ECONOMICS AND BUSINESS ADMINISTRATION FACULTY
VILNIUS UNIVERSITY

FINANCE AND BANKING

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MASTER THESIS

INVESTUOTO KAPITALO GRĄŽOS IR P/E RODIKLIO POVEIKIS AKCININKŲ GRĄŽAI: PAVYZDŽIAI IŠ AKCIJŲ RINKOJE KOTIRUOJAMŲ BALTIJOS ĮMONIŲ	**THE EFFECT OF RETURN ON INVESTED CAPITAL (ROIC) & P/E RATIO ON SHAREHOLDER RETURNS: EVIDENCE FROM BALTIC PUBLIC COMPANIES**

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Date of submission of Master Thesis: 31.12.2020
Ref. No.

Vilnius, 2020

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Finance and Banking Master Programme

Faculty of Economics and Business Administration, Vilnius University

Supervisor prof. Dr. Antanas Laurinavičius, Vilnius 2020

SUMMARY

80 pages, 10 figures, 2 tables, 39 references.

This research describes and explores the connection between return on invested capital, price-to-earnings ratios, and long-term shareholder returns. The goal of this work is to find out whether investing in high-ROIC, low-P/E companies delivers abnormal, market-beating returns over five years. The first chapter holds a theoretical framework around the two variables, the Efficient Market Hypothesis (EMH), behavioral finance and different investing strategies. The chapter also contains extensive research regarding Magic Formula investing and previous studies conducted to test return on invested capital and P/E ratios' effect on shareholder returns. The second chapter explains the methodology behind the study. It shows how the research is conducted, what variables are tested, and the hypothesis established. The chapter also contains information on data collection methods as well as constraints and limitations. The third chapter shows the empirical results of the study and proves that high-ROIC, low-P/E portfolios indeed beat Baltic benchmark index during 2015-2019. The results also show statistical significance. However, an unexpected result emerged regarding portfolios of companies based on low-P/E ratio alone. This set of companies not only outperformed the market during 2015-2019 but also high-ROIC, low-P/E based portfolios. This phenomenon must be further researched in other markets such as NYSE, NASDAQ, and Euronext. This research paper may be of practical and theoretical value to investors, portfolio managers and other researchers.

Keywords: return on invested capital, price-to-earnings, ROIC, P/E, portfolio, Magic Formula, Baltic benchmark index.

Language of Master Thesis: English

SANTRAUKA

Moksliniame darbe nagrinėjamas investuoto kapitalo grąžos (ROIC) ir P/E rodiklio poveikis ilgalaikei investicinei grąžai. Pagrindinis tyrimo tikslas išsiaiškinti, ar investavimas į įmones, kurios turi aukštą investuoto kapitalo grąžos ir žemą P/E rodiklį, lemia geresnius nei rinkos vidurkis rodiklius penkerių metų laikotarpyje. Pirmojoje darbo dalyje apibūdinama teorinė darbo struktūra, apžvelgiama efektyvi rinkos hipotezė ir skirtingos investavimo strategijas. Taip pat pristatomi tyrimai, susiję su „Magic formula investing“ teorija bei tyrimai, nagrinėjantys investuoto kapitalo grąžos (ROIC) bei P/E rodiklio poveikį ilgalaikei akcininkų grąžai. Antrojoje darbo dalyje pristatoma tyrimo metodologija, kintamieji, iškeliamos hipotezės. Šioje dalyje taip pat apibūdinami duomenų rinkimo metodai bei galimi metodų trūkumai. Trečiojoje tyrimo dalyje pristatomi empiriniai darbo rezultatai. Jie rodo statistiškai reikšmingą rezultatą – aukštesnę kapitalo grąžą ir žemą P/E rodiklį turinčios įmonės generuoja spartesnę investicinę grąžą nei „Baltic benchmark“ indeksas 2015–2019 metais. Papildomai nustatyta, kad įmonės, kurios turėjo žemą P/E rodiklį, ne tik generavo spartesnę investicinę grąžą nei „Baltic benchmark“ indeksas, bet taip pat aplenkė ir tas įmonės, kurios turėjo aukštą kapitalo grąžą ir žemą P/E rodiklį. Šis reiškinys reikalauja detalesnio tyrimo kitose rinkose, tokiose kaip NYSE, NASDAQ ir Euronext. Šis mokslinis darbas gali ne tik suteikti teorinės, bet ir praktinės naudos investuotojams, investicinių portfelių valdytojams ir kitiems tyrėjams.

Raktiniai žodžiai: investuoto kapitalo grąža, pelnas nuo kainos, ROIC, P / E, portfelis, „Magic Formula“, Baltijos šalių etalonas.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Return on Invested Capital (ROIC) is one of the most scrutinized measures in finance world. It is used to assess the company's profitability and overall financial position. Remuneration committees sometimes use ROIC to create incentive plans for the top management. Famous investor Joel Greenblatt was the first one to use ROIC and P/E ratio to derive his 'Magic Formula', portfolio strategy that beat the market by a wide margin. Multiple studies have been conducted to test the 'Magic Formula' all over the world. The topic is still relevant today as portfolio managers always struggle to build a portfolio that would perform as good as the market but with lower risk. As hedge funds underperform the market in the long term, the fund managers following long positions need a reliable strategy when choosing which companies to invest in. Retail investors in the Baltic region hunting for bargains would have a clearer understanding of the strategy leading to good investment results after reading this research paper. Currently, passive investment strategies are gaining market share at the expense of active portfolio managers. Multiple studies confirm that most active portfolio managers do not add any value to their clients because of excessive fees. The strategy outlined in this work can be described as passive and low-cost because it does not require a portfolio manager to make individual decisions. The portfolio can be constructed and run using a simple model with as many constraints as it suits the investors.

The theoretical value of the research is supported by the fact that Baltic portfolio managers need a strategy to create a well-balanced portfolio that would deliver consistent results in the future. Some of the money managers focus only on short-term results which is detrimental to the shareholder value. Researching ROIC and P/E ratio will help the mangers and the researchers better understand the fundamentals of financial analysis which can be used to create a better investment strategy. Practically, the research will help the investors achieve higher risk-adjusted returns over the investment period. A low-cost 3X leveraged ETF could be constructed based on the findings of this research. It could potentially outperform market return with a wide margin over the next 5-10 years. ETFs are generally very liquid structures and allow investors to get in or out quickly if they need to raise liquidity.

I decided to choose this topic as it would be a further continuation of my bachelor work "Dividend Policy and Its Effect on Shareholder Returns" where I looked at long-term shareholder returns. I looked at how dividends influence shareholder returns in the long-run and whether buying dividend-paying companies would deliver superior results. After completing this research, I realized what could be done better and what variables shall be reviewed to enhance the previous work and create even better research. In addition, I am very interested in equity

research. I read financial reports daily and have a clear understanding about different industries and businesses. I think I can contribute to the finance world with my personal work experience. I use Morningstar.com, Thomson Reuters Eikon databases to analyze thousands of European equities. Having designed multiple portfolios for my clients and myself, I noticed that I consistently use ROIC and P/E ratio to filter, sort, and group companies. The strategy I used helped me find outstanding investment opportunities. I noticed that the better the company managers allocate shareholders' capital the more the company is worth ceteris paribus. That is why I decided to start this research and help others build their own strategy that would, hopefully, provide consistent returns for a lifetime.

The goal of this research is to find out whether ROIC and P/E-ratio-based portfolio outperforms the Baltic stock index over the course of 5 years. Specifically, the research objectives are defined as following:

- Build a reliable theoretical framework around efficient market hypothesis (EMH) and behavioral finance.
- Explore various active and passive investing strategies.
- Describe ROIC and P/E variables in depth to understand various factors affecting these variables.
- Explore whether investors following the ROIC and P/E ratio strategy achieve superior returns using sensitivity analysis and comparing the returns of different portfolios.
- Describe the key factors that make the portfolio outperform the index.
- Predict the trend of the strategy into the future.
- Design financial models that would help the portfolio managers make more informed decisions regarding capital allocation and diversification.
- Build a reliable framework for future studies on this subject (2019).

This research paper is divided into five parts: introduction, three chapters and conclusions. Introduction provides an outline of the work that has been done, provides definitions, key concepts, and objectives. The first part is bibliography. It gathers the most important information about the subject as well as previous research, studies and arguments of various authors regarding ROIC and P/E ratio, Efficient Market Hypothesis theory, behavioral finance, and various investing strategies. It does not just paraphrase the information but explores how different researchers approached the topic and what conclusions shall be made based on their respective research studies.

Several research methods are used to achieve the purpose of this work. This research includes mostly quantitative, secondary data used for descriptive purposes. Statistical analysis such as T-tests are used to find if the results are statistically significant. Regression analysis is done to predict the behavior of dependent variable and explain the effect of the independent variable on the dependent variable.

A variety of literature has been used to conduct this research such as financials, journals, articles, previous studies, and research papers. Among them are JSTORE, Emerald, Cambridge and Wiley databases and other libraries. To make research as relevant and up to date as possible, only new sources are referred to. Ten years is considered a good timeline considering that key financial concepts and definitions do not change much over the years.

One of the biggest limitations of this research is that it looks at the past data to project future returns. In the finance world, the future can be drastically different from the past. What worked in the past, may not work in the future. The finance industry is evolving at a rapid pace. Machine learnings, AI and other high technology revolutionize investing profession making it harder to predict what is going to happen in the years to come. The other limitation is rather technical. It is quite hard to create hypothetical portfolios without the survivorship bias. It is difficult to find the complete list of companies operating in 2015 to make the research as objective as possible.

Second chapter is methodology. The chapter starts with the course of action. Then clear hypotheses are established. This part of the research explains how significance tests and regression analysis are conducted. Methodology also relates to key variables, research strategy, data collection methods, design purpose, approach and the key assumptions made during the financial model building process. The chapter also deals with sampling, procedures, and the constraints of the research.

The third chapter covers empirical results. It elaborates on the results that were received during the study. The readers can see which portfolios outperformed the market and which underperformed. The chapter explains various possibilities and reasons behind the outcome. It also contains the comparison of shareholders' wealth based on the chosen portfolios. The final section is about conclusions, and recommendations for future research.

1. THEORETICAL FRAMEWORK BEHIND RETURN ON INVESTED CAPITAL AND P/E RATIO

1.1. Efficient market hypothesis perspective

The Efficient market hypothesis (EMH) is arguably one of the most researched topics in finance according to researchers Yen & Lee (2008). They also stated that Yen Bachelier, a mathematician, was the first one to show that it is virtually impossible to predict stock price movements back in 1900 (Arklid & Hallberg, 2015). Later, Kendall (1953) developed a theory stating that stock prices follow a random walk. After that, Samuelson (1965) published an article that became an inspiration to Fama's research "Efficient Capital Markets: A Review of Theory and Empirical Work" (1970) in which the author presented the the Efficient Market Hypothesis (EMH). It is one of the most debated financial theories today (Arklid & Hallberg, 2015).

During sixties Paul A. Samuelson, En Eugene, F. Fama, developed EMH, which is a cornerstone of academic finance today. According to Fama (1965), EMH states that all new information is reflected in security prices immediately. The necessary assumptions are that all players act rationally, and all information is available free of charge. Fama also developed a random walk theory. It claims that security prices are often unpredictable and do not follow a specific pattern. Prices can potentially go from t to $t + 1$ without any change in historic data. According to a random walk theory, money managers cannot predict security prices accurately. As a result, it is virtually impossible for the fund managers to determine with securities are overvalued and which are undervalued. The implied recommendation for the investors is to invest their funds into a passively managed index. This method will allow investors to save on transaction and management fees. On the other hand, money managers claim that they have a better access to information which allows them to achieve abnormal return (Arklid & Hallberg, 2015).

Furthermore, Fama published an article (1970) in which he categorized EMH into three forms: strong, semi-strong and weak. Weak form EMH states that all publicly available historical data is generally reflected in security prices. Fundamental analysis can help investors earn above-average returns in the short-term, but it does not guarantee such returns in the long-term. Also, patterns do not exist in terms of stock price movements and technical analysis does not work. Semi-strong form claims that neither fundamental analysis nor technical analysis works, and all public information is already priced in. Strong form EMH states that both public and private information is already reflected in the stock prices and hence the investors cannot

gain advantage over the market. Strong EMH does not reject the fact that some money managers or individual investors can achieve abnormal results because these are outliers included in the averages (Arklid & Hallberg, 2015).

In a descriptive research paper, "The Efficient Market Hypothesis: A Critical Review of Literature and Methodology", Lina Novickytė reviewed the development of the capital markets in terms of EMH relevance and empirical validity. The need for this research was inspired by the dynamic nature of the capital markets. In this research paper, the author analyzes efficient market hypothesis in the context of Baltic stock exchange. Lina Novickytė noticed that investors fail to earn abnormal returns even though anomalies exist, and security prices often deviate from their estimated intrinsic values. This research work analyzes theoretical framework of EMH once again as well as uncovers its specifics in Baltic stock market context. Finally, the author suggests methodology to test weak-form efficiency on Nasdaq Baltic market (Novickytė, 2014).

In a research paper "Evidence on the Efficient Market Hypothesis from 44 Global Financial Market Indexes", Helen M. Bowers, William R. Latham used "Granger causality tests" to find out whether historical information impacts financial markets prices across 30-day periods. The dataset includes daily index levels of the (1) open, (2) closed, (3) intraday high, (4) intraday low, and (5) trading volume series from the world's 37 largest stock exchanges. Crude oil, gold and money market prices are included in the research. The results indicate that historical information has a major effect on financial markets price levels. This impact is realized through a cyclical pattern which transcends over decades. These findings turn out to be direct violations of weak form EMH. This in turn means that markets are inefficient. The researchers also describe this recursive impact of information and explain the digestive effect that is taking place (Bowers & Latham, 2013).

In another research article "An Empirical Study on Efficient Market Hypothesis of Indian Capital Markets", Anjala Kalsie and Jappanjyot Kaur Kalra study EMH in Indian markets during 2001-2011. The weak form EMH is tested across various indexes such as NIFTY and 6 major NSE sectors Pharma, IT, MNC, Bank, FMCG and Nifty Junior. Univariate time series data is used to analyze indices returns using a variety of methods such as randomness and non-stationarity test, unit root testing, ACF, correlograms and other relevant statistical methods. The results conclude that null hypothesis is rejected, and hence Indian markets are inefficient in a weak form during the studied period. The results show that emerging markets are not very efficient. Possible implication of weak form EMH rejection is that investors should not use passive index strategy but look for undervalued securities instead (Kalsie & Kalra, 2015).

In “The Efficient Market Hypothesis, the Financial Analysts Journal, and the Professional Status of Investment Management”, Stephen J. Brown talks about practical implications of Efficient Market Hypothesis. He explains how EMH led to the rise in indexing and ETF investing. The author explains that it is hard for portfolio managers to beat the market over the long-term as it requires unquestionable skill to cover management fees and still earn return higher than the market. The author very well explains how EHM theory impacted the world of financial analysis and how the future looks like in terms of technology taking over human labor in security analysis. The author neither rejects nor accepts EMH but tries to predict how investing is going to look like for institutional and individual investors around the world and what the financial analyst job is going to look like (Brown, 2020).

In “An Empirical Study of Efficient Market Hypothesis and Its Existence in Virtual Market”, Jason West evaluates the virtual market for computer games and tries to investigate whether there are any market inefficiencies or anomalies, intra-day effect in particular. The study looks at price movements of football player cards at online game FIFA Ultimate Team. Statistical analysis such as mean, standard deviation, and coefficients of variances tests were completed to understand if there are any market anomalies and reactions to news announcements. The results showed strong correlation and statistical significance in terms of anomalies and information announcements. The researcher spotted significant overreaction and an intra-day effect which led to price increases of up to 200% on some cards. Jason West concluded that inefficiencies exist in a virtual market (West, 2017). Applying common logic, if becomes clear that if inefficiencies exist in such a small market as virtual gaming market, they are virtually sure to exist in much larger financial markets all over the world.

