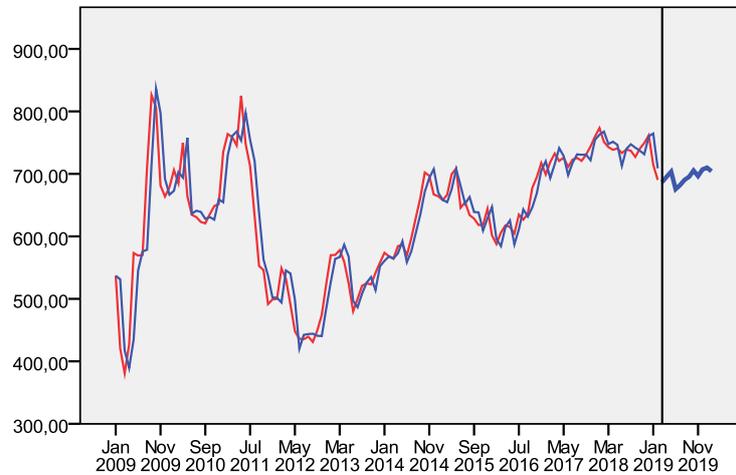
Fig. 5 Original (red line), adjusted (thin blue line) and forecast (thick blue line) values of
BELEX 15 index
Source: Authors

Based on the completed forecast, a mild rise of the BELEX15 values may be expected in the observed period. Also, the forecast includes the values interval (top and bottom values of the interval) for each month subject to the forecast (Table 3).

Table 3 Forecast values of BELEX 15 index between March 2019 and February 2020

Month	Forecast value of BELEX 15: *Winters'* additive model		
	Bottom value of interval	Individual modeled values	Top value of interval
March 2019	612.56	686.90	761.24
April 2019	590.41	695.58	800.75
May 2019	574.62	703.47	832.33
June 2019	526.73	675.57	824.42
July 2019	515.61	682.09	848.57
August 2019	507.97	690.41	872.85
September 2019	498.18	695.32	892.45
October 2019	494.53	705.36	916.18
November 2019	472.81	696.51	920.21
December 2019	471.81	707.16	943.05
January 2020	462.45	709.96	957.47
February 2020	445.59	704.20	962.81

Source: Authors

Based on the data shown in Table 3 it is noted that the forecast values of BELEX15 index for the forthcoming year range between 675.57 and 709.96 index points. This index is expected to reach the lowest value in June 2019 and the highest value in January 2020.
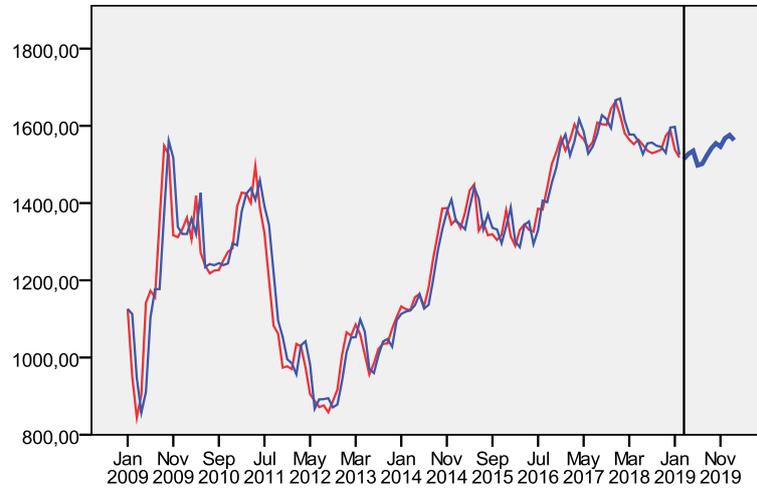
Fig. 6 Original (red line), adjusted (thin blue line) and forecast (thick blue line) values of BELEXline index
Source: Authors

In case of BELEXline index the forecast shows that a mild rise of BELEXline index may be expected in the observed period. Also, the forecast includes the values interval (top and bottom values of the interval) for each month subject to the forecast (Table 4).

