

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics



Diploma Thesis

Technical analysis of PJSC LUKOIL stock

Diana Miroshnichenko

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Technical analysis of PJSC "LUKOIL" Stock

Objectives of thesis

The aim of this diploma thesis is to check the profitability of the Lukoil company stocks by using technical analysis tools. To reach this aim, it is necessary to develop trading strategies and solve the following objectives:

- to select indicators for the trading strategies
- to select parameters for chosen indicators
- provide optimization of selected indicators
- compare results achieved for investors

Methodology

In the practical part, the technical analysis used to check the profitability of the Lukoil company stocks.

The proposed extent of the thesis

40-60

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stock, technical analysis, indicator, trading strategy, optimization, LUKOIL

Recommended information sources

- ELDER, Alexander. Trading for a living: psychology, trading tactics, money management. New York: J. Wiley, c1993. ISBN 978-0471592242.
- MURPHY, John J. a John J. MURPHY. Technical analysis of the financial markets: a comprehensive guide to trading methods and applications. New York: New York Institute of Finance, c1999. ISBN 0735200661.
- PRING, Martin J. Technical analysis explained: the successful investor's guide to spotting investment trends and turning points. Fifth edition. New York: McGraw-Hill Education, [2014]. ISBN 9780071826556.
- SEBREE, Chet'la. Understanding the stock market. New York: Cavendish Square, 2019. ISBN 9781502646064.
- SCHWAGER, Jack D. Technical analysis. New York: J. Wiley, c1996. ISBN 978-0471020516.
- WILDER, J. Welles. New concepts in technical trading systems. Greensboro, N.C.: Trend Research, c1978. ISBN 978-0894590276.

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The Diploma Thesis Supervisor

Ing. Karel Malec, Ph.D.

Supervising department

Department of Economics

Electronic approval: 26. 2. 2020

prof. Ing. Miroslav Svatoš, CSc.

Head of department

Electronic approval: 27. 2. 2020

Ing. Martin Pelikán, Ph.D.

Dean

Prague on 07. 04. 2020

Declaration

I declare that I have worked on my diploma thesis titled " Technical analysis of PJSC LUKOIL stock" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any their person.

In Prague on 7.4.2020

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Technical analysis of PJSC LUKOIL stock

Abstract

This diploma thesis aim is to check the profitability and feasibility of trading strategies of the PJSC Lukoil company stock by using technical analysis. To reach this aim, it is needed to develop trading strategies. The thesis consists of three main parts: methodology, literature review and practical part. The methodological part represents used indicators, equations, evaluation statistics and methods required for the construction and evaluation of trading strategies. The literature review summarizes required theoretical knowledge about the stock market, chart and trend analysis and trading systems. The practical part of the thesis deals with the construction of the trading strategies, based on Relative Strength Index and the combination of Bollinger Bands and Volume indicator. Obtained results are evaluated and optimized, according to analyzed observations, with the purpose to maximize profit. Achieved results of all trading strategies are compared for investors.

Keywords: Technical analysis, stock, technical indicators, chart patterns, trading systems, optimization, LUKOIL, Dow theory, trend.

Technická analýza akcií a.s. LUKOIL

Abstrakt

Cílem diplomové práce je ověřit ziskovost a proveditelnost obchodních strategií pro akcií a.s. Lukoil pomocí technické analýzy. K dosažení tohoto cíle je nutno vypracovat obchodní strategie. Práce se skládá ze tří hlavních částí: metodologie, přehled literatury a praktická část. Metodická část představuje použité ukazatele, rovnice, statistiky hodnocení a metody potřebné pro vypracování a hodnocení obchodních strategií. Přehled literatury shrnuje požadované teoretické znalosti o akciovém trhu, analýze grafů a trendů, a systémech obchodování. Praktická část práce se zabývá vytvořením obchodních strategií, založených na Indexu relativní síly a kombinaci Bollingerova pásma a indikátorů Objemů. Získané výsledky jsou hodnoceny a optimalizovány podle analyzovaných pozorování s cílem maximalizovat zisk. Dosažené výsledky všech obchodních strategií jsou srovnávány pro investory.

Klíčová slova: Technická analýza, akcie, technické ukazatele, grafy, obchodní systémy, optimalizace, LUKOIL, Dowova teorie, trend.

Table of content

1 Introduction	11
2 Objectives and Methodology	12
2.1 Objectives	12
2.2 Methodology	12
2.2.1 Bollinger Bands	12
2.2.2 Volume indicator.....	14
2.2.3 RSI (Relative Strength Index).....	15
2.2.4 Stop-loss	16
2.2.5 Evaluation of trading strategy.....	16
3 Literature Review	17
3.1 Stock market	17
3.1.1 The Stock Exchanges	18
3.1.1.1 New York Stock Exchange	18
3.1.1.2 National Association of Securities Dealers Automated Quotations ..	19
3.1.1.3 London Stock Exchange.....	20
3.2 Approach of the stock market.....	20
3.2.1 Fundamental Analysis	20
3.2.2 Technical analysis	21
3.2.2.1 Dow theory	22
3.3 Chart analysis.....	24
3.3.1 Chart types	24
3.3.1.1 Line chart.....	24
3.3.1.2 Bar chart	25
3.3.1.3 Candlesticks chart	27
3.3.2 Trend lines and trend channels	29
3.3.3 Support and Resistance	30
3.3.4 Graphic formations.....	31
3.3.4.1 Reversal patterns.....	31
3.3.4.2 Consolidation patterns.....	33
3.3.4.3 Gaps.....	34
3.4 Trading system.....	34
3.4.1 Types and styles of trading	35
3.4.2 Trade System Design	37
4 Practical part	39

4.1	Trading strategy based on Bollinger Bands and Volume Indicator of LKOH: MOEX.....	39
4.1.1	Optimization of the trading strategy based on Compression of Bollinger bands.....	43
4.1.2	Optimization of the trading strategy based on extension of Bollinger bands.....	45
4.1.3	Optimization based on dynamic stop-loss.....	48
4.1.4	Optimization based on changing parameters of Bollinger bands.	49
4.2	Trading strategy based on RSI of LKOH: MOEX.....	54
5	Results and Discussion.....	59
6	Conclusion.....	62
7	References	63

List of pictures

Figure 1.	Line chart of Lukoil stock.....	25
Figure 2.	Structure of Bar chart	26
Figure 3.	Bar chart of Lukoil stock	26
Figure 4.	Structure of Candle chart	28
Figure 5.	Candle chart of Lukoil stock.....	28
Figure 6.	Resistance and Support level of Lukoil stock.....	30
Figure 7.	Head and Shoulders Pattern	32
Figure 8.	Representation of sell signal	40
Figure 9.	Representation of buy signal.....	40
Figure 10.	Equity curve of trading strategy based on Bollinger bands and Volume	42
Figure 11.	Compression of Bollinger bands	43
Figure 12.	Signal to open a position during optimization	44
Figure 13.	False signal.....	45
Figure 14.	Ending of the trend	46
Figure 15.	Optimization based on Extension: buy and sell signals.....	46
Figure 16.	False signal generated during extension	47
Figure 17.	Optimization based on dynamic stop-loss	48
Figure 18.	Sell signals with initial set parameters of Bollinger bands	50
Figure 19.	Optimization based on first option of changing parameters of Bollinger Bands – sell signal	51
Figure 20.	Optimization based on second option of changing parameters of Bollinger Bands – buy signal	51
Figure 21.	Optimization based on second option of changing parameters of Bollinger Bands – touching and crossing of bands	52
Figure 22.	Signals to open position leading to loss.....	54
Figure 23.	Trading strategy based on RSI - signals to open a position	55
Figure 24.	Equity curve for trading strategy based on RSI	56
Figure 25.	Sell signal, when price movement quite high	57

List of tables

Table 1. Results of trading strategy based on Bollinger Bands and Volume Indicator	42
Table 2. Results of trading strategy after optimization based on Compression of Bollinger bands.....	45
Table 3. Results of trading strategy after optimization based on Extension of Bollinger bands.....	47
Table 4. Results of trading strategy after optimization based on dynamic stop-loss.....	49
Table 5. Results of trading strategy after optimization based on changing parameters of Bollinger Bands- first option	52
Table 6. Results of trading strategy after optimization based on changing parameters of Bollinger Bands- second option.....	53
Table 7. Results of trading strategy based on RSI	56
Table 8. Results of trading strategy based on RSI after optimization.....	57
Table 9. Strategies comparison	59

1 Introduction

Development of an economy constantly requires mobilization of temporarily saved surplus funds of households, firms, and governments and their distribution and redistribution on a commercial basis between various sectors of the economy. In an effectively functioning economy, this process is carried out in the financial markets.

The term 'financial market' is generally understood to mean markets in which occur supply and demand of financial instruments such as bonds, stocks, foreign exchange, and derivatives. According to the traded types of financial instruments classified stock, bond, commodities and derivatives markets. This diploma thesis concentrated on the stock market. The stock market is an important part of the country's economy.

Nowadays, the interest in investment is growing rapidly, both by individuals and entrepreneurs. As a result, there is a significant increase in interest in various methodologies and technological approaches to price forecasting in existing financial markets. One of the main tasks when investing capital is to try to find such financial instruments and develop a trading strategy which can increase or at least save investments. For this purpose, there are two main types of analysis in the world of investment activity that can be used to predict the future behaviour of company shares and create own trading strategy: technical and fundamental analysis.

Fundamental analysis of a company includes the study of financial indicators based on which it is possible to predict the future behaviour of the price of shares of this company.

Technical analysis, in turn, focuses on predicting future price behaviour by analyzing a graphical representation of price behaviour in the past. Technical analysts use charts, trends, figures, and indicators to make decisions about buying and selling stocks. This diploma thesis will focus on the technical analysis of LUKOIL company stock, that is one of the largest publicly traded, vertically integrated oil and gas companies in the world.

The common shares of Lukoil are listed on the Moscow Exchange in the first level quotation list and are among the most liquid financial instruments on the Russian stock market. The Company's shares and depositary receipts are also listed on the London Stock Exchange and included in a number of international indices: MSCI Emerging Markets EMEA, MSCI Emerging Markets Eastern Europe, FTSE Russia IOB, Bloomberg World Oil & Gas etc.

2 Objectives and Methodology

2.1 Objectives

The aim of this diploma thesis is to check the profitability and feasibility of trading strategies of the Lukoil company stocks by using technical analysis. To reach this aim, it is necessary to develop trading strategies and solve the following objectives:

- to select indicators for the trading strategies ;
- to select input parameters for chosen indicators;
- to provide optimization of the trading strategy ;
- to compare results achieved for investors.

2.2 Methodology

For the process of developing trading strategies, were used quantitative methods using existing primary data from the Finam Trade trading platform, where data were also processed. The analysis was performed on daily data candles. The time period designated is from 1/2010 to 3/2020. The mathematically based technical analysis indicators and their combinations used are Bollinger Bands, Volume and RSI. All the remaining data or parameters were adjusted by author.

For evaluation of performance, the following methods were used: Gross profit/loss, total quantity of trades (one trade contains opening and closing of a position), average profit/loss trade , net profit, profit factor and share between profit/loos trades. For assesment of initial trading strategy was used the Sharpe ratio.

Optimization of indicators of technical analysis was carried out so that trading strategy maximized profitability, thus optimal values of parameters were those, which achieved the highest evaluation. Optimally set and adjusted parameters were compared with the stated parameters.

