PORTFOLIO STRUCTURE PLANNING AND ITS FUTURE PRICE FORECASTING MODEL

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Abstract. The research "Portfolio Structure Planning and Its Future Price Forecasting Model" describes methods which can help to evaluate and choose more optimal and effective decisions, linked with participation in the stock market activity. The new forecasting and decision-making model, based on classic and proven earlier methodology, was created. Its aim is to make the decision-making process easier as well as to ease the investment portfolio optimal structure determination. The efficiency of the model was checked on practice and the results of the new model were compared with previous ones in order to check the hypothesis. The main question solved in the research is a problem of making a choice and realization of stock, investment environment and portfolio structure analysis and evaluation. The most popular models and its actualized variants, which are helping stock market participants to improve decision-making process, especially under conditions of instability and risk, are described in this research.

Keywords: technical analysis, fundamental analysis, stock analysis, decision-making models, forecasting models, investment portfolio.

JEL classification: G11, G17.

1. Introduction

Nowadays economic situation turns out to be really unsustainable and difficult to forecast, that is why today's investors and businessman tend to search constantly for the new ways of investing and saving their capital.

Investing has always been a risky business, but not investing – can cause even more harming effect, so people seek for the ways and methods of investing in order to insure their money and capital.

Stock market provides significant opportunities of earning and saving money that is why it has always been considered as an attractive variant for capital placing, even despite the high risk, caused by unpredicted stock quote fluctuations and high volatility.

In order to avoid the mentioned above risk of investment environment rapid changeability, investors use various methods of analysis, forecasting and decision-making, and the most common are fundamental and technical analysis.

Fundamental analysis provides an opportunity to analyze and forecast security price dynamics caused by objective reasons, such as conditions of the macroeconomic environment, sectors of the national economy or the intrinsic value of stock.

The founders of the fundamental analysis are David Dodd and Benjamin Graham, who were first to describe principles of that methodology in their research called "Stock Analysis" in early 1934. But this method is still popular among the investors who prefer it to other forecasting and analysis methods.

Technical analysis – contrariwise, provides an opportunity to analyze and forecast security price dynamics caused by subjective, sometimes even logically inexplicable, reasons, such as mood and expectations of the market participants.

The founder of Technical analysis was Charles Dow, who was first to describe the method of forecasting stock price fluctuations by using historical data and its graphical interpretation. Charles Dow described his method in a "Wall Street" journal in the beginning of the 18th century. Even though this method turns out to be even older, it stays actual and becomes more and more popular nowadays (CEAE 2012). It is used by such successful traders as Larry Williams (Williams 2012).

The aim of the research was to determine which of the described above methods turns out to be more precise and to find the way to combine them into one forecasting and decision-making model in order to get better (more precise) results.

2. Research approaches and analytic techniques

As it was mentioned previously, the research is focused on the forecasting, analysis and decision-making models used in todays' stock market. It

means that it was necessary to collect information about the main methods of security evaluation and analysis, ways of constructing forecasting and decision-making models for investment projects and portfolio structure. It was planned to try already existing classical methods in order to compare the outputs with the results of the new offered model. So before the implementation of different models it was needed to collect some stock exchange data.

During the research were used following information sources: printed scientific literature, stock exchange statistical data, web sites and electronic data. In the research it was gathered information about the stock market evaluation methods, its prose and cons, as well as portfolio structure determination. Were collected various statistics and historical facts, together with the complementary graphics and diagrams in order to reflect all the information and analysis of the situation more visual.

During the research the new stock quote forecasting combined stochastic model was created and tested on the example of selected stocks in order to determine the synergetic effect, caused by the merge of different instruments into one that is being an essence of the developed model. It has been chosen the most effective and efficient variation of the offered model, in order to achieve better and more precise results in stock analysis, its future price forecasting, linked with the investment process decision-making and optimization of the investment portfolio.

Taking into account the specificity of the research it was worthwhile to use such, methods as:

– Monographic method;
– Secondary data analysis;
– Graphical analysis;
– Mathematical analysis;
– Case study method.

3. Generalization of the existing theoretical basis and newly held research review

Experts still debate which of the mentioned above technique (fundamental or technical analysis) is being more scientifically justified and economically effective, but today it is already known, that parallel use of both methods can help to make a more versatile analysis, precise forecast and correct decision.