Most researchers today reject strong form of efficient market hypothesis as their opinions fall somewhere between semi-strong form and outright rejection of EMH. Famous investors such as Warren Buffet reject EMH claiming that those who beat market averages are not outliers but rather form a well-defined pattern. A small group of value investors continue to beat the market despite the lack of academic proof. These people buy undervalued securities and sell overvalued ones. These investors are Benjamin Graham’s disciples who is the founder of value investing. This research is rejecting all forms of Efficient Market Hypothesis because it strives to establish a market-beating pattern that would allow investors to beat the index over the long-term directly violating the main rule of EMH.

1.2. Behavioral finance perspective

Behavioral finance is an important topic to review is as it involves some of the most heated academic discussions. It is necessary to look at shareholder returns from the perspective of behavioral finance researchers to get the full picture.

"A review paper on behavioral finance: study of emerging trends" by Aditya Sharma and Arya Kumar is helpful as it debates the EMH and tries to correct the asset pricing model by proposing changes to it. This is done through the application of behavioral finance. The authors call the finance community to accept behavior finance as mainstream alternative to EMH (Sharma & Kumar, 2019).

In their research paper "Are investors rational, irrational or normal?" Md. Al Mamun, Md. Abu Syeedb, and Farida Yasmeen try to find true scenarios of of investor's behavior. The authors believe that EMH models are outdated while behavioral finance does not offer a solution in terms of model building. The researchers study the behavior of 200 individual investors on Dhaka Stock Exchange (DSE). The authors were not able to prove rationality or irrationality of the investors and call for additional research that would combine EMH and behavioral finance to study investor behavior.

In "The Impact of Behavioral Finance on Investment Decision-making: A Study of Selected Investment Banks in Nigeria" research work, Olubunmi Edward Ogunlusi and Olalekan Obademi studied the impact of behavioral finance on investment decision-making using responses from investment banks. They found evidence of a positive impact between behavioral finance and investment decision. In this paper, the authors study heuristics which studies mental shortcuts to ease cognitive decision-making processes of the people. Some of the examples of heuristics are rules of thumb & trial and error process. The authors found strong and negative relationship between heuristics and investment decisions. The researchers also pay attention to prospect theory which relates to risk and uncertainty. The theory seeks to explain how people think in terms of utility they receive rather than absolute outcomes. The authors found a strong and negative correlation between prospect theory and investment decisions (Ogunlusi & Obademi, 2019).

In "Potential underdog bias, overconfidence and risk propensity in investor decision-making behavior", Sean Combrink and Charlene Lew research overconfidence and underdog bias and its effect on risk propensity of the investors. The authors found out that overconfidence levels are similar to other populations. They also claim that there is a negative predictive relationship between underdog bias and overconfidence. Further findings suggest that those with

the most investment experience appear to be the most overconfident. In addition, female investors display higher underdog bias than male investors.

Brown (2020) talks about behavioral finance in his work "The Efficient Market Hypothesis, the Financial Analysts Journal, and the Professional Status of Investment Management". He argues that EMH framework is brokern and that few academics today believe in the theory. He says that the flash crash of 1987 and the burst of dot-com bubble prove that market psychology and behavior factors matter today. According to Brown, Ingersoll (1987) showed that EMH is an implication of an equilibrium theory in the capital markets dominated by informed and rational agents (Brown, 2020). Behavioral finance challenges this framework as researchers proved that individuals react differently to losses than to profits which questions the rationalization of an average investor and validity of EMH. The author advocates that many behavioral biases emerged much earlier than the mainstream science. For example, Scott, Stumpp, and Xu (1999) found that overcondifence (tendency to overestimate abilities) and representativeness (tendency to overextrapolate from a small sample) might explain the popularity of relative value metrics for slow-growth companies. Earnings growth might be exptrapolated in an irrational way to suggest that the companies are going to continue growing indefinitely. Daniel and Titman (1999) suggested that representativeness bias might be the cause of popularity in momentum strategies that are based on the notion that past performance will repeat itself in the future. However, there is plenty of evidence that the market diverges from rationality sometimes. These instanes can be attributed to behavioral causes. Shiller (2002) added that attention errors, which arise when investors inconsistently focuse their energies, as well as wishful thinking, which is a tendency to ascribe too high a probability to a desired outcome, are often the causes of boom and busts in the securities market. Thaler (1999) argues that although market opportunities arise from time to time, there could be insufficient amount of those for all active managers to achieve abnormal returns. Shiller's (2002) arguments pose interesting insights that active managers, as a group, may be the victims of the very same behavioral biases which in turn would not allow them to achieve abnormal returns for their asset portfolios. This fact removes the presumption that active managers necessarily add value. This means that the burden lies on the active managers to prove that they can add value for their clients (despite the high management and other costs) (Brown, 2020).

1.3. Active vs passive fund performance

Simon Grima in his work "Active versus Passive Investing: An Empirical Study on the US and European Mutual Funds and ETFs" seeks to put an end to active/passive fund confrontation by studying the risk-adjusted performance and alpha generation. His research is

survivorship bias free and includes 776 equity funds which are domiciled either in North American or Europe and categorized by geographical segmentation, structure, management type, index funds and ETFs. After the classification, the author analyzed monthly net asset values (NAVs) of twelve distinct equally weighted portfolios during 2004-2014. Risk-adjusted performance is examined using single-factor and multi-factor CAPM models. During these ten years, actively managed equity funds achieved the same risk-adjusted gross returns as passively managed equity funds. However, net-of-fees performance shows a whole different story. Actively managed funds underperformed passively managed funds net of fees. Heavy initial fees charged by the management ensure that actively managed funds do not get ahead of the market. In addition, both active and passive funds' performance may be hurt even more if the financial advisors or equity distributors charge additional fees over the houses' expense ratios putting the funds at a significant disadvantage over the passive low-cost ETFs. As a result, the author urges investors to focus on expense ratios and allocate their funds into low-cost funds with replicative structures (Grima, 2016).

On the other hand, Lennart J.P. van Loo and Jonathan Molander argue that active management is still doing well in their research work "Active versus Passive Investing, a Comparative Analysis". The authors analyzed 211 actively managed funds and 191 market and industry-specific indices during 2005-2020 with 5-year sub-periods. They found out that the returns are nearly identical over the full period, however, passively managed funds experience higher standard deviation except during the bearish periods when standard deviation is the same for both types of funds. For both investing strategies, 90% of the returns are explained with the general movements of the market prices. Researchers still advocate for passively managed funds because of various costs involved with the actively managed funds. They do, however, recognize that actively managed funds perform better during bearish periods (Loo & Molander, 2020).

In "Active vs. Passive Funds—An Empirical Analysis of the German Equity Market" research work, Fahling, Steurer, & Sauer (2019) conducted a study to analyze the value creation by active funds in Germany. The authors analyzed 194 actively managed funds. They found out that active money managers can indeed achieve abnormal returns, but these returns are absorbed by management and other fees. This is consistent with Grima (2016). Their regression analysis showed that active funds do not generate significant value in a form of alpha. Despite the common idea that active funds tend to underperform in the long-term, individual investors still try to identify the funds which outperform the index regularly. Sophisticated investors know that NAV does not represent the management's ability pick stocks. Some investors believe that historical abnormal returns are likely to continue in the future even though there are findings that

contradict this popular belief. And the final possible reason is that investors believe that there is a positive correlation between active managers' performance and their respective management fees (Fahling, Steurer, & Sauer, 2019).

1.4. Most popular investing strategies

Many researchers tried to come up with the variables that would construct a perfect portfolio, the one outperforming the market for a long period of time. However, that is not an easy task as everyone wants to beat the market. For decades, academia developed several market-beating strategies but only a few of those work in practice. The most popular investment strategies are Active/Passive investing, Momentum Trading, Algorithmic Trading, Buy & Hold, Long Short Strategy, Indexing, Pairs Trading, Value vs Growth, Dividend growth investing, Dollar cost averaging, Contrarian investment, investing in small cap stocks and many others. It is useful to learn about different strategies to be able to choose the one suitable for an investor's needs.

Active/Passive investing has been debated for a long time. Passive investing emphasizes that it is virtually impossible to beat the benchmark index over a long run. The strategy calls for minimization of transaction costs. Using passive investing, investors do not need to follow the market and try to time it. Active investors believe they can beat the market average if they follow a well-defined strategy. It is worth mentioning, that the higher the capital base, the harder it gets to beat the market averages over the long run.

Momentum trading refers to the idea of buying past winners and selling past losers. The adherents of this strategy believe that companies that performed well for the past few months are more likely to perform well in the future. Momentum trading calls for "buying high and selling higher". Momentum traders look for ways to exploit volatility. They also use the concept of investor herding and try to get out before the stock turns red.

Algorithmic trading refers to computer trading. The investors use machine learning and AI to monitor stock prices, place buy and sell orders. Algorithmic trading can be further divided into trend-following strategies, arbitrage opportunities, index fund rebalancing, mathematical model-based strategies, trading range, volume-weighted average price, time weighted average price etc.

Buy and Hold strategy is similar to passive investing, because it calls for just buying shares or funds and holding them for a long time. The adherents of this strategy believe that it is nearly impossible to time the market for an average investor. Therefore, it is far better to just buy and wait until the law compounding interest builds the wealth of the investor. Buy and hold investors believe that the market earns a satisfactory rate of return over the long run.

Long Short strategy is based on the attempt to buy the stocks that are expected to appreciate and short the ones that are expected to decline. Long short strategy is often based on alpha indicator. The top percentile of the securities ranked according to alpha factor is purchased while the lower percentile is sold. Long short strategy is popular among hedge funds which tend to be market neutral. However, the fund managers prefer to be long biased as the market has an upwards trend in the long run.

Indexing refers to buying into an index such as S&P 500, a mutual fund, or an ETF. Indexing is usually a passive strategy. Index investing strives to replicate market returns. Investors who follow index investing strategy claim that management fees are much lower in this type of strategy. Although it is more time-consuming, there is a lot of evidence that indexing outperforms active asset management over the long run.

Pairs trading is trading strategy that is based on two correlated assets. The bottom asset is purchased while the top one is sold. This trading strategy is based on mean reversion. Z-scores are calculated and the spread between the two assets is analyzed.

Value vs growth is probable the most popular investing styles. Value investors look for undervalued companies and wait until the market realizes their potential value. Growth investors look for companies that are expected to grow their earnings at a rate above industry or market averages. The differences between value and growth are less distinguishable today than it was in the past. The main reason is that more analysts today learn how to find value in growth. They build the financial models that help calculate growth as part of the value of the company. The most famous investor Warren Buffett has a long track record of combining value and growth when making investment decisions.

Those who follow dividend growth investing look for companies that pay consistent, predictable, and increasing dividends for a long time. Dividend-paying companies tend to experience less volatility in their shares. Income investors rely on dividends to fund their cost of living. The strategy is suitable for senior persons. Dividend investing is also popular because the cash received from the dividends can be reinvested into into other assets.

Dollar cost averaging is aimed to minimize losses by buying shares on a regular basis. The investors buy more when the stock appears less expensive and buy less when the market is at high levels. This strategy can be applied successfully because it does not require a large cash outflow from a monthly paycheck. Dollar cost averaging also removes the necessity to time the market as the portfolio contributions are made regularly.

Contrarian investment strategy is buying unpopular stocks at inexpensive levels. The investors who follow this strategy frequently go against the herd. They buy low P/E stocks. They

invest during market downturns. They avoid “glamour stocks”. Contrarian investment strategy is often confused with value investing. However, there are differences between the two. Contrarian investment strategies are closely associated with distressed securities investing.

Small cap investing is investing in companies with low market capitalization. Investors who follow this strategy find it easier to find bargains in the market. They research stocks that do not have any analyst coverage. Small cap companies find it easier to deliver excess returns below of their low capital base. Small capitalization markets tend to outperform mid and large companies in the bull market and underperform during bear market.

High-ROIC, low-P/E strategy falls within several categories. It is a passive, long, value & growth strategy with the elements of buy & hold philosophy. Joel Greenblatt’s ‘Magic Formula’ considers two key variables required for a successful investment. The first one is the profitability of an asset that generates the cash. The second one is the price that an investor pays for this asset. The former variable ensures the quality that an investor gets from our investment. The latter ensures that an investor does not overpay for an investment as it might not be successful in that case.

1.5. Return on invested capital as the most watched profitability ratio

According to Carlisle, one of the most prominent investors of all times Warren Buffett looked for companies that earned high returns on invested capital. The legendary investor called such companies “dream businesses”. The author explains that the higher sustainable return on invested capital means higher intrinsic value of the business ceteris paribus. The investor also noticed that growth destroys value if ROIC is less than cost of capital. Growth does not add business value if ROIC equals cost of capital. However, growth adds value only if the business earns ROIC above its cost of capital. Most businesses cannot maintain ROIC above the firm’s cost of capital for a long time and will see their profitability revert to the mean at some point. Even chronic underperformers may have a good year when they earn above their cost of capital during an economic upturn (2014).

Businesses with extraordinary economics are different from ordinary cyclical companies. Carlisle emphasizes that an economic franchise arises when the product or service is needed or desired; believed to have no close substitute, and it not subject to price regulations. Hence, the economic franchise refers to a special business that can earn a sustainably high return on capital over the course of a business cycle and to be immune to the competition. Managers of a cyclical business usually invest heavily during peak years failing to realize that expected return on investments will be lower in the upcoming economic downturn and vice versa. The companies would be better off if the capital allocators did the exact opposite (2014).

Larsson (2015) supports this idea and adds that businesses with strong economic franchise must be able to have strong barriers to entry to keep the competitors out. Sustainably high ROIC and stable market shares over time are good indicators of where to look for such companies. These businesses can redeploy the cash outflows at high incremental returns. The author differentiates three types of durable competitive advantages: supply and demand side, and economies of scale. Supply-side competitive advantages can be lower costs from better technology, know-how, cheap factors of production etc. Examples of demand-side competitive advantages might be strong customer loyalty and high switching costs. Economies of scale are the strongest type of competitive advantage because it allows the business to create a highly favorable business model where the fixed costs are thinly speeded over the units sold. It requires the incumbent to have customer captivity. Economies of scale must be set in relation to the size of the market.

Viebig, Poddig, & Varmaz are convinced that high returns on capital attract competitors. Companies that earn ROIC above the cost of capital sooner or later attract competition which drives the returns down. Companies that earn return on capital below the cost of capital are forced to restructure, return capital to the owners or file for bankruptcy. The company's ability to earn rates of return above the cost of capital depends on the durability of competitive advantages and the strength of its economic moat (2012).

The firm that is earning a return on invested capital higher than its cost of capital is creating shareholder value. The firms earning ROIC below cost of capital are destroying value. The firm that is earning its cost of capital should be trading at book value because it does not earn any economic profits. Managers must be cautious not too obsessively focus on earning a high ROIC on a low capital base as it might lead to missed opportunities. Net Present Value is still the more important measure (Holland & Matthews, 2017).

1.5.1. Breakdown of ROIC

According to Carlisle, famous investor Joel Greenblatt defined return on capital as

$$ROIC = EBIT \div (Net\ Working\ Capital + Net\ Fixed\ Assets) \quad (1)$$

EBIT is defined as earnings before interest and taxes. Net working capital includes inventories, receivables, marketable securities and required cash. These are the items used in the normal course of business. Net fixed assets include property, plant, and equipment (PP&E), intangibles, investments in subsidiaries, real estate etc. Most analysts define capital as a combination of debt

Operating Approach	=	**Financing Approach**
Current assets		Short-term notes
Less NIBCLs*		Current LT debt
Net working capital		Long-term debt
Net PP&E		Deferred liabilities
Other assets		Shareholders' equity
Invested Capital	=	**Invested Capital**

Figure 1. Breakdown of invested capital.

