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# ASSET PRICING PROBLEMS IN THE BALTIC FINANCIAL MARKETS

Field: Management Science
Sub-field: Business Administration

**Summary of Doctoral Dissertation**

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CONFIRMATION

I hereby confirm that I have written this Doctoral Dissertation which has been submitted for review to Riga Technical University for the promotion to the degree of Doctor of Economics (Dr.oec.). This Dissertation has not been submitted to any other university in order to receive any scientific degree.

Raimonds Lieksnis _____

The Doctoral Dissertation has been written in English. The Dissertation, without appendixes, is presented on 179 pages. The Dissertation consists of the introduction, 5 chapters, conclusions, and proposals; it comprises 22 tables, 43 figures, 42 equations and 6 appendixes. The list of references contains 225 sources of information used to complete the Doctoral Dissertation.

The Doctoral Dissertation and Summary are available at the Scientific Library of Riga Technical University, Kipsalas Street 10, Riga.

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# GENERAL REVIEW

Public financial markets play an important role in today's globalized world. They provide public companies with funds to finance their development and allow both enterprises and individual investors to participate in the business success of public companies by becoming their part owners or creditors as well as to protect their savings from inflation and accumulate money for their pensions. However, the Baltic financial markets lag behind in their development not only if compared to the financial markets of the developed countries, but also in comparison to their peers in Central and Eastern Europe. According to the latest World Bank statistics (World Bank, 2012), the national stock market capitalization as a percentage of GDP in 2011 was only 9.5% for Lithuania, 7.3% for Estonia, and 3.8% for Latvia. However, it was 26.9% for Poland, 17.8% for the Czech Republic, 15.4% for Bulgaria, and 13.4% for Hungary. Scandinavian countries achieved even higher percentages: 87.4% for Sweden, 54% for Denmark, 53.8% for Finland, and 45.1% for Norway. Hence it is important to foster development of the public financial markets in the Baltic States.

Baltic stock exchanges have experienced a period of rapid changes over the last several years. First they were acquired by the Scandinavian OMX Group, which was subsequently taken over by the US giant NASDAQ. The exchanges have become a part of the world's largest stock exchange company - the NASDAQ OMX Group with over 3 700 listed companies. It delivers trading, exchange technology and public company services across the globe. Today all three Baltic stock exchanges and central depositories (except the Central Securities Depository of Lithuania) are majority owned by NASDAQ OMX, creating a single Baltic stock market.

As of December 2012, thirty six Baltic public companies are listed in the Baltic Main list, and forty four companies comprise the Baltic Second list. Fifty five Latvian and Lithuanian government bonds are listed on the government bond fixed income securities list; seventeen bonds are quoted on the corporate bond list. Nevertheless, despite their higher profile, the Baltic exchanges continue to face low turnover and lack of new listings. One of the ways to remedy the backwardness of these markets and increase the popularity of equity investing among both institutions and individuals in the Baltic countries is to research profitable methods for investing in the stocks listed in the Baltic stock exchanges. As many local companies face high business risk, it might be a good idea for them to reduce their

overall riskiness by investing their cash reserves in financial markets, which might provide good returns when a company's profitability is down. This study aims to extend the knowledge about ways to make profitable investments in the Baltic equity markets.

The available research about the demographic trends in the Baltic States indicates the pending misbalance between the number of pensioners and the size of the working age population which will no longer be able to provide funds for their pensions. As a result, employees of Latvian companies need the skills for making profitable investing to accumulate money for their own retirement. They also need to choose the best available pension fund managers to maximize returns from their savings in the funded pension funds that are a component of the mandated state pension scheme. An important source of advice for employees in making this choice is their employer.

Making profitable investments in equity and debt securities requires solving two basic problems – security selection and investment timing. Both companies and individual investors need to know when to enter market and when to stand aside (market timing) and they need to decide which stocks to choose for investing (stock selection). It is especially important for making investments in equity securities.

Both of these investing problems are addressed by the field of finance theory and empirical research known as asset pricing. Asset pricing research aims to establish factors which affect expected returns of stocks and bonds both in a cross-section and time series context. In order to make profit, investors need to know these factors and their importance in the investment decision making. Currently there is a gap in research literature to establish the relevant factors for the Baltic Stock market (BSM) which this dissertation strives to fill.

The third important problem solved by the asset pricing research is the performance evaluation of mutual fund managers. In the Baltic context this is a problem of evaluating managers of second-pillar pension funds in which most Baltic employees have invested though the existing social insurance system which provides for transfer of a part of the mandatory social contributions to the privately managed pension funds. The dissertation addresses this problem as well.

The **goal of the Doctoral Dissertation** is: on the basis of a detailed analysis of asset pricing theories and models used worldwide, their theoretical justification and results of empirical testing, to develop and propose solutions to the main asset pricing problems in the Baltic financial market context and develop methods, which could be used by Latvian companies and individuals to make profitable investing decisions.

The **tasks** to achieve this goal are:

1. Detailed analysis of the main asset pricing theories and models and empirical results of their application in the world financial markets as well as in the Baltic financial market.
2. Choice of the subset of the asset pricing theories and models which might be applicable and useful to solving asset pricing problems pertinent to investors in the Baltic financial markets.
3. Gathering and analysis of information about Baltic public companies, their stock price returns and financial performance indicators, as well the performance of Latvian and Estonian second-pillar pension fund managers.
4. Selection of asset pricing models and developing methods which can be used to forecast time series and cross-sectional returns of stocks listed in the Baltic stock exchanges.
5. Evaluation of the performance of Latvian and Estonian second-pillar pension fund managers (Lithuania was excluded from the analysis due to lack of public fund performance data) using the appropriate asset pricing models and the development of the methodology for their performance evaluation on an ongoing basis.

The **object of the research** is Baltic financial markets, including the second-pillar pension funds, and the asset pricing theories and models, including their applicability to the Baltic financial markets.

The **subject of the research** is the methodological problems of selecting appropriate methods and models for making investing decisions in the Baltic financial markets, as well as the dynamics and interrelations between prices and returns for the Baltic financial assets, and the financial indicators which influence the expected returns of these investment vehicles and hence their attractiveness as high-return, low risk investments by Baltic companies and individual investors.

**The hypothesis of the research:** Asset pricing theories provide tools to make profitable, low risk investments in the Baltic financial market, but only a subset of these theories can be applied to this market.

**The thesis presented for the defense:**

1. The author has proposed classification of asset pricing theories and models in two generations. “Second generation” asset pricing theories, as identified by the author, are more useful and appealing for the investment decision making process than the “first generation” theories.

2. Cross-sectional expected stock returns in the Baltic Stock market (BSM) can be forecasted by the size of the companies measured by their market capitalization and their value as measured by their equity book/market ratio. Stock price momentum is another important factor to explain cross-sectional returns, but it cannot be combined with size and book/market ratio to make profitable investing decisions in the Baltic financial markets, as such a combination reduces returns to investors.
3. A time series momentum or trend following investing strategy like the Trading Range Break approach can be used in the Latvian stock market to achieve returns in excess of the stock market index. Besides, this approach protects companies and individual investors from losing money in the case of an extended bear market. Due to the low liquidity of the Latvian stock market chart pattern analysis cannot be applied.
4. The performance of pension fund managers should be evaluated against a broad composite market index consisting of bank deposit returns and stock market index returns. The Sharpe ratio should be used to evaluate their performance on a risk-adjusted basis.

**Research methods:** empirical research was based on literature analysis, synthesis and the summarization of scientific papers, the econometrical methods described in these papers was used to arrive at the conclusions about asset pricing issues for the US and Western European markets. Generally accepted quantitative and qualitative methods were used, including synthesis, induction and deduction, statistical methods for data analysis and the estimation of parameters, graphical representation and comparison, and expert evaluation methods. These standard methods were adjusted for the realities of the Baltic financial markets which feature small financial data samples and low market liquidity.

**The theoretical and practical methodological basis of the research:** was based on an extensive review of relevant English-language scientific publications in the field of asset pricing written by the most recognized scientists in this field such as the Nobel Prize in Economics laureates Harry Markowitz, William Sharpe, Robert Lucas, Robert Merton, Myron Scholes, Joseph Stiglitz, Daniel Kahneman, Robert Engle, and Edward Prescott; as well as other researchers such as Eugene Fama, Robert Shiller, John Cochrane, and Jeremy Siegel. A comprehensive review of the research performed in the leading Baltic research institutions (Tallinn University of Technology, Estonian Business School, Riga Technical University, University of Latvia, Swedish School of Economics in Riga, Banking Institution of Higher

Education, Vilnius University, Vytautas Magnus University, Vilnius Gediminas Technical University, and Kaunas University of Technology) was undertaken.

**Research restrictions:** research considers theories and models pertinent for only the two main types of publicly traded financial securities: stocks and bonds. It does not consider alternative investments like real estate or private equity and does not address derivative securities like futures and options. Application of financial models to the Baltic financial markets is severely restricted by their shallowness in terms of number of traded securities and low liquidity. Due to the lack of a secondary fixed income market in the Baltics only the Baltic stock market is researched in the empirical part of the Dissertation. As the general approach in Finance is to use many different time periods for analyzing a financial time series and there is no accepted standard for the definition of an investment horizon, the author has referenced asset pricing research using many different time periods, generally longer than ten years. For the Baltic financial market, the researched time period is mainly within the timeframe from 1995 to 2010. There are some minor differences among time periods in the Baltic financial market studies undertaken by the author, but they do not change the overall general conclusions.

**The scientific novelty of the Doctoral Dissertation:** the most relevant novel results presented in the dissertation are the following:

1. The author has researched and critically evaluated the main asset pricing theories and models, proposed their classification in two generations, as well as evaluated their applicability for investing in the Baltic financial market. The author has proposed modifications to these models to be applied in the Baltic financial market.
2. On the basis of analyzed and summarized existing academic research about asset pricing in the Baltic financial market the author has identified gaps in this research to be filled.
3. Using a systematization of analyzed factors which explain cross-sectional expected returns of stocks in the Baltic stock market the author has proposed stock selection methods which should be used by investors to make stock selection decisions for investing in the Baltic stock market.
4. The author has tested the applicability of stock price pattern analysis and stock price trend analysis to make market timing investing decisions in the Baltic stock market, and proposed a trend following investment method applicable for this market.

5. The author has proposed methodology for evaluating the performance of the Latvian and Estonian second-pillar pension fund managers.

**The practical approbation and application of research:** research results have been applied by the author in managing the financial investments of the companies in the Tilde group (SIA Tilde, SIA TVG, SIA Nexum IT in Latvia; Tilde Eesti OU and TVG Eesti OU in Estonia; Tilde IT UAB and TVG UAB in Lithuania) where the author works as a Finance Director since 1998. The author has also advised a number of the more than 180 employees of these firms about managing their pension savings. Research results are also used by author in the Financial Management, Topics of Corporate Finance, and Entrepreneurial Finance courses taught by the author as components of the RTU Riga Business School MBA curriculum. Mr. Lieksnis has been a part-time faculty member and Board member of the Riga Business School since 1998.

**Scientific publications:** the research results have been published in 6 internationally recognized reviewed scientific publications:

1. Lieksnis, R. The Predictive Power of Candlestick Price Patterns in the Baltic Stock Market. Scientific Proceedings of RTU: Economics & Business, Dec 2008, Vol 17, p. 68 - 80. Published by: RTU Publishing House, 2008. ISSN: 1407-7337.
2. Lieksnis, R. Seeking Alpha - Performance of Latvian Second-Level Pension Funds. Scientific Proceedings of RTU: Economics & Business, Jun 2009, Vol 18, p. 41 - 48. Published by: RTU Publishing House, 2009. ISSN: 1407-7337.
3. Lieksnis, R. Evaluating the Financial Performance of Latvian and Estonian Second-Pillar Pension Funds. Research in Economics and Business, 2010, Vol 2, Issue 2, p. 54 -70. Published by Tallinn University of Technology, ISSN: 1736-9126.
4. Lieksnis, R. Multifactor Asset Pricing Analysis of the Baltic Stock Market. Proceedings of the International Conference "The Global Challenges for Economic Theory and Practice in CEE Countries", held in Vilnius, Lithuania, September 16-17, 2010, pp. 233-242. Published by: Vilnius University Publishing House, ISBN: 978-9955-33-594-8.
5. Lieksnis, R. Multifactor Asset Pricing Analysis of the Baltic Stock Market. Ekonomika/Economics, Vol 98, Issue 4 (December 2010), p. 85-95. Published by: Vilnius University Publishing House, ISSN: 1392-1258.
6. Lieksnis, R. Momentum in the Baltic Stock Market. Economics & Management, 2011, Vol. 16, pp 1164 – 1169. Published by: Kaunas University of Technology, ISSN: 1822-6515.

Other scientific publications:

1. Lieksnis, R. Trend Following Strategy for the Baltic Stock Market. Scientific Proceedings of the 49th International Scientific Conference of RTU held in Riga, October 14, 2008, 8 pages. Published by: RTU Publishing House, 2008. ISBN: 978-9984-32-567-5 (CD).
2. Lieksnis, R. Evaluating the Financial Performance of Latvian and Estonian Second-Pillar Pension Funds. Proceedings of 2nd International Conference "Economics of Central and Eastern Europe: Convergence, Opportunities, and

Challenges, held in June 13-15, 2010, Tallinn, Estonia, 7 pages. Published by Tallinn University of Technology, ISBN: 978-9949-430-37-6 (CD).

3. Lieksnis, R. Performance Analysis of Latvian 2nd Level Pension Fund Managers. Conference abstracts of RTU 50th International Scientific Conference, p. 31. Published by: RTU Publishing House, 2009. ISBN: 978-9984-32-173-8.
4. Lieksnis, R. Momentum in the Baltic Stock Market. Program and reviewed abstracts of 16th International Conference "Economics and Management", pp 374-375. Published by: Faculty of Business and Management, Brno University of Technology, Brno, the Czech Republic April 2011. ISBN: 978-80-214-4279-5.
5. Lieksnis, R., Počs, R. Trend Following Investing strategy for the Baltic Stock Market (BSM). Conference abstracts of RTU 49th International Scientific Conference "The Problems of Development of National Economy and Entrepreneurship", pp. 95-96. Published by: RTU Publishing House, 2008. ISBN: 978-9984-32-567-5.

The research results were presented at 5 international and local conferences (in Latvia, Lithuania, Estonia, and the Czech Republic):

1. 49th International Scientific Conference of RTU held in Riga, October 9-13, 2008.
2. 50th International Scientific Conference of RTU held in Riga, October 15-16, 2009.
3. 2nd International Conference "Economics of Central and Eastern Europe: Convergence, Opportunities, and Challenges, organized by Tallinn University of Technology, held in June 13-15, 2010, Tallinn, Estonia.
4. International Conference "The Global Challenges for Economic Theory and Practice in CEE Countries", organized by Vilnius University, held in Vilnius, Lithuania, September 16-17, 2010.
5. 16th International Conference "Economics and Management", organized by Brno University of technology, held in Brno, Czech Republic, April 17-29, 2011.

**Volume and content of the Doctoral Dissertation:** the Doctoral Dissertation, without appendices, is presented on 179 pages. It comprises 22 tables, 43 figures, 42 equations, and 6 appendices. It references 225 sources of information.

**The first chapter** provides an overview and analysis of the process of investing in public securities available in the financial markets. Its main part contains a comprehensive critical analysis of the theories and models of asset pricing outlining the most relevant theories and presenting two generations of thinking in terms of finance theory proposed by the author.

**The second chapter** contains an analysis of the main features of the Baltic financial markets. It also provides a review of the results of existing research on the Baltic financial markets and identifies gaps in this research for further analysis. Some of these gaps are filled in the following chapters, which engage in an empirical analysis of asset pricing models applicable to the Baltic stock market.

**The third chapter** presents the development of a market timing decision method for the Latvian stock market. The applicability of the chart pattern methods of technical analysis

and the trend following trading range break method is analyzed for this market to time entries and exits.

**The fourth chapter** contains the development of a stock selection method for the Baltic stock market considering the main variables used for this decision: a company's capitalization, book-to-market ratio, and its price momentum. In addition to confirming the validity of the Fama-French three-factor model in the Baltics the author researches and compares the applicability of value and growth investing approaches to the Baltic Stock market and develops a method for stock selection.

**The fifth chapter** contains a performance analysis of Latvian and Estonian second-pillar pension fund managers. The research highlights the differences between managers' investing strategies in both countries despite the similar legal framework they face. Research also suggests a methodology to evaluate managers' performance both in terms of outperforming a market index as well as on the risk-adjusted basis.

# MOST RELEVANT SCIENTIFIC RESULTS OF THE RESEARCH

## 1. ASSET PRICING – ANALYSIS OF THEORIES AND EMPIRICAL FINDINGS

After analyzing proposed investing decision-making process summaries by Aswath Damodaran, Campbell Harvey, and Frank Fabozzi, in this chapter of the Dissertation the author proposes the following overview of the investing process as shown in the Figure 1.1.