2.2.1 Bollinger Bands

The invention of the Bollinger bands indicator belongs to the American analyst John Bollinger, who in 1984 set out to create his system for analyzing and calculating investments.

Bollinger bands are lines drawn through and around the price structure on the chart. Bands indicate the direction and range of price fluctuations on the chart, taking into account the trend and volatility characteristic of the current market phase.

Bollinger bands consist of 3 bands. The basis of these bands is a moving average that reflects the medium-term trend and calculated according to the equation (1). The moving average default length is equal to 20 periods.¹ The equation for calculation moving average is:

$$MA = \frac{A1+A2\dots+An}{n}, \quad (1)$$

where A is average in period n and n number of time periods.²

The width of the bands is determined by a measure of volatility known as the standard deviation. The data for calculating volatility is the same as used for the moving average.³

The equation for calculating standard deviation is:

$$SD = \sqrt{\frac{\sum(x-\mu)^2}{N}}, \quad (2)$$

where x is data point, μ the average and N number of points.⁴

The upper and lower bands are drawn at a distance of two standard deviations from the average and calculated according to the equations (3) and (4). Using two standard deviations ensure that 95 % of price data will move between two Bollinger bands.⁵

The equations for calculating Bollinger Bands are:⁶

$$Upper\ Band = MA + 2 * \sqrt{\frac{\sum(x-\mu)^2}{N}}, \quad (3)$$

¹ Bollinger, J., 2002. *Bollinger On Bollinger Bands*. New York, NY [u.a.]: McGraw-Hill, p.50.

² Investopedia. 2020. *Understanding Moving Averages (MA)*.

³ Bollinger, J., 2002. *Bollinger On Bollinger Bands*. New York, NY [u.a.]: McGraw-Hill, p.51.

⁴ Bollinger, J., 2002. *Bollinger On Bollinger Bands*. New York, NY [u.a.]: McGraw-Hill, p.52.

⁵ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.209.

⁶ Bollinger, J., 2002. *Bollinger On Bollinger Bands*. New York, NY [u.a.]: McGraw-Hill, p.50.

$$\text{Lower Band} = \text{MA} - 2 * \sqrt{\frac{\sum (x-\mu)^2}{N}}. \quad (4)$$

Comparing the bands and the indicator can lead to either confirmation or non-confirmation. An example of confirmation is the touch of the upper band in combination with a reasonably reliable indicator. If there is a long position and the price touches the upper band and if the indicator is reliable enough, its touch is a confirmation of the position. An example of non-confirmation is a touch of the lower band, accompanied by a positive indicator value, which means a classic buy signal.⁷

Trading strategy based on Bollinger bands:

Step 1. The definition of a trend: if the price on the chart moves above the moving average, the trend is up, and if it moves below the trend is down. When a stock crosses the line, it indicates the possibility of a trend reversal.

Step 2. Buy or sell. After determining the trend, expecting when the price touches the average. If there is an uptrend, waiting until the price touches the midline and preparing to open a buy position.

2.2.2 Volume indicator

According to the author of the Bollinger bands, the real strength of the bands becomes apparent when they are combined with indicators. The selected indicators are *Volume* indicators, and the preferred mode of operation is to compare the price behaviour inside the bands with the behaviour of the indicator.⁸

The volume reflects the activity of traders and shows the number of transactions made on a given financial instrument per unit of time. Each volume unit reflects the actions of two people: one buys a stock, and the other sells it. Daily volume is the number of shares purchased and sold in one day.

The Volume indicator does not contain complex formulas; it is a tick counter for a specific period. Ticks are displayed in real-time as a cumulative histogram that changes as new transactions appear on the market.⁹

⁷ Bollinger, J., 2002. *Bollinger On Bollinger Bands*. New York, NY [u.a.]: McGraw-Hill, p.135.

⁸ Bollinger, J., 2002. *Bollinger On Bollinger Bands*. New York, NY [u.a.]: McGraw-Hill, p.135.

⁹ Elder, A. (1993). *Trading for a living*. New York: J. Wiley, p.189.

According to Alexander Elder:

1. The high volume confirms the trends. If the price reaches a new peak, and the volume also reaches a new height, then prices are likely to rise again to this peak or higher. An increase in volume with an upward trend foreshadows a continued rise in prices. It is recommended to buy.
2. If the market falls to a new low and volume reaches a new high, prices are likely to fall back to that level or lower. Growing trading volumes in the face of falling prices confirm the bearish trend.¹⁰

The volume should increase in the direction of the existing price trend. In an upward trend, the volume should increase as prices rise and decrease with intermediate falls. In this case, it is assumed that the volume confirms the direction of the market movement. In a downtrend, the volume should increase during price declines.¹¹

2.2.3 RSI (Relative Strength Index)

The RSI was introduced in 1978 by American researcher J. Welles Wilder. It measures the strength of the market through changes in its closing prices.

The RSI is formulated by Wilder as follows:

$$RSI = 100 - \frac{100}{1+RS}, \quad (5)$$

$$\text{Where, } RS = \frac{\text{Average of } x \text{ days' up closes}}{\text{Average of } x \text{ days' down closes}}. \quad (6)$$

According to Wilder, the standard indicator interval is 14 days. The value of the RSI is within the range of 0-100. If the RSI is equal to 70 or more, the stock is considered overbought, and it needs to be careful when buying at this level. If the RSI is equal to 30 or less, the stock is considered to be re-sold, and trader should be careful when selling at this level. The difference between the price movement and the RSI is often considered a strong sign of a market reversal point. The discrepancy occurs when the price reaches new heights

¹⁰ Elder, A. (1993). *Trading for a living*. New York: J. Wiley, p.194.

¹¹ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.162.

in an upward trend compared to the previous peak, but the RSI indicator does not exceed the previous maximum value.¹²

2.2.4 Stop-loss

Stop loss is an instruction to the broker to close the transaction when a certain level of price loss is reached. Stop-loss orders are used to prevent investor losses when the price of a security drops.¹³

Alexander Elder recommends placing a stop loss at the moment of opening a position. When playing for an increase, to put the stop loss below the recent short-term support level, and when playing for a decrease above the recent short-term resistance level.¹⁴

2.2.5 Evaluation of trading strategy

- Total quantity of trades: One trade contains the opening and closing of a position.
- Gross profit: Sum of money from all profitable trades in RUR
- Gross loss: Sum of money from all unprofitable trades in RUR.
- Average profit trade: Gross profit divided by the number of all trades.
- Average loss trade: Gross loss divided by the number of all trades.
- Total net profit: The difference between gross profit and gross loss in RUR.
- Profit factor: The ratio between gross profit and gross loss in %.
- Profitable trades: The number of all profitable trades, a percentage of the total.
- Loss trades: The number of all loss-making trades, a percentage of the total.

¹² Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p3.239-240.

¹³ Investopedia. 2020. *Stop-Loss Order Definition*. [online] Available at: <<https://www.investopedia.com/terms/s/stop-lossorder.asp>> [Accessed 3 April 2020].

¹⁴ Elder, A. (1993). *Trading for a living*. New York: J. Wiley, p.278.

3 Literature Review

3.1 Stock market

The **stock market, or stock exchange**, is an institution or mechanism that brings together buyers and sellers of stocks, shares and bonds.

A **stock** is a negotiable equity security that represents an ownership share in the share capital of a joint-stock company.¹⁵ Stockholders have the right to participate in the company's profitability while holding stocks. Besides, they have the right to distribute income by receiving dividends and the right to assets and income of the company after its liquidation. Ordinary stockholders can also affect the company's management by voting for the election of the Board of Directors.¹⁶

Depending on the stage of the stock's circulation, there is a distinction between **primary and secondary markets**.

The primary market is a financial market where newly issued stocks sold to initial buyers. As a result of the sale in the primary market, the issuer receives the necessary financial resources, and the securities fall into the hands of the initial buyers, who will either keep them or sell them for the purpose of speculative profit.

An important financial institution that assists in the initial sale of securities in the primary market is the investment bank.¹⁷

The secondary market is intending for circulation and resale of previously issued stocks. It provides a continuous and regular market for transactions with securities. Without a developed secondary market, further circulation of securities would be difficult or even impossible.¹⁸ The secondary market is the most active part of the stock market, as this is where most transactions with securities made.

There are primarily two types of secondary markets: **Registered Exchanges and Over the counter (OTC) markets**.

The Registered Exchange is an organized securities market, which is traded strictly according to established rules and schedules during the exchange session. Only securities

¹⁵ SEBREE, Chet'la. *Understanding the stock market*. New York: Cavendish Square. 2019, p. 5.

¹⁶ Investopedia. (2020). *What Rights Do All Common Shareholders Have?*

¹⁷ MISHKIN, Frederic S. a Stanley G. EAKINS. *Financial markets and institutions*. 2012, p.18

¹⁸ Gordon, E. and Natarajan, K. (2010). *Financial Markets*. New Delhi: Himalaya Pub. House, p.8

of reliable issuers are listed on the stock exchange. The criteria of the listing are the company's net income, asset value and the size of the shares issued¹⁹. The New York and American Stock Exchanges for stocks and the Chicago Board of Trade for commodities are examples of organized exchanges.²⁰

Over the counter (OTC) market represents a decentralized market, for companies not registered on official stock exchanges. Stocks are trading electronically; the market does not have a physical location.²¹

The OTC market can be organized or unorganized. Trading on the organized OTC market is provided according to established rules. The criteria of the listing are softer than on an organized exchange. Example of organized over the counter exchange is the National Association of Securities Dealers Automated Quotation (NASDAQ).

The unorganized over-the-counter market characterized by the fact that trading occurs without any general rules, the buyer takes all the risk. At the same time, the terms of transactions are negotiating between the buyer and seller, and information on completed transactions not recorded anywhere.²²

3.1.1 The Stock Exchanges

At present, there are several major stock exchanges on the world level where traded stocks of the most recognized companies.

3.1.1.1 New York Stock Exchange

The largest and most famous stock market in the world is the **NYSE** (New York Stock Exchange). It was founded in 1792 by a group of 24 brokers decided to establish a group applied to the trading of public stocks.²³

In 2008, NYSE Euronext acquired the AMEX (American Stock Exchange), that was once the third-largest stock exchange handled about 10% of all securities traded in the United States.²⁴

¹⁹ Markets, I. (2020). *Stock and over-the-counter markets of securities*

²⁰ MISHKIN, Frederic S. a Stanley G. EAKINS. *Financial markets and institutions*. 2012, p. 19.

²¹ Investopedia. (2020). *Over-The-Counter Market Definition*.

²² markets, I. (2020). *Stock and over-the-counter markets of securities*.

²³ Crayton, L. and Furgang, K. (n.d.). *The stock market*, p.10.

²⁴ Investopedia. (2020). *American Stock Exchange (AMEX)*.