The main idea of the current research is that combination method of both forecasting and analysis methodologies outperforms the method of its parallel usage.

But it is not just about the combination of instruments and its result comparison in a process of decision-making, it is about the creation of a single combined stochastic model, which will bind together two opposite analysis and forecasting instruments in order to get a positive synergetic effect such as a single more precise forecast – serving as an output of the model.

The purpose of the treatise is the experimental research of some forecasting techniques related to both fundamental and technical analysis in order to work out the more optimal analysis and forecasting algorithm and to create a stock quote forecasting combined stochastic model achieving a positive synergetic effect by simultaneous usage of two different approaches.

The creation of such a methodology will lead to the minimization of the risk, that turns out to be more and more significant nowadays (Cumov 2005) of the forecasting error, easement of the decision-making process, minimization of the role of subjectivity in a decision-making process, more versatile analysis, more precise forecast, more effective investment portfolio structure and maximization of income.

Nowadays it turns out to be really popular to diversify business activities by participating in bidding on a stock exchange. Participation in such a complex process as investment or speculations in a stock market, which represents a mix of the various factors and concentration of different circumstances, is definitely being linked with certain difficulties and risks that make such a business extremely difficult.

A lot of various researches of the stock market mechanisms and its forecasting instruments have been held, but since already 1934 experts argue about which of the two forecasting and analysis methodologies is better: fundamental or technical analysis.

Fundamental analysis is used to examine and evaluate the situation on the stock market through the prism of political decisions, economical processes, financial and credit policy, to analyze such events and processes as capital flows, production and trade dynamics, level of inflation, etc. Fundamental analysis school was funded by the Americans David Dodd and Benjamin Graham in the scientific research "Securities Analysis", which was published in the 1934th .

The second method is technical analysis, which is based on graphical techniques and its mathematical interpretation methods. The first person who discovered the method of forecasting of stock price future volatility based on historical price dynamics and fluctuations was Charles Dow – describing this idea in the "Wall Street" magazine already in the 1790s.

Nowadays exist some researches dedicated to the possibilities of parallel use of fundamental and technical analysis instruments in one decision-making model, which are considered to be more effective and efficient, like Tony Coopers research "Optimal Rotational Strategies, using Combined Technical and Fundamental Analysis" (Cooper, 2011). Despite all known and discovered methods of forecasting and decision-making in the stock market, economists, investors, traders and other experts continue searching some new, more advanced techniques and methodologies.

The research "Portfolio Structure Planning and Its Future Price Forecasting Model" provides solutions for making the stock quote dynamics analysis, forecasting and linked with it decision-making process much easier and precise and offers the ways of optimization of the process of calculation of investment portfolio structure as well. The new offered methodology is based on classical proven methods, which were developed and tested earlier by many scientists and experts.

Described research is being unique and actual because of the innovational approach, which implies not only parallel use of both fundamental and technical analysis instruments, but which also provides an absolutely new way of forecasting and decision-making, by creating a generalizing complex-weighted forecasting model, that helps to make a unified forecast and decision. So the main idea was to create one model which will combine and take into account results of both forecasting and analysis methods.

The new forecasting and decision-making model, is based on classic and proven earlier methodology, and its aim is to make the decision-making process more precise and easier as well as to ease the investment portfolio optimal structure determination.

The efficiency of the model was checked on practice and the results of the new model were compared with previous ones, using classical models, in order to check the hypothesis. The research subject is classical analysis and decision-making models.

During the research the new stock quote forecasting model was created and tested on the example of selected stocks"Johnson & Johnson" USA (JNJ), "Grindex" Latvian (GRD) and "Hoffmann La Roche" Swiss (ROC) enterprise stock price and other financial ratio fluctuation statistics in a period of 10 years) in order to determine the synergetic effect, caused by the merge of different instruments into one, that is being an essence of the developed model.

Has been chosen the most effective and efficient variation of the offered model, in order to achieve better and more precise results in stock analysis, its future price forecasting, linked with the investment process decision-making and optimization of the investment portfolio.