Source: Carlisle & Tobias (2014)

and equity (Carlisle & Tobias, 2014):

Mauboussin used two of Porter's forces: differentiation and low-cost production and compared it to net operating profit after tax (NOPAT) margin and invested capital turnover. Return on invested capital equals NOPAT margin multiplied by invested capital turnover. He found that companies that have a high return on invested capital usually achieved it through high NOPAT margin (2014). It is because most companies earn excess returns due to exclusive product and service which allow the company to have above industry average margins. It is much harder to earn excess returns based on capital turnover as the competitors increase sales by lowering prices. For example, it is easier for Apple Inc. to earn excess returns and high ROIC by having above-average profit margins on its products than for Walmart to earn excess returns by increasing capital turnover. Apple profit margins are protected with strong customer loyalty, and intangible assets such as its brand, technology, patents, and trademarks. Walmart capital turnover is harder to increase as the competitors would catch up by lowering prices.

The DuPont formula shows that returns on capital, operating margins and capital turnover are related. Return on invested capital is a product of operating profit margin and capital turnover. Operating profit margin is equal to operating profits divided by net revenues. It indicates how well the operating assets are utilized to generate revenue. Capital turnover equals net revenues divided by long-term invested capital. Long-term invested capital can be divided into non-current assets (capex) and net working capital (ΔNWC). Excess returns can result from unusually high operating margins (most often) or high capital turnover. Sales grow because of investment in property, plant, and equipment (PP&E).

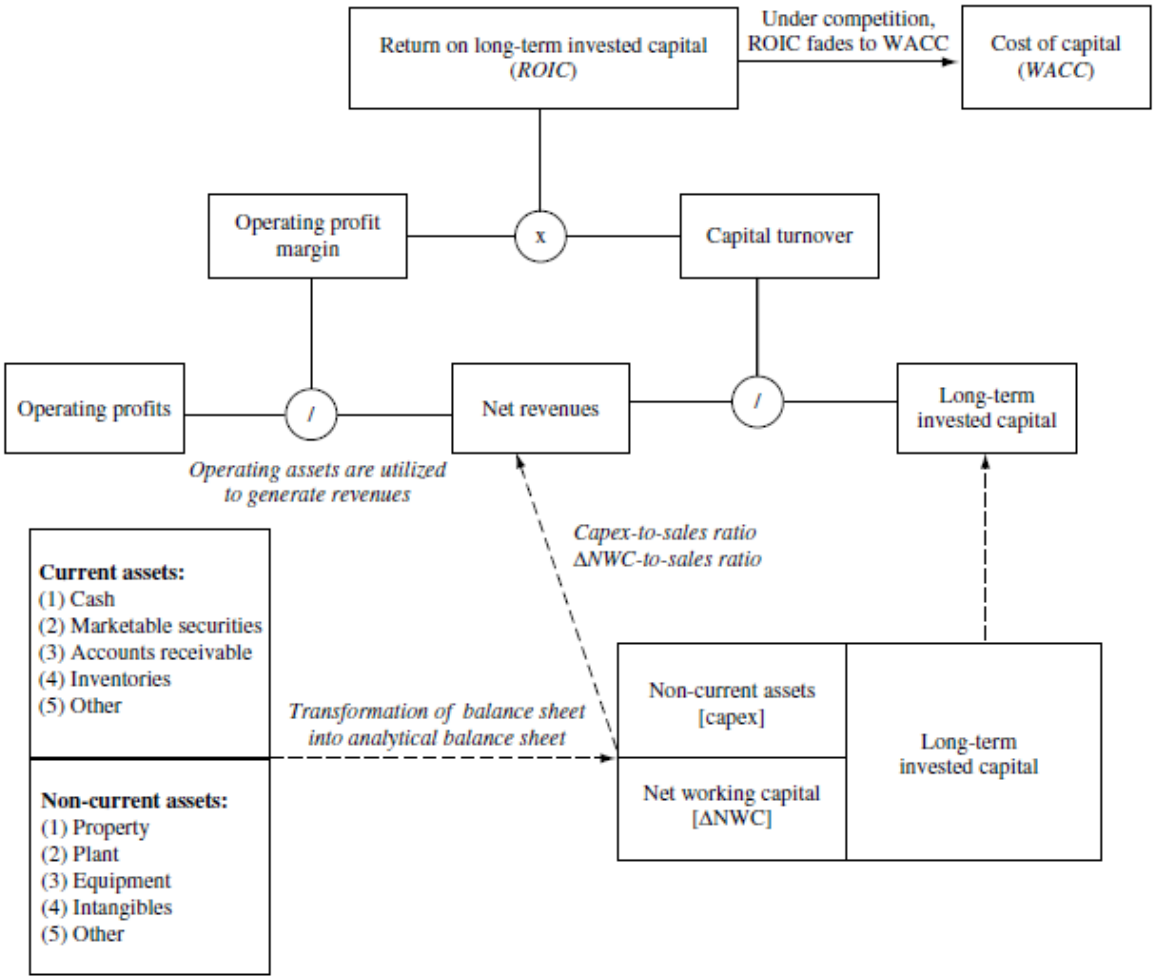

Figure 2. Financial value drivers.

Source: Holland & Matthews (2017)

Analysts monitor ratios such as capex-to-sales and NWC-to-sales as revenue growth assumptions must be consistent with capital reinvestments. Total investments are the sum of change in working capital, capital expenditures, R&D investments, and change in capitalized operating leases (Holland & Matthews, 2017). Usually, ROE[1] is not a very reliable value driver as it can be influenced by a choice of a capital structure. There is a clear relationship between various financial value drivers (Viebig, Poddig, & Varmaz, 2012).

1.5.2. ROIC in valuations

When analysts create financial models and perform valuation analysis, they use several equations:

$$ROIC = (NOPAT/Sales) \times (Sales/Invested\ capital) \quad (2)$$

[1] Return on Equity (ROE)

$$ROIC = Profits\ margin \times Invested\ capital\ turnover \quad (3)$$

$$NOPAT[2] = EBIT + Goodwill\ amortization - Unlevered\ operating\ taxes \quad (4)$$

Holland & Matthews (2017) provide a somewhat different equation of NOPAT:

$$NOPAT = EBIT \times (1 - Tc[3]) = Net\ income + Interest\ paid \times (1 - Tc) \quad (5)$$

Many analysts do not use NOPAT as the nominator in the equation. As long as assumptions are valid and the model makes sense, different measures may be used. For example, some analysts use Free Cash Flow to the Firm (FCFF) as an additional measure of profitability:

$$FCFF = NOPAT - \Delta IC[4] = NOPAT(1 - g/ROIC[5]) \quad (6)$$

Net operating profit after taxes (NOPAT) is sometimes replaced with economic value added (EVA):

$$EVA[6] = (ROIC - WACC) \times invested\ capital = NOPAT - Capital\ Charge \quad (7)$$

Economic profit (EP) is also a popular measure of profitability:

$$EP = NOPAT - Capital\ charge \quad (8)$$

$$Capital\ charge = r[7] \times IC \quad (9)$$

$$EP = (ROIC - r) \times IC \quad (10)$$

Profit margins are an important factor when measuring profitability and performing valuation analysis. However, it is not useful without examining the invested capital base which is the denominator in the equation. "ROIC alone fails to measure value creation without being held to an invested capital base. ROIC/WACC is only part of the economic profit calculation, factoring in the size of the capital base is critical (Viebig, Poddig, & Varmaz, 2012)". It becomes very difficult to maintain a high ROIC as the capital base increases. Small enterprises have more investment projects with high return potential than those with a larger capital base. For example, it is much easier for a small technology company to earn excess returns on its small capital base

[2] Net operating profit after taxes (NOPAT)
[3] Tc = corporate tax rate
[4] Δ IC = change in invested capital = net Capex + Δ working capital
[5] g/ROIC is the reinvestment rate, or plowback.
[6] Economic Value Added (EVA)
[7] r is cost of capital or WACC.

than it is for Google Inc. As a small technology firm grows, the law of diminishing returns takes place and reduces profitability.

According to Larsson (2015), professor Bruce Greenwald from Columbia University approached growth valuation from a different angle. He proved that growth matters only if the company can consistently earn returns higher than its cost of capital (ROIC>WACC). If ROIC equals WACC, growth does not create any shareholder value, because the return on the necessary incremental investments to support the growth equal the cost of obtaining the funding for the investments. For example, suppose the company plans to invest EUR 100 million in a new project with a cost of capital of 10%, the project must return at least 10% to break even. If the company earns only 9% on its investment, the investment will destroy shareholder value.

According to Zenner, inefficient capital allocation is detrimental to the balance sheet and shareholder value. Some companies perform well in terms of ROIC while others do not return their cost of capital. The authors noticed that the companies with the top quartile ROICs delivered the highest stock returns while those stocks that have low ROIC generated low returns. This is in line with Carlisle & Tobias as well as Greenblatt who found similar results in their studies. They also noticed that the smaller the pool of companies the lower the returns of the constructed portfolios. Portfolios that included high-ROIC small-, medium- and large-capitalization stocks outperformed those portfolios that only included large-sized companies (2010).

Zenner also noticed that the historic return on capital of most S&P 500 companies fall somewhere between 9% and 13%. The top quartile earned 16.7% while the bottom one earned 6.7%. The weighted average cost of capital for a typical company was 8.2% (2010). This study may bring some light to our later discussion of cost of equity in the next sections of this research.

Bruce Greenwald from Columbia University developed his own ways of calculating value of growth:

$$PV = C * [(ROC - G)/(R - G)], \text{ where} \quad (11)$$

PV – present value of the investment,

C – capital,

ROC – return on capital,

R – cost of capital,

G – growth.

Growth rate cannot exceed the cost of capital because in that case, the equation does not make sense. Also, 'G' is constant and cannot deviate too much from the long-term GDP growth. This method of calculating growth is trickier because it requires to calculate the correct no-growth cash flow for the business. The analyst must estimate the sustainable return on capital, cost of capital in the future as well as the sustainable growth rate. The author requires to have a higher Margin of Safety when using this method as it is quite easy to make a mistake in assumptions and place an incorrect target price for an investment (Larsson, 2015).

The second method of calculating growth is a more reliable one. The analyst does not get a target price but an expected annual return on investment. Famous investors Warren Buffett and Seth Klarman use this method more often because there is lesser possibility to make a mistake in valuation:

$$TR = \left(\frac{d}{p}\right) + \left[\left(\frac{(e-d)}{p}\right) * \left(\frac{ROIIC}{WACC}\right)\right] + \left[g * \left(\frac{v}{p}\right)\right], \text{ where} \quad (12)$$

TR – total return,
d – distribution of earnings (dividends + share buybacks),
p – price,
e – earnings,
ROIIC – return on incremental invested capital,
WACC – weighted average cost of capital,
g – growth rate,
v/p – value-to-price multiple.

The first step in finding the total expected return is calculating P/E ratio or the inverted PE ratio. After that, it is necessary to find 'd/p' which is the cash distribution return of the company. Next, an analyst must find the reinvestment part which is the '(e-d)/p'. Then, it is important to estimate future ROIIC and WACC to find the 'ROIIC/WACC' multiple. Finally, the growth factor 'g*(v/p)' is organic growth of the company. Growth factor is usually equal to nominal GDP as it is a long-run nominal figure. This number also assumes long-term growth of the economy (Larsson, 2015).

1.6. P/E ratio as the backbone of any value investing strategy

Pre-tax operating earnings are comparable across different capital structures. Greenblatt defined Earnings Yield which is the inverse of the P/E ratio as such:

$$Earnings\ Yield = EBIT \div EV^{8} \quad (13)$$

Basu (1977) found that portfolios of stocks with low P/E ratio outperform a portfolio of stocks with high E/P[9] on a risk-adjusted basis (Badrinath & Kini, 2014). He was the first one to show that low P/E or 'value' stocks outperformed high P/E or 'growth' stocks. Lakonishok, Shleifer, and Vishny (1994) noticed that high E/P stocks are past losers while low E/P are past winners. The authors think that buying low E/P stocks and shorting high E/P ones is a contrarian strategy. Chan, Hamao, and Lakonishok (1991) came up with similar results while researching Japanese equities. These studies have been supported by Fama and French (1992, 1993, 1996), Lakonishok, Shleifer, and Vishny (1994), and Chan and Lakonishok (2004) across all of the continents (Athanassakos, 2010). (Wu, Li, & Hamill, 2012) found that 5-year losers outperform 5-year winners. George Athanassakos found the same results. 30 cheapest stocks outperformed the universe earning 25% p.a. according to Montier study in 2012.

Carlisle & Tobias (2014) found that portfolios based on P/E ratio alone outperform the market on 30-year horizon. They found that adding ROIC as a variable dragged the returns down. Montier concluded that P/E ratio alone outperforms the market in the long run while return on invested capital drags the performance of the selected portfolio. Their conclusion is that stocks with the lowest price-to-earnings ratio outperform stocks with the highest ratio. Researchers do not agree on why high P/E ratio stocks outperform low P/E ratio ones.

Fama and French (1996) think that a three-factor model explains the observed patterns in returns when portfolios are formed based on the E/P ratio, however, it is still not clear what exact factors contribute to this (Badrinath & Kini, 2014). there should be other variables that contribute to the fact that high P/E ratio stocks outperform the low yield ones.

The second group of researchers think that excess returns are based on systematic expectation errors by investors and cannot be explained with risk-adjusted models. This means that investors are too optimistic (pessimistic) about the future profits of low P/E ratio (high P/E ratio) stocks. As a result, negative (positive) earnings surprises for low P/E ratio (high P/E ratio) stocks cause the prices to decrease (increase) which leads to excess returns in strategies that short the low E/P stocks and long the high E/P ones. Similar to this theory, Bauman and Miller (1997) argue that equity researchers sometimes underestimate (overestimate) EPS[10] of high P/E ratio (low P/E ratio) stocks and that performance of high P/E ratio stocks and low P/E ratio stocks is related to EPS surprises (Badrinath & Kini, 2014).

[8] EV = Enterprise Value.
[9] E/P = Earnings / Price.
[10] Earnings per Share (EPS)

The third group of researchers argue that excess returns come from misestimating of systematic risk. However, it has not been agreed on how it is related to E/P.

1.7. Previous studies supporting the viability of the investment strategy

Greenblatt was the first one to test the 'Magic Formula', combining just two variables. He asked the programmer to rank 3500 stocks based on Return on Invested Capital and P/E ratio. They created an equally weighted portfolio of 30 stocks. The portfolio returned 30.8% per year for 17 years beating a market by a wide margin. Greenblatt tried to quantify and replicate Buffett's portfolio of 'wonderful companies':

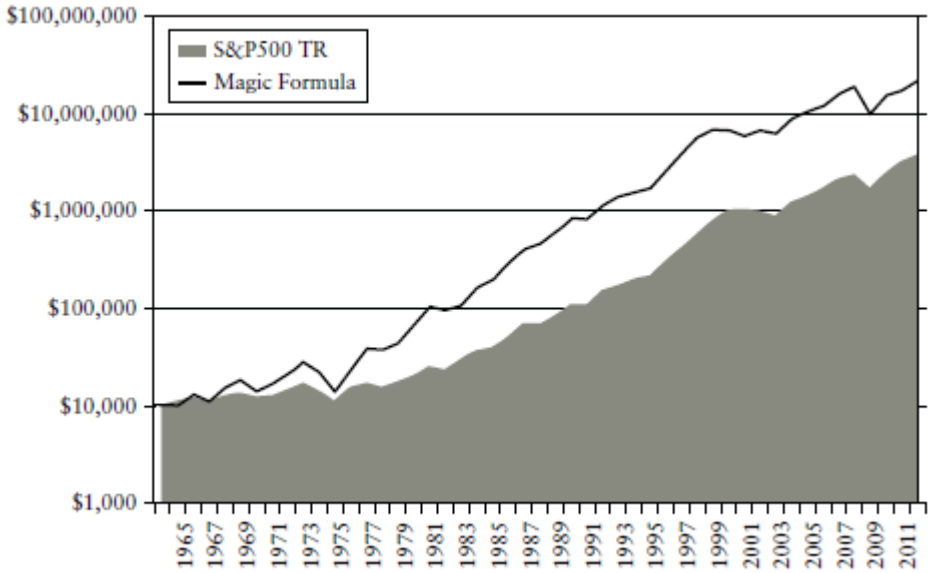

Figure 3. Logarithmic Chart of Magic Formula and S&P 500 (Total return). Performance 1964-2011
Source: Eyquem Investment Management LLC.