At present, about 2.800 companies trade shares on the NYSE, in a range of sectors from technology and healthcare, to financials and energy. The total market capitalization of the company is \$28 trillion according to June 2018.²⁵

In most cases, NYSE shares are "blue chips" and fast-growing companies. To trade on the NYSE, all companies must meet the high listing requirements, as the exchange regularly works to preserve its high reputation by offering firm and reliable shares for trading for over 225 years.²⁶

3.1.1.2 National Association of Securities Dealers Automated Quotations

Another influential stock exchange is the **NASDAQ** (National Association of Securities Dealers Automated Quotations), the world's largest organized over-the-counter market, controlled by the SEC (Securities and Exchange Commission) and specializing in high-tech stocks. It represents dealer-mediated, quote driven market, where market-makers post quotes and providing liquidity to the market, and on the other side investors decides to accept quotas or not. According to the NASDAQ rules and regulation, the liquidity provision is also market-makers duty. Other market participants are investors and brokers.²⁷

The first trading on this exchange took place on February 8, 1971, when NASDAQ became the world's first electronic stock exchange.

By market capitalization, NASDAQ is the second-largest market in the world after the New York stock exchange. More than 3,000 companies are traded on the NASDAQ exchange. Compared to the New York stock exchange, NASDAQ is fully automated exchange it doesn't have a physical trading floor in the stock market; it's just a network of computers and phones connecting more than five hundred brokerage firms.²⁸

²⁵ Nyse.com. (2020). *NYSE Total Market Cap*.

²⁶ Nyse.com. (2020). *Why List or IPO | IPO at the NYSE*.

²⁷ Darley, V. and Outkin, A. (2007). *A NASDAQ market simulation*. Hackensack, NJ: World Scientific, pp.13-15.

²⁸ Advfn.com. (2020). *NASDAQ : A-Z Company Listing* .

3.1.1.3 London Stock Exchange

Among the most important European exchanges is **LSE** (London Stock Exchange). LSE is the primary stock exchange in the U.K. and the largest in Europe.²⁹ It was first organized in 1773 by a group of brokers who opened an exchange in a coffee shop, and in 1802 for the first time the exchange moved into a modern building in Chapel Court.³⁰ It is considered highly international — it trades 50 percent of the shares of companies from all over the world, it is one of the largest and oldest exchanges in Europe and one of the world's most famous securities markets. The total market value of all companies, including PJSC Lukoil socks, trading on the London Stock Exchange was more than 5.1 trillion USD in December 2019.³¹

3.2 Approach of the stock market

3.2.1 Fundamental Analysis

Fundamental analysis is a method of predicting future movements of securities quotations based on economic, political and other significant factors that will have an impact on the demand and supply of securities. It studies the overall economy, industry, financial conditions and management of companies.³² The purpose of the fundamental analysis is to identify securities whose value overestimated or underestimated and to decide which stocks to buy, how long to hold them, and when to sell.³³

There are two fundamental approaches in conducting fundamental analysis. The traditional approach is *Top-down Investing*. It starts with macroeconomic analysis, followed by an analysis of the state of the industry, and then moves on to microeconomic analysis (analysis of the company's state). Based on the received data, the investor selects

²⁹ Investopedia. (2020). *London Stock Exchange (LSE)*.

³⁰ Tradecrowd.com. (2020). *A History of London Stock Exchange*.

³¹ Statista. (2020). *Market value of firms on London Stock Exchange 2015-2019 | Statista*.

³² Kumar, N. and Mohapatra, S. (n.d.). *The use of technical and fundamental analysis in the stock market in emerging and developed economies*. p.36.

³³ Thomsett, M. (2006). *Fundamental analysis*. Hoboken, N.J.: J. Wiley and Sons, p.3.

suitable industries, and then companies from these industries since the global trend can affect them favorably.³⁴

The alternative approach is *Bottom-up Investing*. This approach focuses on how a particular company in a sector performs. Specific stocks that show non-standard results are selected before the study of global economic trends begins. Companies that issue shares are evaluated based on financial ratios, financial reports and accounting statements, quotes, or personal impressions of the company's services or products. The main idea of this approach is that individual companies can show good results even when the industry as a whole is in a difficult situation.³⁵

3.2.2 Technical analysis

Technical analysis represents an approach for forecasting of price changes in the future based on the analysis of price changes in the past.

The technical analysis main aim is to identify a trend reversal and ride on that trend until the weight of the numerous scientifically determined indicators shows or proves that the trend reversed.³⁶

Technical analysis is based on the following **assumptions**:

- ***The market considers everything.***

It means that the current price is a reflection of all data known to the market that can affect this market. It includes everything that affects supply and demand: information about the economy, political factors, news and others.

Any changes in the dynamics of supply and demand are indicated in the price. If demand exceeds supply, prices increase, and the market is profitable for bulls. If supply exceeds demand, prices go down the market is profitable for bears.³⁷

- ***Price moves according to trends.***

³⁴ Krantz, M. (2016). *Fundamental analysis for dummies*. Hoboken, N.J.: For Dummies, p.248.

³⁵ Investopedia. (2020). *Bottom-Up Investing Definition*.

³⁶ Pring, M. (2002). *Technical analysis explained*. New York: McGraw-Hill, p.3.

³⁷ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.3.

It assumes that during any period, price changes do not occur chaotically, but subordinate to some regularity, which exists for some time and displays itself in a tendency of a specific orientation. This trend will continue until, for any reason, the opposite direction is reached.

In other words, one of the possible trends — up, down, range - is present in the market at any given time on a given chart scale.

• ***History repeats itself.***

The assumption lays the foundation for any predictive method of technical analysis.

Chart patterns which have been identified and classified, reflect specific pictures that appear on price charts. Analysts assume that if certain types of analysis have worked in the past, they will work in the future because this work is based on stable human psychology. In other words, from the point of view of technical analysis, understanding the future lies in the study of the past.³⁸

3.2.2.1 Dow theory

"Dow Theory" has been known for almost 100 years, but even in the current global financial markets, the main components of the theory are still relevant.

Developed by Charles Dow, corrected by William Hamilton, and released by Robert Rhea, Dow's theory concerns not only a technical analysis of price charts but also market philosophy.³⁹

Based on market research, Dow has formulated six main principles, which are as follows:

➤ **The average price discounts everything.**

Its signals to buy or sell were based on closing prices.

The price reflects the influence of all possible factors; this is still the primary axiom of technical analysis, which have mentioned above.

➤ **There are three kinds of trends:**

Primary trend. This trend is a tide that lasts for more than a year and may run for several years, without paying attention to waves or ripples.

³⁸ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.3-5.

³⁹ Pring, M. (2002). *Technical analysis explained*. New York: McGraw-Hill, p.36.

When each subsequent price increase reaches a higher level than the previous one, and the price trend reverses from down to up at a higher level than the previous reaction, the primary trend is Up. It is a Bull Market. Conversely, when each subsequent high and low of the price is less than the previous ones, the primary trend is down. A downtrend is a bear market.⁴⁰

Secondary trend. These trends defined as a significant decline in a bull market or increase in a bear market. Represents waves and troughs and last from 3 weeks to many months. In fact, a wave or trough that occurs during a change in the direction of the tide will later be part of the tide itself.⁴¹

Daily fluctuations. Daily fluctuations represents ripples and surges on the surface, when stocks move up, down, and sideways every day. Individually unimportant, these daily fluctuations are part of the action of the water that makes up the tide.⁴²

➤ **The primary trend consists of three phases.**

Accumulation phase - the most discerning investors begin to sell or buy, feeling the changes in the current market direction.

Then starts a period of an upward trend, when, after the dissemination of information, more and more investors join the game. During this period, those who use technical methods to follow trends are included in the game. The incoming economic information, in conjunction with the forecasts of analysts, is becoming more optimistic.

After the price reaches the peak, there is another period of consolidation, during which the investor's activity is increased under the influence of market information.⁴³

➤ **Indexes must confirm each other.**

That means that signals that occur in one index must match signals in another. If one index confirms a new primary uptrend, but the other index continues in the main downtrend, traders should not assume that a new trend has started.

➤ **The volume of trade should confirm the nature of the trend.**

⁴⁰ Edwards, R., Magee, J. and Bassetti, W. (2001). *Technical analysis of stock trends*. Boca Raton (Fla.): St. Lucie Press, p.15.

⁴¹ Schannep, J. (2008). *Dow Theory for the 21st Century: Technical Indicators for Improving Your Investment result*. John Wiley & Sons, p.7.

⁴² Schannep, J. (2008). *Dow Theory for the 21st Century: Technical Indicators for Improving Your Investment result*. John Wiley & Sons, p.8.

⁴³ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.25-26.

Dow considered the volume of trade to be an important secondary factor for confirming signals received on price charts. The trading volume increases or decreases depending on where the price is moving (in the direction of the trend or against it). If the main trend goes up, volume increases in line with rising prices. Conversely, volume decreases when prices fall.⁴⁴

➤ **The trend is valid until it gives clear signals that it has changed.**

The assumption that the trend will continue until an external force appears that will make it turn around.

To determine the reversal, traders use various technical tools, including the study of support and resistance level, trendlines, moving averages.⁴⁵

3.3 Chart analysis

Chart analysis is understood as working with a visual (graphical) representation of the price and its dynamics, in which any conclusions are made based on the analysis of simple graphical elements, as lines, levels, shapes, and price charts where the analyst tracks certain graphical models, "patterns", or trends.

3.3.1 Chart types

3.3.1.1 Line chart

Line charts are considered to be the simplest type of graphical representation. It is a two-dimensional curve based on the closing prices of certain periods, with the X-axis coordinates representing time, and the Y-axis representing price (Figure 1) .⁴⁶

The points are connected by a line so that the graph has a continuous pattern.

The closing price of a period is the last price that occurred at the close of a given period.

For example, considering hourly periods, the closing price is the price that was formed last

⁴⁴ Investopedia. (2020). *How to Use the Dow Theory to Analyze the Market*.

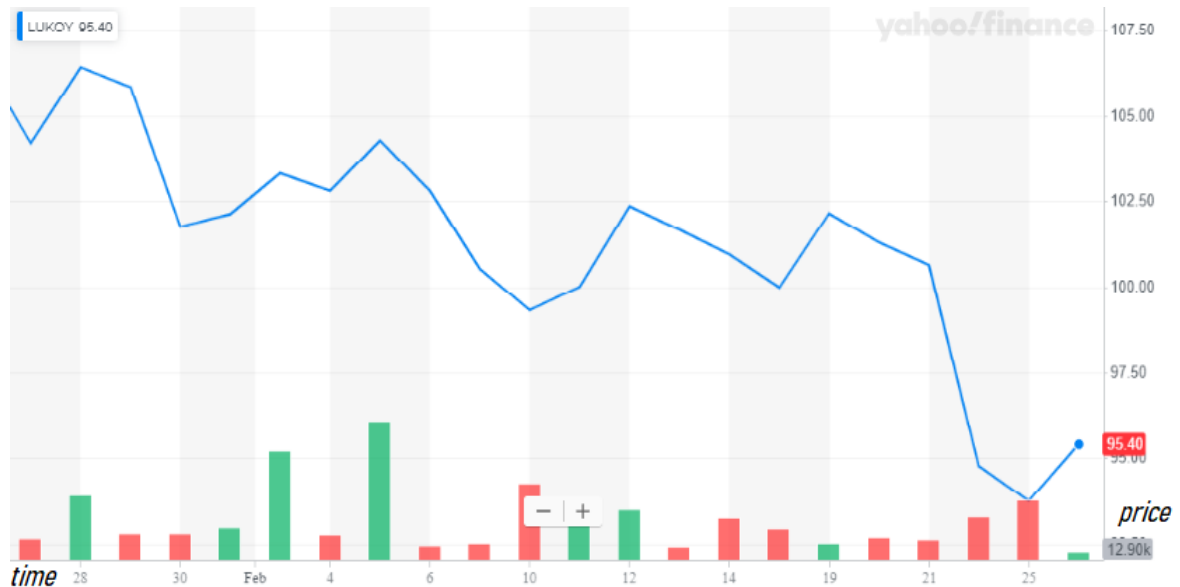
⁴⁵ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.28.

