

# Investment Planning in the Context of Business Cycle Volatility

Jekaterina Nazarova, *Riga Technical University*

**Abstract** – The presented research describes methods, used to evaluate and choose more efficient solutions, regarding participation in stock market activities. A newly developed forecasting model, based on classically applied and time-proven methodologies, was created. Its aim was to ease the decision-making in the related area as well as to rationalize the optimal investment portfolio structure determination process.

**Keywords** – Technical analysis, fundamental analysis, stock analysis, decision-making models, forecasting models, investment portfolio.

## I. INTRODUCTION

Investing has always been a risky business, but restraining from doing so may cause even greater harm, 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.

Fundamental analysis provides an opportunity to analyse and forecast security price dynamics caused by objective reasons, such as the conditions of macroeconomic environment, sectors of 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 the principles of this methodology in their research called “Stock Analysis” in early 1934. But this method is still popular among the investors who prefer it to other methods of forecasting and analysis.

Technical analysis – contrariwise, provides an opportunity to analyse and forecast security price dynamics caused by subjective, sometimes even logically inexplicable, reasons, such as mood and expectations of 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 the “Wall Street” Journal in the beginning of the 18th century. Even though this method turns out to be even older, it stays topical and becomes more and more popular nowadays. It is used by such successful trader as Larry Williams.

The aim of the research is to determine which of the above described methods delivers more accurate results and to find the way to combine them into one forecasting and decision-making model in order to acquire more accurate results.

## II. METHODOLOGY OF THE RESEARCH

The main idea of the current research is that a methodological combination of both fundamental and technical analysis and forecasting approaches - outperform the method of its’ parallel usage. It does not focus merely on the combination of instruments and comparison of the results in the process of decision-making, it is about the creation of a single combined stochastic model, which binds together two opposite analysis and forecasting instruments in order to get a positive synergetic effect such as 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 a more optimal analysis and forecasting algorithm and to create a combined stochastic model of stock quote forecasting to achieve a positive synergetic effect by simultaneous usage of two different approaches.

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

## III. EXPERIMENTAL MODELLING AND ITS’ ANALYSIS

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

During the performance of fundamental analysis the following steps were taken (Forex Educational Portal, 2012):

- Evaluation of investment sphere and environment 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);
- Implementation of the single factor forecasting model.

When performing the technical analysis two steps were taken (Investment Portal: Technical Analysis, 2013):

1. Implementation of the instruments of technical analysis:

- Analysis of classical graphical shapes;
- Analysis of 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 Bollinger Bounds (Naiman, 2009);
- Analysis of CCI oscillator (Kann, 2005, Investment Portal „Bull&Bear”, 2012) was used in order to analyse less volatile markets, because it is known, that the 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).

2. Implementation of the forecasting model.

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

- There was an offer to buy (so called “Bull” strategy) “Johnson & Johnson” (the USA enterprise) stocks, the share of which in the portfolio would be 63%;
- There was an offer to buy (so called “Bull” strategy) “Hoffmann La Roche” (Swiss enterprise) stocks, the share of which in the portfolio would be 29%;
- And there was an offer to sell (so called “Bear” strategy) “Grindex” (Latvian enterprise) stocks, the share of which in the portfolio would be 8%.

All the forecasts were made for the period of one year (December 2011 – December 2012) and each of the instruments provided its own forecast. The real prices in December 2012 were as follows (Yahoo, 2012, NASDAQ, 2012, Johnson & Johnson, 2013, Grindex, 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.

TABLE I  
STOCK FUTURE VALUE FORECASTS (SOURCE: COMPILED BY AUTHOR)

Stocks	Forecast (USD)		
	JNJ	GRD	ROC
<b>Instruments of Fundamental Analysis</b>			
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

<b>Instruments of Technical Analysis</b>			
Analysis of classical graphical shapes	74.88	7.30	179.19
Analysis of the moving average dynamics	72.56	6.31	179.19
Analysis of Bollinger Bounds	72.56	6.31	168.78
Fractal analysis: Hurst coefficient and its' interpretation	75.15	7.90	194.64

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

Though the main goal of the research was the creation of a unified forecasting and decision-making combined stochastic model in order to achieve 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 levelling the risk.

The draft of graphical interpretation of the model can be seen in Fig. 1, where *P* stands for “Price” and *R* is “Forecasting instrument rank”. 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 the 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 formulas can also be seen in Fig. 1.