Similar studies proved that ROIC and P/E ratio outperform the market in the long run. A study by Carlisle found out that P/E ratio alone outperformed the market by a wider margin than the 'Magic Formula'. Companies with the lowest P/E ratio overperformed the market in the long run:

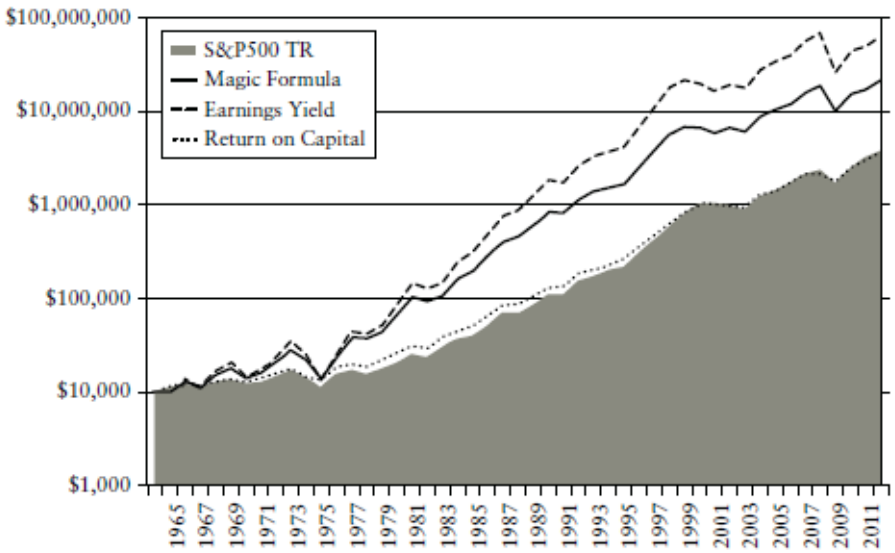

Figure 4. Logarithmic Chart of Magic Formula (Market Weight), P/E ratio, Return on Capital, and S&P 500 (Total Return). Performance (1974 to 2011)

Source: Eyquem Investment Management LLC.

Michael J. Mauboussin conducted a series of research programs in which he showed that most businesses revert to the mean. He analyzed 1000 companies from 2000 to 2010 and demonstrated that ROIC returns to the historic cost of capital at some point in time. However, the researcher could not identify what factors lie behind the companies that are able to earn consistently higher rates of return on capital employed than the historic cost of capital. According to microeconomics, the companies which earn excess returns attract competition that gradually erases profitability in the industry. Reversion-to-the-mean phenomenon leads the industry to zero economic profits:

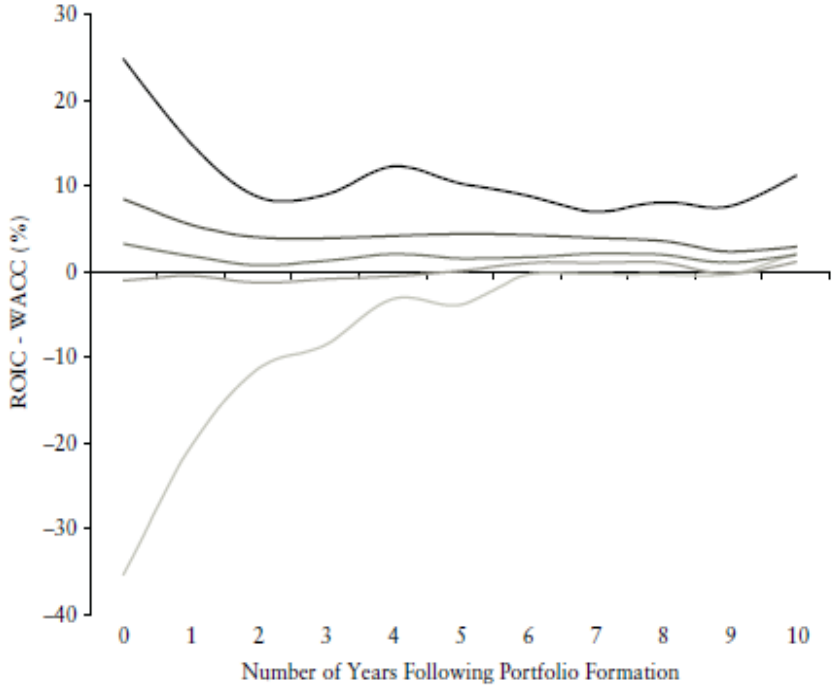

Figure 5. Change in median ROIC by Quintile (2000 to 2010)

Source: *Michael J. Mauboussin,* The Success Equation: Untangling Skill and Luck in Business, Sports and Investing. *(Boston: Harvard Business Review Press), 2012*

Mauboussin examined historical growth rates, the economics of the business's industry, and the business model as potential possibilities influencing future return on capital but could not prove or identify the factors (2014).

Several researchers who studied Baltic stock market found out that the small firm effect allowed the portfolios achieve abnormal returns, or above average investment results. In addition, they found that low P/E stocks slightly outperformed high P/E stocks during 2000-2014. However, the results regarding the P/E ratio are not statistically significant (Arklid & Hallberg, 2015).

In this chapter, two variables were examined: Return on Invested Capital and Price/Earnings ratio. Specifically, Return on Invested Capital has been broken down and the relationship with other financial measures has been shown. Also, the chapter covered how ROIC can be used in stock valuations. Then P/E ratio and its importance in portfolio construction were analyzed. Previous studies related to this research were explored. The methodology explains how the portfolios are constructed and financial models are built.

2. METHODOLOGY FOR CONSTRUCTING PORTFOLIOS BASED ON RETURN ON INVESTED CAPITAL AND P/E RATIO

The purpose of this empirical research is to find out whether Return on Invested Capital (ROIC) and P/E ratio-based portfolios can deliver superior investment results in comparison to OMX Baltic index. The study will help to understand if less expensive companies with outstanding ROIC record allow the investors to accumulate wealth more rapidly.

This research is based on positivism philosophy. It can be described as "external, objective, and independent" (Saunders et al., 2010). Observable and credible data is in the core of this study. The research is also well-structured and quantitative with the author maintaining an objective view. Deductible approach is the most suitable approach for this type of study. At first, a clear hypothesis is set up. Then all of the variables, key definitioans and formulas are described. Finally, the hypothesis is tested to observe if the theoretical framwork holds or should be adjusted accordingly. The study is conducted using explanatory design. The main goal is to analyze the relationship between the two variables ROIC & P/E ratio and virtual portfolio returns (Holyanych, 2019).

The strategy of this study is archival research. Secondary data is the main source of data. When the financial data is collected, it is analyzed and transformod into a financial model to calculate the returns of the portfolio. This study is also action type of research because it involves searching for public company information, analyzing financial statements, and deciding which companies to include in each portfolio (Holyanych, 2019).

Gray & Carlisle (2013) have done a somewhat similar methodology in their work on "Magic Formula" investing. They tested their results for statistical significance but have not done a regression analysis to analyze how independent variable affects the dependent variable or predict the behavior of the dependent variable in the future.

Greenblatt (2010) was the pioneer in the research on return on invested capital and P/E ratio. However, his book lacks the necessary statistical data to support the findings. For example, he does not provide any statistical evidence in terms of significance or correlation.

The course of action for empirical part of the research is the following:

- The population includes all firms (active and insolvent) listed on Nasdaq Baltic from 2015 until 2020. This period can be described as financially stable. There were not any significant financial crises which could distort the results. Five years is also a minimum recommended investment horizon for individual investors.

- There are several company samples such high-ROIC, low-P/E, and a combination of the two.
- All the necessary data is collected through Morningstar.com, Yahoo Finance and Thomson Reuters Eikon.
- The companies are ranked according to their ROIC or P/E and then grouped into the portfolios.
- Returns are compounded annually to account for the dividend reinvestments.
- T-test and regression analysis are conducted to test the significance of the results.

2.1. Established hypotheses

Hypotheses are established to check the statistical significance of the results. Various portfolios are constructed based on one or two variables. The returns of the portfolios are compared between each other as well as with the broader index. Since the purpose of the research is to examine the possibility of ROIC and P/E based portfolios to generate excess returns, the hypotheses are created using these two variables. Portfolio consisting of high-ROIC and low-P/E companies are compared to high-ROIC, low P/E, and index portfolios. Portfolio returns with high-ROIC companies are compared to the portfolio returns with low-ROIC businesses, portfolio returns with low-P/E companies, and index benchmark. Similar comparisons are conducted for the portfolio consisting of low-P/E companies. Statistically, these hypotheses are described as such:

Hypothesis 1a

$H_0: r_{high\ ROIC,low\ P/E} \leq r_{high\ ROIC}$

$H_1: r_{high\ ROIC,low\ P/E} > r_{high\ ROIC}$

Hypothesis 1b

$H_0: r_{high\ ROIC,low\ P/E} \leq r_{low\ P/E}$

$H_1: r_{high\ ROIC,low\ P/E} > r_{low\ P/E}$

Hypothesis 1c

$H_0: r_{high\ ROIC,low\ P/E} \leq r_m$

$H_1: r_{high\ ROIC,low\ P/E} > r_m$

Hypothesis 2a

$H_0: r_{high\ ROIC} \leq r_{low\ ROIC}$

$H_1: r_{high\ ROIC} > r_{low\ ROIC}$

Hypothesis 2b

$H_0: r_{high\ ROIC} \leq r_m$

$H_1: r_{high\ ROIC} > r_m$

Hypothesis 3a

$H_0: r_{low\ P/E} \leq r_{high\ P/E}$

$H_1: r_{low\ P/E} > r_{high\ P/E}$

Hypothesis 3b

$H_0: r_{low\ P/E} \leq r_{high\ ROIC}$

$H_1: r_{low\ P/E} > r_{high\ ROIC}$

Hypothesis 3c

$H_0: r_{low\ P/E} \leq r_m$

$H_1: r_{low\ P/E} > r_m$

$r_{high\ ROIC,low\ P/E}$ — return of the portfolio consisting of high-ROIC and low-P/E companies

$r_{high\ ROIC}$ — return of the portfolio consisting of high-ROIC companies

$r_{low\ ROIC}$ — return of the portfolio consisting of low-ROIC companies

$r_{low\ P/E}$ — return of the portfolio consisting of low-P/E companies

$r_{high\ P/E}$ — return of the portfolio consisting of low-P/E companies

r_m — return of the benchmark index

After hypotheses are defined, it is researcher's task to test them. If the null hypothesis is rejected, it means that the assumptions are true. Similar methodology has been conducted by Arklid & Hallberg (2015) but with the different variables.

2.2. Significance test and regression analysis

The next step is to check if the results are statistically significant with a t-test. Since sample size is large enough, normal distribution can be assumed. First the mean of all portfolios is calculated:

$$\bar{r} = \frac{r_1 + r_2 \ldots + r_n}{n} \tag{14}$$

$\bar{r}$ — average return

r_n — individual returns

n — number of observations

After the mean is calculated, it is crucial to calculate the standard deviation:

$$s = \sqrt{\frac{1}{n-1}} \sum (r_i - \bar{r})^2 \tag{15}$$

s — standard deviation

$\bar{r}$ — average return

r_i — return for the period i

Now it is possible to perform a paired two-sample t-test (Arklid & Hallberg, 2015):

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} \tag{16}$$

t — t-statistics

$\bar{x}$ — sample mean difference

μ — sample mean

s — sample standard deviation

n — sample size

Once t-value is obtained, it is possible to check if the results are statistically significant. The limits of significance are set at 1% and 5% respectively. After that, the critical t-values are compared to the model t-values. If the critical t-test values are lower than the model t-values values, then the null hypothesis can be rejected and the results are statistically significant (Arklid & Hallberg, 2015).

The next step is to do a regression analysis which is a statistical model to check the relationship between the two variables. Market return is independent variable, and the researched portfolio return is a dependent variable. The goal is to see how these two variables behave and make the necessary conclusions based on that. The relationship is seen through a regression line:

$$y = a + \beta x \tag{17}$$

y — dependent variable

a — Alpha

β — Beta

x — independent variable

To complete a regression analysis, it is important to get Alpha, Beta, t-values, and R-squared. R-squared can vary from 0% to 100% and it shows the degree to which the model explains the variability of the data.

2.3. Data collection and samples

The research uses a variety of secondary data. The information is extracted from the documentary and multiple source data sources. Financial data regarding ROIC, P/E and dividends is retrieved from Thomson Reuters Eikon and Morningstar.com. Stock quotes and historic prices are accessed from Yahoo and Google Finance. A full list of companies (the

population), both active and dissolved, is taken from the OMX Tallinn, OMX Riga and OMX Vilnius exchanges which together form a Nasdaq Baltic exchange. It is quite challenging to include all firms that traded during 2015-2020 to avoid survivorship bias. Press releases and corporate websites are accessed if any additional information needed such as financial reports or dividend payment schedules. (Holyanych, 2019).

There are several samples that are collected to model the returns of the high-ROIC and low-P/E companies. The general list of the companies is retrieved from the main website of Nasdaq Baltic. Then the samples are generated based on Return on Invested Capital (ROIC) and P/E ratios. There are five samples in total: 1) high-ROIC & low-P/E; 2) high-ROIC, 3) low-P/E; 4) low-ROIC; 5) high-P/E; and 6) low-ROIC & high-P/E. Portfolios returns of the six samples are compared with the returns of the benchmark index.

Several samples were created out the population consisting of 68 companies traded on Nasdaq Baltic stock exchange. Population consists of 16 companies relating to consumer discretionary industry, 8 – financials, 9 – industrials, 3 – health care, 7 – real estate, 10 – consumer staples, 5 – utilities, 5 – basic materials, 3 – telecommunications, 1 – technology, 1 – energy. Some companies were excluded from the portfolios based on certain limitations. For example, companies with revenues less than EUR 10 million during 2010-2019 were excluded from the research due to the illiquidity of their shares, high volatility in operating performance and absence of financial data. In addition, investment companies and investment funds were not included in the samples due to the difference in their nature and structure.

2.4. Portfolio construction and return calculation

At first, all the necessary data is compiled such as Return on Invested Capital and earnings per share for every public company on Baltic stock exchange for the years 2010-2019. After that, 5-year average Return on Invested Capital is calculated for the years 2010-2014. The same procedure is applied for earnings per share. Now that average earnings per share are calculated, it is possible to calculate a Price-to-average-5-year-earnings ratio as of 02.01.2015.

The next step is to index or number the companies by their 5-year average Return on Invested Capital. For example, the company with the highest Return on Invested Capital will be assigned a rating of “1” and the lowest – “68”. Similar step must be done for the Price-to-average-5-year-earnings ratio. The company with the lowest ratio is assigned “1” while the

company with the highest ratio is assigned "68". The same principle was applied in Joel Greenblatt's Magic Formula research.