⁴⁶ Ponsi, E. (2016). *Technical Analysis and Chart Interpretations: A Comprehensive Guide to Unde*. John Wiley & Sons, p.58.

before the start of the new hour. Depending on the speed of the formation of new prices, this may be the last second of the hour or the last few seconds.⁴⁷

The chart follow is the line chart of PJSC LUKOIL where the timeframe is 1 day.

Figure 1. Line chart of Lukoil stock



Source: finance.yahoo.com, 2020

3.3.1.2 Bar chart

A bar chart is a chart, each element of which reflects four prices corresponding to a given time interval. These four prices are: opening price(open), maximum for the period(high), minimum for the period(low), closing price(close), (Figure 2,3).⁴⁸

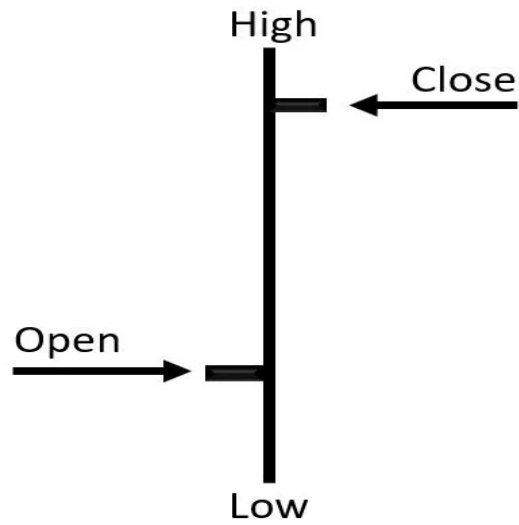
At each point in time, the stock price fluctuation is represented by a bar where small horizontal bars symbolize the opening and closing price of the stock. The length of the vertical bar indicates the range between the minimum and maximum price of the stock.⁴⁹

⁴⁷ Investopedia. (2020). *Line Chart Definition*.

⁴⁸ Ciana, P. (2011). *New frontiers in technical analysis*. Hoboken, N.J.: Bloomberg Press, p.6.

⁴⁹ Ponsi, E. (2016). *Technical Analysis and Chart Interpretations: A Comprehensive Guide to Unde*. John Wiley & Sons, p.60.

Figure 2. Structure of Bar chart



Source: investopedia.com, 2019

Figure 3. Bar chart of Lukoil stock



Source: barchart.com, 2020

Chart: X-axis coordinates representing time, and the Y-axis representing price.

3.3.1.3 Candlesticks chart

Japanese candles were invented in the seventeenth century. That was done by Japanese rice traders to predict the future movement of the rice price based on the past movement.

A Japanese candlestick chart is a chart where each element indicates four prices corresponding to a given time interval (Figure 4,5). These four prices are the same as for the bar chart (open, high, low, close).

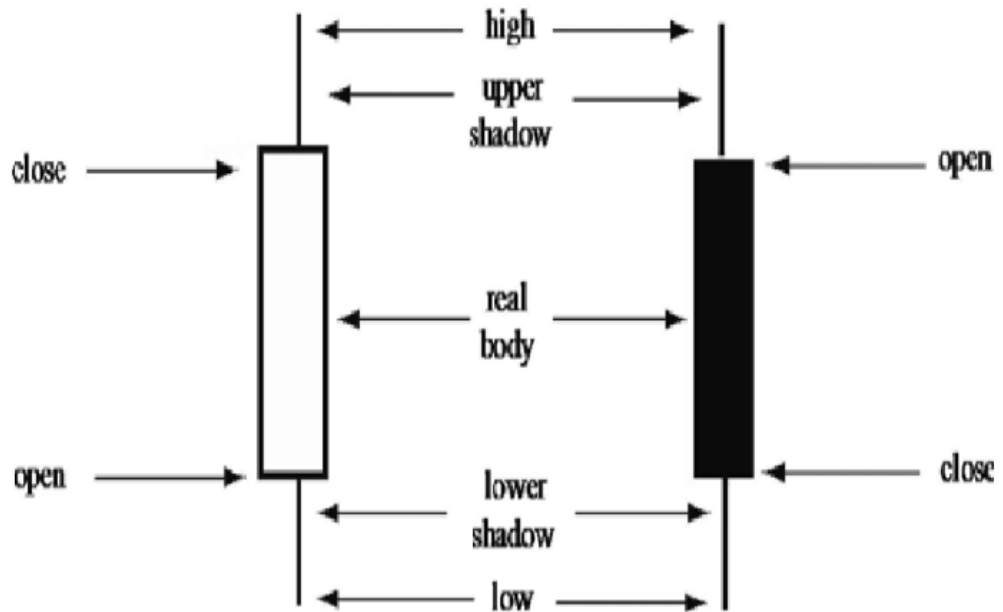
The difference between a candlestick chart and a bar chart is that the range between the opening and closing prices is represented on the candlestick chart by a rectangle painted in black or white (red and green). The rectangle is called the body of the candle.⁵⁰ Thin lines above and below the body are called shadows, they represent the maximum and minimum values of the price for the selected period of time. The shadow above the body of the candle is called the upper shadow, and the shadow under the body of the candle is the lower shadow. Thus, the top of the upper shadow is the daily maximum, and the end of the lower shadow is the daily minimum.

The colour and shape of the candle visually show who came out the winner in the fight of "bulls" and "bears." The long white body tells us that the situation is owned by "bulls," while the long black body reflects the trading day when "bears" ruled.⁵¹

⁵⁰ Investopedia. (2020). *Understanding a Candlestick Chart*.

⁵¹ Thomsett. (2017). *Candlestick Charting*. De|G Press, p.6.

Figure 4. Structure of Candle chart



Source: (Thomsett., 2017), p.18.

Figure 5. Candle chart of Lukoil stock



Source: trading.finam.ru, 2020

Chart: X-axis coordinates representing time, and the Y-axis representing price.

3.3.2 Trend lines and trend channels

A **trend line** is a line that connects consecutive data values to determine the direction of the market.

The *upward trend line* connects the local lows of the price. It passes under the minimum values and joins at least three following rising minimum values of the price.

The *downtrend trend line* connects the local maximum price values. It passes over the maximum values and connects at least three consecutive falling maximum values.

In the classical definition, the line should not cross any other points, but according to modern concepts, this is acceptable under certain conditions.⁵²

Significance of the trend line according to DR. Alexander Elder can be evaluated by five factors: the time scale, its length, the number of touches by columns, the angle of inclination and the volume of trade.

- The larger the time scale, the higher the importance of the line. On a weekly chart, the trend line is more important than on a daily chart, and so on.
- The longer the trend is, the more significant it is. A short line shows the actions of the crowd during a short time. And a long line over a more extended period.
- The higher the number of times prices touch the trend line, the more reliable it is.
- The angle between the trend line and the horizontal reflects the intensity of emotions among the dominant market group. A steep line means that the dominant group is dynamic.
- If the volume of transactions increases when prices move in the direction of the trend, and decreases with small price reversals, then the trend is reliable.⁵³

A breakthrough of the trend line means that the dominant group that led the market in this direction has lost its strength and the market has moved to the power of the opposite group (bulls, bears).

A **trend channel** is formed by two parallel lines, between which prices are concluded. The boundaries of the uptrend channel are the uptrend and the resistance line located parallel to it. For a downtrend channel, there is a downtrend and a support line. When the trend and the channel line are horizontal, the channel is called a range.⁵⁴

⁵² *An introduction to technical analysis*. 1999. New York: John Wiley & Sons (Asia), 1999, p.70.

⁵³ Elder, A. (1993). *Trading for a living*. New York: J. Wiley, pp.90-91.

⁵⁴ Brooks, A. (2012). *Trading price action trends*. Hoboken, N.J.: John Wiley & Sons, p.191.

3.3.3 Support and Resistance

A **support level** is a price level at which active demand may suspend or reverse a downtrend. It is represented by a horizontal line that connects a series of consecutive local lows. The support level limits the price movement downwards, showing the price at which the majority of investors expect it to rise.

A **resistance level** is a price level at which active sales may suspend or reverse an uptrend. It is represented by a horizontal line that connects a series of consecutive local highs. The resistance level limits the price movement upwards.⁵⁵ Resistance levels show the price at which most investors believe it will fall.⁵⁶ On the figure below (Figure 6), when the price for the analyzed period falls to the level of \$ 94.50, bulls (buyers) take the initiative, preventing further price declines. That means that at the price of \$ 94.50 buyers considered the acquisition of this company's stock profitable (and sellers did not want to sell at a price below \$ 94.50). This price situation is called support since buyers support the price of \$ 94.50.

Figure 6. Resistance and Support level of Lukoil stock



Source: trading.finam.ru, 2020

Chart: X-axis coordinates representing time, and the Y-axis representing price. The red line is resistance level, and the blue line is support level.

⁵⁵ Elder, A. (1993). *Trading for a living*. New York: J. Wiley, p.75.

⁵⁶ Achelis, S. (2014). *Technical analysis from A to Z*. McGraw-Hill Education.

3.3.4 Graphic formations

There is a method that uses reading a chart for forecasting trend. It based on the assumption that some certain graphic formations and patterns tend to repeat over time. The method is mainly used in continuous trading markets, where the price develops during the day.

Graphic formations are divided into several groups depending on their features to:

- Reversal patterns;
- Consolidation patterns;
- Gaps.

3.3.4.1 Reversal patterns

The reversal models indicate that a peak or bottom of market prices has been reached, after which a trend reversal occurs. The model observed after a downtrend is a mirror image of the uptrend model, although this is not always clearly expressed. The most important reversal patterns are head and shoulders, double/triple tops and bottoms, wedges.⁵⁷

➤ *Head and Shoulders*

This model consists of three peaks. The central top - the head, is higher than the side tops, which are roughly equal in height, the model as if depicts a person shrugging his shoulders (Figure 7).

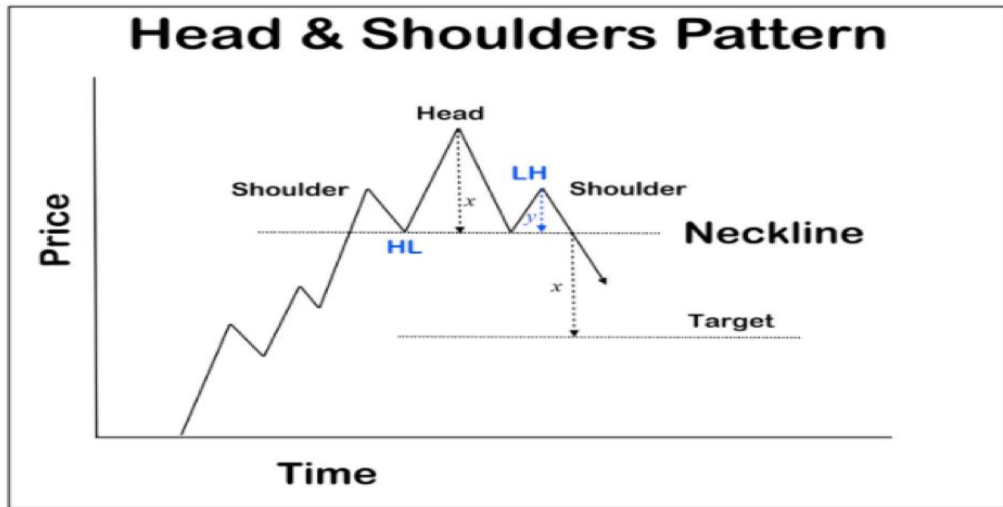
The model usually appears at the end of a long upward trend and is one of the most frequently occurring and reliable models. The left shoulder and head represent the struggle between sellers and buyers at large trading volumes.