4. Summarization of the Research Analytic Results

After studying the theoretical aspects of creation of forecasting, decision-making and investment portfolios' structures' determining models, described in the theoretical part instruments and methodologies were implemented in practice. In order to analyze and make forecasts were used two types of analysis: fundamental and technical.

During performance of the fundamental analysis were made such steps as (Forex Educational Portal 2012):

– Investment spheres' and environments' evaluation (PwC, 2013), (PwC:Russia, 2013);
– Analysis of enterprise activity and ratios (Semjonova, 2011), (BeInTrend, 2012), (EF, 2012);
– Correlation analysis of macroeconomic factors and stock quote dynamics (WB, 2012), (Latvian Central Statistical Bureau, 2012);
– Regression analysis of macroeconomic factors and stock quote dynamics (Freinats, 2008);
– Single factor forecasting models' implementation.

During performance of the technical analysis were made such steps as (Investment Portal: Technical Analysis, 2013):

– Implementation of the instruments of technical analysis:
– Analysis of the classical graphical shapes;
– Analysis of the moving average dynamics and performance of complex trading rules based on moving averages over longer horizons than those usually considered (Isakov, Marti, 2011);
– Analysis of the Bollinger Bounds (Naiman, 2009);
– Analysis of the CCI oscillator (Kann, 2005), (Investment Portal „Bull&Bear", 2012) was used in order to analyse less volatile markets, because it is known, that technical trading rules are most (least) profitable during the period with the highest (lowest) volatility levels (Kazyra, Lento, 2011);
– Fractal analysis: Hurst coefficient and its interpretation (CTWM, 2012).
– Forecasting models' implementation.

After the analysis of the selected stocks and its dynamics was determined the structure of the investment portfolio, using such method as implementation of the Harry Markowitz model (Markowitz 1952), which results are as following:

- It was offered to buy (so called "Bull" strategy) USA enterprise "Johnson & Johnson" stocks, that weight in the portfolio would be 63%;
- It was offered to buy (so called "Bull" strategy) Swiss enterprise „Hoffmann La Roche" stocks, that weight in the portfolio would be 29%;
- And it was offered to sell (so called "Bear" strategy) Latvian enterprise „Grindex" stocks weight in the portfolio would be 8%.

All the forecasts were made for a year long period (12.2011 – 12.2012) and each of instruments provided its own forecast. The real prices at 12.2012. were as follows (Yahoo 2012), (NASDAQ 2012), (Johnson$Jonhson 2013), (Grindeks, 2013), (Hoffmann-La-Roche 2013), (NASDAQ.OMX Baltics 2012), (Swiss Stock Exchange 2012):

- "Johnson & Johnson" (JNJ) stock price was 70,10 USD;
- „Grindex" (GRD) stock price was 6,55 USD;
- „Hoffmann La Roche" (ROC) stock price was 186,90 USD.

The next step after finishing the analytical part was creation of the generalizing table, which helped to evaluate the preciseness of the forecasts by comparing dispersion – forecasted price deviation from the actual one.

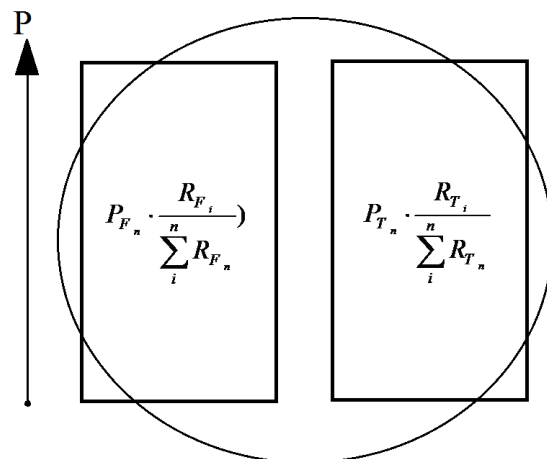**Table 1.** Stock Future Value Forecasts. (source: compiled by author)