Finally, two indexes are added, and the companies are sorted top to bottom. The companies with the lowest overall index have the highest Return on Invested Capital and lowest P/E ratio:

Ticker	Name	ROIC Index	P/E Index	Overall index
SFG1T	Silvano Fashion Group	3	1	4
IVL1L	Invalda INVL	5	5	10
RER1R	Rīgas elektromašīnbūve	16	3	19
VBL1L	Vilniaus baldai	2	17	19
OLF1R	Olainfarm	8	13	21
VLP1L	Vilkyškių pieninė	13	12	25
LNA1L	Linas Agro Group	18	8	26
ZMP1L	Žemaitijos pienas	17	9	26
BAL1R	Latvijas balzams	31	2	33
GRD1R	Grindeks	23	10	33
APG1L	Apranga	6	31	37
TKM1T	Tallinna Kaubamaja Gru	19	19	38
AUG1L	AUGA group	33	7	40

Figure 6. Indexing process for the companies.

Source: Author's research worksheet

The first portfolio consists of the top five companies with the lowest overall index: Silvano Fashion Group, Invalda INVL, Rīgas elektromašīnbūves rūpnīca, Vilniaus baldai, and Olainfarm. Each investment is assumed to have a beginning value of EUR 10,000. The overall portfolio is worth EUR 50,000. The beginning value is calculated on January 2 which is usually the first trading day of the fiscal year. Dividends are not invested but held as cash until January 2, 2020. The ending value is calculated on the same date of the next year. The following formula is used to calculate cumulative return of a single stock position.

Annualized return is derived from formula:

$$r_{an} = \left(\frac{V_{end}^{\frac{1}{n}}}{V_{beg}} - 1 \right) * 100\% \quad (18)$$

Cumulative return is calculated using the following formula:

$$r_{cum} = \left(\frac{V_{end} - V_{beg}}{V_{beg}} \right) * 100\% \quad (19)$$

Mean return is calculated by averaging individual portfolio returns.

2.5. Procedures

The first step of the research is to identify all the companies, both active and delisted, that traded on Nasdaq Baltic during 2015-2020. After the population is defined, it is necessary to create five portfolios discussed previously. When constructing the portfolios, the focus is on the ROIC and P/E ratios. The companies are ranked according to these measures. The main portfolio is comprised of the companies that have the highest ROIC and lowest P/E ratios. Other portfolios include the companies that score the highest or lowest on one of the researched variables.

All calculations are done in Microsoft Excel. The first step is to calculate the beginning equity values for each portfolio as of 2015. The stock positions are equally weighted to provide adequate diversification. The next step is to find out the exact dividend payments to be able to reinvest those back into the portfolios every year until 2020. Returns of the portfolios are compounded annually as most European companies pay dividend annually rather than quarterly. After that, 2020 prices are used to calculate the end liquidation value of each portfolio. Then cumulative returns are calculated according to formula (19).

After the calculations are done, it is possible to compare the returns of the different portfolios and either accept or reject the hypotheses. Finally, the results are tested if they are statistically significant.

2.6. Previous studies & research methods

Similar studies were conducted by Arklid & Hallberg (2015), Paškevičius & Mickevičiūtė (2011), and Legenzova, Jurakovaitė, & Galinskaitė (2018). Arklid & Hallberg (2015) conducted a study exploring the returns of the Baltic companies. They compared the

returns of the P/E based portfolio and small capitalization portfolio with the broader index. This study uses similar research methods. Arklid & Hallberg (2015) built a financial model where they compounded dividends from 2000 until 2014 replacing companies that no longer met their criteria. The sample size is the different in two of the portfolios. The researchers found that the P/E effect was statistically insignificant while small capitalization effect portfolio earned excess returns during the researched period.

Paškevičius & Mickevičiūtė (2011) employed similar research methods in their study about contrarian strategies in small capitalization markets. Several portfolios were formed based on low-performing and well-performing companies. Each portfolio had the same number of companies. The companies were ranked based on their prices. The researchers found that the contrarian approach did not perform as well as expected because the strategy does not work in small capitalization markets.

Legenzova, Jurakovaitė, & Galinskaitė (2018) took a somewhat different approach in their study on how the dividend announcements effect stock prices and returns. The researchers calculated the returns separately for company rather than forming the portfolios. It is probably a more suitable approach due to the nature of the research question. The data on how the dividend news impact several companies simultaneously would not be very precise.

2.7. Constraints and necessary assumptions

The financial model excludes some of the costs related to the transactions. Brokerage and maintenance fees are not accounted for since they cannot be measured accurately. Income taxes are also not considered when measuring portfolio returns. These constrains are in line with the previous studies that were conducted on the Baltic stock exchange. The number of companies in each portfolio is not the same as there are not many companies on Nasdaq Baltic that meet the research criteria.

The results will show which hypotheses can be rejected and the initial assumption proved correct. After that, the empirical findings will be tested for statistical significance. Then the regression analysis will be completed to spot a relationship between the variables. Finally, the next chapters will show is high-ROIC, low-P/E portfolio is a reliable strategy to earn excess returns over the long run.

3. COMPARISON OF INVESTOR RETURNS DERIVED FROM INDEX & ROIC AND P/E BASED PORTFOLIOS

This chapter interprets the results of the study, draws the necessary conclusions, points to research limitations, and suggests areas for future research related to the topic. It explains the performance of various constructed portfolios and shows the opportunity behind a high ROIC, low P/E strategy.

3.1. Comparison of portfolio returns

Table 1. Portfolio yearly and cumulative returns.

Source: Author's worksheet

Returns of the different portfolios are listed below:

	2015	2016	2017	2018	2019	Annualized	Cumulative
High ROIC, low PE portfolio - 5	4%	36%	23%	(9%)	11%	**12%**	**76%**
High ROIC, low PE portfolio - 10	7%	31%	32%	(10%)	20%	**15%**	**98%**
High ROIC, low PE portfolio - 15	8%	27%	31%	(9%)	17%	**14%**	**89%**
High ROIC, low PE portfolio - 21	7%	27%	28%	(11%)	15%	**12%**	**79%**
High ROIC, low PE portfolio	*6%*	*30%*	*28%*	*(10%)*	*16%*	***13%***	***86%***
Low ROIC, high PE portfolio - 5	8%	3%	11%	(18%)	(9%)	**(2%)**	**(7%)**
Low ROIC, high PE portfolio - 10	7%	14%	11%	(14%)	3%	**4%**	**19%**
Low ROIC, high PE portfolio - 15	2%	17%	20%	(10%)	3%	**6%**	**34%**
Low ROIC, high PE portfolio - 19	5%	19%	28%	(16%)	4%	**7%**	**40%**
Low ROIC, high PE portfolio	*6%*	*13%*	*18%*	*(14%)*	*0%*	***4%***	***21%***
Low PE portfolio - 5	17%	34%	27%	(3%)	13%	**17%**	**118%**
Low PE portfolio - 10	12%	32%	36%	(8%)	22%	**18%**	**125%**
Low PE portfolio - 15	12%	30%	29%	(9%)	17%	**15%**	**99%**
Low PE portfolio - 21	9%	27%	27%	(10%)	17%	**13%**	**84%**
Low PE portfolio	*13%*	*31%*	*30%*	*(8%)*	*17%*	***16%***	***106%***
High PE portfolio - 5	8%	35%	31%	(18%)	13%	**12%**	**78%**
High PE portfolio - 10	6%	16%	24%	(15%)	12%	**8%**	**46%**
High PE portfolio - 15	6%	21%	24%	(14%)	10%	**8%**	**49%**
High PE portfolio - 25	5%	21%	28%	(14%)	13%	**10%**	**61%**
High PE portfolio	*6%*	*23%*	*27%*	*(15%)*	*12%*	***10%***	***58%***
High ROIC portfolio - 5	7%	35%	2%	(12%)	18%	**9%**	**54%**

High ROIC portfolio - 10	2%	29%	25%	(10%)	14%	**11%**	**71%**
High ROIC portfolio - 15	3%	23%	23%	(9%)	18%	**11%**	**68%**
High ROIC portfolio - 21	7%	27%	28%	(11%)	15%	**12%**	**79%**
High ROIC portfolio	*5%*	*29%*	*20%*	*(10%)*	*16%*	***11%***	***68%***
Low ROIC portfolio - 5	9%	7%	7%	(10%)	(9%)	**0%**	**1%**
Low ROIC portfolio - 10	(0%)	12%	16%	(16%)	(1%)	**1%**	**7%**
Low ROIC portfolio - 15	(1%)	17%	23%	(9%)	3%	**6%**	**33%**
Low ROIC portfolio - 21	5%	19%	28%	(16%)	4%	**7%**	**40%**
Low ROIC portfolio	*3%*	*14%*	*18%*	*(13%)*	*(1%)*	***4%***	***20%***
OMX_Baltic_Benchmark_GI	13%	25%	21%	(9%)	13%	**12%**	**74%**

The first column shows different sets of portfolios. Each set is comprised of four portfolios. Portfolio – 5 means that top five companies that meet the criteria and have the highest (or lowest) index are included in the portfolio. Portfolio – 10 means that top 10 companies are included in it etc. Portfolio – 15 means that top 15 companies are included in the portfolio. Finally, Portfolio – 19 and portfolio – 21 include top 19 and 21 companies, respectively. Each row in italics is where mean return of the portfolio set is calculated. Columns 2015-2020 show yearly returns for each portfolio. Green-colored cells indicate which portfolios outperformed the market while red-colored ones indicate which underperformed. Only two sets of portfolios high ROIC, low PE portfolio and low PE portfolio outperformed Baltic index.

3.1.1. Results of the outperforming portfolios

Initial expectations turned out to be correct for high ROIC, low PE portfolio set as each portfolio outperformed the market as indicated with a light green color. This set of portfolios is constructed from the companies which were indexed according to their ROIC and PE ratios scores. Exact components and their respective returns are available in Appendix 2 (47). The results are consistent with Joel Greenblatt's study (2010). Joel Greenblatt used the combination of these two factors on a 3500 list of US companies and his annualized return turned out three times higher than the market return. Although this study's population is much smaller (68<3500), it is still surprising that the same strategy works in such a small market as Baltic stock exchange. In Greenblatt's study, portfolio based on the first 30 best-ranked stocks always outperformed the next 30 best-ranked companies. This study has not confirmed this phenomenon because of a small sample size. Greenblatt's Magic formula returned 23.8% annually during

1988-2009 versus 9.5% for S&P 500. High ROIC, low PE portfolio returned 13.2% versus Baltic stock market index return of 11.7% during 2015-2020. The next step is to check statistical significance in the next section of this chapter. Gray & Carlisle (2013) conducted their own research on the Magic Formula. They found that the portfolios based on high ROIC and low PE ratios outperformed the market during 1964-2011. Magic formula portfolio achieved a 12.79% annualized return while S&P 500 scored 9.52% on an annual basis. High ROIC, low PE portfolio underperformed Joel Greenblatt's portfolios due to a much lower population set. Mihaljevic (2013) emphasizes that high ROIC, low PE portfolios work better in larger population sets, at least several thousand companies. In Baltic stock exchange case, the population is much smaller. However, the results are still satisfactory and show that it is possible to beat the market using high ROIC, low PE strategy.

However, there is a surprising result from a different set of portfolios. Low PE portfolio outperformed both high ROIC, low PE portfolio (Magic Formula) and the market. Low PE portfolio delivered 15.6% versus 13.2% for high ROIC, low PE portfolio and 11.75% for the index return during 2015-2020. The results are consistent with the study conducted by Gray and Carlisle (2013) who thoroughly analyzed Joel Greenblatt's findings regarding the Magic Formula. The researchers had S&P 500 as population. The portfolio based on Magic formula delivered 13.94% on an annual basis during 1974-2011. Portfolio based on high earnings yield (or low PE ratio) returned 15.95%. Portfolio based on single variable ROIC delivered 10.37% on annual basis. S&P 500 scored 10.46% during 1974-2011. Therefore, low PE portfolio outperformed Magic Formula, high ROIC and index portfolios. These results come in line with this research as low PE set of portfolios turned out to be the most profitable one. However, low-PE portfolio outperformed market return by a much smaller margin. The reason is that the smaller the population the less effect is seen from the high earnings yield strategy.

Arklid & Hallberg (2015) study partially supports findings obtained in this research. The researchers found that portfolio based on the lowest PE ratio and a portfolio based on small capitalization stocks outperformed index returns during 2000-2014. However, the PE effect was found to be statistically insignificant. The researcher, however, did not consider the companies' ROIC ratios. Had they accounted for this ratio and eliminated low quality assets; the results of the study might have been different. The main goal of ROIC analysis is to eliminate

underperforming, low quality assets that cannot earn their economic cost of capital. Such companies are usually unprofitable on an average basis. They also drag portfolio returns due to their poor operating performance and disappointing results.

Basu (1977) was one of the first to prove that portfolios based on low P/E ratio outperformed the ones with high P/E ratio. Lakonishok, Schleifer & Vishny (1994) and Kelly, McClean & McNamara (2008) also received similar results. Goodman & Peavy (1986) studied 125 industrial companies in the U.S. during 1970-1980 and found that low P/E companies indeed outperformed high P/E stocks on the contrary to CAPM model. Fama & French (1992) concluded that there was a P/E effect on the U.S. stock market during 1963-1990. Johnson, Fiore & Zuber (1989), however, received different results when they researched equities from 1979 to 1984. They found that abnormal returns could be achieved investing in high P/E stocks and questioned Basu's theory. Most researchers believe low priced stocks outperform higher priced ones over a longer period (Arklid & Hallberg, 2015).

3.1.2. Results of the underperforming portfolios

Low ROIC, high P/E portfolio is the mirror portfolio to high ROIC, low P/E one. The result was expected to be poor. The mean return for the period is only 21% comparing to the 74% for the index. This set of portfolios includes the most expensive and lowest quality assets. The results come in line with Greenblatt's study, in which bottom quartile of the companies drastically underperformed both top quartile companies and the market (Mihaljevic, 2013).

Only one high P/E portfolio outperformed the market. The main reason is a very good mix of companies which turned out to be high-quality assets. Mean return of high P/E portfolios underperforms the market. It consists of the most expensive companies. The results are still better than low ROIC, high P/E portfolio returns. Some authors concluded that investing in high P/E stocks can bring abnormal returns. Among them are Johnson, Fiore & Zuber (1989). However, most researchers believe high P/E portfolios underperform the market over a longer period.

Portfolios based on just one variable ROIC underperformed the market during 2015-2020. Only portfolio – 21 slightly outperformed due to a rather big number of companies included in it comparing to the population. The results are consistent with Greenblatt's (2010)

and Gray & Carlisle (2013) studies which concluded that ROIC based portfolios underperform the market.

Low ROIC portfolios are the most underperforming group of stocks in this research. This set of portfolios includes the worst low-quality assets. Most companies are unprofitable and show poor operating and financial results. Cumulative return is 20% versus 74% for the market during 2015-2020.