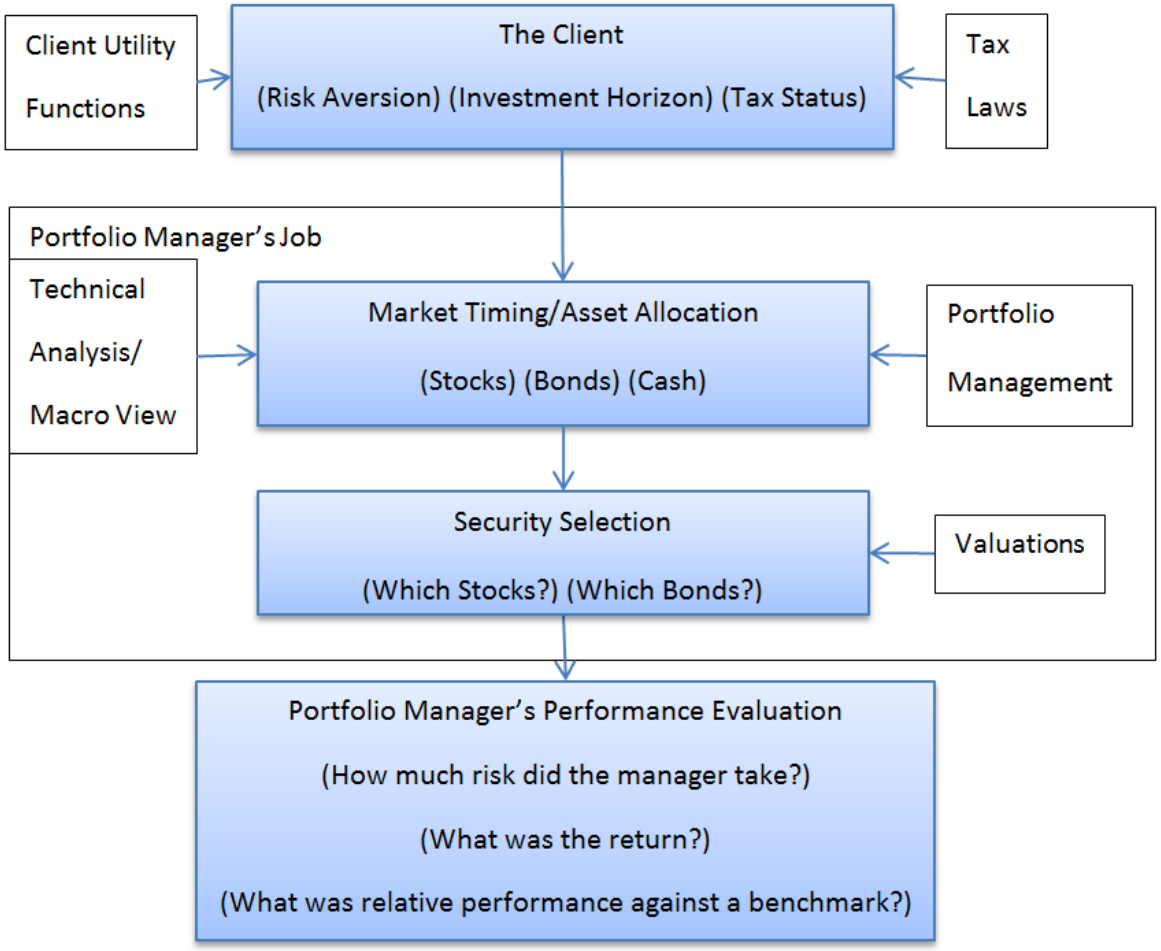


**Figure 1.1 The Investment Process**

*Source: Author's summary*

The process in this chart consists of three steps:

1. Understanding the client, his or her risk preferences and investment horizon;
2. Portfolio construction which again can be divided into two sub-steps: a decision on how to allocate the portfolio across different asset classes; and the asset selection decision, where individual assets are picked for investment and investments are made.
3. Evaluation of portfolio performance: in this step the portfolio manager evaluates how well the investment did – what the risk-adjusted portfolio return was.

From this investing process definition the author formally defines the **main asset pricing problems** which are solved by making the following decisions when making equity investments:

4. Decisions to be made by the active investor who makes the actual decisions himself or herself:
    - Asset allocation decision (portfolio management) and market timing – deciding when to allocate money to investing in stocks, bonds, or other asset classes.
    - Security selection – when the allocation decision has been made, choosing individual securities for investing.
5. Decision to be made by passive investor who delegates these decisions to a money manager – the choice of the manager and the evaluation of his or her performance.

Since its inception in 1950s the area of financial management science known as asset pricing has come a long way and attracted attention from hundreds of researchers all over the world. This research has yielded a sizable number of scientific publications: a recent search in the Ebsco database on the subject of "asset pricing" yielded 4,612 research articles, 3,735 of them published in academic journals. Hence summarizing and analyzing the subject presents a serious challenge and only few authors have tried it. In this chapter of the Dissertation the author reviews the most relevant asset pricing theories and tackles the issue of classifying asset pricing theories by proposing their organization into two groups.

**The efficient market hypothesis (EMH)** is one of the cornerstones of early research in asset pricing. Market efficiency is defined as inability by investors to benefit from all available information about an asset when buying it to achieve profit from its subsequent sale. As a result, *any information about asset price history or other ratios or variables which might explain future returns from investing in this asset is useless when making the asset allocation decision if the EMH holds.* The related **random walk model** of movements in stock prices was developed by Eugene Fama in his Ph.D. thesis (Fama, 1965a) and states that stock market prices evolve according to a random walk and thus cannot be predicted. Randomly evolving stock prices are the necessary consequence of rational investors competing to discover relevant information on which to buy or sell securities before the rest of the market becomes aware of this information.The author concludes that, although mathematically compelling and relatively simple, the random walk model does not describe the actual stock returns which are

to some extent predictable. This predictability might be required to compensate investors for the risk of owning stocks.

When studying the predictability of stock prices and returns, researchers have discovered a number of unexplained asset pricing anomalies or puzzles. In this chapter of the Dissertation the author reviews and evaluates research on these puzzles: the volatility puzzle, the predictability puzzle, and the equity premium puzzle.

Dividend-price ratios as well as other **financial ratios** can be used to predict **annual stock returns**. John Cochrane in the empirical survey on the asset pricing subject (Cochrane, 2005) remarks that "ratios (to price) formed with just about any sensible divisor work about as well, including earnings, book value, and moving averages of past prices". **Macroeconomic variables** are also shown to predict stock returns. An example of such variable is the consumption/wealth ratio *cay* which is calculated as the ratio of log consumption to aggregate wealth. Martin Lettau and Sydney Ludvigson (Lettau & Ludvigson, 2001) show that *cay* performs better than the dividend-price ratio when predicting future returns at shorter time horizons.

An important group of time series models is related to the application of the **technical analysis** of stock price histories to predict the expected returns of stocks and other financial instruments and profit from this forecast. However, opinions about the relevance of the technical analysis and short-term stock price and return predictability remain different for different researchers. John Cochrane concludes (Cochrane, 2005) that "daily, weekly, and monthly stock returns are still close to unpredictable and "technical" systems for predicting such movements are still close to useless after transaction costs". Nevertheless, multiple researchers continue to strive to uncover models and methods to predict both long-term and short-term stock returns. In a recent article Tobias Moskowitz from the University of Chicago and other researchers (Moskowitz, Ooi, & Pedersen, 2012) document significant **time series momentum** in equity index, currency, commodity, and bond futures for returns of each of 58 liquid futures instruments studied. Moskowitz et al. analyze securities returns over previous 12 months and find significant persistence in one to 12 month returns that partially reverses over longer horizons. This novel strategy, in essence, is a reincarnation of the old concept of trend following which forms the basis of technical analysis and is applied by the author to investing in the Baltic equity market – see Chapter 3.3 of the dissertation.

Apart from the market timing decision which takes advantage of the time series predictability models, investors have to choose individual stocks and bonds for their investing. The class of theories and models of asset pricing which helps investors in making

this decision can be generalized as cross-sectional asset pricing domain. **Capital Asset Pricing Model (CAPM)** remains one of the most widely accepted theories in the asset pricing area of modern finance. The model provides a precise prediction of the relationship between the risk of a security and its expected return. The classical, one-factor CAPM postulates that the expected return of any stock depends on its beta or regression slope coefficient against return of the stock market index. It was developed in 1960s by William Sharpe (Sharpe, 1964) and John Lintner (Lintner, 1965). After its development, a number of alternative models have been developed.

Eugene Fama and Kenneth French (Fama & French, 1993) made the most influential empirical study case against one-factor CAPM by showing that there are two other factors which explain the cross-sectional returns of stocks. **The three-factor Fama-French model** assumes that, besides beta, the two other factors that explain cross-sectional returns of stocks are the size of the company (measured by its relative capitalization) and the ratio of its book value of equity to the market value of equity. In Chapter 4.1 of the dissertation a more detailed description of this model and its application to the Baltic stock market is provided.

An alternative to CAPM which considers macroeconomic indicators instead of financial ratios was developed by Stephen Ross in 1976 (Ross, 1976). The **Arbitrage Pricing theory (APT)** relies on the key assumptions that: (1) security returns can be explained by a factor model; (2) there are a sufficient number of securities to diversify away company-specific risk; (3) investors will always take advantage of arbitrage opportunities. An **arbitrage** opportunity arises when an investor can earn risk-free profits without making a net investment, e.g., buying a stock of the same company in one stock exchange and selling short (borrowing and selling the stock) it in another exchange.

All previous theories analyze asset pricing from the point of view of the financial time series. Next the author reviews the alternative view on asset pricing – from the point of view of the human decision maker making investments in the financial markets.

Unlike the classical EMH, which assumes rational investors, the field of **behavioral finance** starts with the assumption that investors might not be rational. In Chapter 18 of (Constantinides, Harris, & Stulz, 2003) Richard Thaler and Nicholas Barberis define the two basic building blocks of behavioral finance as *limits to arbitrage* – an inability of rational investors to correct mispricing of assets in the financial market in the presence and active participation of less rational investors; and the *psychology* of individuals who might act irrationally, committing errors in *information processing (overconfidence, overreaction,*

*anchoring, the representativeness bias)* or having *behavioral biases (prospect theory, framing, regret avoidance)*.

Although many arguments presented by behavioral finance are quite convincing, the author concluded that the main drawback of this theory is that the behavioral explanations of EMH violations do not give guidance as to how to profit from investor irrationality. For investors, the question is still how money to be made from mispricing is, and behavioral finance is largely silent on this point.

**Fixed income securities** are the other main asset class besides stocks which is used by investors to make investments. The size of the global bond market is comparable to the global market for public company stocks. Governments are the main issuers of bonds, thus financing their budget deficits and balancing their budgets. Historically bonds have not provided the best returns to investors either in the US or other countries. Stock returns have exceeded those of bonds both in absolute terms and on a risk-adjusted basis. In this chapter of the dissertation the author provides a brief overview of bond pricing theories. In terms of **pricing** bonds present a much less of a challenge as stocks, as bonds provide fixed payments of coupon interest and principal, risk free in terms of (investment-grade rated) government securities. Bonds issued by risky countries and companies carry an additional risk of default. In the most general case, the value of a bond is calculated as the present value of interest payments and principal repayment, using the bond market yield as a discount rate. Yields for comparable bonds can be calculated from their observed market prices using the internal rate of return equation. The main driver of the bond returns, by far, is the general level of *interest rates* in the economy, which in turn in the most basic case depends on the expectations of future economic activity and inflation. Several yield curve theories are reviewed in the chapter.

After having reviewed the main theories and models which help investors to make market timing and stock selection decisions, in this chapter of the Dissertation the author reviews building a well-diversified portfolio to achieve the investment goals of an active individual or institutional investor or a money manager who manages money for passive individual investors. The main fundamental theory in this domain is **the modern portfolio theory** of asset pricing. One of its central ideas is that all investors should hold diversified securities portfolios rather than invest in individual securities. In this way they achieve higher expected returns with lower risk by eliminating the firm-specific or idiosyncratic risk. An alternative to MPT developed over the recent decade and is known under the name of **Post-Modern Portfolio Theory (PMPT)** – a term which was introduced in the academic community by Brian Rom and Kathleen Ferguson in 1994 (Rom & Ferguson, 1994). An

important element of PMPT is the **Sortino Ratio**, which measures a mutual fund manager's performance by the ratio of the actual rate of return in excess of the investor's target rate of return (*minimum acceptable return or MAR*), per unit of downside risk; or over-performance divided by root-mean-square underperformance. The author reviews the main problems in evaluating the performance of mutual fund managers in general and the second-pillar pension fund managers in Latvia and Estonia in particular in Chapter 5 of the dissertation.

On the basis of the analysis of the relevant theories the author proposes classifying them into two generations and offers his opinion about the real-life investing applicability of the relevant asset pricing theories reviewed in this chapter:

**Table 1.1**

**Generations of Asset Pricing Theories and Their Evaluation by Author**

| **Theory** | **Generation** | **Applicability for making investing decisions in the stock market** |
|---|---|---|
| Efficient Market Hypothesis (EMH) | First | Does not hold true in empirical testing and hence cannot be used for making investment decisions. |
| Random walk model (RW) | First | Simplifies creation of linear mathematical models, which can be used for educational purposes, but mostly cannot be applied to making investment decisions. |
| Volatility puzzle | Second | Cannot directly be used to make investment decisions, but imply mean reversion in stock prices, which may be used for stock market timing. |
| Predictability puzzle, other structural models using financial ratios | Second | Can be applied to make market timing investing decisions in the stock market. |
| The equity premium puzzle | First | Implies long-term superior performance of stocks, which can lead to losses from sharp bear markets. Should not be applied in decision making. |
| Consumption CAPM | First | Empirical evidence indicates that this theory cannot be applied to make investment decisions, as it implies extremely high risk aversion level by investors. |
| Lettau-Livingston cay model, other macro factor models | First | Cannot be applied to investment decisions due to the stale nature and revisions in the explanatory macro variables. |
| GARCH type models | First | Can be applied for option pricing, but cannot be used to predict stock returns. |
| ARMA type models | First | May be used to exploit calendar effects, but importance of these effects has diminished in the stock market. |
| Technical analysis | Second | Methods not recognized by academic community, but widely used by market practitioners. Applicability of these methods implies frequent trading and hence influenced by transaction costs. |
| Modern Portfolio Theory (MPT) | First | Like EMH and RW, makes unrealistic assumptions and cannot be used in real-life decision making. |
| Capital Asset Pricing Model, Arbitrage Pricing Theory | First | Like EMH, RW, and MPT, makes unrealistic assumptions and cannot be used in real-life decision making. |

| | | |
|---|---|---|
| Fama-French 3 Factor Model, value investing framework | Second | Can be applied to making stock selection decisions. |
| Cross-sectional momentum model | Second | Can be applied to making stock selection decisions. |
| Behavioral finance | Second | Can be used to explain behavior of investors in the stock market, but cannot be directly applied to making investing decisions |
| Black-Litterman model | Second | Requires subjective stock return forecasts as inputs, hence its applicability is limited. |
| Post-Modern Portfolio Theory | Second | Can be applied to making stock market timing decisions |

*Source: Author's evaluations*

Building upon the analysis made in this chapter of the dissertation author makes the following **conclusions about asset pricing theories and empirical research results**:

1. The main goal of the asset pricing theory is to help investors in making their investing decisions. Investors need theories and tools to choose the financial assets which provide maximum risk-adjusted returns within their chosen investment horizon.
2. "First generation" asset pricing theories; although intellectually appealing and computationally simple, have a limited usefulness and applicability for making real-life investment decisions.
3. "Second generation" asset pricing theories are more useful and appealing for the decision making process. However, many of them are very new and still being contested and improved. Some of them (like PMPT, and the derivatives pricing models which are out of scope of this dissertation) require an advanced level of calculations and justify "deployment" of a high level of scientific "firepower" (today there are more physics PhDs in the US working in finance than in physics).

Nevertheless, a subset of the "second generation" models and theories can be applied to solving asset pricing problems in the Baltic financial market. In the next chapters of the dissertation author reviews these theories and systematically modifies them for applications in the Baltics.

# 2. BALTIC FINANCIAL MARKETS – MAIN FEATURES AND EMPIRICAL RESEARCH FINDINGS

In order to apply the asset pricing theories, methods, and empirical results analyzed in the previous chapter, it is important to adapt them to the chosen markets for research: the Baltic financial markets. Hence in this chapter the author reviews the historical development of the Baltic financial markets, determines their main features, as well as analyzes the current empirical research results about the Baltic financial markets.

The author concludes that, since the accession of the three Baltic States to the EU, Latvia clearly lags the other two Baltic countries in terms of market turnover and the total equity market capitalization. However, in terms of market returns the performance of the Latvia market mirrors that of the Lithuanian market, with Estonia having a clear lead over the other two markets. Although the Estonian market features a much smaller number of listed companies and lower market capitalization, the higher quality of the listed stocks allows Estonia to outperform Lithuania in terms of equity market returns. Still, for investors who started investing in 1998, all three equity markets have provided positive total returns over the last 14 years. In contrast to the stellar performance of its equity market, Estonia clearly lacks a developed public market for fixed income securities. The author notes that the Estonian securities market as of today does not feature any listed fixed income securities. Although both Latvia and Lithuania feature relatively active fixed income trading in their exchanges, this trading is sustained mostly by auctions and sporadic secondary market trading of their government bonds. The corporate bond market in the Baltics is almost non-existent and extremely illiquid. For example, although there were seven corporate bonds listed in the NASDAQ OMX Riga fixed income market list by five issuers (ABLV Bank, Trasta Komercbanka, former Parex Bank, Acme Corporation, and Moda Kapitals) as of May 2012, only one corporate bond was traded at all in 2011 (Acme Corporation 2-year bond with coupon rate of 6% p.a.) and only 367 of these bonds were traded with total turnover of around 90 thousand EUR.

Before the author continues with an overview of the empirical research of specific asset pricing problems for the Latvian as well as the Baltic securities market, it is important to get a general overview of the **performance of different asset classes in Latvia**. Unfortunately a lack of a free market economy for the better part of the 20$^{th}$ century precludes construction of long-term returns. However, it is still possible to observe real returns for several asset classes over the recent 13 years for Latvian market – see Figure 2.1.