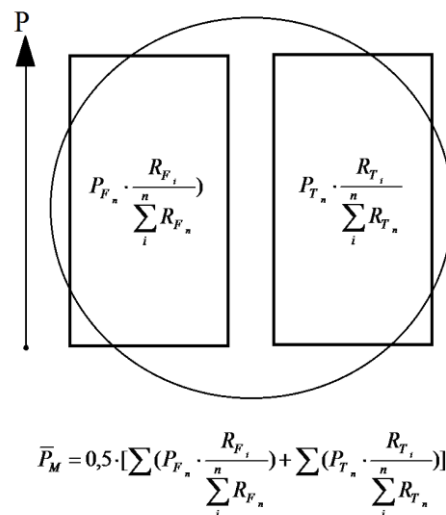


Fig. 1. General graphical interpretation of complex-weighted forecasting model (Source: compiled by author).

The final variant of graphical interpretation of the model can be seen in Fig. 2 which explains the calculation of the weights used in the model as well as the determination of the forecasted future value of stock quote.

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

- Ranging of the used forecasting instruments within each analysis group;
- Calculation of scales;
- Creation of the forecasting model and its different variations;
- Model implementation – forecasting;
- Defining the models' optimal variant;
- Calculation of the investment portfolio 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 were as follows: within the group of fundamental analysis instruments rank 1 was assigned to the correlation analysis of macroeconomic factors and stock quote dynamics (average forecasting error 5%) and rank 2 – to the regression analysis of macroeconomic factors and stock quote dynamics (average forecasting error 4%).

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

It means that both analysis and forecasting techniques are equally represented in the model, but the fundamental analysis may be represented with 2 instruments (correlation analysis of macroeconomic factors and stock quote dynamics with weights 33%; regression analysis of macroeconomic factors and stock quote dynamics with weights 67%) and technical analysis – 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 the average forecasting error among the instruments used in the model, it was qualitatively proved that the best variation of the complex-weighted forecasting model is following (see Fig. 2).

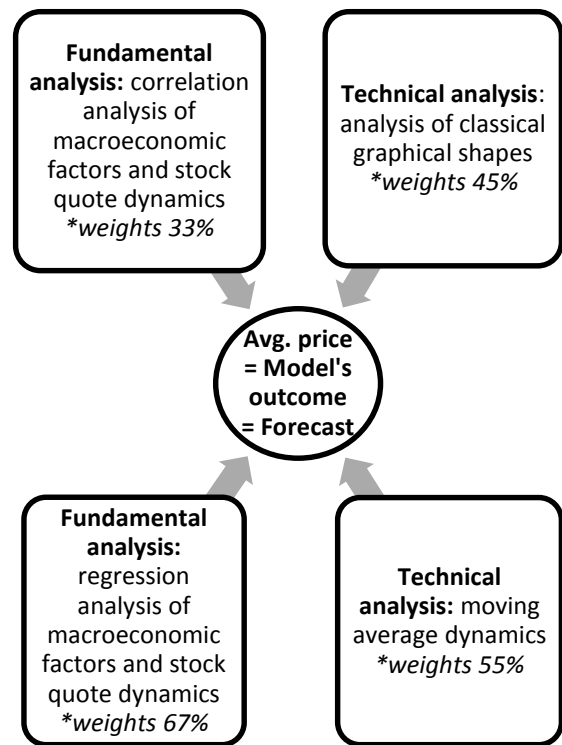


Fig. 2. Final variant of graphical interpretation of complex-weighted forecasting model (Source: compiled by author).

After several improvements, implemented to the model (see Fig. 2), both analysis and forecasting techniques will still be equally represented in the model, however the 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 the technical analysis – also with 2 instruments (analysis of the moving average dynamics with weights 55%, and analysis of classical graphical shapes 45%).

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

Generalization of current results:

- The statistical weights applied for each individual indicator as well as their functional cluster groups were developed by conducting a course of lengthy experimental modelling, employing the multi-factor analysis of the available statistical data and stochastic leveraging techniques, which, while being implemented simultaneously, enable the detection of optimal proportion of the developed indicator set by consistent monitoring of the prevailing relevant empirical trend, with the consequential projection of the revealed tendencies on the defined research objects with the goal of enabling their coherent integration into a unified econometric calculation system, thus ensuring the occurrence of a positive synergetic effect.