3.1.3. Comparison of investors' wealth

The following graph shows how various portfolio performed during 2015-2020. Low PE portfolio outperformed both high-ROIC-low-PE portfolio and benchmark index:

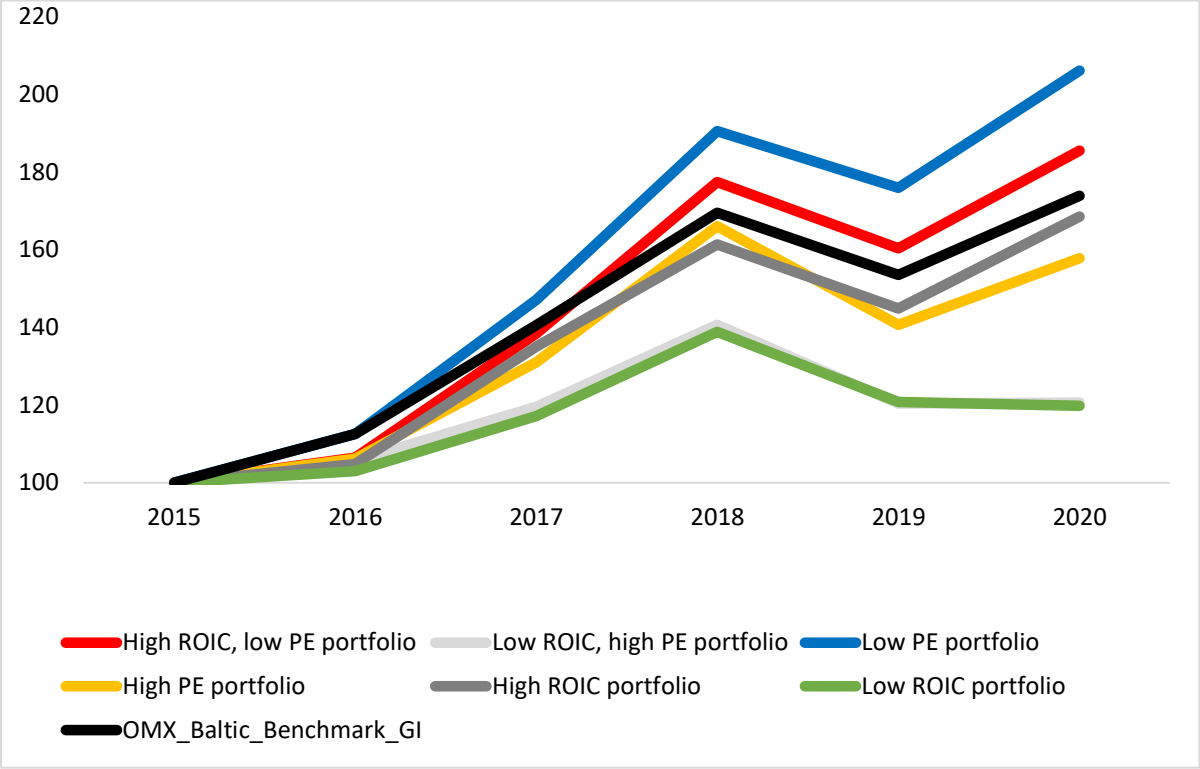

Figure 7. EUR 100 invested in different portfolios vs Baltic benchmark index*

*Based on the portfolios' mean returns.

Source: Author's worksheet

The following table reflect investors' wealth depending on where they allocate their investment funds. EUR 100 invested in different portfolios delivered the following results during 2015-2020:

Table 2. EUR 100 invested in different portfolios vs Baltic benchmark index*

*based on the portfolios' mean returns

Source: Author's worksheet

	2015	**2016**	**2017**	**2018**	**2019**	**2020**
High ROIC, low PE portfolio	100	106	138	178	160	186
Low ROIC, high PE portfolio	100	106	120	141	120	121
Low PE portfolio	100	113	147	191	176	206
High PE portfolio	100	106	131	166	141	158
High ROIC portfolio	100	105	135	161	145	169
Low ROIC portfolio	100	103	117	139	121	120
OMX_Baltic_Benchmark_GI	100	113	141	170	154	174

Low P/E portfolio brings the most money to an individual investor according to the above comparison. If the investors remove the low-quality assets which have ROIC less than their cost of capital and then invest their money in 10 or 15 cheapest (based on P/E) stocks, they should do well over the next 5 years. After that period, they can rebalance the portfolio and repeat the required steps. At some point, the investors will achieve their investment goals and reach financial well-being.

3.2. Analysis of statistical significance of the results

The next step is to check whether portfolio returns are statistically significant. Null hypothesis is either accepted if results are not statistically significant and rejected if results are statistically significant.

Hypothesis 1a

$$H_0: r_{high\ ROIC,low\ P/E} \leq r_{high\ ROIC}$$

$$H_1: r_{high\ ROIC,low\ P/E} > r_{high\ ROIC}$$

Mean: -11.27

$\mu = 0$

$$S^2 = SS / df = 538.24/(11-1) = 53.82$$

$$S_M^2 = S^2/N = 53.82/11 = 4.89$$

$$S_M = \sqrt{S_M^2} = \sqrt{4.89} = 2.21$$

T-value Calculation

$$t = (M - \mu)/S_M = (-11.27 - 0)/2.21 = -5.09$$

The value of t is -5.09486. The value of p is .00023. The result is significant at p < .05 which means that H_0 can be rejected and H_1 holds true. As a result, high ROIC, low PE portfolio indeed outperformed high ROIC portfolio during 2015-2020. Investors are better off investing in portfolios based on two variables high ROIC and low P/E than a single ROIC ratio.

Hypothesis 1b

$$H_0: r_{high\ ROIC,low\ P/E} \leq r_{low\ P/E}$$

$$H_1: r_{high\ ROIC,low\ P/E} > r_{low\ P/E}$$

μ = 0

$$S^2 = SS\ /\ df = 10457.97/(11-1) = 1045.8$$

T-value Calculation

$$t = (M - \mu)/S_M = -0.54$$

The t-value is -0.53589. The p-value is .298971. The result is not significant at p < .05 which means that H_0 cannot be rejected and H_0 holds true. As a result, high ROIC, low PE portfolio underperformed low-PE portfolio during 2015-2020. Investors should sort the companies by eliminating stocks with return on invested capital lower than their cost of capital and then choosing 10-15 companies with a lowest P/E ratio. Such strategy should bring abnormal returns according to the results of this study.

Hypothesis 1c

$$H_0: r_{high\ ROIC,low\ P/E} \leq r_m$$

$$H_1: r_{high\ ROIC,low\ P/E} > r_m$$

Mean: -4.25

μ[11] = 0

$$S^2 = SS / df = 326.04/(11-1) = 32.6$$

$$S_M^2 = S^2/N = 32.6/11 = 2.96$$

$$S_M = \sqrt{S_M^2} = \sqrt{2.96} = 1.72$$

T-value Calculation:

$$t = (M - \mu)/ S_M = (-4.25 - 0)/1.72 = -2.47$$

The value of t is -2.467537. The value of p is .01662. The result is significant at p < .05 which means that H_0 can be rejected and H_1 holds true. As a result, high ROIC, low PE portfolio indeed outperformed Baltic stock market index during 2015-2020. This market beating strategy has been proved several times, famous investor Joel Greenblatt in particular.

Regression analysis for high ROIC, low P/E portfolio and the market is useful because of several reasons. The first reason is to try to predict and forecast portfolio returns and a second reason is to find potential causal relationships between different variables. Here is the regression analysis between high ROIC, low P/E and the market:

Sum of X = 1579.56

Sum of Y = 1626.29

Mean X = 143.5964

Mean Y = 147.8445

Sum of squares (SSX) = 7484.7959

Sum of products (SP) = 8808.3618

$$\hat{y} = bX + a$$

$$b = SP/SS_X = 8808.36/7484.8 = 1.17683$$

$$a = M_Y - bM_X = 147.84 - (1.18 * 143.6) = -21.14453$$

$$\hat{y} = 1.17683X - 21.14453$$

[11] Population mean

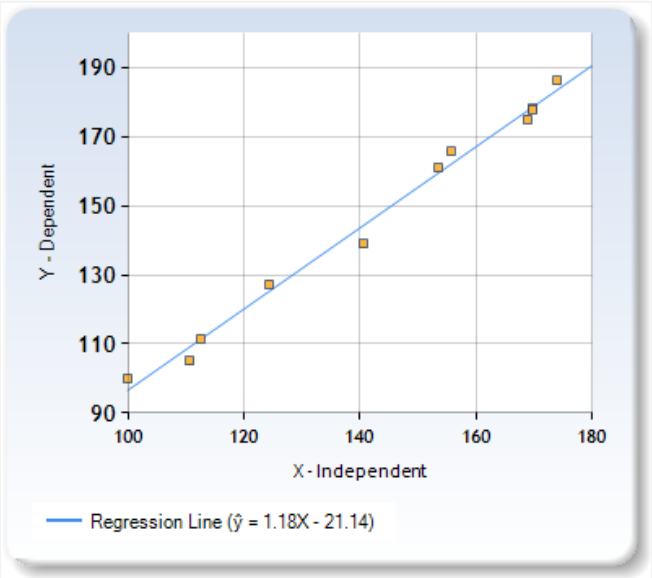

Figure 8. Regression line for high ROIC, low PE portfolio & the market

Source: socscistatistics.com/tests/regression/default.aspx

Hypothesis 2a

$$H_0: r_{high\ ROIC} \leq r_{low\ ROIC}$$

$$H_1: r_{high\ ROIC} > r_{low\ ROIC}$$

Mean: 13.75

μ = 0

$$S^2 = SS / df = 6221.35/(11-1) = 622.14$$

$$S_M^2 = S^2/N = 622.14/11 = 56.56$$

$$S_M = \sqrt{S_M^2} = \sqrt{56.56} = 7.52$$

T-value Calculation

$$t = (M - \mu)/S_M = (13.75 - 0)/7.52 = 1.83$$

The value of t is 1.828943. The value of p is .04867. The result is significant at p < .05 which means that H_0 can be rejected and H_1 holds true. As a result, high ROIC portfolio outperformed low ROIC portfolio during 2015-2020. However, both strategies are not very profitable. Investors would be better off leaving their money in an index fund than investing in abovementioned portfolios.

Hypothesis 2b

$$H_0: r_{high\ ROIC} \leq r_m$$

$$H_1: r_{high\ ROIC} > r_m$$

$$S^2 = SS / df = 7484.8/(11-1) = 748.48$$

T-value Calculation

$$t = (M - \mu)/S_M = 0.61$$

The t-value is 0.61067. The p-value is .274147. The result is not significant at p < .05 which means that H_0 cannot be rejected and H_0 holds true. As a result, high-ROIC portfolio underperformed index return during 2015-2020. Investors would be better off investing in an index fund than in portfolio only based on ROIC ratio.

Regression analysis for high-ROIC portfolio and the market is useful to better understand the relationship between different variables and predict or forecast returns in the future:

Sum of X = 1579.56

Sum of Y = 1502.32

Mean X = 143.5964

Mean Y = 136.5745

Sum of squares (SSX) = 7484.7959

Sum of products (SP) = 7186.0643

$$\hat{y} = bX + a$$

$$b = SP/SS_X = 7186.06/7484.8 = 0.96009$$

$$a = M_Y - bM_X = 136.57 - (0.96 * 143.6) = -1.29063$$

$$\hat{y} = 0.96009X - 1.29063$$

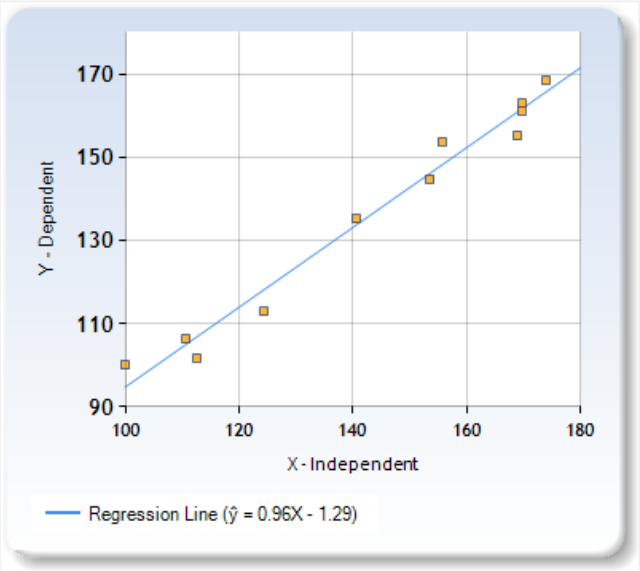

Figure 9. Regression line for high-ROIC portfolio & the market

Source: socscistatistics.com/tests/regression/default.aspx

Hypothesis 3a

$$H_0: r_{low\ P/E} \leq r_{high\ P/E}$$

$$H_1: r_{low\ P/E} > r_{high\ P/E}$$

Mean: 22.21

μ = 0

$$S^2 = SS\ /\ df = 3155.12/(11-1) = 315.51$$

$$S_M^2 = S^2/N = 315.51/11 = 28.68$$

$$S_M = \sqrt{S_M^2} = \sqrt{28.68} = 5.36$$

T-value Calculation

$$t = (M - \mu)/S_M = (22.21 - 0)/5.36 = 4.15$$

The value of t is 4.146519. The value of p is .001. The result is significant at p < .05 which means that H_0 can be rejected and H_1 holds true. As a result, low-PE portfolio outperformed high-PE portfolio during 2015-2020. Even though certain researchers believe high P/E stocks outperform low P/E ones, the vast majority believes otherwise. The higher the earnings yield the higher return can investors expect from their holdings.

Hypothesis 3b

$$H_0: r_{low\ P/E} \leq r_{high\ ROIC}$$

$$H_1: r_{low\ P/E} > r_{high\ ROIC}$$

Mean: 19.65

μ = 0

$$S^2 = SS / df = 2164.6/(11-1) = 216.46$$

$$S_M^2 = S^2/N = 216.46/11 = 19.68$$

$$S_M = \sqrt{S_M^2} = \sqrt{19.68} = 4.44$$

T-value Calculation

$$t = (M - \mu)/S_M = (19.65 - 0)/4.44 = 4.43$$

The value of t is 4.429661. The value of p is .00064. The result is significant at p < .05 which means that H_0 can be rejected and H_1 holds true. As a result, low P/E portfolio outperformed high-ROIC portfolio during 2015-2020. Low P/E portfolio outperformed all the portfolios in this study.

Hypothesis 3c

$$H_0: r_{low\ P/E} \leq r_m$$

$$H_1: r_{low\ P/E} > r_m$$

Mean: -12.63

μ = 0

$$S^2 = SS / df = 1881.46/(11-1) = 188.15$$

$$S_M^2 = S^2/N = 188.15/11 = 17.1$$

$$S_M = \sqrt{S_M^2} = \sqrt{17.1} = 4.14$$

T-value Calculation

$$t = (M - \mu)/S_M = (-12.63 - 0)/4.14 = -3.05$$

The value of t is -3.053445. The value of p is .00609. The result is significant at p < .05 which means that H_0 can be rejected and H_1 holds true. As a result, low P/E portfolio outperformed

index returns during 2015-2020. Investors who stick to the P/E strategy outlined in this research will likely enjoy abnormal returns in the future, beating the index over long-term period.

Regression analysis for low-PE portfolio and the market is useful to see certain relationships between the two variables. Also, it is possible to forecast or predict returns based on the following regression analysis results:

Sum of X = 1579.56

Sum of Y = 1718.47

Mean X = 143.5964

Mean Y = 156.2245

Sum of squares (SSX) = 7484.7959

Sum of products (SP) = 11021.8373

$$\hat{y} = bX + a$$

$$b = SP/SS_X = 11021.84/7484.8 = 1.47256$$

$$a = M_Y - bM_X = 156.22 - (1.47 * 143.6) = -55.23022$$

$$\hat{y} = 1.47256X - 55.23022$$

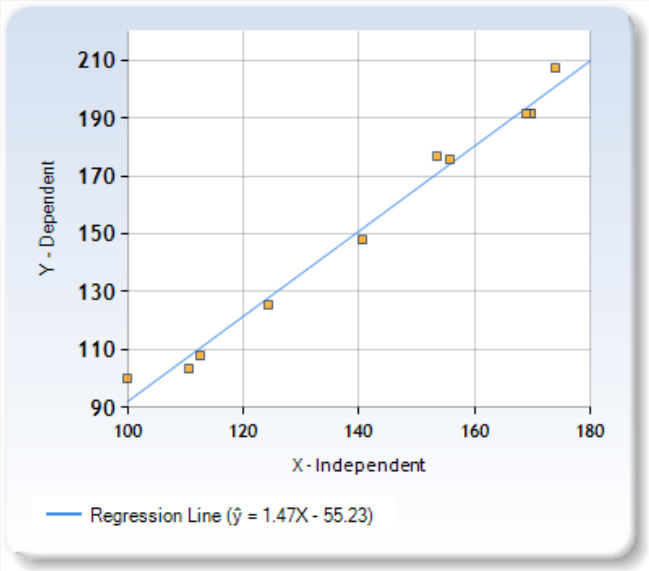

Figure 10. Regression line for low-PE portfolio & the market

Source: socscistatistics.com/tests/regression/default.aspx

CONCLUSIONS AND PROPOSALS

The purpose of this research is to find out whether high ROIC, low P/E portfolio can outperform Baltic stock market index over the period of 5 years by comparing different portfolios and finding an optimal strategy to help investors navigate with their investments. Several other research objectives include describing the factors that helped the portfolios outperform the index, predicting the future behavior of the strategy, providing advice to portfolio managers that would help make investment decisions, and, finally, building a reliable framework for further research in this area.

