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Calibration of Bollinger Bands Parameters for Trading Strategy Development in the Baltic Stock Market

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In recent decades there was a robust boom in investment sector in Lithuania, as more people chose to invest money in investment funds rather than keep money in the closet. The Baltic States Market turnover has increased from 721 MEUR in 2000 to 978 MEUR in 2008 (with peak 2603 MEUR in 2005). When difficult period appeared in global markets, a lot of attention was dedicated towards the managing of investments. Investment management firms in Lithuania gain significance in personal as well as in business section increasingly; even though these firms are considerably young (the first one in Lithuania was established in year 2000).

Successful investment begins with the financial analysis of stock, asset or index, which you are going to invest. Professionals can be divided into two groups as far as this point is concerned: supporters of fundamental analysis and the supporters of technical analysis. Fundamental analysts try to determine a company's value by looking at the balance sheet, cash flow statement and income statement. Technicians, on the other hand, assume that all these fundamentals are accounted for in the stock's price and analyses charts of price movements and various indicators derived from the price and volume. Technical analysis suffered major criticism when Fama (1965) presented his efficient-market hypothesis (EMH), which states that past prices cannot be used to profitably predict future prices. However, many researches showed that EMH is not adequate in many aspects. With this background the "Quantitative Behavioral Finance" theory was introduced (see recent works of Gunduz Caginalp, Vernon Smith, David Porter, Don Balenovich, Vladimira Ilieva, Ahmet Duran, and Ray Sturm). This theory includes some topics of classical theories, but mainly it is based on behavioral analysis of market agents and helps to understand behavioral biases in conjunction with valuation. This means that there is no reason to criticize the technical analysis, but in difficult cases (e.g. crises) it should be supplemented by behavioral analysis of agents. In this paper some methods of technical analysis are used to create an investment strategy trading in Baltic States stock market.

The main objectives of this research are: adapt Bollinger Bands to the Baltic market, determine which investment period with – long term or short term – Bollinger Bands is more efficient, research the efficiency of Bollinger Bands depending on the parameters. In this paper the optimal parameters are calibrated and the expected profit is estimated without the information about the transaction costs.

"Bollinger plotter" was developed using the most popular mathematical toolbox MatLab in order to solve stated problems. Application is capable of charting Bollinger Bands and 6 other technical indicators with desired period of time. This software is not a fully automated decision making system, as decisions are usually made based on value judgment.

Since the stock returns usually have distributions with fat tails, then less than 95% of data fit in the Bollinger trading channels. However the Bollinger bands trading signals were supported by additional indicators (e.g. %b), so the loss of data is not significant.

Our calibration results show that short term investor should apply 10 days moving average and use a trading channel with the width of 1.8 standard deviations, for the Bollinger bands.

Keywords: *Bollinger bands, trading bands, short term, investment, portfolio optimization, parameter calibration, Baltic stock market, standard deviation, moving average, technical analysis.*

Introduction

Lately, the number of investors in Lithuania was growing rapidly, and they entrusted their savings to investment funds. People realized that over time money loses its value when it lies in a drawer or a bank account and therefore, decided to take some minimal risks and invest some free capital with the hope of the benefit.

In the meantime, during the difficult economic situation, a lot of investors are focused on optimal investment management. Although Lithuanian investment management companies are still young (the first investment management company established in Lithuania in 2000), but they play a larger role every year in both personal and business financial management structures. To have successful investment, it is necessary to perform comprehensive and very accurate analysis of the market, index or stock company. The analysts usually are divided in to 2 different schools: fundamental analysts and technical analysts. Fundamentalists analyze company financial performance from their submitted reports to estimate the company's value. The supporters of technical analysis consider that all these figures are reflected in stock price and focuse only on the share price changes, i.e. their analysis is based on graphical analysis. The latter theory was criticized by economists in the context of 1960–1970, when Professor E. Fama introduced his famous efficient

market hypothesis (see Fama, 1965, 1965 and Fama & Miller, 1972). This theory states that all past information is reflected in today's price, so it is impossible to predict the direction of price movement basing it on historical data. Nowadays this theory is replaced by so called "Behavioral Finance" (see, e.g. Baltussen, 2009), which states that the stock price is a reflection of traders (agents) behavior. Furthermore, Mandelbrot (1963, 1964) has showed that the daily stock price returns are not normally distributed and the effective market hypothesis is not adequate. Nowadays, many scientists claim that the daily stock returns fit the so called α-stable distribution (Kabašinskas et al, 2009, Kabasinskas et al, 2010, Rachev et al, 2005, Belovas et al, 2006, etc.) and may be modeled by GARCH time series techniques.

Nonparametric adequacy hypothesis H_0: "Return of the stock is normally distributed" was tested for each of the selected stocks from the Baltic stock market (see Kabašinskas et al, 2009, and Belovas et al, 2006). The Kolmogorov-Smirnov criterion rejected the null hypothesis for all the data. Theoretically if the width of trading channel is chosen to be of two standard deviations, approximately 95% of data should fit into this trading channel. However, it is wrong to rely on this assumption as returns of the stocks are not normally distributed (see Kabašinskas et al, 2009, and Rachev et al, 2005). It is likely that less than 95% of data fit in the trading channel as returns usually have fat tailed distributions. This means, that there are more data points in the far tails of the distribution than normal distribution, and empirical tests supports this assumption (Kabašinskas et al, 2009, Kabašinskas et al, 2010, and Belovas et al, 2006b). However, Liu et al. (2006) proved that Black–Scholes model really possesses the Bollinger band property of real stock market when K=2.

The price of a security is a consensus between a buyer and seller. Whether a trader decides to buy or sell depends on his expectations. If a price is expected to rise, the trader would buy, and if a price is expected to decrease, the trader would sell. Technical analysis encounters greatest challenge because of a human factor. As expectations of an individual person are neither easily measurable nor predictable, all automated decision making systems remain inconsistent (Achelis, 2000). The management of the investment requires cool mind and objectively assessment of all circumstances, because emotions often lead to the edge of the abyss.

However, in our work we analyze the investment methods that are based on technical analysis principles. We will analyze the possibilities of application of one of the technical analysis methods – the Bollinger bands methods (Bollinger, 1992 and 2001) for the investment in the Baltic stock market. Bollinger bands method is widely used, however, not so thoroughly studied in a scientific way (see Ryazanova Oleksiv, 2008). In Lithuania this problem is not studied at all. Therefore our main objective of this study is to examine the scientific and empirical validity of the method mentioned above. Usually the efficiency of Bollinger bands varies depending on the selected parameters. So in this paper we will focus on this problem. As also we will determine which investment - long-term or short term, this approach is better suited.