When the right shoulder appears, the volume should decrease. The end of the model signal is a price break below the neckline, which is a strong indication of further price declines.⁵⁸

⁵⁷ Xm.com. (2020). *Reversal Patterns*.

⁵⁸ Investopedia. (2020). *Head And Shoulders Pattern*.

Figure 7. Head and Shoulders Pattern



Source: medium.com, 2020

➤ *Double/Triple Tops and Bottoms*

Double and triple tops/bottoms represent a sequence of rises and declines of approximately the same height on the chart, which reflect the continued struggle of sellers and buyers for dominance in the market. These models usually indicate average or long-term trend changes. Sooner or later, the buyers or sellers are winning, and there comes a trend reversal.

The double top is similar to the letter M, and the double bottom is similar to the letter W. The triple tops and bottoms are similar to the model head and shoulders but without a definite head.

Double and triple tops and bottoms can be distinguished from the model head and shoulders by their volume. With double and triple tops/troughs at the tops, volumes are usually decreasing, while with the head and shoulders model, the volume is usually decreasing sharply when the right shoulder is forming.⁵⁹

➤ *Wedges*

In terms of shape and duration of formation, the wedge model resembles a symmetrical triangle. The wedges have edges bevelled towards each other. They can be directed upwards or downwards. Ordinarily, like a flag, a wedge is turned against the direction of the prevailing trend. A breakdown of the wedge must occur before the top of

⁵⁹ *An introduction to technical analysis*. New York: Wiley (Asia), 1999, p.77.

the wedge is reached. Thus, a wedge pointing downwards is considered to be a bullish model, and a wedge pointing upwards is considered to be bearish.⁶⁰

3.3.4.2 Consolidation patterns

Consolidation patterns are found during consolidation periods when prices move sideways after an uptrend or downtrend. Models are named for their geometric shapes: triangles, rectangles, flags and pennants.

➤ Triangle

Alexander Elder defines the triangle as an area of price consolidation, the boundaries of which intersect on the right. It can be a sign of a reversal or, more often, a continuation of a trend. The market is shrinking, and the energy of the players is shrinking to splash out of the triangle.⁶¹

John J. Murphy defines four types of triangles: symmetrical, ascending, descending and expanding triangle or expanding formation.⁶²

➤ Rectangles

Rectangles represent the resistance and support created by sellers and buyers. Rectangles can be formed for months and last up to a year. If the breakout matches the trend direction, prices continue to rise, but if the breakout goes against the trend, this should be considered a powerful reversal pattern.

➤ Flag or pennant

These are short-term patterns that usually last no more than a few days and occur in dynamic markets where there are sharp price increases.

A significant breakout outside the flag or pennant in the opposite direction to the expected one, i.e. against the main trend, can be considered as a signal of a potential reversal of the trend.⁶³

⁶⁰ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.146.

⁶¹ Elder, A. (1993). *Trading for a living*. New York: J. Wiley, p.131.

⁶² Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.132.

⁶³ *An introduction to technical analysis*. New York: Wiley (Asia), 1999, p.73.

3.3.4.3 Gaps

A gap is a price gap between two subsequent candles. There is a significant distance between the closing of the first candle and the opening of the second one, which is visible on the chart. The price seems to make a jump and instantly changes at the moment when the drawing of the previous candle ends and the next one begins.⁶⁴

Jack Schwager, in the book "Technical analysis" defines four main types of breaks:

➤ **Common gap**

Such gaps occur when moving sideways and usually indicate a lack of interest in securities at a given price. Common gaps are usually found with small trading volumes and a small number of active participants.

➤ **Breakaway gap**

Is observed at the moment when the prices go beyond the trading range. Quotes leave the area where active trading was conducted. The gap that has not been filled for several days when breaking through the range level is considered one of the most reliable signals.

➤ **Runaway gap**

It appears when the trend accelerates. Characterizes "bullish" or "bearish" market as strong. The more gaps, the stronger is the trend. Such gaps often appear after the reversal, before which there was a strong movement in the previous direction.

➤ **Exhaustion gap** is also observed after a significant price movement followed by a reversal.⁶⁵

3.4 Trading system

A trading system represents a set of rules according to which a decision to open or close a position is made. These rules should be clearly formulated so that they can be written as an algorithm for automatic work in the market. And these rules should not allow any uncertainty.⁶⁶

⁶⁴ Investopedia. (2020). *Gap*.

⁶⁵ Schwager, J. (1996). *Technical analysis*. New York: Wiley, p.106.

⁶⁶ Tradingsim. (2020). *Trading Systems – Everything You Need to Know*.

According to Charles D. Kirkpatrick, designing a workable, profitable system starts with some essential personal attitudes. Some of the features of the required mindset include the following:

- Understanding the difference between manual and automated systems. The author recommends choosing more towards a automated system, for which the rules are explicit and constant.
- Respond to the market situation rather than to own expectations.
- Realize that losses will occur, but try to keep them small and infrequent.
- Understand that the profit will not necessarily be constant or consecutive.
- Understand that emotions can fluctuate and encourage change or manipulation of the system. Such emotions need to be controlled.
- To be organized.
- Create a consistent plan for each investment horizon (daily, monthly, yearly).
- Test, test, and test again. Most systems fail because they have not been tested.
- Follow the final tested plan without exception. No one is smarter than a computer, no matter how painful the loss may be.⁶⁷

3.4.1 Types and styles of trading

The three main categories of trading systems are:

- **Trend following.**
These systems trade in the direction of the primary trend, buying after the bottom and selling after the top.⁶⁸
- **Counter trend** is a trading method that attempts to make a profit by trading against the current trend. ⁶⁹It includes support and resistance, oscillators.
- **Pattern recognition.**⁷⁰

⁶⁷ Kirkpatrick, C. and Dahlquist, J. (2011). *Technical analysis*. Upper Saddle River, N.J: FT Press, p.533.

⁶⁸ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.496.

⁶⁹ Investopedia. (2020). *Countertrend Strategy Definition*.

⁷⁰ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.496.

Depending on the degree of trade automation, trading systems are divided into **Manual and Automated**.

Manual trading is a trading process that involves a person making decisions about entering and exiting trades based on their abilities, experience, impressions, and intuition. Manual traders often use computer programs to consolidate information. In some cases, they can also set automatic indicators that warn them about potential trading opportunities. However, in all cases, a trader contribution is required to authorize transactions in manual trading.⁷¹

An alternative is **automatic trading** systems that allow traders to set specific rules for entering and exiting trades, which, once programmed, can be automatically executed using a computer. Murphy identifies three main benefits of automated trading systems:

- Ability to test ideas before we trade them.
The computer allows us to test ideas on historical data. By helping us see how the system worked in the past, it allows us to make better decisions when making future trades.
- Possibility be more objective and less emotional.
Most people find it challenging to apply their objective analysis to real trading situations. Automatic trading is based on rules and statistics, while manual trading can be based on emotions. That is an advantage because traders often lose money due to emotional decisions. The automatic system also reduces other trading pitfalls-resale, premature actions, inactivity, and constant decision-making. However, this should not always be the case, since a manual trader can base his strategy on sound logic, statistics, and discipline.
- Chance to do more work by increasing our capabilities.
The automated system trades for us, and we can devote the time saved to developing other systems.⁷²

Depending on the period of time that traders hold open positions, there are four general styles of trading:

⁷¹ Investopedia. (2020). *Manual Trading Definition and Tactics*.

⁷² Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, p.494.

Position trading is a long-term trend trading, whether this is weeks, months or even years. Position trading very often uses fundamental analysis (its macroeconomic part) and technical method of forecasting. Position traders are unconcerned with short-term market fluctuations, but they focus on the general market trend.

Swing trading involves trading over several days or weeks to take advantage of short and medium-term market movements.

The primary purpose of swing trading is to determine the trend and then to earn on falls and peaks that provide entry points. A swing trader uses technical analysis to identify these key price points. They look for two types of market movements: “swing high” when the price moves up and “swing low” when the market price goes down.

Day trading is a style that defines that a trader will open and close all his positions before the markets close every evening. Day traders buy and sell multiple assets during the trading day, to take advantage of short-term market movements. In doing so, they avoid some of the risks and additional costs associated with holding a position overnight.

Scalping is a trading style that is characterized by a high frequency of trades, short holding time from a few seconds to a few minutes at most.⁷³

3.4.2 Trade System Design

J. Murphy, in his book "Technical analysis of the financial markets", offers the following five-step plan for creating a trading strategy:

1. Start with a concept

It is necessary to understand and explore how that market works. Essential to start by observing a huge number of charts, determining signals, oscillator configurations, reading professional books on technical analysis, as well as trading systems and examples of what others have already achieved.

2. Turn it into a set of objective rules

It is the hardest action in the five-step plan. It is necessary to express the idea in objective terms and define in detail what and how the system should do.

3. Visually check it out on the charts

⁷³ IG. (2020). *The complete guide to trading strategies and styles*.

By following the explicit rules from the second step, visually check the generated trading signals on the price chart.

4. Formally test it with a computer

Here we transfer our system to the computer code. After writing the program, we move to the test stage. It is necessary to determine on which data we will test and how many to use for building a system.

5. Evaluate the results

Three critical statistics for analysis are:

Profit factor. It is the ratio of gross profit for winning trades to the gross loss for losing trades. This statistic tells how many dollars system made for every \$1 it lost and is a measure of risk.

Average profit/loss per trade is the mathematical expectations of our system. It should be at least high enough to cover the transaction costs of making a trade.

Maximum intraday drawdown is a drop from the highest peak to the lowest bottom.⁷⁴

⁷⁴ Murphy, J. (1999). *Technical analysis of the financial markets*. New York: New York Institute of Finance, pp.495-500.

4 Practical part

The practical part consists of two trading strategies. The first one is based on the combination of Bollinger Bands and Volume and the second one on the Relative Strength index. Trading with Lukoil stock is provided on the Moscow stock exchange in the Finam Trading platform.

4.1 Trading strategy based on Bollinger Bands and Volume Indicator of LKOH: MOEX

The trading strategy is based on the combination of Bollinger bands and the Volume indicator and divided into several steps.

Step 1. The definition of a trend.

One of the primary assumptions of the technical analysis is that the price follows the trend until the trend shows signs of a reversal. Based on this assumption, in the trading strategy will be determined the trend reversal points.

The Bollinger Bands will be used as a trend indicator and to identify the points of opening positions. To determine the trend is used a middle band of Bollinger Bands, moving average, that is set for 20 days by default. If prices are above the moving average, the trend considered to be rising, and if prices are below the moving average, the trend supposed to be descending.