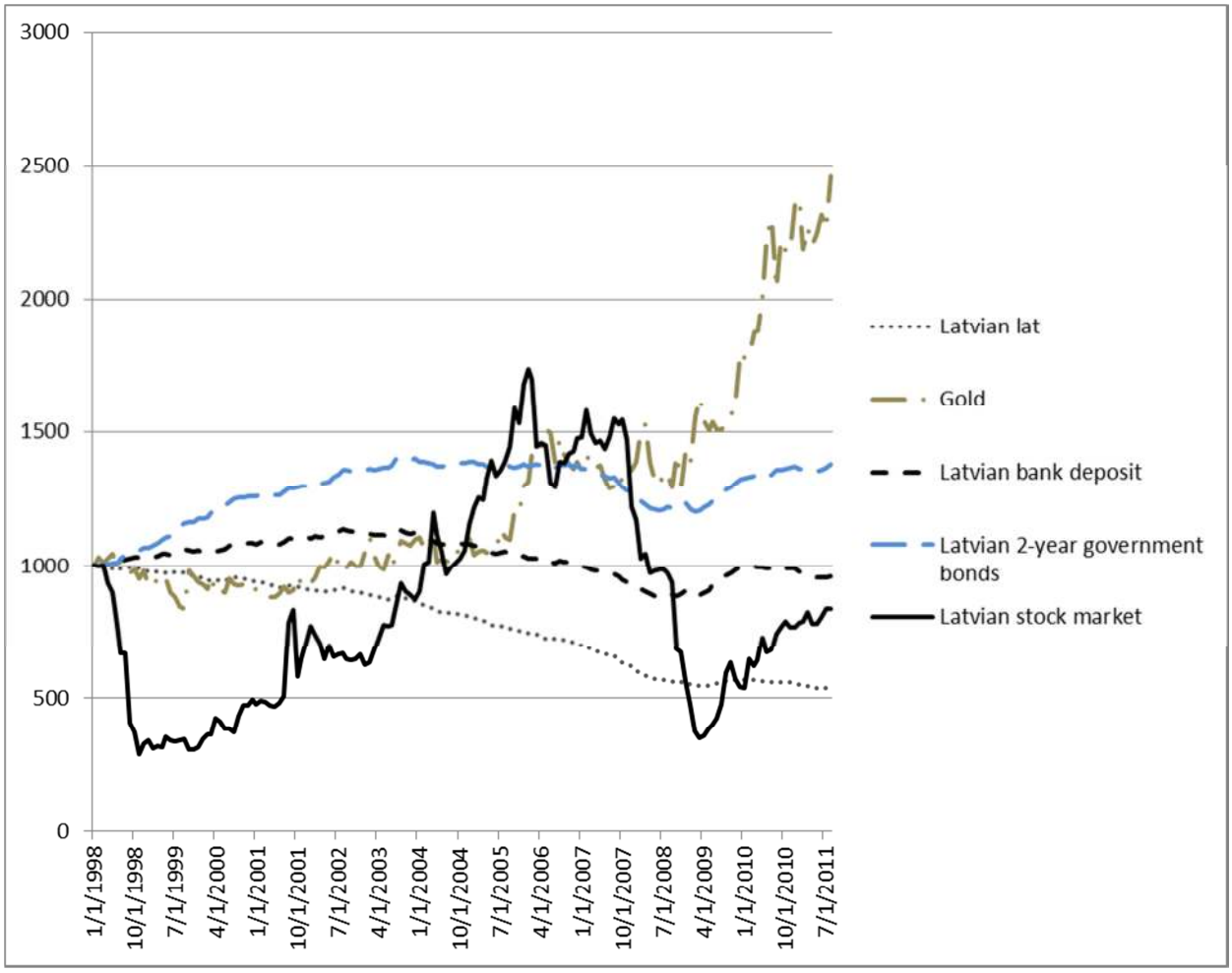


**Figure 2.1 Real Returns on 1,000 Ls Reinvested Monthly, 1998 – 2011**

*Sources: Author's calculations using data from Datastream, Bank of Latvia*
*Notes: All returns are deflated by Latvian HICP CPI. The price of gold price was derived from the Bank of Latvia daily statistics of gold prices in lats. S&P Latvia BMI total return index is used as a proxy for the Latvian stock market return. Latvian lats deposit rates and government bond returns were obtained from Datastream.*

The author concludes from figure 2.1 that only gold and government securities have provided positive real returns to Latvian investors. 1,000 Ls invested in 1998 would have yielded 2,461 Ls if invested in gold, and 1,379 Ls if invested in Latvian government bonds. Bank deposits provided almost no real returns, and the extremely high volatility of the Latvian stock market caused a negative real return for investors in the stock market. This result is in line with findings by Jeremy Siegel who observed that, for short holding periods (2 to 3 years), bonds might provide better returns than stocks (see Chapter 1.1 of the dissertation).

Next the author briefly summarizes the main results and themes of the empirical research on Baltic financial market asset pricing problems. The summary is done along the lines of the overview of relevant asset pricing theories in the previous chapter of the dissertation.

An important topic of research tackled by several researchers is the **Baltic stock market returns in relation to returns of other world stock markets**. The method of choice for this type of analysis is the co-integration test approach. Jurga Stasiukonyte and Asta Vasiliauskaite from Kaunas University of Technology (Stasiukonyte & Vasiliauskaite, 2008) analyzed returns of Baltic and Scandinavian stock market indices for the time period from 2000 to 2006. They concluded that Baltic stock market indices are not co-integrated with Scandinavian indices. The co-integration results were confirmed by Per-Ola Maneschiold (Maneschiold, 2006). Jeo Lee and Geoff Stewart (Lee & Stewart, 2010) who also studied interactions between Baltic and Nordic stock market returns and interactions with US, UK and German stock market indices in terms of volatility spillovers using daily data from September 2001 to 2008. They concluded that there are significant spillovers from Latvian to Estonia stock market returns; from Sweden and Lithuania to Finland and from Denmark to Lithuania. German returns influenced both Nordic and Baltic stock market returns, and US stock market returns influenced only Latvian and Estonian returns.

Some researchers have studied interactions between Baltic and Russian stock market index returns. Petras Dubinskas and Stanislava Stunguriene from Vilnius University (Dubinskas & Stunguriene, 2010) used Granger causality tests to analyze relationships between Baltic and Russian stock markets and concluded that stock index returns for these markets are closely co-integrated. Kurt Braannaas and Albina Soultanaeva (Braannaas & Soultanaeva, 2011) studied capitalization-weighted daily stock price indices of Estonian, Latvian, Lithuanian, Russian, and US markets for time period 2000-2005 using an advanced ARasMA model augmented with asQGARCH model to study interactions between these indices in terms of market news impact. Braanaas and Soultanaeva concluded that for the Riga Stock exchange, neither good nor bad news (market advances and declines) arriving from New York or Moscow has any significant impact. For Tallinn, good news from New York has a positive impact on returns, while bad news from Moscow and New York has a negative impact, and the effect of bad news from abroad is stronger. Good news from Moscow has no significant effect on returns in Vilnius, whereas bad news has a negative impact. News from New York has much smaller effect on the Vilnius stock market.

Using the innovative approach of PMPT (see Chapter 1.7 of the dissertation) Nerijus Mačiulis and Vaiva Lazauskaite (Mačiulis, Lazauskaite, & Bengtsson, 2007) evaluated and compared the performance of three Nordic and three Baltic stock exchanges. Baltic markets clearly outperformed the Nordic markets with Riga and Tallinn stock exchange indices sharing the first place in terms of risk-adjusted performance measured by the expected tail

loss measure. However, unlike their expectations, both traditional and PMPT measures provided similar results in terms of rankings.

Many researchers have tackled the problems of the analyzing and forecasting Baltic stock market returns. The first important research area is the **general statistical parameters and market efficiency research** of the stock market in the Baltics. The studies in this important area have been constrained by lack of returns history for both individuals stocks and market indices. However, early studies appeared already in 2002. Virmantas Kvedaras from Vilnius University and Olivier Basdevant (Kvedaras & Basdevant, 2002) tested the stock market index returns of the Baltic States for the presence of autocorrelation and characteristics of variance ratios and concluded that while Lithuanian and Estonian stock markets are generally efficient, the Latvian stock market, in contrast, is highly inefficient. Kristina Leviškauskaite and Vytautas Jūras from Vytautas Magnus University (Leviškauskaite & Jūras, 2003) tested market efficiency using the prices of individual stocks listed in the three Baltic exchanges from 1998 to 2001 and concluded that stock returns do not follow random walk. Robert Kitt (Kitt, 2003) from Tallinn University of Technology researched the compliance of stock index returns with Hurst exponent characteristic H, indicating persistence in returns and the presence of long-term memory, and general market inefficiency. Gediminas Milieska (Milieska, 2004) analyzed the returns of theLithuanian stock market index for January 2001 – June 2004 and obtained contradictory results: the LITIN-G index appeared to fail the random walk tests using the autocorrelation and runs test procedures, but returns of the other index (LITIN-10) appeared to follow the random walk. Reverse results were obtained using tests for normality of returns distribution. A more elaborate analysis in this area of research was done by two Brazilian researchers (Cajueiro & Tabak, 2006). Using daily closing prices for equity indexes for the Estonian and Latvian stock markets obtained from Bloomberg for time period from 1998 till 2004 they found strong evidence of short-term predictability and long-range dependence with time-varying Hurst exponents.

The next important area of research about the asset pricing problems is the **times series predictability of stock returns** Results for univariate models for predicting these returns in BSM are reviewed in Chapter 3.1 of the dissertation, the other types of time series models reviewed in this chapter. The first relevant study on the factors influencing BSM time series predictability was done by Tiago Mateus from Universita Luigi Bocconi, Italy (Mateus, 2004). Mateus first ran cross-section regression to establish relevant risk factors for monthly stock market index returns for TALSE, DJRSE, and LITIN-G indexes of the BSM from December 1997 through December 2002. The weighted short-term G-7 real interest rate had

the most explanatory power in this regression, and it was the only statistically significant explanatory factor in terms of its p-value – see Table 4 in (Mateus, 2004). Next, Matheus used conditional asset pricing model with this indicator to see if the interest rate has any predictive power for expected returns and obtained a negative result – the predictive power of the real interest rate was not statistically significant. The impact of local macro factors on stock market returns in BSM using the Granger causality tests was performed by Donatas Pilinkus from Kaunas University of Technology. In the first study, together with Vytautas Boguslauskas (Pilinkus & Boguslauskas, 2009), Pilinkus and Boguslauskas analyzed the impact of gross domestic product growth, consumer price index, narrow money supply, unemployment rate, short-term interest rate, and LTLUSD exchange rate. They determined that GDP and money supply have a positive impact on the OMX Vilnius stock market index, and the other four variables exhibit a negative relationship. In the next article (Pilinkus, 2009) Pilinkus examines lead-lag relationships among macro variables and the Lithuanian stock market index. He concludes that some macroeconomic variables (GDP deflator, net exports, foreign direct investment) lead the stock market returns; some other variables (GDP growth, material investment, construction volume index) are being led by the stock market index; and some variables and the stock market returns Granger-cause each other. Rasa Norvaišiene, Jurgita Stankevičiene, and Rytis Krušinskas from Kaunas University of Technology analyzed the impact of leverage variables (Norvaišiene, Stankevičiene, & Krušinskas, 2008). Using a dataset of 76 listed Baltic companies for time period from 2000 to 2006 Norvašiene et al. concluded that there is a negative relationship between leverage and growth rate of companies, i.e., companies with slower growth rate use more debt financing.

The important research area of significance of fundamental financial ratios to forecasting stock returns in BSM is addressed by RTU PhD student Julia Bistrova and RTU Professor Natalja Lāce. In their first article (Bistrova & Lāce, 2009) they analyzed 45 Baltic listed companies which were part of the OMX BBGI stock market index for January 2000 – November 2008 using monthly stock returns downloaded from Bloomberg and fundamental information from company's financial reports. Relationships between fundamental ratios like ROE, debt-equity ratio, PE ratio, and price-to-book ratio, ROIC and stock returns were checked. Bistrova and Professor Lāce determined that it was not possible to achieve superior returns by choosing companies with better financial ratios, with the exception of PE ratio. In their second article (Bistrova & Lāce, 2010) they extended their research to the post-crisis period after 2008 financial crisis and concluded that importance of the other financial ratios increased dramatically and companies with high ROE and low leverage ratios outperformed

the stock market index. Besides, they concluded that liquid stocks achieved superior returns in the BSM. Julia Bistrova's and Professor Natalja Lāce's research results are generally in line with research results by the author of the dissertation about the application of the Fama-French model in particular and value investing in general to the Baltic Stock Market – see Chapter 4.2 of the dissertation.

An important topic of time series forecasting of stock returns is the **forecast models of the stock returns volatility or GARCH type models**. The first researcher to tackle this issue in the context of BSM was Deimante Teresiene from Vilnius University (Teresiene, 2009). Teresiene analyzed the application of various GARCH type models from the GETIP class of models to forecasting volatility of daily returns of the OMX Vilnius main and sector stock market indices and concluded that the best model for forecasting volatility for the main index and most sector indices is the EGARCH(1,1) model. The time period for this analysis was from January 2000 to January 2008. Renata Korsakiene and Rasa Smaliukiene from Vilnius Gediminas Technical University together with Bora Aktan (Aktan, Korsakiene, & Smaliukiene, 2010) used a wider set of GARCH models to predict volatility in the Baltic Stock market. They analyzed daily returns for BSM indexes for February 2002 – January 2009 and concluded that asymmetric EGARCH correctly describes these returns as having a strong leverage effect. The presence of this effect was confirmed by the analysis of the application of GJR-GARCH and APARCH models.

Only one study exists about stock market anomalies in terms of **calendar effects at BSM**. Aleksej Avdejev and Mindaugas Kvekšas from SSE Riga (Avdejev & Kvekšas, 2007) investigated day-of-week and month-of-the-year stock market anomalies using stock market index returns for 2000 – 2007 and found the following. There were positive Tuesday and Friday effects for the Estonian market, positive Tuesday, Thursday, and Friday effects for the Latvian market, and positive Wednesday and negative Monday effects for the Lithuanian market. The author concludes from this research that only the Lithuanian market is subject to the weekend effect. Several researchers have performed **event studies** for the stocks listed in the Baltic stock market. The most important group of event studies is related to earnings announcements and the effect of *post earnings announcement drift (PEAD)*. The first research in this area was done by Kristiana Ķiete and Gediminas Uloza from SSE Riga (Ķiete & Uloza, 2005). Ķiete and Uloza analyzed 203 quarterly earnings announcements for 12 Latvian stock market listed companies and 807 quarterly earnings announcements for 45 Lithuanian stock market listed companies. They observed PEAD which lasted for up to 10 days in the Latvian stock market and 5 days in the Lithuanian stock market. Next the effects of "good"

and “bad” news announcements were analyzed with previous period earnings as a benchmark. The “good” news caused clear upward overreaction on the announcement day in Lithuanian market with a subsequent correction for over one week. The Latvian market absorbed “good” news much more slowly, with positive abnormal returns lasting for about a week. The “bad” news caused an insignificant reaction on the announcement day in both countries, with more significant reaction in the following day for Latvia and some activity implying insider trading before the announcement in Lithuania. Another SSE Riga student – Danelius Stasiulis did a follow-up study (Stasiulis, 2009), generally confirming results of Ķiete and Uloza. Vaida Jazepčikaite from Central European University, Hungary (Jazepčikaite, 2008) performed earnings announcements event studies for all three markets using events for 31 Lithuanian, 11 Latvian, and 9 Estonian publicly listed firms for 2001 - 2007. Jazepčikaite confirmed presence of PEAD with the shortest time with abnormal returns being 5 days for the Latvian market, as well as possible insider trading with buying and selling before the actual announcement. It was possible to make money by buying on the announcement day and holding for the time of abnormal returns. Extensive research in the area of event studies was performed by Laivi Laidroo from Tallinn University of Technology. In his first published article (Laidroo, 2008) Laidroo analyzed a sample of all companies listed in the Baltic stock exchanges for 2000 – 2005 and concluded that 27% of rapid stock price and trading volume change events can be traced to the news announcements, and 15% of events were related to announcements of companies’ financial results. Interestingly, 7% of events could be traced to announcements about the activities of companies’ strategic investors and other owners. In the second article (Laidroo, 2011) Laidroo analyzed the link between market liquidity and the quality of the public disclosure. He concluded that the quality of the disclosure, number and length of announcements, and above average quality of the disclosure for companies listed on the same stock exchange improved liquidity in the following year. Event studies are also a research topic addressed by Asta Klimavičiene from ISM University of Management and Economics, Lithuania (Klimavičiene, 2011). She analyzed the impact of sovereign credit rating announcements by Moody’s, S&P, and Fitch to stock price indices of the Baltic States and determined that there was an asymmetric reaction: the price impact of negative events was several times larger than that of the positive announcements. The announcements of upgrades affect the Latvian market the most, while downgrades affect Estonian market most. Besides, the BSM exhibit the strongest price reaction to announcements by Moody’s.

Another important area of asset pricing research is the analysis of **cross-sectional asset pricing**. The first relevant study on factors influencing cross-sectional returns of BSM

stocks was done by RTU RBS faculty member Anete Pajuste together with Gatis Ķepītis and Peter Hoegfeldt (Pajuste, Ķepītis, & Hoegfeldt, 2000). They analyzed how arbitrage pricing theory (APT) affects the Estonian stock market monthly return forecasting during the time period from 1996 to 1998. Pajuste et al. concluded that local risk factors like exchange rate, foreign reserves, and foreign trade are the most important predictive variables in the context of APT. In his PhD thesis defended in 2007 (Kimmelis, 2007), RTU student Juris Kimmelis applied arbitrage pricing theory (APT) to the Latvian stock market by developing a three-factor linear regression model to forecast stock market returns (using DPS, dividend growth ratio, and GDP growth ratio as prediction variables) and a three factor model to predict companies' returns using ROA, EPS growth, and dividend payout ratio as variables. Kimmelis concluded that the relationships do not seem to be statistically significant. In his PhD thesis defended in 2006 (Kakānis, 2006), University of Latvia student Raivis Kakānis analyzed the applicability of CAPM to Latvian stock market and found it impossible to apply due to a lack of a market index. Besides, he found serial autocorrelation in stock prices over 1-3 month time frame. SSE Riga students Laimonas Devyžis and Gintautas Jankauskas (Devyžis & Jankauskas, 2004) used a sample of liquid publicly traded Eastern European company stocks including 12 from BSM to arrive at variables which influence stock market returns. They concluded that "stocks exhibit momentum, small stocks outperform large stocks and value stocks outperform growth stocks". M/B and P/E ratios were used to distinguish between value and growth stocks. Other Baltic researchers who have analyzed the applicability of cross-sectional asset pricing models to BSM are: Paulius Avižinis and Anete Pajuste (Avižinis & Pajuste, 2007), Vilius Maniušis and Mykantas Urba from SSE Riga (Maniušis & Urba, 2007), as well as Kaia Kivistik and Taavi Mandell from SSE Riga (Kivistik & Mandel, 2010). Their research about Fama-French and momentum models for cross-sectional asset pricing is referenced and analyzed in Chapter 4 of the dissertation.