This paper is organized as follows. In the first section we give some methodology of Bollinger and other trading bands. Section 2 deals with the methodology of the selection of optimal parameters of Bollinger bands. Section 3 explains the nature of the selected data and related problems. In the section 4 we give some empirical results of calibration of Bollinger bands parameters and conclude with conclusions and discussions.

Trading bands

The *trading bands* are curves plotted as envelopes in the graph of security price. Hurst (1970) was first to apply trading bands in investment analysis. The author suggested to graph continuous curves over and down from original stock price. By this technique analysts tried to evaluate cycles (seasonality) of the share price (Bollinger 1992, 2001).

Next improvement was introduced in mid 1970's. The price shell was formed shifting moving average up and down by a fixed constant. This technique remains popular as it is a simple way to draw trading bands. Figure 1 (upper) illustrates a 21 day moving average with a trading bands shifted up and down by 4%.

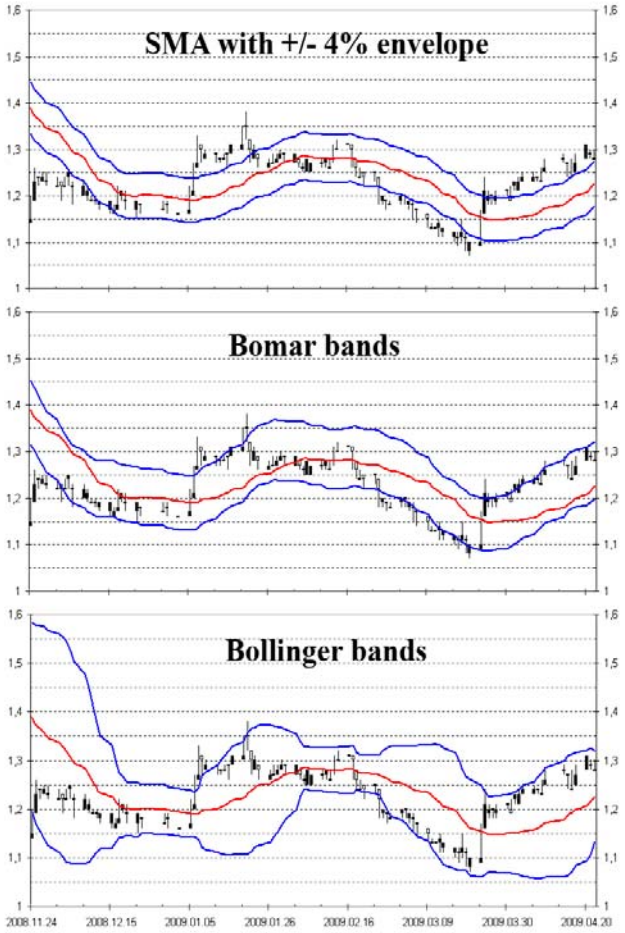

Figure 1. Evolution of the trading bands with TEO1L stocks

It is trivial to draw this kind of bands. First 21 day moving average is calculated and drawn. Then upper band is moving averages times 1.04 and lower band is moving average times 0.96.

All the primitive trading bands were symmetric. But at the beginning of 1980's Chaikin together with Brogan introduced first trading bands that did not require any additional parameters (Bollinger, 1992 and Kancerevycius, 1999). These trading bands were named Bomar bands. It was suggested to use a certain percent of historical prices.

Figure 1 (middle) depicts a Bomar bands with 85% of historical data. The widths of upper and lower bands differ. In the case of a bull market the width of upper band is increased and the width of lower band is decreased, and vice versa – in the case of a bear market upper band is narrower and lower band is wider (Bollinger 1992 and 2001). However, this technique of trading bands did not gain its popularity as it faced complicated calculations and computer science technologies at that time were incapable of dealing with huge amounts of data.

Bollinger bands

"Asking the market what is happening is always a better approach than telling the market what to do" said Bollinger (2001). Trading band technique became even more attractive when Bollinger suggested concentrating on volatility. Standard deviation was selected as the best measure for volatility because of its sensitivity to extreme deviations (Bollinger, 1992, 2001).

It is possible to define relatively high and low prices of the security using Bollinger bands. The price is high on a relative basis when price tags the upper band and the price is low on a relative basis when the price tags the lower band (Figure 1 bottom). Bollinger bands consist of three bands:

- Middle band (*MiddleB*) represents intermediate term trend. It is calculated as *N* period simple moving average. Middle band is a frame of reference for the upper and lower bands.

$$MiddleB = SMA = \frac{1}{N} \cdot \sum_{i=M-N}^{M} x_i , \qquad (1)$$

here M total number of observations, x_i – historical data set.

- Upper band (*UpperB*) is shifted up by *K* standard deviations above the middle band.

$$UpperB = SMA + K \cdot \sigma_N , \qquad (2)$$

here $\sigma_N = \sqrt{\frac{1}{N} \cdot \sum_{i=M-N}^{M} \left(x_i - SMA\right)^2}$ is a standard deviation calculated for the newest *N* observations

- Lower band (*LowerB*) is shifted down by *K* standard deviations below the middle band.

$$LowerB = SMA - K \cdot \sigma_N \qquad (3)$$

The optimal parameter *N* is 20 for individual stocks and stock indexes. Satisfactory intermediate term trend is obtained using this parameterization. For short term trends parameter *N=10* also works well. For long term trends it is a good idea to use *N=50*. Parameter *K* is set to 2 in the basic model of the Bollinger bands, although it can be adjusted (in the best case calibrated) according to the specifications of the market. In the case a longer moving average is used parameter *K* must be increased to 2.1, when *N=50*. On the contrary, if shorter moving average is used, then parameter *K* should be decreased to 1.9, when *N=10*.

A few modified sell/buy indicators based on Bollinger bands were introduced by Bollinger (2001). These indicators supply with additional information when making decisions on investment. We will shortly overview only two of these indicators:

- Indicator %b tells us where we are according to the trading bands. When the price tags upper band indicator equals 1, and when price tags lower band indicator equals 0. %b indicator is calculated using formula

$$\%b = \frac{x - LowerB}{UpperB - LowerB} . \qquad (4)$$

- The bandwidth of Bollinger band. When bandwidth is extremely small, it is high probability of seeing radical changes in price direction. This indicator is calculated using this formula

$$BandWidth = \frac{UpperB - LowerB}{MiddleB} . \qquad (5)$$

Different investors have a different approach on using Bollinger bands. Some of them try to buy securities when price drops below the lower band and sell when price rises above the moving average. Other investors buy when security price crosses up the upper band and sell when price is going below the lower band. Furthermore, Bollinger band technique is used not only by stock trader. For example, it is rational to sell options when Bollinger bands are far apart for some period of time and buy options when Bollinger bands are close together for some period of time. In both situations, it is expected price volatility to get back to its average value during a long term period (Lento&Gradojevic, 2007). In this case option traders can expect profit.