Stocks	Forecast [USD]		
	JNJ	**GRD**	**ROC**
Fundamental analysis instruments			
Trend determination by using correlative macroeconomic ratio methodology	74,45	6,59	169,30
Single factor regression forecasting model	67,11	6,55	173,79
Technical analysis instruments			
Analysis of the classical graphical shapes	74,88	7,30	179,19
Analysis of the moving average dynamics	72,56	6,31	179,19
Analysis of the Bollinger Bounds	72,56	6,31	168,78
Fractal analysis: Hurst coefficient and its interpretation	75,15	7,90	194,64

5. Scientifically-practical Experiment, Its Results and Empirical Comparison

The main goal of the research was the creation of unified forecasting and decision-making, combined, stochastic model in order to achieve the positive synergetic effect, which would provide an opportunity of making more precise forecasts, calculating more optimal investment portfolio structure and facilitating the decision-making process by minimizing the influence of the subjective judgments thereby leveling the risk.

The draft of the models' graphical interpretation can be seen on the Fig. 1. Where P stands for "Price" and R is "Forecasting instrument rang". The left part of the model combines different forecasting instruments of the fundamental analysis, but the right side - different forecasting instruments of the technical analysis.

The model in general helps to calculate single forecasted value, which is being more precise than the result of the classical model because of the positive synergetic effect caused by the specific calculated combination of different methodologies. All the formulas can also be seen on Fig.1.

$$\overline{P}_M = 0{,}5 \cdot \left[\sum \left(P_{F_n} \cdot \frac{R_{F_i}}{\sum\limits_i^n R_{F_n}} \right) + \sum \left(P_{T_n} \cdot \frac{R_{T_i}}{\sum\limits_i^n R_{T_n}} \right) \right]$$

Fig. 1. Complex-weighted Forecasting models' general graphical interpretation (source: compiled by author)

The final variant of models' graphical interpretation can be seen on the Fig.2 that explain the calculation of the weights used in the model as well as the determination of the stock quote forecasted future value.

In order to create the mentioned above model, it was crucial to fulfill all of the current steps:

- Ranging of the used forecasting instruments within each of the analysis groups;

– Calculation of scales;
– Creation of the forecasting model and its different variations;
– Model implementation - forecasting;
– Defining the models' optimal variant;
– Calculation of the investment portfolios' structure;
– Comparison and interpretation of the results;
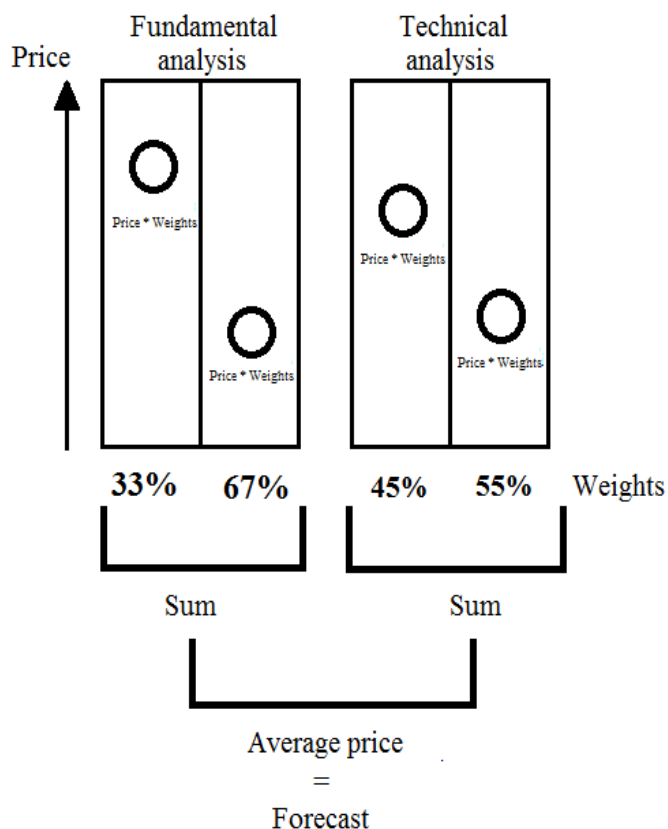– Defining the more effective and efficient methodology;
– Conclusion.