After analyzing portfolio returns, comparing them with the market and testing for statistical significance, it is safe to say that high ROIC, low P/E strategy indeed outperformed Baltic benchmark index during 2015-2020. Cumulative return for the set of portfolios is 86% versus 74% for the market during the five years. Null hypothesis has been rejected and thus the results are significant. The results are consistent with Gray & Carlisle (2013) and Greenblatt (2010) who received similar results when analyzing U.S. stock market.

However, new, and unexpected results emerged during this research. Low P/E portfolio constructed with companies in which return on invested capital is higher than cost of capital outperformed all the portfolios as well as the index. The cumulative return for low P/E portfolio is 106% versus 74% for the market during 2015-2020. Null hypothesis is rejected and thus the results are statistically significant. The results are also consistent with Gray & Carlisle (2013), Basu (1977), Lakonishok, Schleifer & Vishny (1994), Kelly, McClean & McNamara (2008), Goodman & Peavy (1986) who also received similar results.

There are two factors that allowed high ROIC, low P/E & low P/E portfolios outperform the market. It is quality and price of the assets. ROIC assures that assets certain level of earning power comparing to the capital invested in them while P/E ratio ensures that investors do not overpay for the assets. High ROIC, low P/E portfolio includes stocks with the highest rating on both variables. Low P/E portfolio contains companies that have passed the ROIC>WACC test and have the lowest P/E ratio. Average ROIC and earnings are used to avoid any particularly good or bad years and smooth out operating results.

This research has certain important limitations. One of the most important limitations is that past returns do not guarantee future returns. Even if the strategy works in theory, it might

not work in practice. Investors should always keep this factor in mind. The next limitation is that this study might be a subject of a survivorship bias. The population has been changing for the past 5 years and some companies that could have been added in 2015 went private, became acquired or insolvent. Another limitation is that dividends are not reinvested back into the portfolios due to complexity of the model and low marginal effectiveness. The cash from the dividends shall be reinvested at the end of the five-year period during portfolio rebalancing. Brokerage, treading fees, taxes and other miscellaneous costs are excluded from the model.

This research's theoretical and practical contribution is important in finance and portfolio management. It may provide useful insights for future studies in the related topic. Portfolio managers may be able to use the finding to finetune their investment strategies and enhance their annual returns. Companies' managements should take a hard look at the quality of their companies and make sure they enhance shareholder value by building wonderful companies. They should make sure that shareholders earn a satisfactory return on the capital they contributed as well as make sure that the stock price is not too high high or too low. Investment bankers could construct a low-cost 3X leveraged ETF based on the findings of this research. It could potentially outperform market return with a wide margin over the next 5-10 years.

One of the recommendations for future research is to look at this strategy for a longer period, 10-15 years. Researchers could also explore how this strategy works in other markets. More research is needed to explore low P/E strategy which includes only companies with return on capital higher than cost of capital. It would also be interesting to see similar research with other variables such as ROA (return on assets) or gross margin.

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ANNEX 1. STATISTICAL CALCULATIONS AND REGRESSION ANALYSIS DATA

High ROIC, low PE (T1)	Index (T2)	Diff (T2 - T1)	Dev (Diff - M)	Sq. Dev
100.00	100.00	0	4.25	18.05
104.96	110.72	5.76	10.01	100.16
111.54	112.56	1.02	5.27	27.75
127.26	124.38	-2.88	1.37	1.87
138.87	140.59	1.72	5.97	35.62
165.61	155.62	-9.99	-5.74	32.97
178.03	169.58	-8.45	-4.2	17.66
177.83	169.72	-8.11	-3.86	14.91
160.95	153.57	-7.38	-3.13	9.81
175.08	168.87	-6.21	-1.96	3.85
186.16	173.95	-12.21	-7.96	63.39
		M: -4		S: 326.04

High ROIC, low PE (T1)	High ROIC (T2)	Diff (T2 - T1)	Dev (Diff - M)	Sq. Dev
100.00	100.00	0	11.27	127.01
104.96	106.28	1.32	12.59	158.51
111.54	101.81	-9.73	1.54	2.37
127.26	112.82	-14.44	-3.17	10.05
138.87	135.09	-3.78	7.49	56.1
165.61	153.77	-11.84	-0.57	0.32
178.03	161.15	-16.88	-5.61	31.47
177.83	162.96	-14.87	-3.6	12.96
160.95	144.75	-16.2	-4.93	24.3
175.08	155.19	-19.89	-8.62	74.3
186.16	168.50	-17.66	-6.39	40.83
		M: -11.27		S: 538.24

High ROIC, low PE (T1)	Low PE (T2)	Diff (T2 - T1)	Dev (Diff - M)	Sq. Dev
100.00	100.00	-47.84	-56.22	2289.10
104.96	103.31	-42.88	-52.91	1839.08
111.54	107.83	-36.30	-48.39	1318.02
127.26	125.51	-20.58	-30.71	423.72

138.87	147.73	-8.97	-8.49	80.54
165.61	175.81	17.77	19.59	315.61
178.03	191.43	30.19	35.21	911.16
177.83	191.75	29.99	35.53	899.13
160.95	176.68	13.11	20.46	171.75
175.08	191.38	27.24	35.16	741.77
186.16	207.04	38.32	50.82	1468.07
		M: 147.84		

High ROIC (T1)	Low ROIC (T2)	Diff (T2 - T1)	Dev (Diff - M)	Sq. Dev
100.00	100.00	0	-13.75	189.19
106.28	104.20	2.08	-11.67	136.3
101.81	135.28	-33.47	-47.22	2230.16
112.82	135.26	-22.44	-36.19	1310.05
135.09	117.06	18.03	4.28	18.28
153.77	130.12	23.65	9.9	97.92
161.15	138.76	22.39	8.64	74.57
162.96	129.52	33.44	19.69	387.52
144.75	120.68	24.07	10.32	106.41
155.19	120.51	34.68	20.93	437.87
168.50	119.63	48.87	35.12	1233.1
		M: 13.75		S: 6221.35

Low PE (T1)	High PE (T2)	Diff (T2 - T1)	Dev (Diff - M)	Sq. Dev
100.00	100.00	0	-22.21	493.16
103.31	107.07	-3.76	-25.97	674.3
107.83	103.09	4.74	-17.47	305.11
125.51	107.62	17.89	-4.32	18.64
147.73	130.92	16.81	-5.4	29.13
175.81	157.42	18.39	-3.82	14.57
191.43	166.27	25.16	2.95	8.72
191.75	157.43	34.32	12.11	146.72
176.68	140.85	35.83	13.62	185.58
191.38	145.48	45.9	23.69	561.35
207.04	158.04	49	26.79	717.85
		M: 22.21		S: 3155.12

High ROIC (T1)	Index (T2)	Diff (T2 - T1)	Dev (Diff - M)	Sq. Dev
100.00	100.00	-36.57	-43.60	1337.70
106.28	110.72	-30.29	-32.88	917.76

101.81	112.56	-34.76	-31.04	1208.57
112.82	124.38	-23.75	-19.22	564.28
135.09	140.59	-1.48	-3.01	2.20
153.77	155.62	17.20	12.02	295.68
161.15	169.58	24.58	25.98	603.95
162.96	169.72	26.39	26.12	696.19
144.75	153.57	8.18	9.97	66.84
155.19	168.87	18.62	25.27	346.54
168.50	173.95	31.93	30.35	1019.23
		M: 136.57		SS: 7058.95

High ROIC (T1)	Low PE (T2)	Diff (T2 - T1)	Dev (Diff - M)	Sq. Dev
100.00	100.00	-0	-19.65	386.12
106.28	103.31	-2.97	-22.62	511.66
101.81	107.83	6.02	-13.63	185.78
112.82	125.51	12.69	-6.96	48.44
135.09	147.73	12.64	-7.01	49.14
153.77	175.81	22.04	2.39	5.71
161.15	191.43	30.28	10.63	113
162.96	191.75	28.79	9.14	83.54
144.75	176.68	31.93	12.28	150.8
155.19	191.38	36.19	16.54	273.57
168.50	207.04	38.54	18.89	356.83
		M: 19.65		S: 2164.6

Index (T1)	Low PE (T2)	Diff (T2 - T1)	Dev (Diff - M)	Sq. Dev
100.00	100.00	0	12.63	159.47
110.72	103.31	7.41	20.04	401.53
112.56	107.83	4.73	17.36	301.31
124.38	125.51	-1.13	11.5	132.21
140.59	147.73	-7.14	5.49	30.12
155.62	175.81	-20.19	-7.56	57.18
169.58	191.43	-21.85	-9.22	85.04
169.72	191.75	-22.03	-9.4	88.39
153.57	176.68	-23.11	-10.48	109.87
168.87	191.38	-22.51	-9.88	97.65
173.95	207.04	-33.09	-20.46	418.69
		M: -12.63		S: 1881.46

Index, X	High ROIC, low PE, Y	X - Mx	Y - My	(X - Mx)2	(X - Mx)(Y - My)

100.00	100.00	-43.5964	-47.8445	1900.6429	2085.8482
110.72	104.96	-32.8764	-42.8845	1080.8553	1409.8879
112.56	111.54	-31.0364	-36.3045	963.2559	1126.7611
124.38	127.26	-19.2164	-20.5845	369.2686	395.5601
140.59	138.87	-3.0064	-8.9745	9.0382	26.9807
155.62	165.61	12.0236	17.7655	144.5678	213.6054
169.58	178.03	25.9836	30.1855	675.1494	784.3279
169.72	177.83	26.1236	29.9855	682.4444	783.3291
153.57	160.95	9.9736	13.1055	99.4734	130.709
168.87	175.08	25.2736	27.2355	638.7567	688.339
173.95	186.16	30.3536	38.3155	921.3432	1163.0134
M: 143.5964	M: 147.8445			SS: 7484.7959	SP: 8808.3618

Index, X	High ROIC, Y	X - Mx	Y - My	(X - Mx)2	(X - Mx)(Y - My)
100.00	100.00	-43.5964	-36.5745	1900.6429	1594.5172
110.72	106.28	-32.8764	-30.2945	1080.8553	995.9745
112.56	101.81	-31.0364	-34.7645	963.2559	1078.9651
124.38	112.82	-19.2164	-23.7545	369.2686	456.476
140.59	135.09	-3.0064	-1.4845	9.0382	4.4631
155.62	153.77	12.0236	17.1955	144.5678	206.7519
169.58	161.15	25.9836	24.5755	675.1494	638.5597
169.72	162.96	26.1236	26.3855	682.4444	689.284
153.57	144.75	9.9736	8.1755	99.4734	81.539
168.87	155.19	25.2736	18.6155	638.7567	470.4802
173.95	168.50	30.3536	31.9255	921.3432	969.0536
M: 143.5964	M: 136.5745			SS: 7484.7959	SP: 7186.0643

Index, X	Low PE, Y	X - Mx	Y - My	(X - Mx)2	(X - Mx)(Y - My)
100.00	100.00	-43.5964	-56.2245	1900.6429	2451.1857
110.72	103.31	-32.8764	-52.9145	1080.8553	1739.6378
112.56	107.83	-31.0364	-48.3945	963.2559	1501.9907
124.38	125.51	-19.2164	-30.7145	369.2686	590.2219
140.59	147.73	-3.0064	-8.4945	9.0382	25.5377
155.62	175.81	12.0236	19.5855	144.5678	235.4884
169.58	191.43	25.9836	35.2055	675.1494	914.7657
169.72	191.75	26.1236	35.5255	682.4444	928.0541
153.57	176.68	9.9736	20.4555	99.4734	204.0153
168.87	191.38	25.2736	35.1555	638.7567	888.5062

173.95 M: 143.5964	207.04 M: 156.2245	30.3536	50.8155	921.3432 SS: 7484.7959	1542.4338 SP: 11021.8373

ANNEX 2. HIGH ROIC, LOW P/E PORTFOLIO COMPONENTS AND THEIR RESPECTIVE RETURNS

	(02.01.2015)					*(02.01.2020)*	
	2015	2016	2017	2018	2019	2020	
Portfolio 5							
Silvano Fashion Group							1
Price	1.33	1.27	3	2.29	2.31	2.23	
# of shares	7519	7519	7519	7519	7519		
dividend per share	0.10	0.15	0.20	0.20	0.20		
dividend amount	751.88	1,127.82	1,503.76	1,503.76	1,503.76		
equity (at the begin.)	10,000.00	10,751.88	11,879.70	13,383.46	14,887.22	23,157.89	131.58%
Invalda INVL							2
Price	2.99	3.47	3.95	5.25	4.7	6.9	
# of shares	3344	3344	3344	3344	3344		
dividend per share							
dividend amount							
equity (at the begin.)	10,000.00					23,076.92	130.77%
Vilniaus baldai							3
Price	15.4	14.4	13.4	12.8	7.6	7.8	
# of shares	649	649	649	649	649		
dividend per share	0.00	1.00	0.27	0.26	0.08		
dividend amount	0.00	649.35	175.32	168.83	51.95		
equity (at the begin.)	10,000.00	10,000.00	10,649.35	10,824.68	10,993.51	6,110.39	-38.90%

Rīgas elektromašīnbūves rūpnīca							4
Price	1.17	1	1	2.76	2.6	2.5	
# of shares	8547	8547	8547	8547	8547		
dividend per share	0.00	0.00	0.00	0.00	0.00	0	
dividend amount							
equity (at the begin.)	10,000.00					21,367.52	113.68%

Olainfarm							5
Price	5.95	7.13	8.6	8.4	6.65	7.3	
# of shares	1681	1681	1681	1681	1681		
dividend per share	0.00	0.18	0.66	0.21	0.10		
dividend amount	0.00	304.20	1,109.24	352.94	168.07		
equity (at the begin.)	10,000.00	10,000.00	10,304.20	11,413.45	11,766.39	14,203.36	42.03%

Beginning value	50,000.00
Ending value (no reinvestment)	87,916.09
Cumulative return on invesmtnet (no reinvestment)	75.83%

Portfolio 10

Vilkyškių pieninė							6
Price	2	1.73	2.34	3.75	2.09	2.26	
# of shares	5000	5000	5000	5000	5000		
dividend per share	0.07	0.00	0.12	0.14	0.00		
dividend amount	350.00	0.00	600.00	700.00	0.00		
equity (at the begin.)	10,000.00	10,350.00	10,350.00	10,950.00	11,650.00	12,950.00	29.50%

Žemaitijos pienas							7
Price	0.7	0.65	1.08	1.74	1.58	1.8	
# of shares	14286	14286	14286	14286	14286		
dividend per share	0.00	0.12	0.10	0.15	0.08		
dividend amount	0.00	1,714.29	1,428.57	2,142.86	1,142.86		
equity (at the begin.)	10,000.00	10,000.00	11,714.29	13,142.86	15,285.71	32,142.86	221.43%

Linas Agro Group							8
Price	0.7	0.66	0.64	0.65	0.64	0.6	
# of shares	14286	14286	14286	14286	14286		
dividend per share	0.00	0.01	0.01	0.02	0.00		
dividend amount	0.00	142.86	108.57	264.29	0.00		
equity (at the begin.)	10,000.00	10,000.00	10,142.86	10,251.43	10,515.71	9,087.14	-9.13%