It is said to be low price volatility period when bands are situated close to each other for some period of time. And vice versa, it is high price volatility period when bands are far apart from each other. If the bands are sloping slowly and upper and lower bands are situated almost parallel, it means that security price is fluctuating between the bands like in a channel.

However, it is highly recommended not to make decisions based only on Bollinger bands. There are variety of indicators and methods to combine with the technique of trading bands and came out with the best decision. Bollinger bands are one of the oscillator methods, so it should be used with non oscillator methods (Edwards et al, 2001, Wooley, 2007). If other methods confirm the signal generated by Bollinger bands, it is more likely that predictions made using trading bands are correct.

Optimal parameters

It is essential for an investor to have possibility to adjust the parameters of any method not only for a single stock but also for the stock indexes, etc. These parameters also can vary while taking into account that inspected period can be long term as well as short term. As it has been mentioned above, it is known that Bollinger bands

generate best results analyzing short term data with one parameterization, however, other parameterization for analyzing long term data is needed.

In this paper we will try to determine which parameterization and in which situation should be used. The research was based on the investor who is interested in short a term investing. For our analysis two Baltic market stocks were used. Charts with Bollinger bands were plotted using three different sets of parameters for each of the stock. We assume that the investor will observe the stock prices and, according to the generated signals, instantly will make a decision. The minimal timeframe for making decisions is one day. So, every day investor decides whether to buy, sell or retain his position in the market. After the certain timeframe the returns are calculated for each set of parameters.

Bollinger bands have some parameters that can be changed. Firstly, the calculation method of the middle band can alter. Usually simple moving average (SMA) is used. However, weighted moving average (WMA) or exponential moving average (EMA) can be used as well.

Calculating weighted moving average for N periods, the newest prices have the biggest weights while the older prices have arithmetically decreasing weights (6). In that way the newest prices have the biggest impact on the final result whereas arithmetically smaller impact is made by older prices.

$$WMA = \frac{\sum_{i=0}^{N-1}(N-i)\cdot x_{M-i}}{\sum_{i=1}^{N} i} \tag{6}$$

A special case of linearly weighted moving average is exponential moving average:

$$EMA = \frac{\sum_{i=M-N}^{M}(1-\alpha)^{M-i}\cdot x_i}{\sum_{i=M-N}^{M}(1-\alpha)^{M-i}}, \tag{7}$$

here α is a constant smoothing factor between 0 and 1. In this case (7) corresponding weights are decreasing exponentially. Therefore newest prices have significantly greater impact than the older ones. However, the oldest data are not rejected and still are taken into account. A constant smoothing factor α in most of the software toolboxes is calculated automatically considering the amount of the total data points N. Usually for a smoothing factor the following formula is used $\alpha = 2/(N+1)$.

Figure 2. Software ("Bollinger plotter") for charting Bollinger bands

Second possible customization concerns the setting of upper and lower bands, i.e. the distance between middle and upper/lower band. Traditionally this distance is described by the number of standard deviations. As it has been mentioned above, the most common setting is when upper and lower bands shift by 2 standard deviations respectively up and down.

Problem oriented software was developed for our research. "Bollinger plotter" has special properties needed for the investigation of the parameters of the Bollinger bands. All the parameters mentioned above can be easily adjusted using the graphical user interface (see Figure 2).

There is possibility to change the following settings:

- Calculation method of the middle band. It can be chosen between simple moving average, linearly weighted moving average and exponential moving average.
- Length of the moving average measured in days.
- Width between the upper/lower band and middle band. Possibility to adopt a number of standard deviations by which upper/lower band is shifted up/down from the middle band.

Example of Bollinger Bands for stock of TEO LT (TEO1L) can be seen in Figure 2. Simple moving average for 20 days timeframe was used for middle band calculation. Upper and lower bands are respectively shifted up and down by two standard deviations from the middle band.

In the next examples and analysis we use historical data sets of Baltika (BLT1T) and Klaipedos nafta (KNF1L) from the Baltic States stock market (see NASDAQ OMX Baltic link).

AS Baltika (Baltika Ltd.) has core business in clothing retail since 1991 and is listed in a Tallinn Stock Exchange list since 1997. During the analysis time frame (from 2009-03-12 to 2009-05-14) the average daily price was 0.5614 EUR and the average daily turnover was about 20 thousand EUR.

Klaipedos Nafta AB has core business in export and import of oil products since 1994 and is listed in a Vilnius Stock Exchange list since 1996. During the analysis time frame (from 2009-03-12 to 2009-05-14) the average daily price was 0.9036 LTL and the average daily turnover was about 48 thousand LTL.

Stocks of companies mentioned above have high liquidity in a market, so they are good examples for our analysis.

Graphical examples of two stocks BLT1T and KNF1L Bollinger bands and additional indices are given in Appendices A–C. Charts are formed using three different sets of parameters (see next section). Additional indicator %b supplements the charts. As it has been mentioned above, this indicator describes the situation of price according to Bollinger bands. Sell signal (marked with dark red) or buy signal (marked with green ring) is indicated when closing price tags or penetrates respectively upper or lower band. Price state is represented using Japanese candle sticks (see Figure 3). This method is convenient as low, high, open and close prices are presented at the same time.

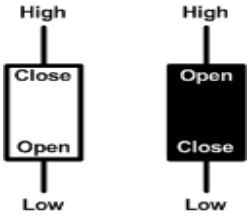

Figure 3. Japanese candlesticks for daily stock price

Also, when the price during the trading session has increased, then the candle body is empty and when the price has decreased then candle body is filled (Nison, 1991).

The optimal Bollinger band parameters are calibrated using historical data, so you can trust the generated signals only in case if the stock price process is stationary and stable. However for a short time investment these requirements are not necessary.

Results of the calibration of Bollinger bands parameters

Performing the analysis of the charts for a short term investment, it was understood that in most cases Bollinger bands are far apart and the price crosses the edge of the trading channel only after extreme price changes. In addition, moving average calculated for 20 days, is lagging after the price fluctuation. Absorbing the extreme price changes moving average can only indicate long term trends and miss out the short term movements. Due to this, a short term investor made notably less investment decisions than a long term investor. It can be deduced, that using the same parameters for trading bands a short term investor generated less signals than a long term investor has. These problems lead us to the conclusion that parameters of the Bollinger bands (length and calculation method of the moving average, width of the bands) should be selected individually for short and long term investors. Our research is focused on the optimal parameters for the short term investor.

Chart analysis of Baltika (BLT1T) and Klaipedos nafta (KNF1L) stocks was performed using following three sets of parameters:

1) $N = 20$, $K = 2$ (see Appendix A);
2) $N = 10$, $K = 1.8$ (see Appendix B);
3) $N = 5$, $K = 1.6$ (see Appendix C).