Step 2. Identification of signals to open a position.

After determining the trend, it is expected the price value will touch the moving average. When the price candle crosses the moving average, it is the signal to prepare to open a position opposite to the current trend. Since the moving average is a dynamic line of support and resistance, its crossing signals a change in the market mood.

In an uptrend, the aim is to look for entry points to sell, as it represented in Figure 8. In a downtrend, the aim is to look for entry points to buy, shown in Figure 9. After finding the entry point, it is needed to confirm the received signal using the Volume indicator.

Figure 8. Representation of sell signal



Source: Own processing, 2020

Figure 9. Representation of buy signal



Source: Own processing, 2020

Step 3. Confirmation based on Volume.

According to the Dow Theory, the volume is considered to confirm the trend. The essence of the statement is that a significant volume must confirm changes in the market trend.

When there is an uptrend, and the volume indicator continues to grow, it is a signal that the trend strength is still sufficient. When the volume values fall, it is possible for the market to freeze and even change the trend—an identical situation with a downtrend.

When is received a buy or sell signal based on Bollinger Bands, it has to be compared with volume. The candle of the volume indicator when opening a position should not be lower than the previous three candles. If this condition is met, then the opening of a buy or sell position is confirmed and can be realized.

Step 4. Stop loss and take profit.

In accordance with the recommendation of Alexander Elder, stop orders should be placed below the recent short-term support level with the expected increase, while playing lower than the recent short-term resistance level.

Take profit is set based on the channel width at the moment of a position opening. The width of the channel determines from the midline to the extreme line of the Bollinger Bands. Then, this value is added to the entry point and setting the desired value. The channel width is at that moment, an indirect indicator of market sentiment.

Implementation of steps 1-4.

Input parametrs:

- The size of the initial deposit is 100 000 RUR.
- The initial number of shares is 58 (100,000 rubles / 1,700 rubles).
- The transaction fee is 0.01% for one trading day, and depository commission is 177 rubles/month.
- The selected timeframe is a daily chart.
- The selected period is from 1.1. 2010 to 1.3. 2020.
- Buy signal: the price candle crosses the middle line of the Bollinger bands, in a downtrend and confirmed by the Volume indicator.
- Sell signal: the price candle crosses the middle line of the Bollinger bands, with an uptrend and confirmed by the Volume indicator.
- Stop-loss: at the expected increase, is set slightly below the level of the recent short-term support level; with the expected decline, it is placed slightly above the recent short-term resistance level.

Results of the implementation of steps 1-4.

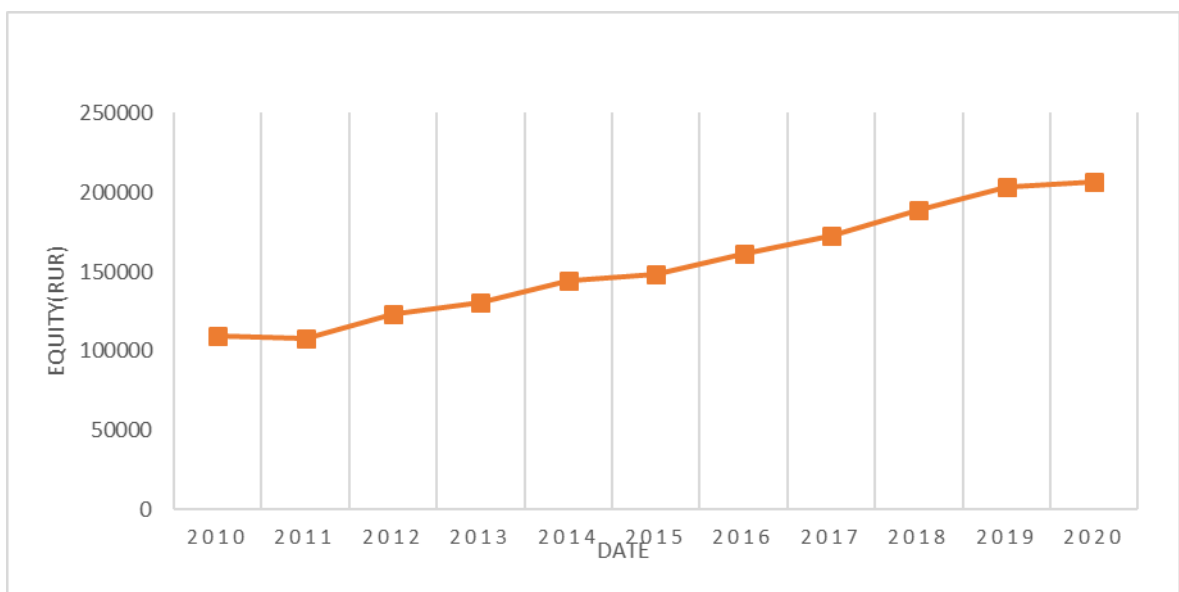
After analyzing the selected time period, the following results were obtained as shown in the table below (Table 1).

Table 1. Results of trading strategy based on Bollinger Bands and Volume Indicator

Initial deposit	100 000 RUR	Number of trades	97
Gross profit	336 869.22	Gross loss	-208 360.36
Net profit (minus broker commission)	106 795.86	Profit factor	1.62
Profit trades %	65.98	Loss trades %	34.02
Average profitable trade	3 472 .87	Average loss trade	-2 148.04

Source: Own processing, 2020

Figure 10. Equity curve of trading strategy based on Bollinger bands and Volume



Source: Own processing, 2020

Step 5. Evaluation and Optimization of the trading strategy.

After getting the results, it is needed to evaluate the trading strategy and identify weaknesses and strengths that have to be analyzed and optimized.

For a more accurate and objective assessment of the trading strategy is used the Sharpe ratio. It shows the relationship between profitability and risk. To calculate the Sharpe ratio first is determined, the average rate of return per transaction, that according to the calculations is 1.03 %. Taking into account the time and the number of transactions, the

average rate of return is 15.67% per year. Then it is necessary to set the best available rate of return of risk-free security income that is minimally guaranteed. It is very convenient to keep up with bonds because, at the expiration of a certain period, profit is guaranteed. The average rate on federal loan bonds is 7.7% per year. So, the free risk is calculated as the difference between the average rate of return and risk-free income, and equal to 7.93%. As a result, it was got the Sharpe ratio equal to 1,12. This means that the trading system has a positive ratio between possible risk and profitability, but it is not effective enough. The reasons may be the following: a fixed take profit does not allow to get additional profit with strong price movements; entrance is carried out in the price corridor, without strong visible movement, which leads to the appearance of false signals and a decrease in profitability.

For optimization, it is necessary to introduce additional parameter:

- Optimization based on *compression* of Bollinger bands.
- Optimization based on *extension* of Bollinger bands.
- Optimization based on *dynamic stop-loss*.

4.1.1 Optimization of the trading strategy based on Compression of Bollinger bands.

A Bollinger Bands are driven by volatility, and the compression of the bands is a reflection of this volatility. Low volatility generates high volatility, and conversely, high volatility generates low volatility. Figure 11 shows compression and beginning of consolidation. As a result, the trading range is significantly narrowed. The moving average becomes flatter and moves to the centre of the data structure. The Bollinger bands begin to narrow around the price structure.

Figure 11. Compression of Bollinger bands



Source: Own processing, 2020

For optimization, compression will be used as follows:

When the price candle crosses the moving average line, a strong trend is expected to start, and the Bollinger bands channel begins to expand. It is a signal to open a position in the direction of price movement (Figure 12).

Sell signal: When, at the end of compression, the price is above the moving average and moving down, then when the candle crosses the moving average price, it is a signal to work according to the trend and sell.

Buy signal: When, at the end of compression, the price is below the moving average and moves up, then when the candle crosses the moving average price, it is a signal to buy.

The other parameters remain unchanged.

It is also necessary to consider the possibility of a false price breakout when the channel expanding. Often, when the end of compression approaches, the price makes a short deceitful movement and then sharply turns around and rushes in the direction of the emerging trend (Figure 13). To cope with a false breakthrough, it is needed to wait until the movement has developed enough so that there is little doubt about the nature of the emerging trend.

Figure 12. Signal to open a position during optimization



Source: Own processing, 2020

Figure 13. False signal



Source: Own processing, 2020

After analyzing the selected time period, the following results were obtained as shown in the table below (Table 2).

Table 2. Results of trading strategy after optimization based on Compression of Bollinger bands

Initial deposit	100 000 RUR	Number of trades	89
Gross profit	341 017.22	Gross loss	- 192 748.14
Net profit (minus broker commission)	126 498.08	Profit factor	1.76
Profitable trades %	61.79%	Loss trades %	38.21%
Average profitable trade	3 831.65	Average loss trade	- 2 165.70

Source: Own processing, 2020

This optimization improved the profit factor by only 0.14 units. However, the ratio of profitable and unprofitable trades has shifted towards unprofitable trades. This means that this optimization does not significantly affect the performance of the trading strategy.

4.1.2 Optimization of the trading strategy based on extension of Bollinger bands.

According to John Bollinger, expansion gives the following important rule: when a powerful trend is born, volatility increases so much that the lower band turns down in an uptrend or the upper band turns up in a downtrend. When this happens, this is the

Extension, and when the Extension unfolds, the chances are very high that the trend is ending (Figure 14). That does not necessarily mean that the entire movement has ended, but it means that the current segment has almost certainly ended.

Figure 14. Ending of the trend



Source: Own processing, 2020

Optimization based on the expectation of consolidation or a reversal. When the direction of the upper line does not coincide with the direction of the lower line of the bands, this is a signal to open a position in the direction of the trend at the intersection of the moving average, buy and sell signals represented on Figure 15.

Figure 15. Optimization based on Extension: buy and sell signals



Source: Own processing, 2020

After analyzing the selected time period, the following results were obtained as shown in the table below (Table 3).

Table 3. Results of trading strategy after optimization based on Extension of Bollinger bands

Initial deposit	100 000 RUR	Number of trades	92
Gross profit	314 017 .58	Gross loss	- 224 931. 16
Net profit (minus broker commission)	67 315. 42	Profit factora	1.40
Profitable trades %	59.78	Loss trades %	40.22
Average profitable trade	3 413.23	Average loss trade	-2 444.90

Source: Own processing, 2020

The results worsened for all points. That is because the Extension quite often gave false signals, as on the Figure 16. This optimization has not shown its effectiveness.

Figure 16. False signal generated during extension



Source: Own processing, 2020

4.1.3 Optimization based on dynamic stop-loss.

To increase the amount of profit from the transaction and reduce the loss, a dynamic stop-loss is used to optimize the basic strategy. Dynamic stop-loss is when the price moves in the direction of a trend, and also is moved the stop-loss. Stop-loss movement is performed using the moving average of the Bollinger Bands. Since the moving average is a dynamic line of resistance or support, stop loss is moving, as shown in Figure 17.

Figure 17. Optimization based on dynamic stop-loss



Source: Own processing, 2020

- 1- Initially set stop-loss.
- 2- The price candle crossed the moving average and moved up in the direction of the trend. Stop-loss is shifted to the moving average when the candle approaches the upper boundary of the channel of the Bollinger Bands.
- 3- The stop-loss is moved according to the moving average following the movement of the price candles.
- 4- At that point, the stop-loss was implemented, and the position closed.