Grindeks							9
Price	7.08	5.2	4.69	7.46	6.6	14.8	
# of shares	1412	1412	1412	1412	1412		
dividend per share	0.93	0.00	0.15	0.15	1.28		
dividend amount	1,313.56	0.00	211.86	211.86	1,807.91		
equity (at the begin.)	10,000.00	11,313.56	11,313.56	11,525.42	11,737.29	24,449.15	144.49%

Latvijas balzams							10
Price	3.23	6.06	7.47	9.15	8.45	10.3	
# of shares	3096	3096	3096	3096	3096		
dividend per share	0.00	0.00	0.00	0.00	0.00	0	
dividend amount							
equity (at the begin.)	10,000.00					31,888.54	218.89%

Beginning value	100,000.00
Ending value (no reinvestment)	198,433.79
Cumulative return on invesmtnet (no reinvestment)	98.43%

Portfolio 15

Apranga							11
Price	2.66	2.6	2.6	2.57	1.63	2.11	
# of shares	3759	3759	3759	3759	3759		
dividend per share	0.13	0.12	0.16	0.17	0.13		
dividend amount	488.72	451.13	601.50	639.10	488.72		
equity (at the begin.)	10,000.00	10,488.72	10,939.85	11,541.35	12,180.45	10,601.50	6.02%

Tallinna Kaubamaja Grupp							12
Price	5.1	6.75	8.63	9.36	8.6	8.9	
# of shares	1961	1961	1961	1961	1961		
dividend per share	0.40	0.52	0.63	0.69	0.71		
dividend amount	784.31	1,019.61	1,235.29	1,352.94	1,392.16		
equity (at the begin.)	10,000.00	10,784.31	11,803.92	13,039.22	14,392.16	23,235.29	132.35%

Tallinna Vesi							13
Price	13.1	13.8	13.9	10.75	9.6	11.7	
# of shares	763	763	763	763	763		
dividend per share	0.90	0.90	0.54	0.36	0.75		
dividend amount	687.02	687.02	412.21	274.81	572.52		
equity (at the begin.)	10,000.00	10,687.02	11,374.05	11,786.26	12,061.07	11,564.89	15.65%

Rokiškio sūris							14
Price	1.4	1.44	1.74	2.75	2.51	2.58	
# of shares	7143	7143	7143	7143	7143		
dividend per share	0.00	0.07	0.10	0.10	0.10		
dividend amount	0.00	500.00	714.29	714.29	714.29		
equity (at the begin.)	10,000.00	10,000.00	10,500.00	11,214.29	11,928.57	21,071.43	110.71%

Harju Elekter							15
Price	2.75	2.54	2.94	5.36	4.39	4.32	
# of shares	3636	3636	3636	3636	3636		
dividend per share	0.15	0.05	0.18	0.24	0.18		
dividend amount	545.45	181.82	654.55	872.73	654.55		
equity (at the begin.)	10,000.00	10,545.45	10,727.27	11,381.82	12,254.55	18,618.18	86.18%

Beginning value	150,000.00
Ending value (no reinvestment)	283,525.08
Cumulative return on invesmtnet (no reinvestment)	89.02%

Portfolio 21

Telia Lietuva							16
Price	0.99	1.01	0.94	0.96	1.11	1.29	
# of shares	10101	10101	10101	10101	10101		
dividend per share	0.07	0.01	0.03	0.07	0.08		
dividend amount	707.07	101.01	303.03	707.07	808.08		
equity (at the begin.)	10,000.00	10,707.07	10,808.08	11,111.11	11,818.18	15,656.57	56.57%

Pieno žvaigždės							17
Price	1.55	1.32	1.47	1.27	0.91	0.95	
# of shares	6452	6452	6452	6452	6452		
dividend per share	0.07	0.06	0.09	0.00	0.03		
dividend amount	451.61	387.10	580.65	0.00	193.55		
equity (at the begin.)	10,000.00	10,451.61	10,838.71	11,419.35	11,419.35	7,741.94	-22.58%

Grigeo							18
Price	1	1.08	1.13	1.45	1.36	1.48	
# of shares	10000	10000	10000	10000	10000		
dividend per share	0.00	0.02	0.04	0.06	0.06		
dividend amount	0.00	200.00	400.00	600.00	600.00		
equity (at the begin.)	10,000.00	10,000.00	10,200.00	10,600.00	11,200.00	16,600.00	66.00%

Klaipėdos nafta							19
Price	0.35	0.4	0.61	0.57	0.42	0.36	
# of shares	28571	28571	28571	28571	28571		
dividend per share	0.00	0.05	0.03	0.04	0.03		
dividend amount	0.00	1,428.57	857.14	1,277.14	868.57		
equity (at the begin.)	10,000.00	10,000.00	11,428.57	12,285.71	13,562.86	14,717.14	47.17%

Valmieras stikla šķiedra							20
Price	3.73	3.35	3.1	3.8	2.42	1.18	
# of shares	2681	2681	2681	2681	2681		
dividend per share	0.12	0.07	0.00	0.00	0.00		
dividend amount	321.72	187.67	0.00	0.00	0.00		
equity (at the begin.)	10,000.00	10,321.72	10,509.38	10,509.38	10,509.38	3,672.92	-63.27%

Šiaulių bankas							21
Price	0.16	0.17	0.33	0.51	0.4	0.5	
# of shares	62500	62500	62500	62500	62500		
dividend per share	0.00	0.00	0.00	0.01	0.03		
dividend amount	0.00	0.00	0.00	625.00	1,875.00		
equity (at the begin.)	10,000.00	10,000.00	10,000.00	10,000.00	10,625.00	33,750.00	237.50%

Beginning value	210,000.00
Ending value (no reinvestment)	375,663.65
Cumulative return on invesmtnet (no reinvestment)	78.89%

Index returns

OMX_Baltic_Benchmark_GI							
INDEXNASDAQ: OMXBBGI							
Price	571.36	643.1	803.25	968.9	877.43	993.88	
# of shares	18	18	18	18	18		
dividend per share							
dividend amount							
equity (at the begin.)	10,000.00					17394.99	73.95%

Beginning value	10,000.00
Ending value (no reinvestment)	17394.99
Cumulative return on invesmtnet (no reinvestment)	73.95%

ANNEX 3. LOW P/E PORTFOLIO COMPONENTS AND THEIR RESPECTIVE RETURNS

	(02.01.2015)					*(02.01.2020)*	
	2015	2016	2017	2018	2019	2020	
Portfolio 5							
Latvijas balzams							1
Price	3.23	6.06	7.47	9.15	8.45	10.3	
# of shares	3096	3096	3096	3096	3096		
dividend per share	0.00	0.00	0.00	0.00	0.00		
dividend amount	0.00	0.00	0.00	0.00	0.00		
equity (at the begin.)	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	31,888.54	218.89%
Silvano Fashion Group							2
Price	1.33	1.27	3	2.29	2.31	2.23	
# of shares	7519	7519	7519	7519	7519		
dividend per share	0.10	0.15	0.20	0.20	0.20	0.00	
dividend amount	751.88	1,127.82	1,503.76	1,503.76	1,503.76		
equity (at the begin.)	10,000.00	10,751.88	11,879.70	13,383.46	14,887.22	23,157.89	131.58%

Invalda INVL							3
Price	2.99	3.47	3.95	5.25	4.7	6.9	
# of shares	3344	3344	3344	3344	3344		
dividend per share	0.00	0.00	0.00	0.00	0.00		
dividend amount	0.00	0.00	0.00	0.00	0.00		
equity (at the begin.)	10,000.00	10,000.00	10,000.00	10,000.00	10,000.00	23,076.92	130.77%

Rīgas elektromašīnbūves rūpnīca							4
Price	1.17	1	1	2.76	2.6	2.5	
# of shares	8547	8547	8547	8547	8547		
dividend per share	0.00	0.01	0.01	0.02	0.00	0.00	
dividend amount	0.00	85.47	64.96	158.12	0.00		
equity (at the begin.)	10,000.00	10,000.00	10,085.47	10,150.43	10,308.55	21,676.07	116.76%

Linas Agro Group							5
Price	0.7	0.66	0.64	0.65	0.64	0.6	
# of shares	14286	14286	14286	14286	14286		
dividend per share	0.00	0.01	0.01	0.02	0.00		
dividend amount	0.00	142.86	108.57	264.29	0.00		
equity (at the begin.)	10,000.00	10,000.00	10,142.86	10,251.43	10,515.71	9,087.14	-9.13%

Beginning value	50,000.00
Ending value (no reinvestment)	108,886.57
Cumulative return on investment (no reinvestment)	117.77%

Portfolio 10

Vilkyškių pieninė							6
Price	2	1.73	2.34	3.75	2.09	2.26	
# of shares	5000	5000	5000	5000	5000		
dividend per share	0.93	0.00	0.15	0.15	1.28		
dividend amount	4,650.00	0.00	750.00	750.00	6,400.00		
equity (at the begin.)	10,000.00	14,650.00	14,650.00	15,400.00	16,150.00	23,850.00	138.50%

Olainfarm							7
Price	5.95	7.13	8.6	8.4	6.65	7.3	
# of shares	1681	1681	1681	1681	1681		
dividend per share	0.00	0.18	0.66	0.21	0.10		
dividend amount	0.00	304.20	1,109.24	352.94	168.07		
equity (at the begin.)	10,000.00	10,000.00	10,304.20	11,413.45	11,766.39	14,203.36	42.03%

Žemaitijos pienas							8
Price	0.7	0.65	1.08	1.74	1.58	1.8	
# of shares	14286	14286	14286	14286	14286		
dividend per share	0.00	0.12	0.10	0.15	0.08		
dividend amount	0.00	1,714.29	1,428.57	2,142.86	1,142.86		
equity (at the begin.)	10,000.00	10,000.00	11,714.29	13,142.86	15,285.71	32,142.86	221.43%

Rokiškio sūris							9
Price	1.4	1.44	1.74	2.75	2.51	2.58	
# of shares	7143	7143	7143	7143	7143		
dividend per share	0.00	0.07	0.10	0.10	0.10		
dividend amount	0.00	500.00	714.29	714.29	714.29		
equity (at the begin.)	10,000.00	10,000.00	10,500.00	11,214.29	11,928.57	21,071.43	110.71%

Grindeks							10
Price	7.08	5.2	4.69	7.46	6.6	14.8	
# of shares	1412	1412	1412	1412	1412		
dividend per share	0.93	0.00	0.15	0.15	1.28	0.00	
dividend amount	1,313.56	0.00	211.86	211.86	1,807.91		
equity (at the begin.)	10,000.00	11,313.56	11,313.56	11,525.42	11,737.29	24,449.15	144.49%

Beginning value	100,000.00
Ending value (no reinvestment)	224,603.37
Cumulative return on invesmtnet (no reinvestment)	124.60%

Portfolio 15

Harju Elekter							11
Price	2.75	2.54	2.94	5.36	4.39	4.32	
# of shares	3636	3636	3636	3636	3636		
dividend per share	0.15	0.05	0.18	0.24	0.18		
dividend amount	545.45	181.82	654.55	872.73	654.55		
equity (at the begin.)	10,000.00	10,545.45	10,727.27	11,381.82	12,254.55	18,618.18	86.18%

Tallinna Kaubamaja Grupp							12
Price	5.1	6.75	8.63	9.36	8.6	8.9	
# of shares	1961	1961	1961	1961	1961		
dividend per share	0.40	0.52	0.63	0.69	0.71		
dividend amount	784.31	1,019.61	1,235.29	1,352.94	1,392.16		
equity (at the begin.)	10,000.00	10,784.31	11,803.92	13,039.22	14,392.16	23,235.29	132.35%

Klaipėdos nafta							13
Price	0.35	0.40	0.61	0.57	0.42	0.36	
# of shares	28571	28571	28571	28571	28571		
dividend per share	0.00	0.05	0.03	0.04	0.03		
dividend amount	0.00	1,428.57	857.14	1,277.14	868.57		
equity (at the begin.)	10,000.00	10,000.00	11,428.57	12,285.71	13,562.86	14,717.14	47.17%

Tallinna Vesi							14
Price	13.1	13.8	13.9	10.75	9.6	11.7	
# of shares	763	763	763	763	763		
dividend per share	0.90	0.90	0.54	0.36	0.75		
dividend amount	687.02	687.02	412.21	274.81	572.52		
equity (at the begin.)	10,000.00	10,687.02	11,374.05	11,786.26	12,061.07	11,564.89	15.65%

Vilniaus baldai							15
Price	15.4	14.4	13.4	12.8	7.6	7.8	
# of shares	649	649	649	649	649		
dividend per share	0.00	1.00	0.27	0.26	0.08		
dividend amount	0.00	649.35	175.32	168.83	51.95		
equity (at the begin.)	10,000.00	10,000.00	10,649.35	10,824.68	10,993.51	6,110.39	-38.90%

Beginning value	150,000.00
Ending value (no reinvestment)	298,849.27
Cumulative return on invesmtnet (no reinvestment)	99.23%

Portfolio 21

Pieno žvaigždės							16
Price	1.55	1.32	1.47	1.27	0.91	0.95	
# of shares	6452	6452	6452	6452	6452		
dividend per share	0.07	0.06	0.09	0.00	0.03		
dividend amount	451.61	387.10	580.65	0.00	193.55		
equity (at the begin.)	10,000.00	10,451.61	10,838.71	11,419.35	11,419.35	7,741.94	-22.58%

Grigeo							17
Price	1	1.08	1.13	1.45	1.36	1.48	
# of shares	10000	10000	10000	10000	10000		
dividend per share	0.00	0.02	0.04	0.06	0.06		
dividend amount	0.00	200.00	400.00	600.00	600.00		
equity (at the begin.)	10,000.00	10,000.00	10,200.00	10,600.00	11,200.00	16,600.00	66.00%

Apranga							18
Price	2.66	2.6	2.6	2.57	1.63	2.11	
# of shares	3759	3759	3759	3759	3759		
dividend per share	0.13	0.12	0.16	0.17	0.13		
dividend amount	488.72	451.13	601.50	639.10	488.72		
equity (at the begin.)	10,000.00	10,488.72	10,939.85	11,541.35	12,180.45	10,601.50	6.02%

Telia Lietuva							19
Price	0.99	1.01	0.94	0.96	1.11	1.29	
# of shares	10101	10101	10101	10101	10101		
dividend per share	0.07	0.01	0.03	0.07	0.08		
dividend amount	707.07	101.01	303.03	707.07	808.08		
equity (at the begin.)	10,000.00	10,707.07	10,808.08	11,111.11	11,818.18	15,656.57	56.57%

Valmieras stikla šķiedra							20
Price	3.73	3.35	3.1	3.8	2.42	1.18	
# of shares	2681	2681	2681	2681	2681		
dividend per share	0.12	0.07	0.00	0.00	0.00		
dividend amount	321.72	187.67	0.00	0.00	0.00		
equity (at the begin.)	10,000.00	10,321.72	10,509.38	10,509.38	10,509.38	3,672.92	-63.27%

Šiaulių bankas							21
Price	0.16	0.17	0.33	0.51	0.4	0.5	
# of shares	62500	62500	62500	62500	62500		
dividend per share	0.00	0.00	0.00	0.01	0.03		
dividend amount	0.00	0.00	0.00	625.00	1,875.00		
equity (at the begin.)	10,000.00	10,000.00	10,000.00	10,000.00	10,625.00	33,750.00	237.50%

Beginning value	210,000.00
Ending value (no reinvestment)	386,872.19
Cumulative return on invesmtnet (no reinvestment)	84.22%

Index returns

OMX_Baltic_Benchmark_GI INDEXNASDAQ: OMXBBGI							
Price	571.36	643.1	803.25	968.9	877.43	993.88	
# of shares	18						
dividend per share							
dividend amount							
equity (at the begin.)	10,000.00					17394.99	73.95%

Beginning value	10,000.00
Ending value (no reinvestment)	17394.99
Cumulative return on investment (no reinvestment)	73.95%