Although stocks are the most popular financial asset class, the other important asset class besides stocks is **fixed income securities**. Nataļja Točelovska from University of Latvia (Točelovska, 2008) provides an overview of the Latvian fixed income securities market. She segments the market into three parts: government bonds, mortgage bonds (issued by Latvijas Hipotēku un Zemes banka and other Latvian commercial banks), and corporate bonds, and stresses the prevalence of the first segment which comprises 73% of the total fixed income market capitalization. Točelovska considers the market for Latvian government Eurobonds to be the only liquid segment of the Latvian fixed income securities market. In a follow-up article (Točelovska, 2009) Točelovska provides reasons for the underdevelopment of the

Latvian corporate bond fund: inability of Latvian companies to achieve a minimum viable bond offer size of 5 million EUR; and the high average bond flotation costs of 5% of the amount borrowed vs 1.5% cost of obtaining a bank loan.

The main research area in the fixed income asset pricing is their interest rate dynamics, default rates, and yield curves. However, all of these areas can be researched if there is an active market for the fixed income securities and there is information about their market prices and yields. Unfortunately, even the basic information about Baltic fixed income market is not available. There is still no fixed income market index. Still, some researchers have achieved research results even in this difficult environment. Jeļena Zubkova from Bank of Latvia and Ģirts Strautnieks (Zubkova & Strautnieks, 2003) address the application of the most general yield curve theory – expectations hypothesis. They conclude that although strong-form expectation hypothesis can be rejected, it still holds in its weaker form for the yield curve of the Latvian government bonds. Andre Ebner (Ebner, 2009) compares the government Eurobond yield spreads of several CEE countries including Lithuania to the German bund yields and concludes that market-related variables like ECB reference rate and bond market volatility index affect and forecast these spreads, while macroeconomic variables have no impact on the bond spreads.

The final important part of asset pricing research is **portfolio management**. There is only one research article regarding the general mean-variance portfolio optimization in the context of BSM prepared by Marius Bausys from SSE Riga (Bausys, 2009). Bausys uses stocks included in the OMX Baltic Benchmark Index for years 2002 – 2008 to create minimum variance portfolios. After a mean-variance optimized portfolio is created, its performance is compared to the index performance. The resulting portfolio had a 20-30% lower standard deviation without significantly lower returns, which provides an argument for choosing mean-variance optimized portfolios when investing in BSM.

From the analysis done on the main features of the Baltic financial markets and the results of empirical research about their problems the author draws the following conclusions:

1. When comparing the three Baltic public financial markets, the author concludes that Latvia clearly lags the other two countries in its equity market development, and Estonia trails the other countries in terms of the fixed income market development. All three stock markets provided positive nominal returns as of July 2011 for the time period since 1998.
2. An analysis of the performance of different asset classes in Latvia during the last 13 years showed that only gold and Latvian government bonds provided positive

inflation-adjusted returns for investors, with bank deposits yielding near-zero returns. Due to high volatility in recent years, a period of high inflation in Latvia, and the impact of the global financial crisis real returns from owning Latvian stocks have been negative for the time period since 1998 as of July 2011.

3. The problems of the Baltic stock markets are well researched by Baltic researchers, but this research is concentrated only on certain areas: interactions between Baltic and world market returns; basic statistical properties of BSM returns; the impact of macroeconomic variables and company financial ratios on these returns; event studies and PEAD; and application of GARCH-type models for volatility prediction. Some research areas are not covered at all (e.g., behavioral finance), or research has been very limited (e.g., asset pricing puzzles and the related conditional assert pricing models).
4. Despite the relatively large number of studies about the topic, the conclusions about linkages between Baltic and other world stock market returns remain inconclusive. In terms of the general statistical properties BSM research findings generally follow results for other world stock markets. Like in other stock markets around the world, it is difficult to forecast BSM returns using macroeconomic indicators, and BSM companies are generally not valued according to their financial ratios. Event studies indicate presence of PEAD and some possible insider trading. EGARCH is the model of choice to predict volatility of the BSM returns.
5. Research about the fixed income securities markets in Latvia is limited by their low liquidity, lack of market index and reliable price history, and non-existence of the corporate bond market.
6. There is a room for investors to improve performance of their BSM stock portfolios by using the tenants of MPT.

# 3. TIME-SERIES PREDICTABILITY OF THE BALTIC FINANCIAL MARKET RETURNS

After presenting the main features of the Baltic financial markets and the existing empirical research about these markets, in this chapter the author proposes investment methodologies for investing in the Baltic stock markets. The methodologies for fixed income

markets were not considered because of the lack of secondary bond market, as emphasized in the previous chapter of the dissertation. The author concludes from the literature survey in this chapter of the dissertation that there are only a few studies on BSM about forecasting stock returns using only their price histories and applying the tools of technical analysis. Besides classical technical analysis patterns, like double tops and bottoms, head-and-shoulders, wedges, island reversals, etc., which are relatively well researched for American stock, futures, and currency markets, the alternative school of technical analysis refers to the Japanese candlestick chart patterns. Very few scientific studies of profitability of these patterns exist in the financial literature of the Western world and to the author's best knowledge none has been conducted so far on BSM. This, as a result, is the first attempt to analyze the applicability of the candlestick analysis for BSM. Latvian researchers have recognized them as important tools for analyzing the securities markets. Valērijs Praude, Professor in University of Latvia, on p.382, vol. 2 his book (Praude, 2010) provides a brief overview of the main candlestick chart patterns, mentioning them as important tools in technical analysis. Praude reviews seven continuation patterns and seven reversal patterns in the book.

For the **first study** described in this chapter (Lieksnis, 2008a) the author used the stock price history dataset available for download from the NASDAQ OMX Web site (NASDAQ OMX Baltic, 2008). After the initial check it was found out that open prices for all stocks traded at OMX Riga, Vilnius and Tallinn are available only since 1/1/2005, which severely limited the amount of testable data. Opening prices are a crucial aspect in any candlestick pattern and their absence eliminates the possibility of using these methods. The resulting dataset comprised the price history of 69 stocks included in the official and second list, with most stocks having the price history from 1/1/2005 till 1/5/2007. The study has used 38,329 stock price quotes.

In terms of the testable candlestick patterns the testing methodology of Gunduz Carginalp and Heinrich Laurent (Caginalp & Laurent, 1998) was chosen as it can be implemented without using the advanced bootstrapping techniques. Although Carginalp and Laurent use a larger set of data (26,386 price quotes for mutual funds and 265,648 price quotes for S&P 500 stocks), at least for the case of mutual funds the sizes of datasets are comparable. One advantage of the methodology used in the study is that only non-parametric reversal patterns are chosen for testing, so that the analysis avoids curve fitting problems and does not require complex optimization algorithms like genetic programming. The same eight candlestick patterns (4 bullish and 4 bearish) as in the study were used to test their

profitability in BSM: Three White Soldiers (TWS), Three Black Crows (TBC), Three Inside Up (TIU), Three Inside Down (TID), Three Outside Up (TOU), Three Outside Down (TOD), Morning Star (MS), and Evening Star (ES). The search for all eight candlestick patterns was conducted using the dataset described before and it yielded the following results (see Appendix of the Dissertation for the specifics for each stock): TWS occurring in a downtrend – 1 occurrence, TBC in an uptrend – 3, TIU in a downtrend – 3, TID in an uptrend – 38, TOU in a downtrend – 5, TOD in an uptrend – 1, MS in a downtrend – 39, ES in an uptrend – 0. Author concludes that *the only two testable patterns in BSM with sufficient frequency of occurrence are MS and TID*. From the study (Lieksnis, 2008a) author concludes that candlestick technical charting techniques do not create profit opportunities in BSM. Out of eight 3-day reversal patterns only two (Morning Star and Three Inside Down) were present in the considered dataset and they did not increase the probability of reversal. On the contrary, probability seems to have diminished, which might have happened due to the chance in a very small sample of 39 downtrend reversals for Morning Star and 38 uptrend reversals for Three Inside Down tested.

There might be several reasons for this situation. First, for the methodology used in Caginalp and Laurent (Caginalp & Laurent, 1998) the authors estimated the percentage of data points that are either in the uptrend or downtrend to be around 90% for S&P 500 index stock dataset (the study does not present this information directly). For the BSM dataset considered in this study the percentage is only 39%, i.e., BSM stocks spend the majority of time going nowhere due to low liquidity. This precludes reversals from happening as stocks are not trending. Besides, for data points being in the downtrend or uptrend in the S&P 500 stock dataset candlestick reversal patterns occur more than two times more frequently (a 2.5% probability or occurring for S&P 500 versus 1% for BSM).

Further research opportunities exist by increasing the number of tested candlestick chart patterns as it was done by Ben Marshall, Martin Young, and Lawrence Rose (Marshall, Young, & Rose, 2007). Modern bootstrap techniques also might be introduced to improve the testing procedure.

The goal of the author in the **second study** described in this chapter (Lieksnis, 2008b) is to research the possibility of adapting some existing equity investing strategies to the Latvian stock market (LSM). Most of existing strategies like CANSLIM growth investing approach developed by William O'Neil (O'Neil, 1995) for the US equity market or Turtles trend following system developed for the futures market (Faith, 2007) need to be adapted to LSM conditions of low market liquidity and generally low volatility. Analyzing studies

conducted about the applicability of technical analysis to the Latvian and Baltic stock markets, the author is faced with the fact that very few researchers have analyzed this market. A few studies provide contradictory results for profitability of technical analysis rules. A study by Ilja Arslanov and Kristīne Kolosovska (Arslanov & Kolosovska, 2004) analyzed returns from an optimized investment portfolio consisting of 15 stocks traded at BSM. Stock choice and holding period was optimized using genetic algorithms. Results were compared with buy-and-hold returns and stock market index returns. The following technical trading rules were optimized to make buy and sell decisions: moving average crossover, relative strength index, the accumulation/distribution index, the Arms ease of movement indicator. The results did not show statistically significant excess returns from applying technical analysis. However, another study by Timur Mihailov and Dirk Linowski (Mihailov & Linowski, 2002) found such excess returns. It analyzed the Latvian stock market in terms of genetically optimizing investments in the RICI index for the time period from November 1997 to January 2001. The following technical trading rules were optimized: moving average convergence/divergence, relative strength index, stochastic, Arms ease of movement index, and rate of change index. The results showed statistically significant excess returns over buy-and-hold strategy. Chart pattern study by Dmitrijs Dikaņskis and Deniss Kiselovs (Dikanskis & Kiselevs, 2006) tested the head-and-shoulders chart pattern by using fuzzy logic to identify it. The database of 69 stocks listed in the Baltic list (official and second list) of the OMX Baltic stock exchanges with data from 1/1/2000 to 1/1/2006 was used. The results showed statistically significant excess returns over buy-and-hold strategy. Finally, a generic momentum study by Vilius Maniušis and Mykantas Urba (Maniušis & Urba, 2007) based on the methodology used by Narasimhan Jegadeesh and Sheridan Titman (Jegadeesh (Jegadeesh & Titman, 1993) was conducted in 2007. The momentum returns were confirmed for BSM with a look back period of 12 months and an investment period of 3 months with excess returns of 0.5% per month which are more than twice lower than obtained in Jegadeesh and Titman (see Chapter 4.5 of the dissertation for the momentum effect study for the Baltic Stock Market). The study also confirms the presence of 6-month serial autocorrelation in BSM.

The studies on the ability of fundamental analysis to anticipate profitable investment in BSM are related to the application of theories of cross-sectional predictability of stock returns described in Chapter 1.4 of the dissertation. The results of this research for BSM are summarized in Chapters 2.2 and 4 of the dissertation.

As author concludes from the analysis of published research findings in the chapter, sufficient proof exists that using some sort of technical analysis would outperform buy-and-

hold strategy both in the US and Baltic stock markets. The presence of price momentum and serial autocorrelation in stock returns confirms idea that some sort of trend following system can be used for BSM. Although Dikanskis and Kiselevs (Dikanskis & Kiselevs, 2006) confirm the ability of stock price patterns to deliver superior returns, the author considers this a result of curve fitting using elaborate mathematics (fuzzy logic). Besides, previous research presented in this chapter (see Chapter 4.3 of the dissertation) suggests that LSM is too illiquid to create any meaningful short-term profitable chart pattern and the few which are generated do not provide any value to the investor. Lack of short selling services in LSM limits the ability to apply results from Maniušis and Urba (Maniušis & Urba, 2007) and capture a 0.5% monthly excess return from buying winners and selling losers. As a result, the author decided to use Donchian channels which are a part of the classical trend following Turtle system. The popular CANSLIM system also uses breakout entry on cup-and-handle pattern so it serves as an additional confirmation to use this approach.

The original Turtle trading system (Faith, 2007) is optimized for futures markets and uses 20 day look back period to enter and 10 day look back period to exit market on breakouts. A breakout is defined as the price exceeding the high or low of a particular number of days. Thus, a 20-day breakout would be defined as exceeding the high or low of the preceding 20 days. A long position would be opened immediately after the price exceeds a 20-day high and subsequently closed when it falls below a 20-day low. The author concludes that the system provides both entry and exit rules and it is easy to program for back testing and optimization.

The daily stock prices of 11 Latvian company stocks with the highest trading volume in 2007 traded in Riga Stock Exchange were chosen for research (Lieksnis, 2008b) described in this chapter. Realistic brokerage fees of 0.25% of the stock price were used in the analysis (Swedbank charges retail investors a flat 0.35% rate for trading in their electronic platform, SEB applies a variable fee from 0.2% to 0.3% depending on trading volume for similar services). Optimization of the initial trading rules by Amibroker 4.9 software and adjusting its mechanics for end-of-day trading produced the following adjusted investing system (named TRB system further in the text):

1. Buy the next day at Open price if the High price for today exceeds the highest price for the previous 10 trading days;
2. Hold the open position until the Low price for today is lower than the lowest price for the previous 11 trading days, then sell at the Open price the next day;
3. Do not buy if the High price is lower than 0.15 LVL.

Next the TRB system was back tested over the time period from 2001 to 2007 and compared with buy-and-hold investing strategy. In order to compare both strategies, an equal amount of money (10,000 LVL) was invested in each or 11 stocks for buy-and-hold approach and return at the end of holding period as well as quarterly returns were derived. Buy and sell decisions were generated by Amibroker for the proposed system and quarterly and total returns calculated. In order to test the statistical significance of the results, author cannot use t-statistics because stock returns are not normally distributed (Kolmogorov-Smirnov test for the distribution to be different from normal done in SPSS 16 for quarterly returns of Grindex yields test statistic D(27) = 0.195 with p = 0.01 which indicates that distribution is significantly different from normal). The author used the non-parametric test suggested in Field (Field, 2005) – Wilcoxon signed-rank test to compare the mean returns of both strategies. The author derived the following total holding period returns for TRB system:

**Table 3.1**

**Total Returns for TRB System and Buy-and-hold for 2001-2007**

| Stock | TRB | Buy and hold |
|---|---|---|
| BAL1R | 1484% | 800% |
| DPK1R | 150% | 150% |
| GRD1R | 1045% | 1020% |
| GZE1R | 207% | 95% |
| LKB1R | 113% | 160% |
| LME1R | 2226% | 1475% |
| LSC1R | 553% | 306% |
| OLF1R | 761% | 1466% |
| RKB1R | 449% | 289% |
| VNF1R | 345% | 217% |
| VSS1R | 257% | 219% |

*Source: author's calculations*

The author concludes that TRB provides better or similar returns (including transaction costs) than buy and hold for 9 out of 11 stocks. Wilcoxon signed-rank test of these results yields Z = - 1.580 and 2-tailed p = 0.114 so that one-tailed p just about misses the required 0.05 level. However, it is very close to this level and the author concludes that TRB strategy provides significant excess returns when compared to buy and hold.

Next the author analyzes the quarterly returns for each stock and calculates their coefficients of variation (CV) and the statistical significance of their difference. Standard finance theory suggests minimizing CV (standard deviation of returns divided by average returns) as the best strategy for investing. In addition, the author calculates Sharpe Ratios for both investing strategies. The author derives the following results:

**Table 3.2**

**Quarterly Average Returns for TRB System and Buy-and-hold for 2001-2007**

| Stock | TRB average | Buy and hold average return | CV, TRB | CV, buy and hold | SR, TRB | SR, buy and hold |
|---|---|---|---|---|---|---|

| | return | | | | | |
|---|---|---|---|---|---|---|
| BAL1R | 15.4% | 14.6% | 3.07 | 3.5 | **0.29** | 0.26 |
| DPK1R | 4.4% | 6.3% | 3.67 | 4.33 | 0.18 | 0.17 |
| GRD1R | 10.4% | 10.7% | 1.76 | 1.84 | **0.48** | 0.46 |
| GZE1R | 4.9% | 3.2% | 2.94 | 4.07 | **0.23** | 0.13 |
| LKB1R | 7.9% | 9.5% | 2.87 | 2.24 | 0.28 | 0.37 |
| LME1R | 13.7% | 13.3% | 1.58 | 1.98 | **0.56** | 0.45 |
| LSC1R | 9.7% | 8.4% | 1.46 | 2.43 | **0.58** | 0.34 |
| OLF1R | 9.5% | 13.9% | 2.1 | 2.17 | 0.4 | 0.41 |
| RKB1R | 7.7% | 6.9% | 2.33 | 3.06 | **0.34** | 0.25 |
| VNF1R | 6.3% | 5.7% | 2.16 | 3.09 | **0.35** | 0.23 |
| VSS1R | 5.4% | 5.3% | 2.47 | 2.95 | **0.29** | 0.24 |

*Source: author's calculations*

The author concludes that TRB provides smaller or similar CV than buy and hold for 10 out of 11 stocks. Wilcoxon signed-rank test of these results yields Z = - 2.401 and 2-tailed p = 0.016 so that one-tailed p is comfortably below the required 0.05 level. The author also concludes that TRB strategy provides significant excess risk-adjusted returns when compared to buy and hold if risk-adjusted returns are measured by the Sharpe Ratio. Using the average 2-year Latvian government bond yield as a proxy for the risk-free rate, the author also calculates the Sharpe ratios (SR), as shown in Table 3.2. The TRB strategy achieves a higher SR for 8 out of 11 stocks. Finally the author checks the returns of both strategies for 2006-2007 when some stocks experienced losses to see if the TRB strategy will protect us from losing money. The author derives the following results:

**Table 3.3**

**Total Returns for TRB System and Buy-and-hold for 2006-2007**

| Stock | TRB | Buy and hold |
|---|---|---|
| BAL1R | 30% | -28% |
| DPK1R | -46% | -68% |
| GRD1R | -5% | -21% |
| GZE1R | -2% | -28% |
| LKB1R | 14% | 16% |
| LME1R | 78% | 80% |
| LSC1R | 28% | -1% |
| OLF1R | 27% | 18% |
| RKB1R | 13% | -48% |
| VNF1R | -1% | -18% |
| VSS1R | 1% | -50% |

*Source: author's calculations*

Author concludes that the TRB strategy offers effective downside protection – applying this strategy the average return for all 11 stocks for the period is 12% as compared with -14% for buy and hold.