Two additional indicators directly derived from the Bollinger bands were used in the research. These indicators (%b and Bollinger band Bandwidth) are described above in equations (4) and (5). Investigation timeframe was decided to be from 2009-03-12 to 2009-05-14. Investment was determined by the following rules:

- Starting capital for investing is 1 unit of currency.
- When closing price penetrates lower band (in that case indicator %b is smaller or equal to 0), the signal to buy is generated (in Appendices marked with green oval), investor purchases the stock, if he does not have them already and does nothing, if he already has this kind of stock.

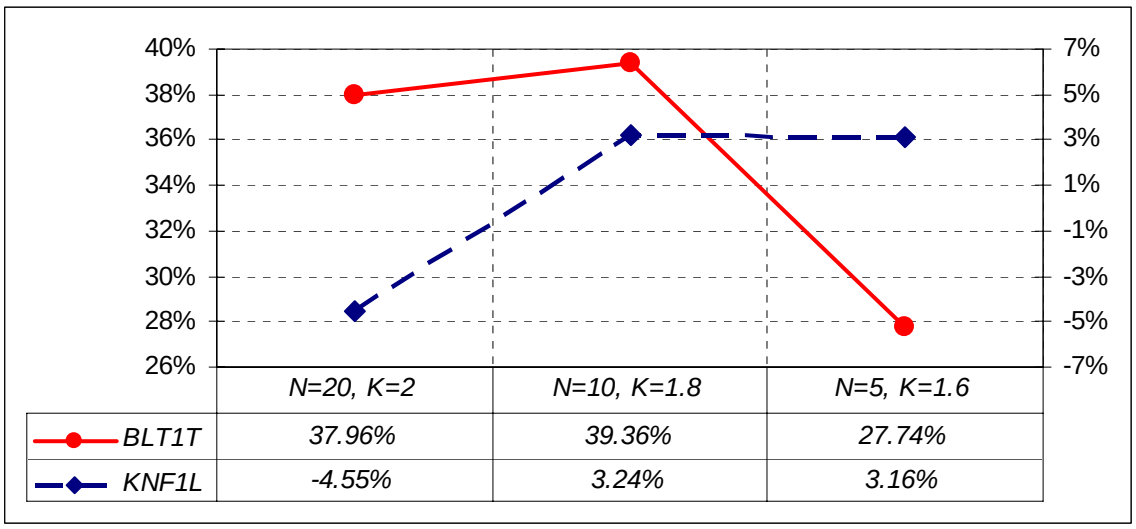

Figure 4. Generated returns of BLT1T and KNF1L with different sets of parameters

- When closing price penetrates upper band (in that case indicator %b is greater or equal to 1), the signal to sell is generated (in Appendices marked with red oval), investor sells out this stock from the portfolio.
- Investor can make another transaction after the selling action.

Using these rules, an investment simulation was committed (following the signals generated by charts given in Appendices A–C) and the profit was summed afterwards for every set of parameters (see Figure 4).

The results confirm the recommendations met in literature (see Bollinger, 2001) to use smaller timeframe for moving average and narrower bands when questioning a short term investment. Profitability was lower (BLT1T 37.96%, KNF1L -4.55%) using the first set of parameters concurrently to the second set (BLT1T 39.36%, KNF1L 3.24%). However, the narrow trading channel with very small timeframe for moving average, leads to disappointment and the profitability does not reached the maximum with the third set of parameters. Profitability of BLT1T was 27.74% and 3.16% of KNF1L.

It should be noted, that for the short term investment the Bollinger bands parameters should be calibrated to $N = 10$ and $K = 1.8$. As shown above, these parameters allow achieving best profitability in short term investment in both cases. This is because price cannot reach edges of the trading channel when the channel is wide. On the other hand, edges of the trading channel are crossed over and over again if the channel is narrow and moving average is calculated for a short period. In this case generated signals may be misleading, cause failure and loss of the investor. Moreover, the investor tends to have less transactions and to not make changes in his portfolio, taking into account that every transaction is taxed by the rules of the stock market.

Conclusion and discussions

Human factor always prevails despite the method selected for the management of investment. This factor influences the expected profit and admissible risk. A single investor has his own perception of the risk and a unique interpretation of every investing method. In that way same investing methods can gain different profit for a particular investor.

The returns of the stocks are not normally distributed, therefore assumption that 95% of data fit in the Bollinger bands trading channel width of two standard deviations, is rejected for almost all data from Baltic States stock exchange. The returns usually have distributions with fat tails, therefore less than 95% of data fit in these trading channels.

The %b indicator together with Bollinger bands was used (in a developed software) to confirm the generated action. All charts were plotted using "Bollinger plotter". Specialized software for this research was developed using MatLab toolbox.

The result of our analysis (of BLT1T and KNF1L) shows that a short term investor should apply following parameters for the Bollinger bands: $N = 10$, $K = 1.8$. The profitability of BLT1T and KNF1L with this set of parameters reached respectively is 39.36% and 3.24%, while $N = 20$, $K = 2$ parameters came up with 37.96% and -4.55% and $N = 5$, $K = 1.6$ parameters gained 27.74% and 3.16% of profit.

During the research it has been deduced that using the same parameters of Bollinger bands, less signals were generated in a short term case, and more signals generated in a long term. That is why individual sets of parameters are needed for a long term and a short term investment, to obtain maximum profitability in either case.

However, a short term investment faces an issue of admission fees. It is essential to evaluate the costs of every transaction made during the short term investment and to study the influence of the transactions cost for the final profit. Also, the optimal parameters should be calibrated individually for different transaction costs. In a long time investment, parameters of Bollinger bands should be selected individually. It would be very interesting to compare investment results of a short time investor (speculator) and a long time investor.

Appendix A

Following figures (see Figure A1 and Figure A2) depict sell and buy signals generated by Bollinger bands. Generated sell signals are marked red, buy signals are marked green. Trading channel with parameters *N*=20, *K*=2 is rather wide, therefore only rare signals are generated.