As it was mentioned previously, the first step was to rank all used forecasting and analysis instruments from 1 to n (n = number of instruments and maximal rank). The most precise instrument was ranked with the highest rank n, and the less precise with the lowest rank 1. The results are as following:

Within the group of fundamental analysis instruments rang 1 was assigned to correlation analysis of macroeconomic factors and stock quote dynamics (average forecasting error 5%) and rang 2 – regression analysis of macroeconomic factors and stock quote dynamics (average forecasting error 4%).

Within the group of technical analysis instruments maximal rang 4 was assigned to analysis of the moving average dynamics (average forecasting error 6%); rang 3 – analysis of the classical graphical shapes (average forecasting error 7%); rang 2 - analysis of the Bollinger Bounds (average forecasting error 11% with minimal deviation) and minimal rang 1 – fractal analysis: Hurst coefficient and its interpretation (average forecasting error 11% with high deviation).

It means that both analysis and forecasting techniques will be equally represented in a model, but fundamental analysis may be represented with 2 instruments (correlation analysis of macroeconomic factors and stock quote dynamics with weights 33% and regression analysis of macroeconomic factors and stock quote dynamics with weights 67%) and technical – with 4 instruments (analysis of the moving average dynamics with weights 40%, analysis of the classical graphical shapes 30%, analysis of the Bollinger Bounds 20% and fractal analysis: Hurst coefficient and its interpretation 10%).

But in order to minimize an average forecasting error among the used in the model instruments, it was qualitatively proved that the best complex-weighted forecasting models' variation is following (see Fig.2).

Fig. 2. Final variant of the Complex-weighted Forecasting casting models' graphical interpretation (source: compiled by author)

Using formulas, mentioned in Fig.1. it is possible to make two forecasts by using fundamental or technical analysis techniques and the average value of these forecasts turns out to be an outcome of the model – the final forecast.

Generalizing current results:
– Complex-weighted forecasting model consist of two equal parts. Each parts' weight is 50%, i.e. final forecast will be calculated by using the average method.
– The first part of the model represents fundamental analysis as a technique which allows predicting the future prices by analyzing quotation fluctuations caused by objective factors (for example changes in economical or political environment).
– The second part of the model represents technical analysis as a technique which allows predicting the future prices by analyzing quotation fluctuations caused by subjective factors (for example traders expectations, mood, e.t.c.);
– The first part includes two fundamental analysis forecasting instruments: correlation analysis of macroeconomic factors and stock quote dynamics with weights 33% and regression analysis of macroeconomic

factors and stock quote dynamics with weights 67%;

- The second part includes two technical analysis forecasting instruments: analysis of the moving average dynamics with weights 55% and analysis of the classical graphical shapes 45%;
- Nevertheless both fundamental and technical analysis are considered as equal, technical analysis results turned out to be less precise, that is why the difference of weights is more "smoothed".

After getting the forecasted values for each stock, the structure of the investment portfolio was determined by using special calculating table.

Mentioned investment portfolio structures' determination instrument can be considered more precise than classical ones, because it is based on the results of all previous analysis and forecasting activities.

Generalizing results of the experiment it should be mentioned that:

- "Johnson & Johnson" USA enterprise forecasted future price is 71,46 USD;
- "Hoffmann La Roche" Swiss enterprise forecasted future price is 172,59 USD;
- "Grindex" Latvian enterprise forecasted future price is 6,71 USD.

After the implementation of the investment portfolio structures' calculation table it is offered use a "bullish" strategy regarding all the stocks (unlike it was when classical model was implemented – advising to sell GRD stocks) to create an investment portfolio which will include:

- 47% "Johnson & Johnson" USA enterprise stocks,
- 5% "Grindex" Latvian enterprise stocks,
- 48% "Hoffmann La Roche" Swiss enterprise stocks.

While comparing the results of classical analysis and forecasting methods and new ones – offered in this research, it must be outlined that: if trader will invest 1 000 000 USD, then:

Using classical analysis, forecasting and decision-making methods he will buy 11120 stocks:

- 6961 "Johnson & Johnson" USA enterprise stocks,
- 931 "Grindex" Latvian enterprise stocks and 3228 "Hoffmann La Roche" Swiss enterprise stocks).

Taking into account the real price dynamics – investors income will be 97425,03 USD:

- 31463,12 USD from "Johnson & Johnson" USA enterprise stocks,
- 427,35 USD from "Grindex" Latvian enterprise stocks,

- 65534,56 USD from "Hoffmann La Roche" Swiss enterprise stocks).