The advantages of this method, as can be seen from Figure 16, that the size of the profit exceeds the initially set (take profit is half the channel width at the time of opening the position). The disadvantage is the fluctuation of the candlestick prices can trigger the stop-loss with a loss or near-zero profit. This is because when the price reaches the upper

border of the channel, the take-profit rearranged above the channel border. The price may rollback, which will trigger the stop-loss.

Optimization: Opening a position when the candle crosses the moving average price in the opposite direction of the price movement. Confirmation from the Volume indicator. Closing a position (optimization) - when the stop-loss is triggered.

After analyzing the selected time period, the following results were obtained as shown in the table below (Table 4).

Table 4. Results of trading strategy after optimization based on dynamic stop-loss

Initial deposit	100 000 RUR	Number of trades	83
Gross profit	297 016.52	Gross loss	- 188 531. 63
Net profit (minus broker commission)	86 713.89	Profit factor	1.57
Profitable trades %	53.01	Loss trades %	46.99
Average profitable trade	3 578.51	Average loss trade	-2 271.46

Source: Own processing, 2020

As a result of optimization, the profit factor changed insignificantly by 0.05 points. However, the percentage of losing trades increased by 12.97%. This is due to the fact that the stop loss is triggered frequently earlier when the price jumps.

4.1.4 Optimization based on changing parameters of Bollinger bands.

The basic strategy used the following parameters of Bollinger bands:

- moving average with a period of 20 days;
 - the upper and lower border of the bands with two standard deviations from the average;
- Also, the position was opened in the opposite direction of the candle movement when crossing the moving average (Figure 18).

Figure 18. Sell signals with initial set parameters of Bollinger bands



Source: Own processing, 2020

John Bollinger tested six markets where Bollinger Bands with 10th, 20th, 30th and 50th periods were calculated. The bandwidth for all was set to contain 89% of data points, which is the average number contained in 20-day bands for all six series. Test results in all markets were very consistent. Based on the results, the author recommended when using two standard deviations and a 20-period calculation as a reference point, to decrease the bandwidth to 1.9 standard deviations at 10-periods and increase it to 2.1 standard deviations at 50 periods.⁷⁵

According to the recommendations of the creator of the Bollinger bands, two options are applicable for optimization:

First Option:

- Moving average with a period of 10 days;
- The upper and lower border of the bands with a deviation from the moving average of 1.9 (Figure 19).

Second Option:

- Moving average with a period of 50 days;

⁷⁵ _Bollinger, J., 2002. *Bollinger On Bollinger Bands*. New York, NY [u.a.]: McGraw-Hill, p.54.

- The upper and lower border of the bands with a deviation from the moving average of 2.1 (Figure 20).

The other parameters remain the same as in the basic strategy.

Figure 19. Optimization based on first option of changing parameters of Bollinger Bands – sell signal



Source: Own processing, 2020

Figure 20. Optimization based on second option of changing parameters of Bollinger Bands – buy signal



Source: Own processing, 2020

After analyzing the selected time period, the following results were obtained as shown in the table below (Table 5).

Table 5. Results of trading strategy after optimization based on changing parameters of Bollinger Bands- first option

Initial deposit	100 000 RUR	Number of trades	123
Gross profit	375 401.17	Gross loss	- 264 152.49
Net profit (minus broker commission)	50 945.73	Profit factor	1.42
Profitable trades %	57.72	Loss trades %	42.28
Average profitable trade	3 052.04	Average loss trade	-2 147 .58

Source: Own processing, 2020

According to the obtained results, the profit ratio decreased by 0.2 points. The percentage of losing trades increased by 12.26 %. This is due to the fact that price candles cross the moving average much more often than with the basic strategy. Also, price candlesticks touch the upper and lower borders of the channel more often than in the base one (Figure 21). This causes the stop-loss to be triggered. The stop loss is set as in the basic version.

Figure 21. Optimization based on second option of changing parameters of Bollinger Bands – touching and crossing of bands



Source: Own processing, 2020

The application of this optimization is inefficient due to the set of signals that lead to a loss.

After analyzing the selected time period, the following results were obtained after implemented second option as shown in the table below (Table 6).

Table 6. Results of trading strategy after optimization based on changing parameters of Bollinger Bands- second option

Initial deposit	100 000 RUR	Number of trades	54
Gross profit	171 435.18	Gross loss	- 301 069.27
Net profit (minus broker commission)	-151 405.09	Profit factor	0.57
Profitable trades %	35.18	Loss trades %	64.82
Average profitable trade	3 174.72	Average loss trade	-5 575.36

Source: Own processing, 2020

The results of testing trading strategy after optimization are negative in all respects. The profit ratio decreased by 1.05 points. Total net profit showed negative values. This is due to the following:

The channel of the Bollinger bands is wide enough, and the touch and the intersection of the moving average occur much less frequently than when using the period with lower values.

There is a strong movement of price candles in the direction of the trend. In the basic strategy, the price candle crossing the moving average is used as the primary signal to open a position. In this case, touching the moving average is considered a correction, but not a trend reversal.

According to the basic strategy shown in Figure 22, a buy signal appears at point 1, but as it can be seen in the figure, opening this position will lead to a loss. The same is observed in points 2 and 3. From the point of view of optimizing the basic strategy, an increase in the period leads to an expansion of the channel, and this increases the risk-capital ratio; opening a position against the movement of a candle when it crosses the moving average leads to a strong increase in the percentage of losing trades. This period is not recommended for improving the basic strategy.

Figure 22. Signals to open position leading to loss



Source: Own processing, 2020

Results of changes in periods and deviations of the Bollinger Bands.

Bollinger bands with a period of 10 days and a deviation of 1.9, led to worse results compared to the basic strategy due to more frequent touching of the upper and lower borders of the channel, plus the appearance of more frequent false signals to open a position.

Bollinger bands with a period of 50 days and a deviation of 2.1, led to negative indicators of profitability for the study period. This is due to the following points: when the moving average candle crosses the price, the trend does not unfold mainly, but a correction occurs.

4.2 Trading strategy based on RSI of LKOH: MOEX

Step 1. The definition of a trend.

If the RSI has been above the 50 values for a long time or has been at the level above the average value for a significantly longer time, only occasionally crossing it, without falling significantly lower – the price of the instrument demonstrates a relatively stable uptrend.

Finding the value of the RSI chart for a certain period of time in the range of values from 50 to 70 means the formation of a confident uptrend in this area.

The formation of a downward price trend is reflected on the RSI chart by a steady movement of the indicator values in the range between 30 and 50. Regular intersections of

the 50 level chart indicate a sideways price movement, and a drop below 30 indicates an oversold instrument and an early price correction after a downward movement. The intersection of one of the threshold values of 30 or 70 indicates the expected end of the trend movement.

Step 2. Identification of signals to open a position.

A decrease in the RSI indicator below the value of 30 indicates that the instrument is oversold and is a buy signal since there is a certain probability of a trend reversal.

If the RSI indicator exceeds the value of 70, it indicates overbought and is a signal to sell (Figure 23).

Figure 23. Trading strategy based on RSI - signals to open a position



Source: Own processing, 2020

Step 3. Stop loss and take profit.

Stop-loss is placed just above the nearest price extreme. Take-profit is determined by the nearest support and resistance levels.

Implementation of steps 1-3.

Input parametr:

- The size of the initial deposit is 100 000 RUR.
- The initial number of shares is 58 (100,000 rubles / 1,700 rubles).

- The transaction fee is 0.01% for one trading day, and depository commission is 177 rubles/month.
- The selected timeframe is a daily chart.
- The selected period is from 1.1. 2010 to 1.3. 2020.

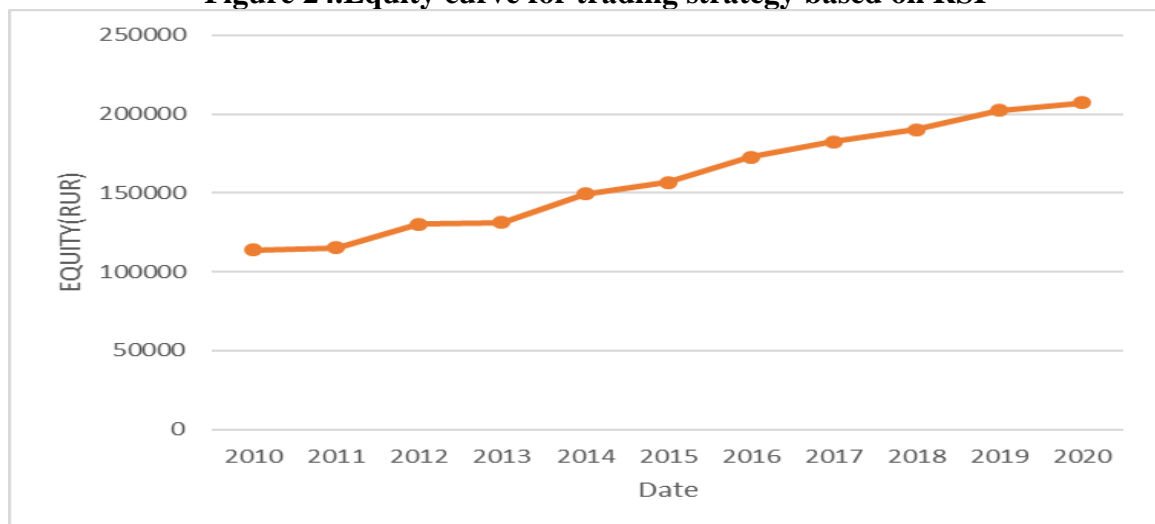
After analyzing the selected time period, the following results were obtained as shown in the table below (Table 7).

Table 7. Results of trading strategy based on RSI

Initial deposit	100 000 RUR	Number of trades	44
Gross profit	398 017.57	Gross loss	-268 930.79
Net profit (minus broker commission)	107 315.78	Profit factor	1.48
Profitable trades %	65.90	Loss trades %	34.10
Average profitable trade	9 045.85	Average loss trade	-6 112.06

Source: Own processing, 2020

Figure 24. Equity curve for trading strategy based on RSI



Source: Own processing, 2020

The strategy shows a good profit factor compared to the basic strategy. The main loss occurred on transactions where the price movement was quite high, despite the indicator being in the oversold or overbought zone (Figure 25).

Figure 25. Sell signal, when price movement quite high



Source: Own processing, 2020

To optimize the strategy, is reduced the overbought and oversold zones, by setting the values 75 and 25. It gives fewer signals, but they should be stronger.

After analyzing the selected time period, the following results were obtained as shown in the table below (Table 8).

Table 8. Results of trading strategy based on RSI after optimization

Initial deposit	100 000 RUR	Number of trades	13
Gross profit	39 440.00	Gross loss	- 85 608.00
Net profit (minus broker commission)	67 939.00	Profit factor	0.46
Profitable trades %	53.84	Loss trades %	46.16
Average profitable trade	9 045.85	Average loss trade	-6 112.06

Source: Own processing, 2020

After applying these values to the indicator, the profit factor decreased by 1.02 points compared to the basic strategy. Net profit showed negative values. The main reason for

such low results is the absence of nearby support or resistance levels when the price rises sharply.

5 Results and Discussion

The table below represents the comparison of trading strategies above.