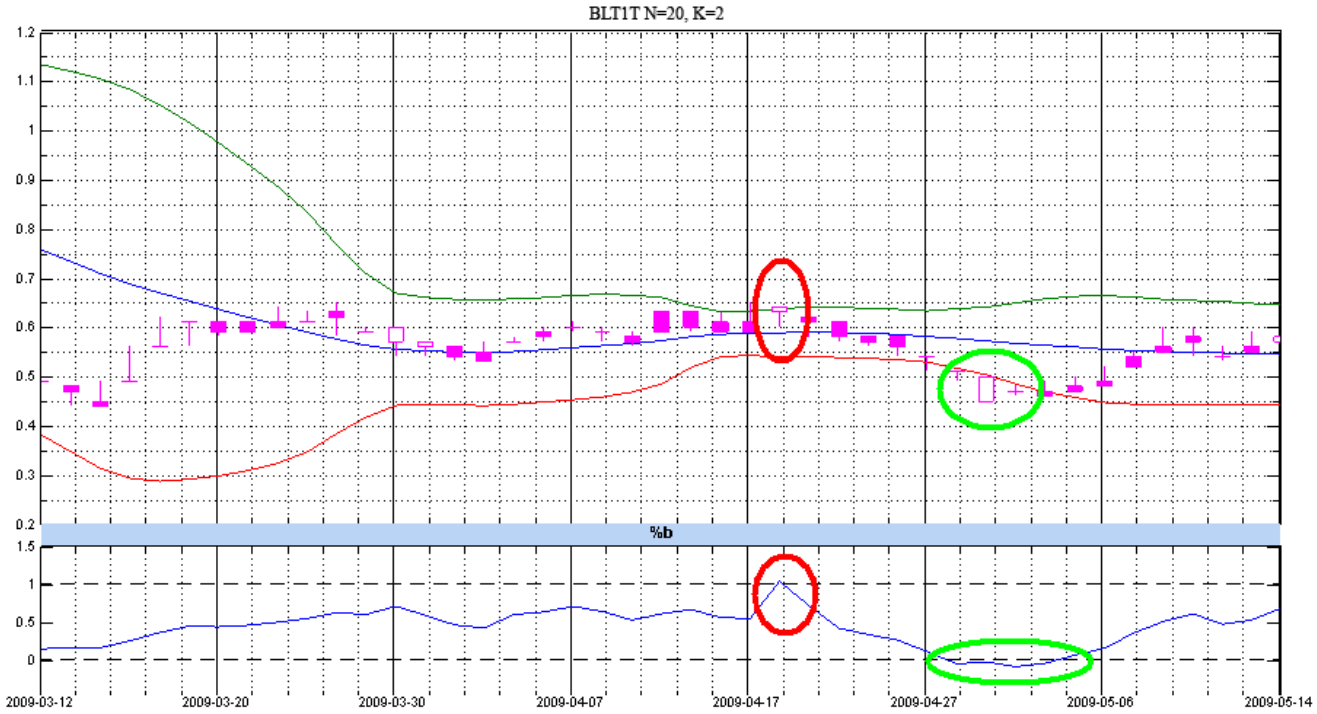

Figure A1. Bollinger bands with parameters *N*=20, *K*=2 and %b indicator for BLT1T stock

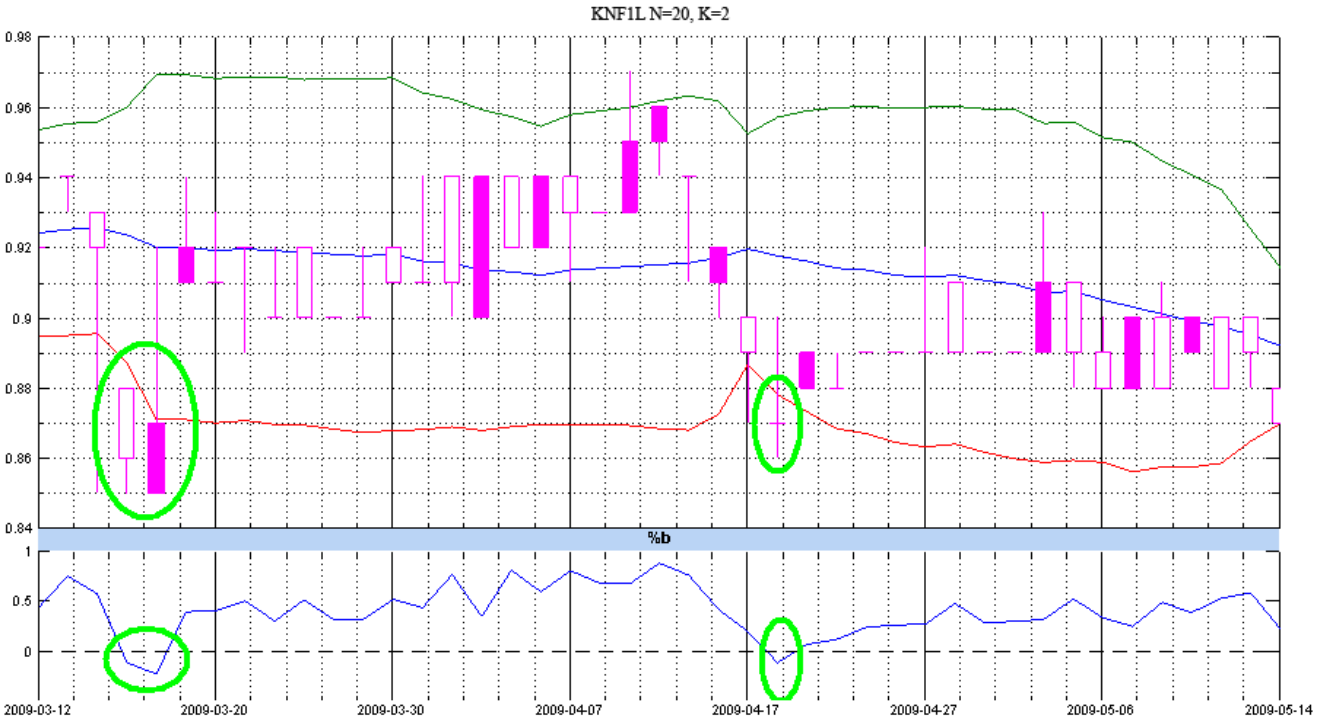

Figure A2. Bollinger bands with parameters *N*=20, *K*=2 and %b indicator for KNF1L stock

Appendix B

Following figures (see Figure B1 and Figure B2) depict sell and buy signals generated by Bollinger bands. Generated sell signals are marked red, buy signals are marked green. Trading channel with parameters N=10, K=1.8 is considered to well fit the price movement during the selected time frame.