If trader would have used only Markowitz models' results then his income would be only 96570,33 USD.

Using the newly developed analysis, forecasting and decision-making methods he will buy 9000 stocks:

- 4237 "Johnson & Johnson" USA enterprise stocks,
- 445 "Grindex" Latvian enterprise stocks,
- 4318 "Hoffmann La Roche" Swiss enterprise stocks).

Taking into account the real price dynamics – investors income will be 107016,32 USD:

- 19151,98 USD from "Johnson & Johnson" USA enterprise stocks,
- 204,07 USD from "Grindex" Latvian enterprise stocks,
- 87660,27 USD from "Hoffmann La Roche" Swiss enterprise stocks).

Comparing the results it can be seen that the newly created methodology is much more efficient (107016,32 - 97425,03 (taking into account previous analysis); = 9591,29 USD 107016,32 - 96570,33 (taking into account only Markowitz models' results) = 10445,99USD) – helping to create more precise forecast and less risky investment portfolio.

6. Conclusions

After completion of the research the optimal variation of the stock quote forecasting combined stochastic model was found and positive synergetic effect, provided by synthesis of different analysis methodologies, was succeeded as the confirmation of the hypothesis.

The research provides solutions for making the stock quote dynamics analysis, forecasting and linked with it decision-making process much easier and precise and offers the ways of optimization of the process of calculation of investment portfolio structure as well. The new offered methodology is based on classical proven methods, which were developed and tested earlier by many scientists and experts.

In the finalizing part of the research, besides the stock quote forecasting combined stochastic model, author introduced:

- An algorithm which will serve as a step-by-step explanation of the quote forecasting combined stochastic models' implementation process;
- Investment portfolio structure defining instrument.

After the implementation of the model and offered additional instruments in real practice it will be easier to get more precise forecasting results as well as optimal structure of the investment portfolio, that will make a decision-making process less complicated, and will lead to the minimization of risks related with this process.

Summarizing the conducted research, acquired qualitative and quantitative analysis results, the following conclusions can be made:

- During the research it was possible to check the proposed hypothesis. The results of the hypothesis testing turned out to be positive, so confirming the hypothesis and in addition demonstrating the logics of regional diversification presumption, even despite the fact that the basic objective of the research were not to create an ideal investment portfolio;
- The analysis confirmed the correctness of the forecasted growth of the selected stock quotes (in a period from the end of the 2011 – till the end of the 2012);
- During the research it was determined that the Markowitz model was much more suitable for current situation than for example mentioned Sharp's or Tobin's models, because Markowitz model can be used for making an investment portfolio consisting from the different region enterprise stocks (JNJ – USA, GRD – Latvia and ROC - Swiss);
- It was proved, that parallel use of different methods turns out to be less efficient and precise than its combining technique;
- The offered in a research working algorithm can help to make a more precise forecast, to ease the decision-making process;
- The author of the research offers to use both: complex-weighted forecasting model and the investment portfolio calculation instrument based on this model. In that case it is possible to make a more lucrative decision;
- The newly created model and working algorithm were implemented in practice and it was proved, that that the newly created methodology is much more efficient, helping to earn more and to risk less (risk minimization and profit maximization);

All in all following recommendations can be offered:

- After the selected "Johnson & Johnson" stock analysis it can be offered to open a "long" (buy) position, because in this case the trend is growing and it is more likely that it will continue its "bullish" tendency. "Johnson & Johnson" stocks are under evaluated, so these stocks can be included into the investment portfolio (of course using hedging and data actualization techniques);
- After the selected "Hoffmann La Roche" stock analysis it can be offered to open a "long" (buy) position, because also in this case the trend is growing and it is more likely that it will continue its "bullish" tendency. "Hoffmann La Roche" stocks are under evaluated, so these stocks can be included into the investment portfolio (of course using hedging and data actualization techniques);
- "Grindex" stocks also are under evaluated, but its future growth comparatively is not so high – only 0,62 USD per stocks. That is why the inclusion of these stocks into investment portfolio should be evaluated accordingly the investors' strategy;
- It is offered to use the new complex-weighted stochastic forecasting model as well as investment portfolio structures' calculation table and offered working step-by-step algorithm;
- It is offered to use in a model following components: fundamental and technical analysis techniques;
- Fundamental analysis techniques which allow predicting the future prices by analyzing quotation fluctuations caused by objective factors will be presented in a model with 33% and 67% weights;
- Technical analysis techniques which allow predicting the future prices by analyzing quotation fluctuations caused by subjective will be presented in a model with with 45% and 55% weights;
- After implementing the investment portfolio structures' determining instrument is can be offered to use following structure: 47% "Johnson & Johnson" USA enterprise stocks, 5% "Grindex" Latvian enterprise stocks and 48% "Hoffmann La Roche" Swiss enterprise stocks.