As there is no regular research on the profitability of using fundamental information about companies to gain excess returns in LSM, the author decided to apply a simplified fundamental filter to the proposed TRB investing strategy to see if it changes the resulting performance. Although Devyžis and Jankauskas (Devyžis & Jankauskas, 2004) suggest

preferring the value investing approach, a growth investing filter was applied due to the fact that there are no established benchmarks for LSM to derive optimal BV/MV or P/E ratio for filtering value investing cases. For the growth investing which focuses on the dynamics of company profits rather than value benchmarks it is easy to apply a non-parametric filter. A basic filter that requires a company's quarterly net income to be bigger than the one for the comparable quarter previous year was used. Income statements were acquired from the stock exchange Web site. As applied to the existing TRB entries and exits, only entries at the time when profit was growing were taken. The following results were derived:

**Table 3.4**

**Total Returns for TRB System with and without Fundamental Filter for 2001-2007**

| Stock | TRB | TRB Filtered |
|---|---|---|
| BAL1R | 1484% | 145% |
| DPK1R | 150% | 59% |
| GRD1R | 1045% | 88% |
| GZE1R | 207% | 91% |
| LKB1R | 113% | 119% |
| LME1R | 2226% | 678% |
| LSC1R | 553% | 115% |
| OLF1R | 761% | 169% |
| RKB1R | 449% | 409% |
| VNF1R | 345% | 82% |
| VSS1R | 257% | 223% |

*Source: author's calculations*

The author concludes that requiring company's profit to grow is a not feasible when investing in LSM as such approach would sacrifice a significant portion of returns in a bull market. Except a very small improvement for LKB1R, the fundamental filter significantly reduces total returns for all other stocks.

A literature review suggests that it should be possible to achieve returns superior to buy and hold strategy in the Latvian stock market and our developed trading range break strategy provides such a return both in terms of money earned and risk adjusted returns. The average total return for a 7-year period for the TRB strategy was 690% as compared to a 563% average total return for a buy and hold strategy. The difference was statistically significant both for total returns and benchmark for risk adjusted returns – coefficient of variation. Besides, the TRB strategy protected investors from loss in the difficult 2006-2007 period when many stock prices went down.

Anecdotal evidence suggests that investors choose timing of their investments in LSM based on sentiment and perception about performance of country's economy rather than the performance of individual companies. Together with real estate prices, P/E ratios and market prices for LSM stocks skyrocketed when the Baltic States joined the EU in 2004. Research findings by the author generally uphold this point of view by showing that a simple

fundamental growth investing filter significantly reduces stock returns. As a result, the stated aim of combining both fundamental and technical elements in the investing system was not achieved and the proposed TRB system is a classical technical trading system like the Turtle trend following futures trading system.

Further research might include out-of-sample testing of the results, applying modern bootstrap techniques to test findings, and extending the number of stocks in the dataset. Besides, there remains the important task of finding fundamental variables which are able to improve the investment performance for LSM. Possible candidates would include the M/B and P/E ratios mentioned in Devyžis and Jaunkauskas (Devyžis & Jankauskas, 2004).

The main advantage of the proposed TRB system is the protection provided to Latvian investors from losing money in extended bear markets like those in years 2006 and 2007. The downside of the system is the necessity to analyze stock prices daily or weekly to spot breakouts and possibility to underperform buy and hold strategy in positive years.

It is very important for Baltic companies and individual investors to acquire superior tools for making market timing decisions when investing. These decisions are especially important for the stock market, because the buy-and-hold approach when investing there can lead to inferior performance and investment losses. However, only some tools can be applied in the Baltic and Latvian stock markets due to their extremely low liquidity. Application of the chart pattern technical analysis tools is thus very limited by the low liquidity of BSM and they generally cannot be used. However, longer time frame trend following tools like Trade Range Break method still can be used by investors for making market timing decisions.

The author makes the following conclusions about the choice of market timing tools for the Latvian stock market:

1. Application of chart pattern technical analysis tools like the candlestick patterns is very limited in the Baltic and Latvian stock markets due to their extremely low liquidity with prolonged periods of a choppy price action without clear stock price trends. Comparing results with a benchmark study for the US stock market, the author concludes that the Baltic stock market spends only 39% of time in a clear short-term trend, while there is a clear trend 90% of the time in the US stocks which are included in the S&P 500 stock market index.
2. Applying TRB trend following method to the Latvian stock market helps investors to make the correct market timing decisions. In comparison to a buy-and-hold approach investors achieve higher risk-adjusted returns using the TRB method. However, this improvement is not guaranteed as the higher Sharpe Ratio was

achieved only for 8 of the 11 Latvian stocks researched. Nevertheless, the TRB method saved investors from losing significant amounts of money during the recent market downturn.

3. Latvian stock market investors should rarely pay attention to the financial results of companies when making the market timing decisions. If it is required that a company's net income should grow in previous quarter before making an entry, the resulting investing profits go down significantly. This finding is in line with the research results by Julia Bistrova and Professor Natalja Lāce in (Bistrova & Lāce, 2009).

# 4. FACTORS EXPLAINING CROSS-SECTIONAL EXPECTED RETURNS IN THE BALTIC FINANCIAL MARKETS

As mentioned in the Chapter 1 of the dissertation, a number of theories help investors to make investing decisions in the stock market. In this chapter of the dissertation the author reviews and applies the most important "second generation" theory for making stock selection decisions - the Fama-French model. This model uses size and value - together with the general riskiness of a security in the well diversified stock portfolio measured by its Beta – in making this investing decision. Eugene Fama and Kenneth French (Fama & French, 1993) proposed to measure the size factor in each period as the differential return on small capitalization firms versus large capitalization firms. This factor is usually called SMB (for "small minus big"). Similarly, the other factor is typically measured as the return on firms with high book-to-market ratios minus that on firms with low ratios, or HML (for "high minus low"). Therefore, the Fama-French three-factor asset pricing model can be specified as:

$$r_{jt} = \alpha_j + \beta_j r_{mt} + s_j SMB_t + h_j HML_t + u_{jt}, \quad t = 1,2,\ldots, T \tag{4.1}$$

where: SMB and HML - returns on value-weighted, zero-investment, factor-mimicking portfolios for capitalization and book-to-market ratio,

$r_{jt}$ - portfolio excess returns over the risk-free rate,

$r_{mt}$ – excess return of the stock market index.

Unfortunately the application of this model to the Baltic Stock Market has not been studied sufficiently. There are only two published studies which deal with Fama-French factors in the Baltic stock market context. Esmeralda Lyn and Edward Zychowitz (Lyn &

Zychowitz, 2004) analyzed the monthly total returns of the stock market indices of 13 East European markets including those in the Baltic States in relation to their market beta against a world equity index, liquidity measure (market turnover divided by market capitalization), market average earnings-to-price ratio, market average book-to-market ratio, as well as average dividend yield in each market. The results showed a statistically significant beta for the book-to-market ratio. The study did not implement cross-sectional factor analysis for individual countries or securities. Laimonas Devyžis and Gintautas Jankauskas from SSE Riga (Devyžis & Jankauskas, 2004) collected a sample of stocks and their returns with a minimum market capitalization of 50 million USD from Central and Eastern Europe to include only companies which are recognized by international investors. Only one Latvian, 8 Lithuanian, and 3 Estonian companies made it into this sample. Weekly prices from January 1998 to October 2003 were used. Multivariate regression was calculated with market-to-book ratio, P/E ratio, trading frequency measure, share turnover velocity measure, and market capitalization as independent variables. The chosen model lacked a stock market index as an important factor in the standard factor model specifications and hence the obtained results were not statistically significant and regression $R^2$ did not exceed 5%. However, Devyžis and Jankauskas showed the economic significance of the book-to-market factor by comparing two portfolios – one portfolio was rebalanced each quarter by including 10 companies with the highest ratios in this portfolio the other – with the same number of companies with the lowest ratios. Companies with the highest book-to-markets ratios (value stocks) outperformed the other portfolio by achieving many times the return of the latter over the reference period. The author concludes that neither of the studies addresses the applicability of the Fama-French three-factor model to the Baltic stock market, and the aim of this study is to fill this gap in the financial research on the Baltic financial markets.

For the **first study** presented in this chapter (Lieksnis, 2010b) the capitalization and book values as well as monthly stock prices of up to 8 Latvian, 13 Estonian, and 27 Lithuanian companies with acceptable liquidity (measured by the minimum number of stock sales transactions of 600 transactions per year) for the time period from June 2002 to February 2010 were obtained from the NASDAQ OMX Web site (NASDAQ OMX Baltic, 2010). Financial companies were excluded from the sample in line with Eugene Fama and Kenneth French (Fama & French, 1993). Table 4.1 summarizes the descriptive statistics of the collected sample in comparison to the sample used in the emerging markets study by Christopher Barry et al. (Barry, Goldreyer, Lockwood, & Rodriguez, 2001). In order to compare capitalizations, statistics for the Baltic stock markets were converted from EUR to

USD using the average exchange rate over the reference period. As the author concludes from the table, the sample of Baltic stocks used for this study does not contain extreme values in terms of book-to-market ratios, unlike the sample used in the study by Barry et al. The sample used in this study is also comparable with samples for other Eastern European countries in terms of company capitalizations, with average capitalization for Baltic States being comparable to such countries as the Czech Republic and Slovakia. Comparable book-to-market and capitalization figures for the Baltic stock market sample were achieved by filtering out extremely illiquid stocks with few trades and thus avoiding a nontrading bias in the subsequent cross-sectional regression analysis. The **nontrading bias** (as defined in (Damodaran, 2002) p. 187) arises because the returns in nontrading periods are zero (even though the market may have moved up or down significantly in those periods). Using these nontrading period returns in the CAPM-type model regression analysis reduces the correlation between stock returns and factor returns and betas for the analyzed factors. Removing illiquid stocks from the sample allows controlling for this bias.

**Table 4.1**

**Descriptive Statistics for Baltic and Eastern European Stock Markets**

| Market | Average BE/ME | Min BE/ME | Max BE/ME | Average cap, million $ | Min cap, million $ | Max cap, million $ |
|---|---|---|---|---|---|---|
| Baltics | 1.44 | 0.14 | 11.19 | 151.35 | 1.00 | 1,291.58 |
| Czech Rep | 2.14 | (0.26) | 33.33 | 198.24 | 0.38 | 5,111.53 |
| Greece | 0.53 | 0.00 | 6.25 | 530.03 | 6.04 | 15,162.81 |
| Hungary | 0.85 | 0.08 | 5.56 | 387.51 | 2.54 | 9,643.34 |
| Poland | 0.7 | 0.04 | 7.69 | 310.22 | 5.04 | 12,815.11 |
| Portugal | 0.76 | 0.00 | 8.33 | 526.70 | 5.57 | 15,785.15 |
| Russia | 7.23 | 0.01 | 100 | 1,481.01 | 2.92 | 35,307.54 |
| Slovakia | 3.88 | (33.33) | 50 | 60.01 | 0.47 | 552.39 |
| Turkey | 0.4 | (0.11) | 5.88 | 559.21 | 1.55 | 15,392.49 |

*Source: (Barry, Goldreyer, Lockwood, & Rodriguez, 2001), author's calculations for Baltics*

In line with the reference study by James Davis, Eugene Fama and Kenneth French (Davis, Fama, & French, 2000) four portfolios were created: high book-to-market ratio, big capitalization companies (BH portfolio), high book-to-market ratio, small capitalization companies (SH portfolio), low book-to-market ratio, big capitalization companies (BL portfolio), and low book-to-market ratio, small capitalization companies (SL portfolio). Sorting was done using the median capitalization and book-to-market ratio as a cut-off variable. Portfolios were rebalanced each June in line with their book value and capitalization at the end of the previous year (an older capitalization number than one used in the reference study was used here because only the annual figures were available from the NASDAQ OMX Web site). The size premium, SMB, is constructed as the difference in returns between the small and the big capitalization stock portfolios, and HML in each period is the difference

between the high and the low book-to-market ratio stock portfolios. Table in Appendix of the dissertation summarizes the sample of companies included in the four portfolios (the reference year is the year the portfolio was established, i.e., year 2002 portfolios are formed from sorting results in June 2002 and stay active until May 2003). The pool of companies in the first year is very small, which is explained by a lack of company annual reports in the exchange Web site for this period. As time progresses, more companies are listed and more reports become available. Regression analysis was performed with OMX Baltic Benchmark index serving as a proxy for the stock market index. The Euro Overnight Index Average rate or EONIA rate was chosen as a proxy for the risk-free rate. It is computed with the help of the European Central Bank as a weighted average of all overnight unsecured lending transactions undertaken in the interbank market, initiated within the euro area by the contributing banks. The regression results are summarized in Table 4.2.

**Table 4.2**

**Results of Three-Factor Regressions for the Baltic Stock Market, 2002-2009**

| Portfolio | Average excess return | Alpha$_j$, (t-stats) | Beta$_j$, (t-stats) | $s_j$, (t-stats) | $h_j$, (t-stats) | $R^2$ |
|---|---|---|---|---|---|---|
| SL | -0.58 | **-1.17 (-3.07)** | **0.92 (21.16)** | **0.70 (11.16)** | **-0.39 (-6.46)** | 0.88 |
| SH | 1.77 | -0.76 (-1.71) | **0.95 (18.58)** | **0.87 (11.7)** | **0.80 (11.37)** | 0.86 |
| BL | -0.54 | **-0.98 (-2.12)** | **0.95 (18.63)** | -0.13 (-1.76) | **-0.21 (-2.94)** | 0.82 |
| BH | 1.44 | **-1.17 (-3.07)** | **0.92 (21.16)** | **-0.30 (-4.67)** | **0.61 (10.29)** | 0.85 |

*Source: author's calculations*

The author concludes from Table 4.2 that all the book-to-market ratio and market index related slope coefficients are statistically significant at the 5% level of significance (marked in bold), but only three of four size-related slope coefficients are statistically significant. In line with Davis et al (Davis, Fama, & French, 2000) there are some statistically significant (three of four) intercepts. The regression $R^2$ is smaller than in the reference study, which can be explained by shorter time period of available returns and smaller number of stocks. Small, high book-to-market ratio company portfolio (SH) produced the highest average returns of 1.44% per month. The overall return impact of the value investing is much more pronounced in the Baltic case in comparison with the US stock market, as investors who chose to invest in the low book-to-market ratio companies, lost money in the reference period, as evidenced by negative average excess returns for portfolios BL and SL in Table 4.2.

The three-factor Fama-French asset pricing model is fully applicable to the Baltic stock market. Investors should regularly follow book-to-market ratios and the relative capitalization of companies to make profitable investments in stocks, rebalancing their

portfolios at least once per year. The table in the Appendix of the dissertation shows that only three companies (Linas, Ditton Pievadķēžu Rūpnīca, and Latvijas Balzams, marked bold) were part of the winning SH portfolio in all portfolio rebalancing instances. The study controlled for nontrading bias, but did not control for the survivorship bias as no information was available about the delisted companies in the OMX Web site.

The most profitable choice for BSM investors during 2002-2009 time periods was small capitalization companies with relatively high book-to-market ratios. As shown in Figure 4.1, 10,000 EUR invested in June 2002 in each of the four portfolios yielded completely different amounts in February 2010: SH – 31,002 EUR, BH - 12,023 EUR, BL – 3,685 EUR, SL – 3,614 EUR. Only investors who invested in small value stocks with high book-to-market ratios (SH portfolio) made money in this time period and managed to outperform the market index (OMXB). The portfolio of big value stocks (BH) did as well as the market index, but the two portfolios containing small and big growth stocks with low book-to-market ratios (BL and SL) significantly underperformed the market.

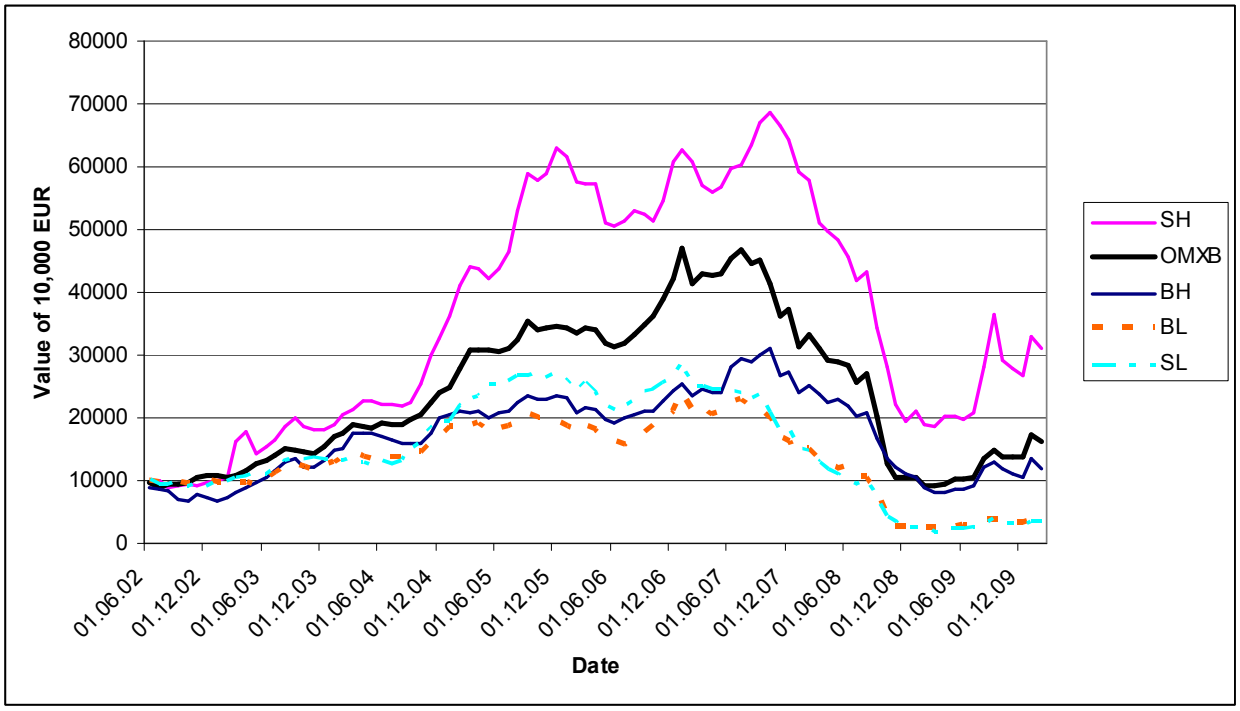


**Figure 4.1 Value of 10,000 EUR Invested in June 2002, Four Factor Portfolios and Stock Market Index Portfolio**

*Source: author's calculations*

Stock price momentum is another important variable which is shown to explain cross-sectional expected returns of stocks. It was introduced by Narasimhan Jegadeesh and Sheridan Titman (Jegadeesh & Titman, 1993). Jegadeesh and Titman concluded that zero-cost winners-minus-losers portfolio selected on the basis of their past 6 month performance realized

compounded excess returns averaging 1% per month. In a follow-up study, Eugene Fama and Keeneth French (Fama & French, 1996) concluded that the momentum effect cannot be explained by the three Fama-French factors. They analyzed monthly US stock returns for the years 1966 to 1996 sorting stocks into 10 portfolios each month according to their past short-term and long term returns. The difference between average monthly returns for the first and tenth decile with a 12-month look-back was 1.31%. Each of ten momentum time series was then regressed against the three Fama-French factors. The regression intercepts were strongly negative for short-term losers and strongly positive for short-term winners indicating strong explanatory power of the momentum factor. Geert Rouwenhorst (Rouwenhorst, 1998) confirmed the existence of the momentum effect in Western European stock markets by researching stock prices of 12 countries for 1978 to 1995 and finding the average 1% monthly outperformance in line with findings of Jegadeesh and Titman for the US market. Rouwenhorst (Rouwenhorst, 1999) also analyzed momentum effect in 20 emerging markets for years 1982 to 1997 generally confirming its presence. From twenty analyzed markets only in six of them there was statistically significant momentum effect.