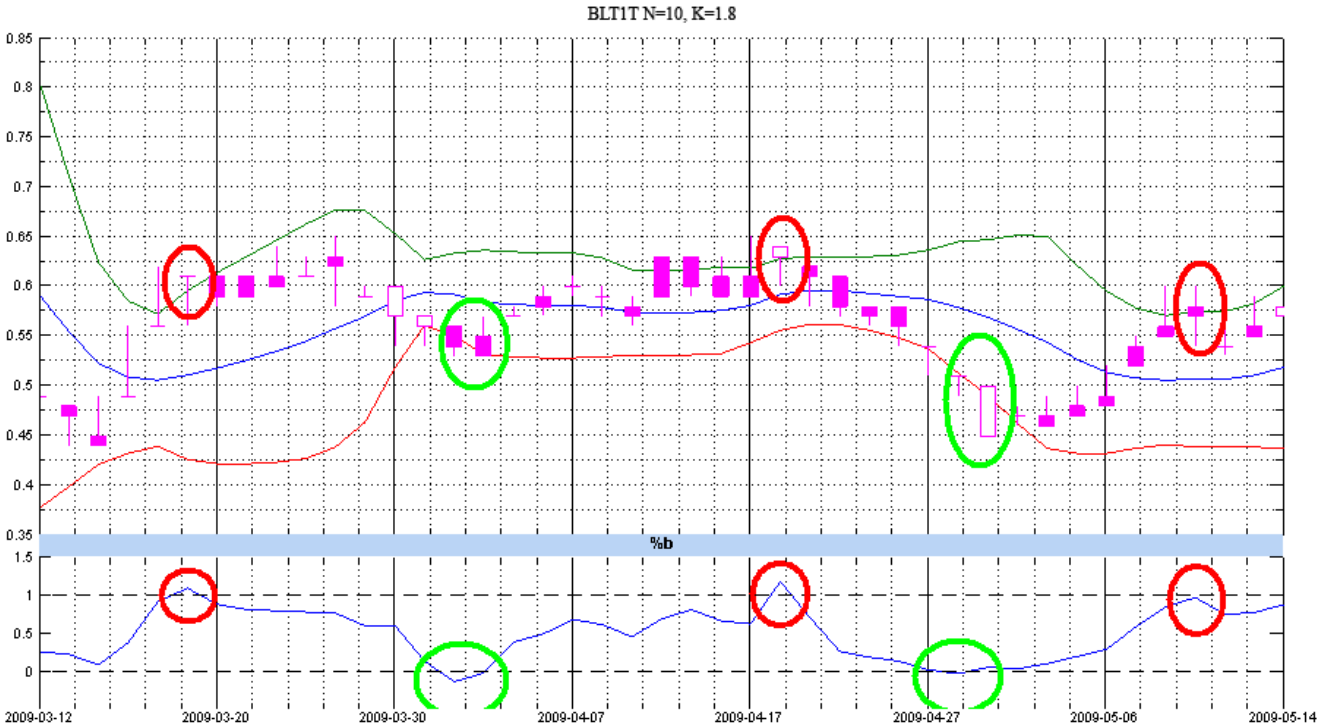

Figure B1. Bollinger bands with parameters N=10, K=1.8 and %b indicator for BLT1T stock

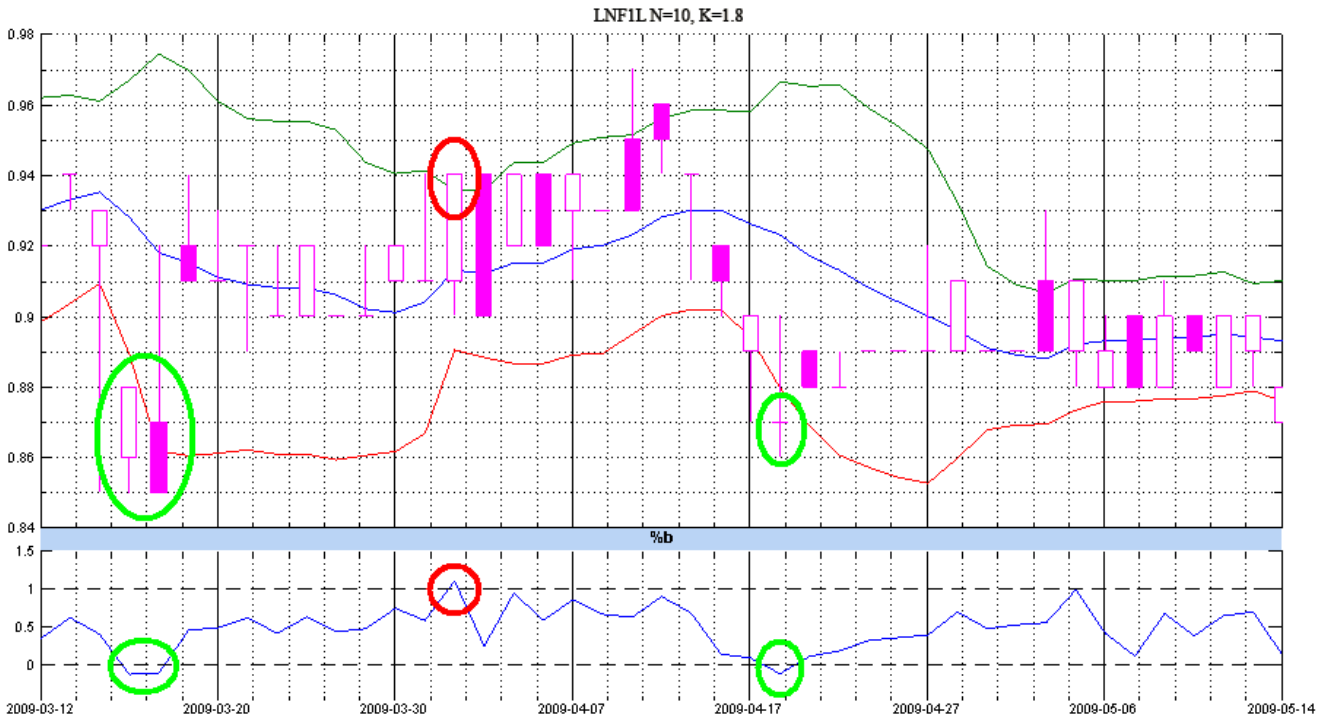

Figure B2. Bollinger bands with parameters N=10, K=1.8 and %b indicator for KNF1L stock

Appendix C

Following figures (see Figure C1 and Figure C2) depict sell and buy signals generated by Bollinger bands. Generated sell signals are marked red, buy signals are marked green. Trading channel with parameters N=5, K=1.6 is rather narrow, therefore considerably more signals are generated.