Table 4 Forecast values of BELEXline index between March 2019 and February 2020

Forecast value of BELEXline: *Winters*' additive model			
Month	Bottom value of interval	Individual modeled values	Top value of interval
March 2019	1395.24	1514.51	1633.77
April 2019	1358.91	1527.64	1696.37
May 2019	1328.42	1535.16	1741.90
June 2019	1258.90	1497.72	1736.54
July 2019	1234.66	1501.78	1768.89
August 2019	1229.97	1522.69	1815.42
September 2019	1225.51	1541.82	1858.12
October 2019	1216.31	1554.60	1892.88
November 2019	1187.27	1546.22	1905.17
December 2019	1189.43	1567.95	1946.47
January 2020	1178.86	1576.02	1973.18
February 2020	1147.78	1562.76	1977.75

Source: Authors

It can be noticed that the forecast values of BELEXline index for the forthcoming year range between 1497.72 and 1576.95 index points. As in the case of BELEX15 index, BELEXline index is expected to reach its lowest value in June 2019 and its highest value in January 2020.

DISCUSSION AND CONCLUSION

The conducted empirical research indicates that the share market in the Republic of Serbia will have no significant trends in 2019. Bearing in mind that the turnover of shares in the BELEX15 index basket makes more than 60% of the entire share turnover, it may be concluded that the Belgrade Stock Exchange will have a scarce share turnover between March 2019 and January 2020. The expected increase of the BELEX15 index values in this period shall amount to less than 20 index points. Forecasts made by the time series methods are based on the determination of principles in the previous phenomenon development and projection of its movement in the future. However, forecasting cannot precisely establish future movements, so the analysis and interpretation of the obtained results should be regarded as having potential errors. Uncertainty and potential errors are in proportion to the length of the forecast period, which suggests that the forecast should be directed towards a short time period. Also, in forecasting time series multiple methods should be used in order to compare the results and minimize potential errors. With this in mind, future research concerning the field of short-term forecasting of BELEX15 and BELEXline index values may apply other well-utilized methods for this type of research (e.g. the Box-Jenkins (ARIMA) methodology and neural networks model).

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KRATKOROČNO PREDVIĐANJE KRETANJA
BELEXLINE I BELEX15 INDEKSA

Početkom 2019. godine globalna ekonomija je suočena sa brojnim makroekonomskim problemima koji su se znatno uvećali tokom prethodnog desetogodišnjeg perioda. Usporena stopa ekonomskog rasta, uvećani budžetski deficiti, veliki javni i privatni dug su samo neki od problema koji su krajem 2018. godine doveli do pada vodećih berzanskih indeksa. Imajući u vidu da su S&P 500, DJIA i NASDAQ kompozitni indeks prekinuli višegodišnji rastući trend započet 22. marta 2009. godine, mogu se očekivati novi potresi na globalnom finansijskom tržištu. Za razliku od razvijenih svetskih berzi koje su se u velikoj meri oporavile od kraha nastalog 2008. godine, Beogradska berza u posmatranom periodu nije zabeležila neki značajniji trend rasta. S tim u vezi, bez obzira na zabeležene padove najpoznatijih svetskih berzanskih indeksa, nije realno očekivati neku značajniju promenu na tržištu akcija Beogradske berze, što bi trebalo da potvrdi sprovedeno empirijsko istraživanje. Osnovni cilj istraživanja jeste utvrđivanje tendencije u kretanju BELEXline i BELEX15 indeksa za naredni jednogodišnji period, na mesečnom nivou. Osnovna hipoteza rada jeste da na tržištu akcija Beogradske berze u narednom jednogodišnjem periodu neće doći do značajnijih promena u kretanju vrednosti odabranih berzanskih pokazatelja.

Ključne reči: *Kratkoročno prognoziranje, BELEXline, BELEX15, Winters-ov aditivni metod,*
                Winters-ov multiplikativni metod.