Table 9. Strategies comparison

STRATEGY		TOTAL NET PROFIT	PROFIT FACTOR	CHANGE IN THE DEPOSIT AMOUNT FOR THE PERIOD 2010- 2020 IN %	NUMBER OF TRADES
Bollinger Bands and Volume Indicator	Basic strategy	106 795.86	1.62	+106.80	97
	Optimization based on Compression of Bollinger bands	126 498.08	1.76	+126.49	89
	Optimization based on Extension of Bollinger bands	67 315.42	1.40	+67.32	92
	Optimization based on dynamic stop-loss	86 713.89	1.57	+86.71	83
	Optimization based on changing parameters of Bollinger bands- first option	50 945.73	1.42	+50.95	123
	Optimization based on changing parameters of Bollinger bands- second option	-151 405	0.57	-151.40	54
RSI	Basic strategy	107315.78	1.48	+107.32	44
	Optimized RSI	-67 939	0.46	-67.94	13

Source: Own processing, 2020

The initial trading strategy based on the combination of Bollinger bands and Volume has a good ratio between possible risk and return. Over the period from 2010 to 2020, the initial capital increased by 106.80% (10.68% per annum on average). This value is higher than the bank deposit rate, but it is not sufficient to recognize the trading system as the most effective.

The reasons may be as follows: a fixed take profit does not allow to get additional profit with strong price movements; the entry is made in the price corridor, without an apparent strong movement, which leads to false signals and a decrease in profitability.

Optimization was performed in several ways: the first one was based on Compression of Bollinger Bands, which allowed to increase the net gross profit by 19.31% in the studied time period, despite the increase in the percentage of loss-making transactions. But the profit factor changed only by 0.14 units.

The second optimization was based on Expansion of Bollinger Bands, and the use of this optimization significantly reduced the overall net profit. This reason was caused by a lot of false signals issued by the Extension.

The third optimization was based on a Dynamic stop-loss. The advantages of this method that the profit size exceeds the initially set. The disadvantage is that fluctuations in the price candles can trigger a stop loss with a loss or near-zero profit. This is because when the price reaches the upper limit of the channel, the take profit is moved above the channel border. The price can make a rollback, which will trigger a stop-loss, although the direction of price movement will be selected correctly.

Change in the period of Bollinger bands from 20 days and two standard deviations to a period of 10 days and a standard deviation of 1.9, according to the results, decreased the profit ratio by 0.22 points. The percentage of losing trades increased by 6.2 %. This is since price candles cross the moving average much more often than with the basic strategy. Also, price candlesticks touch the upper and lower borders of the channel more often than in the base one. It causes the stop-loss to be triggered. Change of the period of Bollinger bands from 20 and deviation 2.0 to the period of 50 and deviation 2.1, showed a negative profitableness.

A trading strategy based on the RSI indicator was also studied. The basic version with a standard period of 14 and values of 30 and 70 for oversold and overbought zones produced indicators comparable to the indicators of the basic strategy based on Bollinger

bands and Volume. When improving the strategy to the RSI, the values 25 and 75 were selected to get more reliable signals to open a position. However, optimization has shown negative results. After applying these values to the indicator, the profit ratio decreased by 1.02 points compared to the basic strategy. Net profit showed negative values. The main reason for such low results is the lack of nearby support or resistance levels when the price rises sharply.

6 Conclusion

The aim of this diploma thesis was to check the profitability and feasibility of trading strategies of the Lukoil company stocks by using technical analysis. To reach this aim, it was necessary to develop trading strategies. In order to create the strategies, it was needed to choose indicators. Chosen indicators were Bollinger Bands, Volume and Relative Strength Index.

The first trading strategy was based on the combination of two indicators, which were Bollinger bands and the Volume indicator since the creator of Bollinger bands believed that the real strength of the bands becomes apparent when they are combined with Volume indicators. The Volume was taken as a confirmation indicator that reacts to the mood of the market and its participants. The trading strategy had a positive ratio between possible risk and profitability, but not sufficient enough. To improve the results of the trading strategy, several optimizations were adopted.

Optimizations based on Compression and Extension of Bollinger bands, dynamic stop-loss, changing parameters of Bollinger bands- first option were profitable; however, the total net profit of the optimization was not satisfied, except compression. In optimization based on compression; however, the ratio of profitable and unprofitable trades has shifted towards unprofitable trades. Optimization based on Change of the period of Bollinger bands from 20 and deviation 2.0 to the period of 50 and deviation 2.1, showed a negative profitability.

The second trading strategy was based on the RSI. The basic version of the trading strategy of RSI produced values comparable to the values of the basic strategy based on Bollinger bands and Volume. When improving the strategy to the RSI, optimization has shown negative results, and net profit showed negative values.

The results in the practical part could help the readers determine whether to trade with LKOH or not.

7 References

Printed documents

- An introduction to technical analysis*. New York: Wiley (Asia), 1999. ISBN 0471831271.
- CIANA, Paul. *New frontiers in technical analysis: effective tools and strategies for trading and investing*. Hoboken, NJ: Bloomberg Press, c2011. ISBN 9781118155592.
- DARLEY, Vincent a Alexander V. OUTKIN. *A NASDAQ market simulation: insights on a major market from the science of complex adaptive systems*. Hackensack, NJ: World Scientific, c2007. ISBN 9789812700018.
- EDWARDS, Robert D., John MAGEE a W. H. C. BASSETTI. *Technical Analysis of Stock Trends*. 9th ed. New York: Amacom - American management association, c2006. ISBN 978-0-8493-3772-7.
- ELDER, Alexander a Alexander ELDER. *The new trading for a living: psychology, discipline, trading tools and systems, risk control, trade management*. Hoboken, New Jersey: John Wiley, [2014]. Wiley trading series. ISBN 9781118443927.
- Gordon, E. and Natarajan, K. (2010). *Financial Markets*. New Delhi: Himalaya Pub. House. ISBN 9781329355989.
- KIRKPATRICK, Charles D. a Julie R. DAHLQUIST. *Technical analysis: the complete resource for financial market technicians*. 2nd ed. Upper Saddle River, N.J.: FT Press, c2011. ISBN 9780137059447.
- KUMAR, Naveen B. a Sanjay MOHAPATRA. *The use of technical and fundamental analysis in the stock market in emerging and developed economies*. North America: Emerald, [2015]. ISBN 9781785604058.
- KRANTZ, Matt. *Fundamental analysis for dummies*. 2nd edition. Hoboken, NJ: John Wiley, [2016]. --For dummies. ISBN 111926359X.
- MISHKIN, Frederic S. a Stanley G. EAKINS. *Financial markets and institutions*. 7th ed. Boston: Prentice Hall, c2012. ISBN 9780132136839.
- MURPHY, John J. *Technical Analysis of the Financial Markets: A Comprehensive Guide to Trading Methods and applications*. [1st ed.]. New York: NYIF New York Institute of Finance, c1999. ISBN 0-7352-0066-1.

PONSI, Ed. *Technical analysis and chart interpretations: a comprehensive guide to understanding established trading tactics for ultimate profit*. Hoboken, New Jersey: Wiley, [2016]. ISBN 9781119048336.

PRING, Martin J. *Technical analysis explained: the successful investor's guide to spotting investment trends and turning points*. New York: McGraw-Hill, 2002. ISBN 9780585069029.

SEBREE, Chet'la. *Understanding the stock market*. New York: Cavendish Square, 2019. ISBN 9781502646071.

SCHANNEP, Jack. *Dow theory for the 21st century: technical indicators for improving your investment results*. Hoboken, N.J.: J. Wiley, c2008. ISBN 9780470240595.

SCHWAGER, Jack D. *Getting started in technical analysis*. New York: John Wiley, c1999. ISBN 978-0471295426.

Thomsett, M. (2006). *Fundamental analysis*. Hoboken, N.J.: J. Wiley and Sons. ISBN 100471754463.

THOMSETT, Michael C. *Candlestick charting: profiting from effective stock chart analysis / Michael C. Thomsett*. Boston: Walter de Gruyter, [2018]. ISBN 9781501515804.

Electronic documents

Advfn.com. (2020). NASDAQ : A-Z Company Listing :. [online] Available at: <https://www.advfn.com/nasdaq/nasdaq.asp> [Accessed 15 Feb. 2020].

Investopedia. (2020). Over-The-Counter Market Definition. [online] Available at: <https://www.investopedia.com/terms/o/over-the-countermarket.asp> [Accessed 14 Feb. 2020].

Investopedia. (2020). London Stock Exchange (LSE). [online] Available at: <https://www.investopedia.com/terms/l/lse.asp> [Accessed 15 Feb. 2020].

Investopedia. (2020). Bottom-Up Investing Definition. [online] Available at: <https://www.investopedia.com/terms/b/bottomupinvesting.asp> [Accessed 14 Feb. 2020].

Investopedia. (2020). How to Use the Dow Theory to Analyze the Market. [online] Available at: <https://www.investopedia.com/terms/d/dowtheory.asp> [Accessed 25 Feb. 2020].

Investopedia. (2020). Line Chart Definition. [online] Available at: <https://www.investopedia.com/terms/l/linechart.asp> [Accessed 25 Feb. 2020].

Investopedia. (2020). Understanding a Candlestick Chart. [online] Available at: <https://www.investopedia.com/trading/candlestick-charting-what-is-it/> [Accessed 25 Feb. 2020].

Investopedia. (2020). Head And Shoulders Pattern. [online] Available at: <https://www.investopedia.com/terms/h/head-shoulders.asp> [Accessed 4 Mar. 2020].

Investopedia. (2020). Gap. [online] Available at: <https://www.investopedia.com/terms/g/gap.asp> [Accessed 6 Mar. 2020].

Investopedia. (2020). Countertrend Strategy Definition. [online] Available at: <https://www.investopedia.com/terms/c/countertrend.asp> [Accessed 6 Mar. 2020].

Investopedia. (2020). Manual Trading Definition and Tactics. [online] Available at: <https://www.investopedia.com/terms/m/manual-trading.asp> [Accessed 5 Mar. 2020].

IG. (2020). The complete guide to trading strategies and styles. [online] Available at: <https://www.ig.com/uk/trading-strategies/the-complete-guide-to-trading-strategies-and-styles-190709> [Accessed 5 Mar. 2020].

Markets, I. (2020). Stock and over-the-counter markets of securities | IFCM. [online] Ifcmarkets.com. Available at: <https://www.ifcmarkets.com/en/about-forex/exchange-and-over-the-counter-markets-of-securities> [Accessed 14 Feb. 2020].

Nyse.com. (2020). NYSE Total Market Cap. [online] Available at: <https://www.nyse.com/market-cap> [Accessed 14 Feb. 2020].

Nyse.com. (2020). Why List or IPO | IPO at the NYSE. [online] Available at: <https://www.nyse.com/why-nyse> [Accessed 14 Feb. 2020].

Stock and over-the-counter markets of securities | IFCM. [online] Ifcmarkets.com. Available at: <https://www.ifcmarkets.com/en/about-forex/exchange-and-over-the-counter-markets-of-securities> [Accessed 14 Feb. 2020].

Statista. (2020). Market value of firms on London Stock Exchange 2015-2019 | Statista. [online] Available at: <https://www.statista.com/statistics/324578/market-value-of-companies-on-the-london-stock-exchange/> [Accessed 14 Feb. 2020].

Xm.com. (2020). Reversal Patterns. [online] Available at: <https://www.xm.com/education/chapter-2/reversal-patterns> [Accessed 4 Mar. 2020].