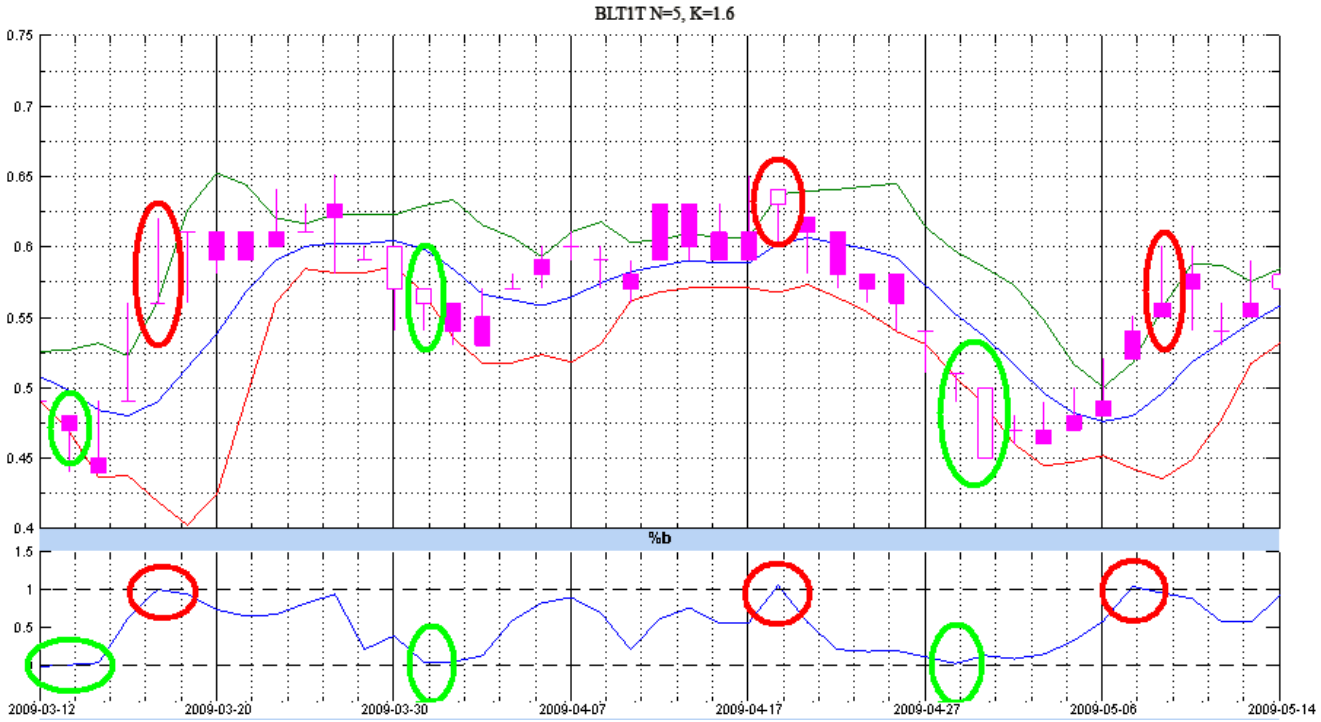

Figure C1. Bollinger bands with parameters N=5, K=1.6 and %b indicator for BLT1T stock

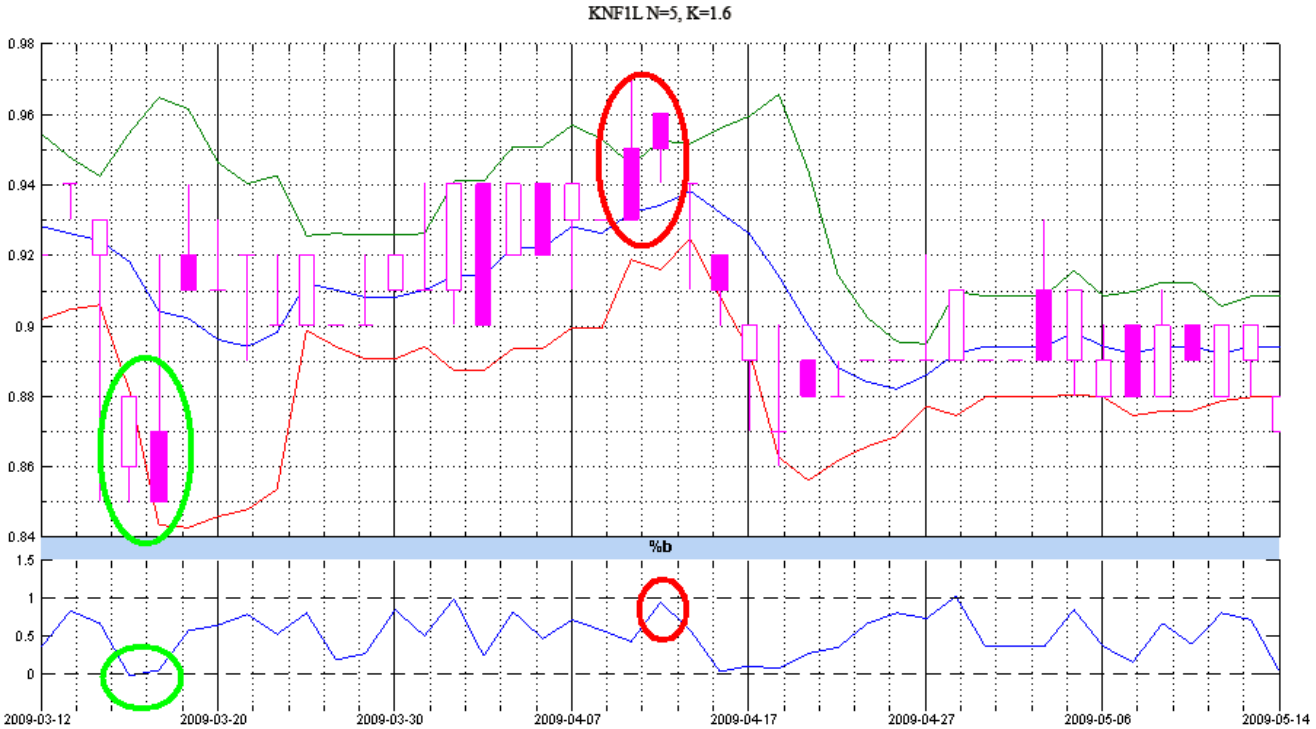

Figure C2. Bollinger bands with parameters N=5, K=1.6 and %b indicator for KNF1L stock

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Bolingerio juostų metodo parametrų kalibravimas sudarant prekybos Baltijos šalių akcijomis strategiją

Santrauka

Pastaruoju metu Lietuvoje sparčiai daugėjo investuotojų, o šalies gyventojai vis dažniau patikėdavo savo santaupas investiciniams fondams. Gyventojai suprato, kad pinigai, gulėdami stalčiuje ar banko sąskaitoje, laikui bėgant praranda savo vertę, todėl ryžosi prisiimti nors ir minimalią riziką ir investuoti laisvą kapitalą tikėdamiesi iš to gauti naudos.