- Complex-weighted forecasting model consists of two equal parts. Each part's weight is 50%, i.e. the final forecast is calculated by using the average method.
- The first part of the model represents fundamental analysis as a technique which allows predicting of future prices by analysing the quotation fluctuations caused by objective factors (for example changes in economic or political environment).
- The second part of the model represents technical analysis as a technique which allows predicting the future prices by analysing quotation fluctuations caused by subjective factors (for example traders' expectations, mood, etc.);
- 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 obtaining the forecasted values for each stock, the structure of the investment portfolio was determined by using a special calculating table.

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

Generalizing the results of the experiment it should be mentioned that:

- forecasted future price of the USA enterprise "Johnson & Johnson" is 71.46 USD;
- forecasted future price of Swiss enterprise "Hoffmann La Roche" is 172.59 USD;
- forecasted future price of Latvian enterprise "Grindex" is 6.71 USD.

After the implementation of the calculation table of the investment portfolio structure it is suggested to use the "bull" strategy regarding all the stocks (unlike it was when implementing the classical model – advising to sell GRD stocks) to create an investment portfolio which would include:

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

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

using the classical analysis, forecasting and decision-making methods he will buy 11 120 stocks:

- 6 961 "Johnson & Johnson" (the USA enterprise) stocks;
- 931 "Grindex" (Latvian enterprise) stocks;
- 3 228 "Hoffmann La Roche" (Swiss enterprise) stocks.

Taking into account the real price dynamics the investors income will be 97 425.03 USD:

- 31 463.12 USD from "Johnson & Johnson" (the USA enterprise) stocks;
- 427.35 USD from "Grindex" (Latvian enterprise) stocks;
- 65 534.56 USD from "Hoffmann La Roche" (Swiss enterprise) stocks.

If a trader would have used only Markowitz model's results his income would be only 96570.33 USD.

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

- 4 237 "Johnson & Johnson" (the USA enterprise) stocks;
- 445 "Grindex" (Latvian enterprise) stocks;
- 4 318 "Hoffmann La Roche" (Swiss enterprise) stocks.

Taking into account the real price dynamics - investor's income would be 107016.32 USD:

- 19 151.98 USD from "Johnson & Johnson" (the USA enterprise) stocks;
- 204.07 USD from "Grindex" (Latvian enterprise) stocks;
- 87 660.27 USD from "Hoffmann La Roche" (Swiss enterprise) stocks.

Comparing the results it can be seen that the newly created methodology is much more efficient (107 016.32 – 97 425.03 (taking into account previous analysis results) = 9 591.29 USD; 107 016.32 – 96 570.33 (taking into account only Markowitz model's results) = 10 445.99 USD) which helps to create a more precise forecast and less risky investment portfolio.

#### IV. CONCLUSION

The research provides the solutions for carrying out stock quote dynamics analysis, forecasting and decision-making process rationalization, making it much easier and more precise, while simultaneously providing in practice a verified optimization solution for investment portfolio structuring calculus. The newly offered methodology is based on classically used and time-proven methods, which were developed and tested earlier by various scientists, scholars and experts.

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

- During the research it was possible to verify the proposed hypothesis. The results of the hypothesis testing turned out to be positive, thus confirming the hypothesis and in addition demonstrating the logics of regional diversification presumption, even despite the fact that the basic objective of the research was not to create an ideal investment portfolio;

- The analysis confirmed the correctness of the forecasted growth of the selected stock quotes (in the period from the end of the 2011 – until 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 the Markowitz model can be used for making an investment portfolio consisting of the different region enterprise stocks;
- It was proved, that parallel use of different methods turns out to be less efficient and precise than the combining technique;
- The working algorithm offered in the research can be used to achieve a more precise forecast, thus easing the investment decision-making process.

Concerning the described stock analysis, the following recommendations can be made:

- 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 "bull" 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 stock. That is why the inclusion of these stocks into the investment portfolio should be evaluated accordingly to 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 step-by-step working algorithm;
- It is offered to use the following components in the model: fundamental and technical analysis techniques;
- The fundamental analysis techniques which allow predicting the future prices by analysing the quotation fluctuations caused by objective factors will be presented in the model with weights 33% and 67%;
- The technical analysis techniques which allow predicting the future prices by analysing the quotation fluctuations caused by subjective factors will be presented in the model with weights 45% and 55%;
- After implementing the investment portfolio structures' determining instrument it can be offered to use the following structure: 47% of "Johnson & Johnson" (the USA enterprise) stocks, 5% of "Grindex" (Latvian enterprise) stocks and 48% of "Hoffmann La Roche" (Swiss enterprise) stocks.