References

Cooper, T. 2011. *Optimal Rotational Strategies using Combined Technical and Fundamental Analysis* Available from Internet: http://samuelssonsrapport.se/optimal-rotational-strategies-using-combined-technical-and-fundamental-analysis-tony-cooper/

Cumov, D. 2005. *Asset Allocation Based on Shortfall Risk*. Technischen Universitat Chemnitz. 340.

Freinats, L.;Voronova, I. 2008. Methodical Base of the Short-time Investment in the Stock Market, in *5th International Scientific Conference Business and Management* 7.

Grindeks. 2013. Enterprise homepage. http://www.grindeks.lv/lv

Hoffmann – La Roche. 2013. Enterprise homepage. Available from Internet: http://www.roche.com/index.htm#/browse/all

Johnson & Johnson. 2013. Enterprise homepage. Available from Internet: http://www.jnj.com/connect/

Isakov, D.; Marti, D. 2011. Technical Analysis with a Long Term Perspective, *Trading Strategies and Market Timing Ability* 43.

Kozyra, J.; Lento, C. 2011. *Using VIX Data to Enhance Technical Trading Signals*. Available from Internet: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1930018

Markowitz, H. 1952. Portfolio Selection, *The Journal of Finance* 91(7): 77. http://dx.doi.org/10.1111/j.1540-6261.1952.tb01525.x

NASDAQ. 2012. Stock exchange. Available from Internet: http://www.nasdaq.com/

PwC. 2013. Report Forecasts for Pharmaceutical Companies. Available from Internet: http://www.pwc.com/us/en/press-releases/2012/pwc-report-forecasts-a-golden-era.jhtm l

The World Bank. 2012. Database. Available from Internet: http://www.worldbank.org/

Semjonova, N. 2011. Finance Basics. www.ortus.rtu.lv

Yahoo. (2012) Database. Available from Internet: http://finance.yahoo.com/;_ylt=AowscmWXZs.tN ZTDeVxF6bUnv7gF

Kann, M. N. 2005. *Technical Analysis*. 275.

Capital Times Wealth Management (CTWM). 2012. Trend Determination by Using Hurst. Available from Internet: http://www.capital-times.com.ua/index.php?option=com_content&task=view&id=11623&Itemid=88888963

Larry Williams. 2012. The Way to Success and Big. Available from Internet: http://tvoidengy.ru/library/vilams_biography.html

BeInTrend. 2012. Bancrupcy Forecasting Altmans' Model. Available from Internet: http://www.beintrend.ru/z-score-altman

Naiman, E. 2009. *Traider Encyclopedia*. 455.

Center of Economic Analysis and Expertise (CEAE). (2012) Technical Analysis – Historu of Development. Available from Internet: http://www.assessor.ru/forum/index.php?t=525

Economic Faculty (EF). 2012. Finance Analysis. Available from Internet: http://books.efaculty.kiev.ua/finpd/1/r10/

NASDAQ.OMX Baltics. 2012. Stock exchange. Available from Internet: http://www.nasdaqomxbaltic.com/market/?lang=lv

Latvian Central Statistical Bureau. 2012. Available from Internet: www.csb.gov.lv

PwC report forecasts for pharmaceutical companies: Russia. 2013. Available from Internet: http://www.pwc.ru/en/

Swiss Stock Exchange. 2012. Available from Internet: http://www.six-swiss-exchange.com/index_fr.html