Although value and momentum are the two most significant variables to explain cross-sectional returns of stocks, a few researchers have investigated interaction between these variables, i.e., if both of them should be used at the same time to choose the best stocks for investment. One such investigation was done by ex-CEO of Goldman Sachs Clifford Asness (Asness, 1997). Asness used a monthly dataset of all public US companies that traded in the major US stock exchanges from July 1963 through December 1994. Portfolios were created by independently sorting all stocks into five portfolios depending on their 12-month return momentum and book/market ratio creating two sets of five portfolios and then combining sort results creating 25 portfolios. The winner momentum portfolio had an average monthly return of 1.48%, and value portfolio of high B/M ratio stocks produced return of 1.36%. High B/M ratio, momentum loser (HL) portfolio produced average monthly return of 0.03%; high B/M ratio, momentum loser (HW) portfolio yielded 1.5%; low B/M ratio, momentum loser (LL) portfolio yielded 1% and low B/M ratio, momentum winner (LW) portfolio yielded 1.62%. The author concludes that combining both strategies produced only marginal improvements in the average returns. The winner portfolio yielded the same returns as HW portfolio and adding the momentum sort increased value portfolio return from 1.36% to 1.5%. Asness concluded that both variables were negatively correlated. Value strategies failed for companies with strong momentum and momentum strategies worked only for growth stocks with low B/M ratio. Asness did not include company size and stock beta in the analysis thus

failing to test the complete Fama-French three factor model in terms of its interaction with stock price momentum.

Validity of the Fama-French three factor model to explain cross-section returns of stocks traded in the Baltic Stock Market (BSM) was confirmed earlier in this chapter. Three studies analyzed presence of the momentum effect in the CEE and Baltic stock markets. Paulius Avižinis from SSE Riga and Anete Pajuste, Professor at RTU RBS (Avižinis & Pajuste, 2007) studied a sample of stock market returns for 7 CEE countries: the Baltic States, Poland, Slovenia, Hungary, and Croatia for time period from January 2002 to December 2006 using the methodology of Jegadeesh and Titman (Jegadeesh & Titman, 1993). The most pronounced momentum effect was found for the 6 months of portfolio formation and 6 months for subsequent abnormal returns with an average monthly return of 3% for winner-minus-loser portfolio. Vilius Maniušis and Mykantas Urba from SSE Riga (Maniušis & Urba, 2007) used similar methodology to analyze weekly stock prices of 71 companies listed in the BSM using dividend adjusted weekly closing stock prices from the REUTERS database for the time period from 2000 to 2006. Results showed statistically significant returns for all chosen period combinations of average future returns and average past returns (3, 6,9,12 months). The best performing strategies achieved average monthly winner-minus-loser returns of about 0.5% with portfolio formation time of 3 and 12 months and portfolio holding period of 3 months. Finally, Kaia Kivistik and Taavi Mandell from SSE Riga (Kivistik & Mandel, 2010) explored five-factor regression model with the standard Fama-French three-factor specification augmented by two independent variables – long-short portfolio returns for liquidity and momentum. A dataset of monthly prices for 203 stocks from Estonia, Latvia, Poland, Hungary and Czech Republic was analyzed for the time period from January 2006 until December 2009. Kivistik and Mandell did not find statistically significant slope coefficients for momentum and liquidity, but achieved low regression intercepts and high regression $R^2$.

The author concludes that none of the three studies of momentum effect in the BSM analyzed it in the context of the Fama-French factors. Both Avižinis and Pajuste (Avižinis & Pajuste, 2007) and Maniušis and Urba (Maniušis & Urba, 2007) did not explore the impact of the momentum factor on the Fama-French three factor model at all and used long-short momentum factor portfolio as the only factor to explain cross-sectional returns of the Baltic stocks. Kivistik and Mandell (Kivistik & Mandel, 2010) analyzed the momentum jointly with the liquidity factor and did not perform a separate study for momentum effect alone. Thus, the objective of the second study reviewed in this chapter of the dissertation is to fill the gap in

the empirical literature and to confirm the presence of a momentum effect in the BSM after adjustments for the Fama-French factors using the methodology proposed by Fama and French (Fama & French, 1996) to check its statistical significance as well to employ additional factor portfolio sorts on the momentum factor proposed by Jimmy Liew and Maria Vassalou (Liew & Vassalou, 2000) to confirm its economic significance.

As the author's goal in the **second study** presented in this chapter (Lieksnis, 2011) is to determine if a momentum effect is still present after controlling for the three Fama-French factors, the author first evaluates the best methodology to do it. The basic equation for the Fama-French three factor model is as shown earlier in this chapter is (4.1.). According to the arbitrage pricing model, if the three relevant factors fully explain asset returns, the intercept of this regression should be zero. There are two approaches to determining if momentum can be explained by the three factors in (4.1).

The first approach was used by Fama and French (Fama & French, 1996) and Jegadeesh and Titman (Jegadeesh & Titman, 1993). In both cases datasets of monthly stock returns were sorted into multiple portfolios according to the short-term momentum of stock prices creating winner and loser portfolios and calculating portfolio excess returns $r_{jt}$. After that regression (4.1) was calculated for each of these momentum portfolios and regression alphas recorded. In both cases regression alphas increased in proportion to rank of portfolio and were statistically significant indicating the fact that the momentum effect cannot be explained by the Fama-French factors. Fama and French rebalanced momentum portfolios each month using the cumulative returns for the previous 11 months skipping the portfolio formation month to reduce bias from the bid-ask bounce. Ten equal-weight portfolios were formed. The difference in monthly average returns between extreme loser and winner portfolios was 1.31%. Table 4.3 summarizes regression results for all ten momentum portfolios for regression (4.1).

**Table 4.3**

**Three-Factor Regressions for Monthly Excess Returns, 366 Months**

| **Portfolio** | **Alpha$_j$, (t-stat)** | **Beta$_j$, (t-stat)** | **$s_j$, (t-stat)** | **$h_j$, (t-stat)** | **$R^2$** |
|---|---|---|---|---|---|
| P1 (loser) | -1.15<br>(-5.34) | 1.14<br>(21.31) | 1.35<br>(17.64) | 0.54<br>(6.21) | 0.75 |
| P2 | -0.39<br>(-3.05) | 1.06<br>(33.36) | 0.77<br>(16.96) | 0.35<br>(6.72) | 0.85 |
| P3 | -0.21<br>(-2.05) | 1.04<br>(42.03) | 0.66<br>(18.59) | 0.35<br>(8.74) | 0.89 |
| P4 | -0.22<br>(-2.81) | 1.02<br>(51.48) | 0.59<br>(20.87) | 0.33<br>(10.18) | 0.92 |
| P5 | -0.04<br>(-0.54) | 1.02<br>(61.03) | 0.53<br>(22.06) | 0.32<br>(11.86) | 0.94 |

| | | | | | |
|---|---|---|---|---|---|
| P6 | -0.05<br>(-0.93) | 1.02<br>(73.62) | 0.48<br>(23.96) | 0.30<br>(13.16) | 0.96 |
| P7 | 0.12<br>(1.94) | 1.04<br>(68.96) | 0.47<br>(21.53) | 0.29<br>(11.88) | 0.95 |
| P8 | 0.21<br>(3.08) | 1.03<br>(62.67) | 0.45<br>(19.03) | 0.23<br>(8.50) | 0.94 |
| P9 | 0.33<br>(3.88) | 1.10<br>(51.75) | 0.51<br>(16.89) | 0.23<br>(6.68) | 0.92 |
| P10<br>(winner) | 0.59<br>(4.56) | 1.13<br>(35.25) | 0.68<br>(14.84) | 0.04<br>(0.70) | 0.86 |

*Source: Adapted from (Fama & French, 1996).*

The author concludes that regression alphas increase in almost liner fashion going from momentum loser to momentum winner portfolios confirming the hypothesis that the three factors cannot explain stock return momentum. Jegadeesh and Titman also rebalanced portfolios each month, but employed a 6 month look back period and overlapping portfolios – a momentum decile portfolio in any particular month holds stocks ranked in that decile in any of the previous six ranking months. Jegadeesh and Titman also created ten equal-weight portfolios.

The second approach to check for the momentum effect in the context of Fama-French factors is to add a momentum long-short portfolio as another independent variable in (4.1). This approach was pioneered by Mark Carhart (Carhart, 1997) and used to check performance of mutual fund managers. Carhart created the momentum factor by sorting all stocks according to their past eleven month returns without taking into account their size or book-to-market ratios and then subtracting the returns of the lowest 30% of performers from returns of the highest 30% performers. Liew and Vassalou (Liew & Vassalou, 2000) used the four-factor Carhart model to investigate the ability of these factors to predict GDP growth. Momentum winners-minus-losers portfolio was rebalanced each year using the previous year's stock returns. In order to make factor portfolios orthogonal, Liew and Vassalou employed a unique sorting approach. They first sorted stocks into three book-to-market portfolios, then sorted stocks within each of them by size to create nine portfolios (the standard Fama-French approach would be to employ independent rather than sequential sorts). Finally each of these nine portfolios was sorted by momentum to create 27 portfolios. The drawback of this approach is that composition of each portfolio depends on the order the stocks are sorted. Liew and Vassalou calculated the following average annualized returns for factor portfolios for the US market: HML – 6.74%, SMB – 6.45%, WML – 5.05% for annual rebalancing; HML – 7.99%, SMB – 10,73%, WML – 15.02% for quarterly rebalancing. The author concludes that WML is much bigger, when quarterly rebalancing is employed. Jean-Francois L'Her et al. (L'Her, Masmoudi, & Suret, 2004) applied the four-factor model to explain cross-

section returns in the Canadian market. L'Her et al. did three independent sorts on size, book-to-market ratio, and 11-month momentum skipping the last month. Momentum portfolios were created to be orthogonal to size, but not to book-and-market ratio, creating big-winners-minus-losers and small-winners-losers portfolios. Winner-minus-loser portfolios were created using top 30% and bottom 30% of stocks sorted by their cumulative returns. With annual rebalancing they derived values for average annualized SMB and HML factors return to be only 5.08%, with WML premium being 16.07%. Keith Lam et al. (Lam, Li, & So, 2009) used similar procedure for portfolio formation to analyze cross-sectional performance of the Hong Kong stock market. They added WML as another factor in (4.1) obtaining the following specification:

$$r_{jt} = \alpha_j + \beta_j r_{mt} + s_j SMB_t + h_j HML_t + w_j WML_t + u_{jt}, \quad t = 1,2,\ldots, T \tag{4.2}$$

The regression results with 25 size and book-to-market portfolios showed that out of 25 intercepts, 21 were not significantly different from zero at the 5% level of significance. Most of WML factors were statistically insignificant and there is no clear relationship between WML factors and the 25 factor portfolios. Finally, Kivistik and Mandel (Kivistik & Mandel, 2010) added the long-short liquidity factor to (4.2) and calculated results of this regression for 25 size and book-to-market portfolios for the CEE stocks. Long-short factor portfolios were created using the same methodology as in Lam et al. (2009) and similar results were obtained – only one out of 25 regression results showed statistically significant slope coefficient for WML factor. Besides, 21 out of 25 regression intercepts were not significantly different from zero.

Research in (Lieksnis, 2011) is performed using the same dataset as the one used earlier in this chapter. The author uses this dataset to create multiple portfolios of stocks according to their return momentum. The Fama and French (Fama & French, 1996) approach is generally followed, although five rather than ten portfolios are created reflecting a small number of stocks in the BSM sample. Each month the stocks are sorted into five portfolios according to their cumulative returns during the previous six months skipping the last month to avoid bid-ask bounce effect, and their monthly returns recorded. The composition of each of the five portfolios is provided in Appendix of the dissertation. Excess returns over the risk-free rate of resulting five portfolios were then used as dependent variables in (4.1) to calculate regression results. Table 4.4 summarizes the resulting intercept and slope coefficients.

**Table 4.4**

**Results of Three-Factor Regressions of Momentum Portfolios for the Baltic stock market**

| Portfolio | Average excess return | $Alpha_j$, (p-value) | $Beta_j$, (p-value) | $s_j$, (p-value) | $h_j$, (p-value) | $R^2$ |
|---|---|---|---|---|---|---|
| P1 (loser) | -1.53% | -1.41 (0.35) | 0.69*** (7.4E-5) | 0.25 (0.3) | -0.39 (0.11) | 0.19 |
| P2 | 0.26% | -0.43 (0.70) | 0.64*** (7.4E-7) | 0.4** (0.03) | 0.0056 (0.97) | 0.26 |
| P3 | 0.82% | 0.01 (0.99) | 1.02*** (9E-26) | 0.3*** (0.003) | -0.055 (0.57) | 0.74 |
| P4 | 1.83% | 0.95 (0.20) | 0.96*** (7E-20) | 0.23* (0.055) | 0.014 (0.9) | 0.63 |
| P5 (winner) | 1.5% | 0.35 (0.81) | 0.87*** (3E-7) | 0.55** (0.021) | 0.11 (0.62) | 0.27 |

*Source: author's calculations.*

*Notes: A p-value below 0.01 indicates statistical significance at the 1 percent level and is marked with ***. ** indicates significance between 1 and 5 percent and * indicates significance between the 5 and 10 percent levels.*

As the author concludes from the table, the increase in regression Alphas going from the loser to winner portfolios is not uniform, unlike Fama and French where it is almost linear, as author concludes from Table 4.3. Besides, the HML factor at least partially explains the momentum effect, with the increasing slope coefficient, and regression $R^2$ are very low. One explanation for these discrepancies could be a small dataset which reduces the power of regression.

Next the author checks the ability of a momentum sort to increase returns of the four original portfolios BH, SH, BL, and SL. Modifying the methodology proposed by Liew and Vassalou (Liew & Vassalou, 2000) to a situation of much smaller number of stocks, each six months the author sorts each of these four portfolios into two new portfolios according to aggregate returns for the previous six months of stocks they contain. The average value-weighted excess returns over the risk-free rate of the resulting eight portfolios together with the original four are summarized in Table 4.5.

**Table 4.5**

**Average Monthly Excess Returns of Momentum Sorts for the Fama-French Portfolios**

| Portfolio | BL | BH | SL | SH |
|---|---|---|---|---|
| Unsorted portfolio, excess returns | -0.54% | 1.44% | -0.58% | 1.77% |
| Sorted, loser | -1.18% | 1.02% | -2.67% | 1.12% |
| Sorted, winner | 0.38% | 0.58% | 0.87% | 1.08% |

*Source: author's calculations.*

The author concludes that sorting by the past stock return momentum does improve performance of growth stock portfolios with low book-to-market ratios, but actually diminishes the performance of the value stock portfolios. A comparison of average monthly excess returns over a risk-free rate of the resulting portfolios shows that sorting by the past

stock return momentum does improve performance of growth stock portfolios with low book-to-market ratios (average monthly excess returns increase to 0.38% and 0.87% for momentum-sorted BL and SL portfolios), but actually diminishes the performance of the value stock portfolios (average returns drop to 0.58% and 1.08% for BH and SH portfolios). Figure 4.2 depicts the results of investing 10,000 EUR in the market index portfolio, winner portfolio P5 (see Table 4.5) and SH portfolio derived earlier and depicted in Figure 4.1.