## REFERENCES

- Cooper, T. (2011) Optimal Rotational Strategies using Combined Technical and Fundamental Analysis. Retrieved from Samuelssons rapport, <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. 5th International Scientific Conference Business and Management. 7.
- Grindeks (2013). Retrieved from Enterprise homepage. <http://www.grindeks.lv/lv>
- Hoffmann – La Roche (2013). Retrieved from Enterprise homepage. <http://www.roche.com/index.htm#browse/all>
- Johnson & Johnson (2013). Retrieved from Enterprise homepage. <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. <http://dx.doi.org/10.2139/ssrn.1930018>
- Markowitz, H. (1952) Portfolio Selection. *The Journal of Finance*. 91. 7–77. <http://dx.doi.org/10.2307/2975974>
- NASDAQ. (2012) Stock exchange. Retrieved from <http://www.nasdaq.com/>
- PwC. (2013) Report Forecasts for Pharmaceutical Companies. Retrieved from <http://www.pwc.com/us/en/press-releases/2012/pwc-report-forecasts-a-golden-era.jhtml>
- The World Bank. (2012). Retrieved from database. <http://www.worldbank.org/>
- Semjonova, N. (2011) Finance Basics. ). Retrieved from [www.ortus.rtu.lv](http://www.ortus.rtu.lv)
- Yahoo. (2012). Retrieved from Database, [http://finance.yahoo.com/;\\_ylt=AowscmWXZs.tNZTDeVxF6bUnv7gF](http://finance.yahoo.com/;_ylt=AowscmWXZs.tNZTDeVxF6bUnv7gF)
- Kann, M.N. (2005) Technical Analysis. 275.
- Capital Times Wealth Management (CTWM). (2012) Trend Determination by Using Hurst. Retrieved from [http://www.capital-times.com.ua/index.php?option=com\\_content&task=view&id=11623&Itemid=88888963](http://www.capital-times.com.ua/index.php?option=com_content&task=view&id=11623&Itemid=88888963)
- Williams, L. (2012) The Way to Success and Big. Retrieved from [http://tvaidengy.ru/library/vilams\\_biography.html](http://tvaidengy.ru/library/vilams_biography.html)
- BelTrend. (2012) Bancruptcy Forecasting Altman's Model. Retrieved from <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. Retrieved from <http://www.assessor.ru/forum/index.php?t=525>
- Economic Faculty (EF). (2012) Finance Analysis. Retrieved from <http://books.efaculty.kiev.ua/finpd/1/r10/>
- NASDAQ OMX Baltics (2012) Stock exchange. Retrieved from <http://www.nasdaqomxbaltic.com/market/?lang=lv>
- Latvian Central Statistical Bureau (2012). Retrieved from [www.csb.gov.lv](http://www.csb.gov.lv)
- PwC report forecasts for pharmaceutical companies: Russia. (2013). Retrieved from <http://www.pwc.ru/en/>
- Swiss Stock Exchange (2012). Retrieved from [http://www.six-swiss-exchange.com/index\\_fr.html](http://www.six-swiss-exchange.com/index_fr.html)



**Jekaterina Nazarova**, received the degree Mg. oec. with excellence from Riga Technical University where she studied economics from 2011 – 2013.

In 2012/2013 she studied and successfully completed the course at Vrije Universiteit Brussel in Brussels, Belgium.

She has worked at A/S Swedbank as a technical assistant, at SIA Turon as a manager, at SIA Infomedia as an IT project manager.

She is currently an IT process manager within SIA C labse. She is the author of various publications.

She was awarded the Diploma during the International Conference of Young Scientists "Topical issues of rational use of natural resources" in 2012 by the Mining University of St. Petersburg, St. Petersburg, Russia; the Diploma during the RTU 50th Scientific Conference in 2013 by the Riga Technical University, Riga, Latvia.

E-mail: Catherine.Nazarova@gmail.com