Šiuo metu, esant sunkiai ekonominei padėčiai, itin didelis dėmesys skiriamas investicijų valdymui. Nors Lietuvoje investicijų valdymo bendrovės yra dar jaunos (pirmoji investicijų valdymo bendrovė Lietuvoje įsteigta 2000 m.), tačiau tampa vis reikšmingesnė valdant tiek fizinių asmenų, tiek verslo struktūrų finansus. Norint sėkmingai investuoti, yra būtina atlikti įmonės, rinkos ar indekso, į kurį ruošiamasi investuoti, finansinę analizę. Yra dviejų analizių šalininkai: fundamentaliosios analizės šalininkai ir techninės analizės šalininkai. Fundamentalistai analizuoja įmonės finansinius rodiklius iš jų pateikiamų ataskaitų tam, kad nustatytų įmonės vertę. O „technikai" mano, kad visi šie rodikliai yra atspindėti akcijų kainoje, taigi analizuoja tiktai akcijų

kainų pokyčius, t. y. remiasi grafine analize. Techninė analizė labiausiai buvo kritikuojama 1960-1970 m., kai profesorius E. Fama pristatė efektyviosios rinkos hipotezę (Fama 1965, 1965, Fama ir Miller 1972). Ši teorija teigia, kad visa iki šiol buvusi informacija yra atspindėta šiandienos kainoje, todėl remiantis praeities duomenimis neįmanoma prognozuoti kainos kitimo krypties. Tačiau buvo įrodyta, kad akcijų grąžos nėra pasiskirsčiusios pagal normalųjį skirstinį (Mandelbrot 1963, 1964), todėl efektyviosios rinkos hipotezė nėra pakankama. Dabar vis daugiau mokslininkų teigia, kad akcijų grąžos yra pasiskirsčiusios pagal α-stabiluįį dėsnį (Kabašinskas ir kt. 2009, Kabašinskas ir kt. 2010, Rachev ir kt. 2005, Belovas ir kt. 2006 ir kt.) ir gali būti modeliuojamos taikant GARCH modelį.

Šiame straipsnyje nagrinėjamas Bolingerio juostų metodas ir investicinės vertės kitimas atsižvelgiant į metodo parametrų parinkimą. Bolingerio juostos yra sudarytos iš trijų kreivių: vidurinioji kreivė yra slankusis vidurkis, viršutinioji ir apatinioji kreivės yra atitrauktos nuo slankiojo vidurkio per tam tikrą skaičių standartinių nuokrypių. Taip gaunamas prekybos kanalas, kurį panaudojus galima apibrėžti santykinai dideles ir mažas akcijų kainas (Bollinger 1992). Jei kaina kerta viršutiniąją juostą, tai ji yra laikoma santykinai didele, t. y. akcija yra pervertinta ir tikėtina, kad jos kaina turėtų pradėti kristi. Ir atvirkščiai, kai kaina kerta apatiniąją juostą, tai yra tariama kad akcija yra nuvertinta ir jos kaina turėtų pradėti didėti.

Tiesiogiai iš Bolingerio juostų yra išvestas papildomas rodiklis %b. Šis rodiklis parodo vietą, kurioje yra kaina Bolingerio juostų atžvilgiu. Kai kaina liečia viršutiniąją juostą, %b lygus vienetui, o kai apatiniąją – nuliui (Achelis 2000, Bollinger 1992 ir 2001).

Naujumas. Nors Bolingerio juostų metodas yra plačiai taikomas investuotojų, tačiau yra labai mažai šaltinių, kuriuose būtų tiriamas šio metodo efektyvumas moksliniais metodais (Ryazanova Oleksiv 2008). Taip pat nėra moksliškai pagrįstų nurodymų, kaip pasirinkti Bolingerio juostų metodo parametrus.

Tikslas. Nustatyti optimalų parametrų rinkinį investuojant trumpąjį laikotarpį (2 mėn.) Baltijos šalių vertybinių popierių rinkoje.

Metodai. Sudaromi trys skirtingi parametrų rinkiniai Bolingerio juostoms, parenkamos dvi akcijos iš Baltijos šalių vertybinių popierių rinkos (BLT1T, KNF1L). Parengiama investavimo strategija, paremta Bolingerio juostų metodu ir papildomu rodikliu %b. Atliekama investavimo simuliacija naudojant kiekvieną iš parametrų rinkinių ir apskaičiuojamas investicinis pelnas / nuostolis, gautas iš kiekvienos akcijos. Bollingerio juostų ir kitų papildomų rodiklių grafikams braižyti buvo sukurta speciali programinė įranga.

Rezultatai. Buvo nustatyta, kad investuojant trumpajam laikotarpiui Baltijos šalių akcijų rinkoje didžiausias pelnas pasiekiamas taikant Bolingerio juostų metodą su parametrais N=10, K=1,8. Naudojant šiuos parametrus Bolingerio juostos yra optimalaus pločio (BLT1T akcijos pelningumas 39,36 %, KNF1L akcijos 3,24 %). Jei prekybos kanalas būtų platesnis, būtų generuojama mažiau signalų ir investicijos būtų valdomos nepakankamai efektingai. Esant pirmajam parametrų rinkiniui (N=20, K=2), akcijos BLT1T pelningumas buvo 37,96 %, o investicija į akciją KNF1L buvo nuostolinga –4,55 %. Jei prekybos kanalas būtų siauresnis, būtų generuojama labai daug signalų. Tai investuotojui nėra paranku dar ir dėl to, kad už kiekvieną sandorį akcijų biržoje yra mokamas komisinis mokestis. Esant parametrams N=5, K=1,6, buvo gautas toks akcijų pelningumas: BLT1T 27,24 %, KNF1L 3,16 %.

Svarbu pastebėti, kad akcijų grąžos nėra pasiskirsčiusios pagal normalųjį skirstinį. Taikant Kolmogorovo ir Smirnovo kriterijų, neparametrinė suderinamumo hipotezė buvo atmesta (Kabašinskas ir kt. 2009, Belovas ir kt. 2006). Todėl į dviejų standartinių nuokrypių pločio prekybos kanalą patenka mažiau nei 95 % duomenų.

Straipsnio struktūra. Straipsnį sudaro šešios dalys. Įžangoje aptariama fundamentaliosios ir techninės analizės sampratos ir pagrindinės prielaidos. Antroje dalyje pateikiama trumpa prekybos kanalų istorija ir atsiradimo priežastys. Trečioje dalyje smulkiau aprašomas Bolingerio juostų metodas, jo parametrai ir keli papildomi rodikliai. Ketvirtoje dalyje aptariami tiriami duomenys, pasirinktos akcijos. Taip pat analizuojami Bolingerio juostų metodo optimalūs parametrai. Penktoje dalyje aprašoma tyrimo eiga ir pateikiami pagrindiniai rezultatai. Paskutinėje dalyje pateikiamos išvados ir svarbiausi tyrimo rezultatai.

Raktažodžiai: *Bolingerio juostos, prekybos kanalas, trumpasis periodas, investicijos, portfelio optimizavimas, parametrų kalibravimas, Baltijos šalių akcijų rinka, standartinis nuokrypis, slankusis vidurkis, techninė analizė*.

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