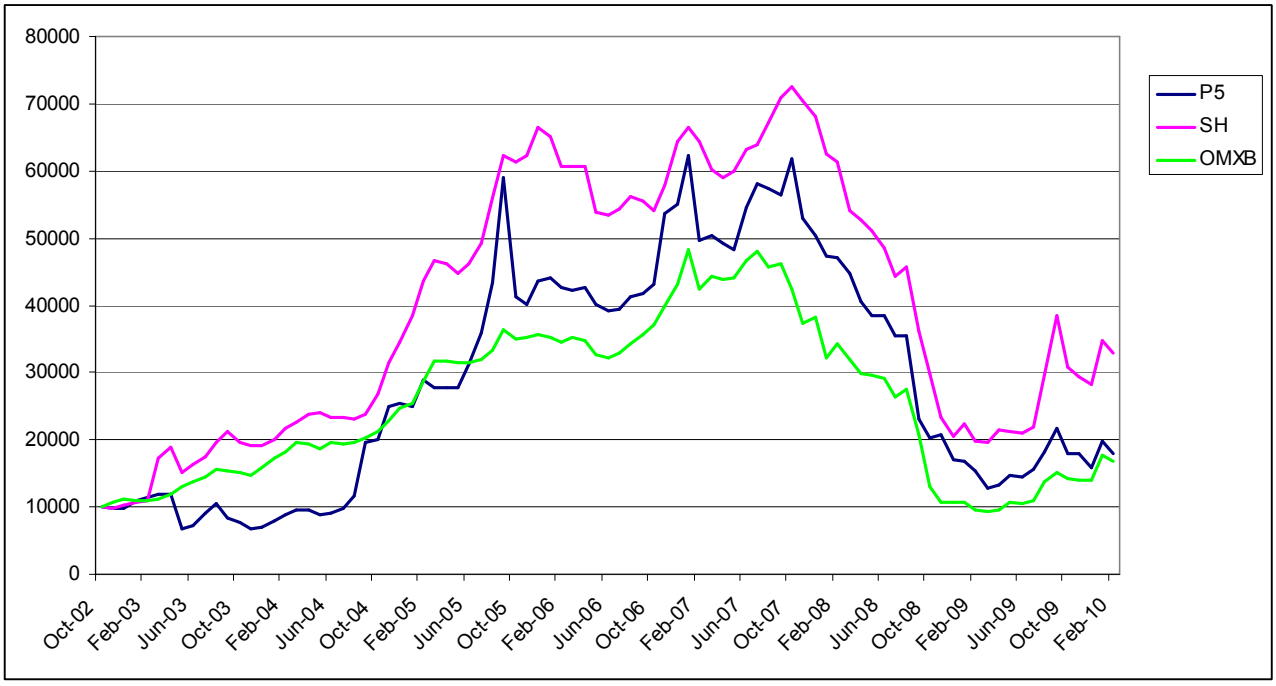


**Figure 4.2 Value of 10,000 EUR Investment in the Market, P5, and SH portfolios**

*Source: author's calculations.*

The author concludes that the higher average return of SH portfolio as compared to winner momentum portfolio P5 results in a better monetary performance. However, during the bear market of 2007 and 2008 both portfolios suffered losses as the global financial meltdown reduced prices of equity securities all over the world.

The research of applicability of the "second generation" stock selection theories to BSM indicates that a value investing approach should generally be preferred when making the stock selection decision. Investing in small value stocks achieves better results than investing in momentum strategies, which generally favors growth stocks. Besides, as author concludes from Table 4.6 (this table compares stock price and sales growth rate for the BSM official list companies with available financial reports for the time period), during the bull market of 2002-2006 stock price growth for leading companies like Olainfarm and Grindeks far outpaced their sales growth. This indicates that these companies were deeply undervalued in the beginning of this period.

**Table 4.6**

**Five-year Stock Price and Sales Growth, 2002-2006**

| Company | Stock price growth, Dec 2001 – Dec 2006 | Sales growth, 2002 to 2006 |
|---|---|---|
| Olainfarm | 3400% | 216% |
| Tallinna Kaubamaja | 1342% | 177% |
| Grindeks | 1284% | 156% |
| Baltika | 1002% | 85% |
| Harju Elekter | 542% | 129% |
| Ventspils Nafta | 235% | 5% |
| Latvijas Kuģniecība | 234% | -18% |
| Silvano Fashion Group | 165% | 217% |
| TEO LT | 125% | -24% |
| Viisnurk (TPD) | 12% | -38% |
| OMX Baltic Benchmark Index | 453% | n/a |

*Source: author's calculations.*

The author draws the following main conclusions from the study:

1. Capitalization and the book-to-market ratio are very significant factors to consider when investing in the Baltic stock markets. As shown in Figure 4.1, only investors who invested in small value stocks with high book-to-market ratios (SH portfolio) made money in 2002-2009 and managed to outperform the market index (OMXB). Thus investors should choose small capitalization value stocks when making the security selection decision in the BSM. Growth stocks generally underperform the value investing strategy as author concludes from the second study.
2. In line with results obtained by Barry et al. (Barry, Goldreyer, Lockwood, & Rodriguez, 2001), the book-to-market ratio is a more economically significant factor to explain cross-sectional returns for Baltic stocks than capitalization. The average excess returns of BH and SH portfolios are positive 1.606% as compared to -0.557% for BL and SL portfolios with the difference between the two averages being 2,183%. However, the average excess return of BH and BL portfolios is 0.903% and 1,195% for SL and SH, so small capitalization stocks outperformed large capitalization stocks only by 0.292% per month on average.
3. Results of the study confirm the original results of Davis et al (Davis, Fama, & French, 2000) – that although the 3-factor model produces a good approximation of reality, it is not statistically accepted, and regression alphas are statistically significant. So the search for the best cross-section factor model for equity market can continue.

4. The momentum effect can be at least partially explained by one of the Fama-French factors – book-to-market ratio, when stock returns of the Baltic Stock Market are analyzed. The average monthly return of the winner stock portfolio containing stocks which increased in price over the previous six months is only 1.5% as author concludes from Table 4.4. This is lower than the average monthly excess return 1.77% of the winning SH portfolio obtained earlier for the Fama-French model.
5. Combining a momentum investing strategy with a value investing strategy can lead to inferior performance results so investors are advised to choose one of them when making stock selection choices for their BSM stock portfolios. Although both strategies produce superior results, value investing is more profitable than momentum strategies in the Baltic Stock Market.

# 5. EVALUATION OF PERFORMANCE OF LATVIAN AND ESTONIAN SECOND-PILLAR PENSION FUND MANAGERS

One of the biggest challenges that the economies of Central and Eastern Europe (CEE) face in the foreseeable future is the aging of their population which will strain their national budgets and existing pay-as-you-go pension systems. As a result, most of these countries have introduced multi-pillar pension systems where the traditional pay-as-you-go first pillar is supplemented by two pillars of funded pensions - mandatory second pillar and voluntary third pillar. Management of funds invested in the funded pension accounts is usually trusted to private money management companies operating within a strict legal framework designed by national legislators to limit investment risk and the volatility of investment portfolios. The goal of this chapter of the dissertation is to analyze the performance of second-pillar pension fund managers in Latvia and Estonia. The research contributes to the existing literature in the following ways. First, it applies the Treynor-Mazuy model to pension fund data for Latvia and Estonia to evaluate stock selection and market timing skills. It partially resolves the controversy in previous findings about the market timing abilities of CEE country pension fund managers – and finds that in line with results for the US pension funds these managers underperform in terms of market timing. Second, it tests the viability of using another alternative for Jensen's one-factor regression model which includes a composite market return index with global rather than country-specific indexes as its components. Third, it evaluates the ability of second-pillar pension fund managers in Latvia and Estonia to outperform both

stock market and composite equity and fixed income indexes on a statistically significant basis.

For the study presented in this chapter (Lieksnis, 2010a) quarterly Net Asset Values and holdings information of 8 Latvian and 9 Estonian "active" (containing an equity component) pension funds operating since 2003 for the time period from 2009 till the end of 2009 were obtained from their quarterly reports published in the respective national pension portals (www.manapensija.lv and www.pensionikeskus.ee) for analysis. The returns are summarized in Appendix of the dissertation. Unfortunately the Estonian pension funds had different holdings reporting practices with most funds providing only a basic breakdown for equity holding percentage on a regular basis and occasionally adding further disclosures. Latvian funds performed much better with consistent disclosure of bank deposit and fixed income securities levels and occasional reporting of geographic information for their portfolios. Holdings information for Latvian pension funds is summarized in Table 5.1.

**Table 5.1**

**Holdings Information of Latvian "Active" Pension Funds**

| Fund name | Cash and bank deposits, % | | Fixed income, % | | Equity, % | | Percentage of total portfolio invested in: | | |
|---|---|---|---|---|---|---|---|---|---|
| | Before 2008 | 2008-2009 | Before 2008 | 2008-2009 | Before 2008 | 2008-2009 | Latvia | EU ex Latvia | Outside EU |
| Hipo Fondi pensiju plāns "Safari" | 57% | 50% | 33% | 42% | 10% | 8% | n/d | n/d | n/d |
| Citadele (ex Parex) aktīvais pensiju plāns | 33% | 43% | 51% | 49% | 16% | 8% | 62% | 30% | 8% |
| SEB aktīvais pensiju plāns | 43% | 51% | 44% | 34% | 13% | 15% | 75% | 19% | 6% |
| SEB Eiropas pensiju plāns | 42% | 50% | 46% | 37% | 12% | 11% | 79% | 18% | 3% |
| Norvik pensiju plāns "Gauja" | 51% | 75% | 34% | 23% | 15% | 2% | n/d | n/d | n/d |
| Finasta (ex Invalda) universālais pensiju plāns | 34% | 48% | 48% | 39% | 18% | 13% | n/d | n/d | n/d |
| Hipo Fondi pensiju plāns "Rivjera" | 57% | 43% | 33% | 48% | 10% | 9% | n/d | n/d | n/d |
| Swedbank pensiju plāns "Dinamika" | 33% | 33% | 48% | 25% | 19% | 42% | 64% | 20% | 16% |
| **Average** | **44%** | **49%** | **42%** | **37%** | **14%** | **14%** | **70%** | **22%** | **8%** |

*Sources: Data from www.manapensija.lv, author's calculations.*

*Notes: The calculation of average geographic breakdown of fund portfolios was done only for 4 funds which provided consistent disclosure of the geographic location of their holdings for the years 2003 to 2009. The table provides separate average holdings calculation before and after the increase of the legal limit for investing in equity from 30% to 50% in 2008.*

The author concludes that almost half of Latvian pension fund money was invested in Latvian bank deposits and a further 40% was invested in fixed income securities, mainly Latvian Treasuries. This home bias first described by Laurens Swinkels, Diāna Vējiņa, and

Rainers (Swinkels, Vejina, & Vilans, 2005) was also evident in the percentage of money invested in Latvia – four pension funds providing this disclosure invested 70% domestically on average. Most funds except the one managed by Swedbank stayed well below the legal limit of equity investing at an average 14% on money in shares and equity mutual funds both before and after the limit was raised from 30% to 50%. Estonian pension fund holdings are analyzed next in Table 5.2.

**Table 5.2**

**Holdings Information of Estonian "Active" Pension Funds**

| Fund name | Maximum stated proportion of equity, % | Actual average proportion of equity, % |
|---|---|---|
| LHV Pensionifond L | 50% | 41% |
| Kohustuslik Pensionifond Sampo Pension 50 | 50% | 42% |
| LHV Pensionifond XL | 50% | 42% |
| Swedbank Pensionifond K3 | 50% | 47% |
| SEB Progressiivne Pensionifond | 50% | 42% |
| **Average** | **50%** | **43%** |
| Kohustuslik Pensionifond Sampo Pension 25 | 25% | 21% |
| Swedbank Pensionifond K2 | 25% | 24% |
| LHV Pensionifond M | 25% | 21% |
| **Average** | **25%** | **22%** |

*Sources: Data from* www.pensionikeskus.ee *, author's calculations.*
*Notes: ERGO Pensionifond 2P2 did not provide consistent disclosure of the actual percentage of equity in its portfolio and hence was not included in the table. The calculation of average holdings was done for years 2003 to 2009 except for the SEB Progressiivne Pensionifond which stopped reporting holdings at the end of 2007 and both Sampo funds which stopped reporting holdings in 2008.*

Unlike Latvian funds, Estonian second-pillar pension funds generally attained the allowed maximum proportion of equity in their portfolios. Unfortunately they almost never reported the amount of money invested domestically lumping Estonian investments together with other Baltic or CEE investments.

Returns information for pension funds is analyzed next (see (Lieksnis, 2010a)). All returns are calculated net of all transaction costs and management fees. Table 5.3 provides descriptive statistics of the analyzed funds for the time period from the second quarter of 2003 to the last quarter of 2009 sorted on Sharpe Ratios over the short-term local currency bank deposit rates:

**Table 5.3**

**Descriptive statistics of Latvian and Estonian "active" pension funds**

| Fund name | Capitalization, million EUR | Maximum stated proportion of equity, % | Value of 1,000 EUR, EUR | Management fee, % | Sharpe Ratio |
|---|---|---|---|---|---|
| **Latvian pension funds** | | | | | |
| Hipo Fondi pensiju plāns | 11.6 | 50% (30% | **1,430** | 1.63 | 0.07 |

| | | | | | |
|---|---|---|---|---|---|
| "Safari" | | until 2008) | | | |
| Norvik pensiju plāns "Gauja" | 13.0 | 50% (30% until 2008) | 1,365 | 1.7 | -0.03 |
| Citadele (ex Parex) aktīvais pensiju plāns | 105.8 | 50% (30% until 2008) | 1,340 | 1.5 | -0.04 |
| SEB aktīvais pensiju plāns | 136.2 | 50% (30% until 2008) | 1,300 | 1.7 | -0.12 |
| Swedbank pensiju plāns "Dinamika" | 308.5 | 50% (30% until 2008) | 1,148 | 1.7 | -0.153 |
| Finasta (ex Invalda) universālais pensiju plāns | 0.7 | 50% (30% until 2008) | 1,239 | 1.71 | -0.21 |
| SEB Eiropas pensiju plāns | 16.7 | 50% (30% until 2008) | 1,260 | 1.7 | -0.22 |
| Hipo Fondi pensiju plāns "Rivjera" | 3.7 | 50% (30% until 2008) | 1,225 | 1.63 | -0.31 |
| **Estonian pension funds** | | | | | |
| LHV Pensionifond L | 31.8 | 50% | ***1,611*** | 2 | **0.20** |
| LHV Pensionifond XL | 6.5 | 50% | ***1,510*** | 1.88 | **0.14** |
| Kohustuslik Pensionifond Sampo Pension 50 | 113.7 | 50% | ***1,396*** | 1.85 | 0.12 |
| LHV Pensionifond M | 3.3 | 25% | ***1,417*** | 1.6 | 0.11 |
| ERGO Pensionifond 2P2 | 23.2 | 50% | ***1,454*** | 1.25 | 0.10 |
| Swedbank Pensionifond K3 | 318.0 | 50% | 1,203 | 1.59 | 0.03 |
| SEB Progressiivne Pensionifond | 219.0 | 50% | 1,218 | 1.5 | -0.01 |
| Kohustuslik Pensionifond Sampo Pension 25 | 8.6 | 25% | 1,259 | 1.75 | -0.02 |
| Swedbank Pensionifond K2 | 137.4 | 25% | 1,110 | 1.49 | -0.08 |

*Sources: Data from www.manapensija.lv, www.pensionikeskus.ee, author's calculations. Notes: Capitalization and management fee information provided as of December 2009. Value of 1,000 EUR investment in each fund invested in January of 2004 was calculated for December of 2009, results outperforming benchmark investment at a local short-term deposit rate are marked in bold, Estonian results outperforming a composite market index are marked in italics.*

Besides the Sharpe Ratios, the value in December 2009 of 1,000 EUR invested in each fund in January 2004 was also calculated. A benchmark 1,000 EUR investment at the local currency short-term bank deposit rate for the same time period yielded 1,386 EUR for Latvia and 1,278 EUR for Estonia. As author concludes from Table 5.3, only one Latvian fund and 5 out of 9 Estonian funds managed to outperform the local currency deposit. Most Latvian pension fund managers invest in Latvian bank deposits and government securities, so the deposit rate is the best benchmark of their performance. As most Estonian pension funds invest a sizable part of money in equity (see Table 5.2), it makes sense to compare their monetary performance against a composite index containing both the local deposit rate and an equity market index (a bond index is not used, as the research later in this section shows that its introduction does not add value to regressions). As disclosure provided by the three LHV funds about the composition of their equity market holding reveals, Estonian funds invest in a diversified portfolio of a global nature. As a result, annual return statistics for the MSCI World equity market index from www.wikipedia.org were used instead of the DJ STOXX 50

index used later in the study. The benchmark 1,000 EUR investments at the composite index of the investment at a local bank deposit rate and the chosen equity market index for the same time period as used earlier yielded 1,293 EUR for 50%/50% split between them and 1,286 EUR for 75%/25% split. 5 out of 9 Estonian funds outperformed this composite index for their target equity proportion; their results are marked in italics in Table 5.3.

A good benchmark for the Sharpe Ratio is calculated by Elroy Dimson et al. (Dimson, Marsh, & Staunton, 2006) for worldwide investing in equity. Dimson et al. calculate this benchmark ratio to be 0.25 p.a. or 0.125 quarterly. Only two Estonian funds and no Latvian fund managed to outperform this benchmark (Their Sharpe Ratios are marked in bold in the Table 5.3). The average Sharpe Ratio for Estonian funds – 0.07 is in line with the one obtained by the OECD study (Hinz, Rudolph, Antolin, & Yermo, 2010) using Estonian bond yields – 0.064. The poor results of Latvian pension funds might be explained by their overinvestment in bank deposits without seeking opportunities in the fixed income and equity markets. Estonian funds allocate a much bigger share of money for equity investing and are able to add value and justify their high management fees which reach 2% p.a. in the case of the top performing LHV Pensionifond L.

Next the author performs a regression analysis for the second-pillar pension funds using both Jensen's Alpha model and the proposed composite index model. The information about short-term (up to 1 year) time deposit rates on national currencies were obtained from reports published by national banks at their Web sites: www.bank.lv and www.eestipank.info. The time series for the DJ STOXX 50 index was downloaded from the European Central Bank Web site www.ecb.int, and the Markit iBoxx EUR index was obtained from www.indexco.com. In order to check the statistical significance of intercepts and slope coefficients while controlling for the small sample sizes of fund returns, residuals were re-sampled with 10,000 replications and bootstrapped p-values for each of $H_0 : \alpha_j = 0; H_0 : \beta_j = 0$ were calculated in line with methodology described in Chapter 4 of Russell Davidson and James MacKinnon (Davidson & MacKinnon, 2009). The next table summarizes the OLS regression results for both models along with their statistical significance in terms of bootstrapped p-values:

**Table 5.4**

**Performance Statistics of Latvian and Estonian "Active" Pension Funds – Jensen's Alpha and Composite Index Models**

| Fund name | Number of obser-vations | Jensen's Alpha model | | | Composite index model | | |
|---|---|---|---|---|---|---|---|
| | | $\alpha$ (p-value) | $\beta$ (p-value) | $R^2$ | $\alpha$ (p-value) | $\beta$ (p-value) | $R^2$ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Latvian pension funds** | | | | | | | |
| Hipo Fondi pensiju plāns "Safari" | 26 | 0.27 (0.58) | 0.14** (0.014) | 0.25 | 0.35 (0.49) | 0.23** (0.027) | 0.25 |
| Norvik pensiju plāns "Gauja" | 24 | 0.11 (0.78) | 0.18*** (0.0006) | 0.36 | 0.2 (0.57) | 0.32*** (0) | 0.45 |
| Citadele (ex Parex) aktīvais pensiju plāns | 27 | -0.1 (0.74) | 0.15*** (0) | 0.49 | -0.02 (0.96) | 0.25*** (0.0013) | 0.46 |
| SEB aktīvais pensiju plāns | 27 | -0.23 (0.47) | 0.13*** (0.0002) | 0.5 | -0.16 (0.67) | 0.21*** (0.0014) | 0.45 |
| SEB Eiropas pensiju plāns | 27 | -0.35 (0.53) | 0.09*** (0.0084) | 0.34 | -0.3 (0.63) | 0.14** (0.027) | 0.29 |
| Finasta (ex Invalda) universālais pensiju plāns | 27 | -0.46 (0.48) | 0.13*** (0.0004) | 0.41 | -0.38 (0.57) | 0.25*** (0.0004) | 0.49 |
| Hipo Fondi pensiju plāns "Rivjera" | 26 | -0.49 (0.53) | 0.08** (0.024) | 0.33 | -0.43 (0.51) | 0.15** (0.017) | 0.27 |
| Swedbank pensiju plāns "Dinamika" | 27 | -0.71 (0.32) | 0.36*** (0.0001) | 0.66 | -0.49 (0.56) | 0.65*** (0) | 0.74 |
| **Average** | | **-0.24** | **0.16** | **0.42** | **-0.16** | **0.28** | **0.42** |
| **Estonian pension funds** | | | | | | | |
| LHV Pensionifond L | 26 | 1.22 (0.14) | 0.45*** (0) | 0.66 | 1.08 (0.2) | 0.78*** (0) | 0.75 |
| LHV Pensionifond XL | 27 | 0.63 (0.52) | 0.43*** (0) | 0.61 | 0.46 (0.68) | 0.73*** (0) | 0.69 |
| ERGO Pensionifond 2P2 | 27 | 0.41 (0.63) | 0.43*** (0.0001) | 0.57 | 0.23 (0.82) | 0.74*** (0) | 0.68 |
| Kohustuslik Pensionifond Sampo Pension 50 | 27 | 0.32 (0.58) | 0.25*** (0) | 0.54 | 0.32 (0.71) | 0.41*** (0) | 0.55 |
| LHV Pensionifond M | 27 | 0.3 (0.68) | 0.27*** (0) | 0.6 | 0.08 (0.92) | 0.65*** (0) | 0.76 |
| Swedbank Pensionifond K3 | 27 | -0.04 (0.94) | 0.5*** (0) | 0.68 | -0.22 (0.74) | 0.82*** (0.0001) | 0.72 |
| Kohustuslik Pensionifond Sampo Pension 25 | 27 | -0.11 (0.76) | 0.16*** (0) | 0.48 | -0.2 (0.54) | 0.32*** (0.002) | 0.44 |
| SEB Progressiivne Pensionifond | 27 | -0.25 (0.7) | 0.53*** (0) | 0.65 | -0.45 (0.56) | 0.87*** (0.0001) | 0.69 |
| Swedbank Pensionifond K2 | 27 | -0.47 (0.36) | 0.32*** (0.0002) | 0.6 | -0.68 (0.36) | 0.68*** (0.0021) | 0.62 |
| **Average** | | **0.22** | **0.37** | **0.6** | **0.06** | **0.67** | **0.65** |

*Source: author's calculations.*

*Notes: Bootstrapped p-values with 10,000 replications are reported. A p-value below 0.01 indicates statistical significance at the 1 percent level and is marked with ***. ** indicates significance between 1 and 5 percent and * indicates significance between the 5 and 10 percent levels.*

The weights for the model were chosen according to the stated target proportion of equity for each pension fund given in Table 5.3. Funds were sorted by regression alphas in Table 5.4. The author concludes from Table 5.4, that the composite index model did not add any value as compared with Jensen's Alpha model for Latvian pension funds with an average regression $R^2$ essentially the same and the regression betas statistically significant for both models. The composite index model did marginally better in the Estonian case with a slight increase in the average $R^2$. Both models present regression alphas, which are not statistically significant so that we can conclude that both Latvian and Estonian second-pillar pension fund managers do not possess statistically significant skills to outperform market benchmarks. The

results obtained contradict the findings of Dariusz Stanko (Stanko, 2003) who analyzed performance of the Polish pension funds and found that one half of the analyzed funds (7 out of 14 survived funds with the longest set of observations, Table 8 in the referenced paper) achieved statistically significant regression alphas at the 5% significance level using Jensen's Alpha model with WIG the Polish stock market index. One possible explanation for this would be the fact that, unlike the results presented here, Stanko did not calculate bootstrapped p-values, although a relatively small sample (46 observations) was used.

Finally the author uses the Treynor-Mazuy model to separately evaluate managers' stock selection and market timing skills (as the composite index model was shown to provide no superior results, the model was not used). Results for this model are summarized in Table 5.5 using the notation, sorting of pension funds, and data applied in the previous calculation.

**Table 5.5**

**Performance Statistics of Latvian and Estonian "Active" Pension Funds – Treynor-Mazuy model**

| Fund Name | Number of observations | $\alpha$ (p-value) | $\beta$ (p-value) | TM (p-value) | $R^2$ |
|---|---|---|---|---|---|
| **Latvian pension funds** | | | | | |
| Hipo Fondi pensiju plāns "Safari" | 26 | 0.65 (0.32) | 0.1* (0.085) | -0.0043 (0.32) | 0.29 |
| Norvik pensiju plāns "Gauja" | 24 | 0.052 (0.93) | 0.18** (0.013) | 0.00074 (0.87) | 0.37 |
| Citadele (ex Parex) aktīvais pensiju plāns | 27 | 0.38 (0.33) | 0.12*** (0.0005) | -0.0048* (0.052) | 0.56 |
| SEB aktīvais pensiju plāns | 27 | 0.28 (0.52) | 0.1*** (0.0033) | -0.0051** (0.02) | 0.58 |
| SEB Eiropas pensiju plāns | 27 | 0.057 (0.93) | 0.07** (0.022) | -0.0041** (0.046) | 0.44 |
| Finasta (ex Invalda) universālais pensiju plāns | 27 | -0.14 (0.87) | 0.11*** (0.0036) | -0.0033 (0.22) | 0.44 |
| Hipo Fondi pensiju plāns "Rivjera" | 26 | -0.69 (0.42) | 0.1** (0.0155) | 0.0024 (0.38) | 0.26 |
| Swedbank pensiju plāns "Dinamika" | 27 | 0.27 (0.83) | 0.3*** (0) | -0.0099** (0.016) | 0.74 |
| **Average** | | **0.11** | **0.14** | **-0.0035** | **0.46** |
| **Estonian pension funds** | | | | | |
| LHV Pensionifond L | 26 | 1.34 (0.45) | 0.44*** (0) | -0.0013 (0.81) | 0.66 |
| LHV Pensionifond XL | 27 | 0.93 (0.49) | 0.42*** (0.0001) | -0.0031 (0.6) | 0.61 |
| ERGO Pensionifond 2P2 | 27 | 1.37 (0.22) | 0.38*** (0.0001) | -0.0094 (0.12) | 0.62 |
| Kohustuslik Pensionifond Sampo Pension 50 | 27 | 0.73 (0.35) | 0.23*** (0.0001) | -0.004 (0.3) | 0.56 |
| LHV Pensionifond M | 27 | 0.23 (0.77) | 0.28*** (0) | 0.00064 (0.86) | 0.6 |
| Swedbank Pensionifond K3 | 27 | 1.63** (0.04) | 0.43*** (0) | -0.016*** (0) | 0.79 |
| Kohustuslik Pensionifond Sampo Pension 25 | 27 | 0.16 (0.71) | 0.14*** (0.0007) | -0.0026 (0.33) | 0.5 |

| | | | | | |
|---|---|---|---|---|---|
| SEB Progressiivne Pensionifond | 27 | 1.55* (0.09) | 0.45*** (0) | -0.018** (0.0026) | 0.76 |
| Swedbank Pensionifond K2 | 27 | 0.84 (0.2) | 0.26*** (0) | -0.013*** (0.001) | 0.75 |
| **Average** | | **0.98** | **0.34** | **-0.0074** | **0.65** |

*Source: author's calculations.*

*Notes: Bootstrapped p-values with 10,000 replications are reported. A p-value below 0.01 indicates statistical significance at the 1 percent level and is marked with ***. ** indicates significance between 1 and 5 percent and * indicates significance between the 5 and 10 percent levels.*

The author concludes that results of the Treynor-Mazuy model show that a majority of Latvian and Estonian fund managers possess positive, but not statistically significant stock selection skills as evidenced by signs and the statistical significance of regression alphas, with only one Estonian fund achieving marginally significant regression alpha showing statistically significant securities selection skills which are cancelled out by statistically significant negative market timing skills for this particular fund. Most fund managers both in Latvia and Estonia possess negative market timing skills as indicated by the sign of the TM coefficient in Table 5.5, but they are statistically significant only for a minority of managers. Research by Stanko (Stanko, 2003) and Martin Bohl et al. (Bohl, Lischewski, & Voronkova, 2008) about the market timing abilities of CEE country pension fund managers produced inconclusive results with positive statistically significant market timing skills for Polish funds as determined by Stanko and statistically insignificant results for timing skills for Polish and Hungarian funds as determined by Bohl et al. The results obtained here in part help to resolve this controversy and bring results in line with the findings for the US market by Daniel Coggin et al (Coggin, Fabozzi, & Rahman, 1993) – Estonian and Latvian pension fund managers possess, positive, but not statistically significant stock selection abilities (as indicated by the sign of the alphas in Table 5.5), and somewhat negative market timing ability when the Treynor-Mazuy model is used to evaluate both of them.

Latvian and Estonian pension fund managers have adopted different approaches to managing their portfolios, although the legal frameworks are similar in both countries. Latvian managers are generally very risk averse and focus on local bank deposits and state Treasuries as their main investment vehicles, investing, on average, only 14% of their portfolios in equities. Estonian managers, on the other hand, fully exploit opportunities in equity markets and generally achieve the proportion of equity mandated in their fund prospectuses. Sharpe Ratio comparisons speak in favor of the Estonian approach – as shown in Table 5.3, Estonian fund ratios are, on average, higher. Besides, most of Latvian second-pillar pension fund managers have trouble outperforming a local currency short term bank

deposit. Hence investors would be better off if they could go directly to banks and invest in deposits rather than paying management fees for managers to do the same for them. Estonian fund managers do invest in equities and as a result, half of them can beat both local currency deposit and a composite benchmark portfolio containing a broad stock market index. Neither Estonian nor Latvian fund managers achieved statistically significant performance against the European stock market and composite indexes. The proposed composite market index is a good benchmark for the Latvian and Estonian pension fund managers. In line with previous findings by Coggin et al (Coggin, Fabozzi, & Rahman, 1993) for US pension funds, pension fund managers in Latvia and Estonia suffer from negative market timing skills, which in some cases are statistically significant. Most of them are able to achieve positive stock selection skills, which are also not statistically significant. However, the significance of results is limited by a small number of observations (27) in the time series of returns, so further research is warranted as time passes and more statistical information is accumulated about fund returns. Besides, in addition to unconditional beta models used in this study, further insights on fund performance might be obtained by using conditional beta regression models in line with Jon Christopherson et al. (Christopherson, Ferson, & Glassman, 1998).

The main implications of this research are the following:

1. In line with US pension funds, it appears that pension fund managers in Latvia and Estonia possess stock selection skills, but suffer from a lack of market timing skills which hampers their overall performance results. However, neither of these conclusions can be confirmed statistically.
2. As only one Latvian pension fund seems to be able to outperform the local currency bank deposit returns, introduction of a balanced index fund might be appropriate to save on management fees (bond fund managed by Latvian State Treasury achieved a management fee of 0.75% – more less than half of the present average). This could be done by lawmakers by mandating the creation of at least one index fund by each pension fund management company. Such index pension funds would serve as a low-cost alternative as well as a good benchmark to evaluate actively managed Latvian funds.
3. Instead of presenting their relative performance within the peer group as it is done in the Latvian mass media today, pension funds' performance should be evaluated against some market index. The proposed methodology for establishing such a benchmark is the composite index consisting of bank deposit rates and a broad stock market index returns. In addition, pension fund Sharpe Ratios calculated

with a meaningful risk-free rate could also be employed as risk-adjusted performance benchmarks.

## GENERAL CONCLUSIONS AND RECOMMENDATIONS

The research performed by the author of this Doctoral Dissertation has led to the following main **conclusions:**

1. After careful evaluation of the relevant asset pricing theories and models as well as their empirical applications author concludes that the "second generation" theories should be preferred when building real-life models for making stock market investment decisions both by companies and by individual investors. In comparison to "first generation" theories, these theories better approximate real-life behavior of asset prices by employing wider variety of explanatory variables and more complex mathematical relationships to explain financial asset values.
2. Many "second generation" methods are very new and still being contested and improved. Some of them require advanced mathematical calculations which limit their applications by an average investor. Nevertheless, some of them can be applied in making investing decisions in the Baltic financial market.
3. "First generation" theories have a limited usefulness and applicability for making real-life investment decisions. Nevertheless, they could still be used mainly for teaching purposes due to their relative simplicity and ease of calculations, which facilitates a better understanding of the subject of asset pricing.
4. The analysis of the main features of Baltic financial markets shows that Latvia clearly lags behind the other two Baltic countries in terms of stock market development, and Estonia trails its Baltic neighbors in terms of the fixed income market development. All three stock markets provided positive nominal returns as of July 2011 for the time period since 1998.
5. An analysis of the performance of different asset classes in Latvia during the last 13 years showed that only gold and Latvian government bonds provided positive inflation-adjusted returns for investors.
6. The public secondary fixed income market is practically nonexistent in the Baltics. Although the government bonds and some corporate bonds are listed in

Latvian and Lithuanian stock exchanges, there are practically no trades in these securities happening.

7. The problems of investing in the Baltic financial markets are generally well researched by the Baltic researchers, but this research is concentrated only in certain areas: interactions between Baltic and world stock market returns, basic statistical properties of Baltic stock returns and applications of technical analysis tools, impact of macro variables and company financial ratios on these returns, event studies, and volatility forecasting. Some of gaps in the research are filled by the studies performed in this dissertation. However, the major gap both in theoretical and empirical work done in the Baltics is theory and applications of behavioral finance, which has caught an attention of academicians in Scandinavia and led to plenty of research there.
8. Although stock market returns can be predicted by a series of financial ratios, which are persistent in relation to the stock returns, the short and medium term market timing decisions still have to be made using the tools of technical analysis. Chart pattern technical analysis tools like the candlestick patterns have a very limited utility in the Baltic and Latvian stock markets due to their extremely low liquidity with prolonged periods of a choppy price action without clear stock price trends. Still, trend following systems like Trading Range Break system can be applied to Latvian stock market with higher risk-adjusted returns for the companies and individual investors who use this methodology. The proposed TRB system also would have protected investors from large losses during the recent bear market.
9. The two competing models for making stock selection decisions today are Fama-French and momentum models, which are also interpreted as investing "styles" of value and growth investing. By analyzing, adjusting, and comparing application of both approaches to the Baltic stock market author concluded that value investing (Fama-French 3-factor) model should be chosen.
10. Although legislation regulating second-pillar pension funds is similar in Latvia and Estonia, fund managers differ in their investing styles. Latvian "active" fund managers are generally very risk averse and focus on local bank deposits and government bonds as main investments in their portfolios, investing on average only 14% of money in equities. In contrast, Estonian "active" fund managers generally invest more in equities and achieve higher risk-adjusted returns.

11. The author has performed the first academic study on performance evaluation of Latvian and Estonian second-pillar pension funds. The results of analysis show that some fund managers can outperform relevant market benchmarks, but no manager can achieve statistically significant outperformance. In line with US pension funds, it appears that pension fund managers in Latvia and Estonia possess stock selection skills, but suffer from lack of market timing skills which hampers their overall performance results.
12. Instead of presenting their relative performance within the peer group as it is done in Latvian mass media today, pension funds' performance should be evaluated against some market index. The proposed methodology for benchmarking fund performance is the composite index consisting of bond market returns and a broad stock market index returns, as well as comparing performance with bank deposit return. Sharpe Ratios could also be employed as risk-adjusted performance benchmarks.

Based on results of the research, the author of the dissertation comes up with the following **recommendations:**

1. The research of finance theory and applications in the Baltics should be further advanced by Baltic researchers in the area of finance by coverage of the important area of the behavioral finance. As the Scandinavian researchers are major contributors to this research in the English-speaking scientific world, cooperation with them may be beneficial.
2. In order to improve returns on their investment, Baltic companies and individual investors should use stock market timing systems. One such system is the Trading Range Break approach developed in the dissertation.
3. When choosing the specific stocks for investing, Baltic investors should apply the value investing approach. Both results of statistical models and real-life stock returns of specific companies like Olainfarm indicate that investors achieve the best returns by investing in undervalued companies when their stocks can be bought cheaply in terms of their book-to-market ratios.
4. Baltic companies are the best source of unbiased advice for their employees about choosing the second-pillar pension fund manager, as most of major Baltic banks also act as fund managers and are thus selling their own services rather than providing unbiased advice. Companies should advise their employees to choose

only those second-pillar fund managers which can outperform the proposed composite market index benchmark.

5. A major flaw in the Latvian second-pillar pension fund system is a lack of index funds as a cheap and effective alternative to the actively managed funds. Index funds could charge a management fee which would be at least two times lower than the average fee of 1.7% and it would save millions of lats for the future Latvian and Estonian pensioners. Latvian lawmakers should mandate the establishment of at least one index fund by each fund management company which is licensed to manage the second-pillar pension funds.

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