



UNIVERSITY OF  
NORDLAND

BODØ GRADUATE SCHOOL OF BUSINESS

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# MASTER THESIS

Diamonds as the Alternative Assets on Financial Markets

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BE305E: Finance and Capital Budgeting  
Master of Science in Business

May 2014



## Abstract

When people speak about the investment portfolio, everyone imagine the set of paper assets as stocks, options, bonds, and it takes some time to remember that there are also hard assets as gold, silver, platinum and gemstones (Genis, 2011). Among all variety of gems diamonds are remaining the most popular stone. People continue admiring the world famous diamonds as Hope, Khulinan, and Golden Eye in the exhibitions; collected, buy them as a present and make proposes. Nowadays more and more investors started looking at them as a new opportunity to safe and earn money, especially in China and India, where 45% and 50% of people respectively, according to the Bain & Company questionnaire 2013, perceive diamonds as the alternative investment. The role of these hard assets as gemstones is undervalued by investors and traders, though their usage can improve their investment portfolios (Deadlock, 2011). These assets that cannot lose their values that are not based on promises and situations in the world, their value is growing, and the interest in them is also increasing.

Therefore the author decided to investigate the effect of including alternative asset class as diamonds in the investment portfolio and present the evidences of positive influence of the gemstone to risk minimization and increasing of the expected return.

Hence the quantitative method, secondary data, Markowitz Modern Portfolio Theory and the software Microsoft Excel were chosen as the basic tool in order to achieve the main goal. Moreover the investigation is built on the professional opinions and recommendations in terms of such kind of investments.

The objects of this research are diamonds and stocks that will take part in portfolio formation process for the investment horizon of 2005-2013. The subject is the well-diversified investor who is interested in new efficient ways for injecting capital.

The Master Thesis presents the detailed description of the data collection and investment portfolio formation processes, research methods and designs, theoretical basics in terms of the research question. One can find the examples of portfolios created for both developed and emerging markets, the comparative analysis of their structures where first variant of the portfolio includes stocks only, the second variant has both securities and diamonds. More deep analysis is provided with respect to portfolios characteristics as values of risk and expected return, also Sharpe-, Treynor indices and Jensen Alfa.

**Key words:** alternative investments, diamonds, gemstones, additional asset class, portfolio formation, Markowitz Modern Portfolio Theory.

## **Acknowledgements**

This Master Thesis is the graduate qualification work of the Master of Science in Business with a specialization in Finance and Capital Budgeting.

I am grateful to my supervisor Øystein Gjerde for his attention, valuable recommendations and constructive criticism.

I also would like to thank Tamar Katsav, the Chief Operations Officer in Israeli subsidiary of International Diamond Exchange IDEX, for providing the necessary data about diamonds' price dynamics.

Besides I would like to thank all people who had the attitude to finance studying and preliminary discussion concerned the alternative investments' issue.

My heartfelt thanks go to my relatives and friends who support, inspire and believe in me in difficult moments.

Maria Fedotova

2014

# Content

Abstract .....	I
Acknowledgement.....	II
List of tables.....	V
List of figures.....	VI
List of acronyms.....	VIII
1: Introduction.....	1
1.1 The background of the research.....	2
1.2. Problem statement.....	3
1.3 Sub goals of the research.....	4
1.4 The structure of the Master Thesis.....	4
2.Theory.....	5
2.1 What is an investment portfolio?.....	5
2.2 Formation of the investment portfolio.....	6
2.3 Markowitz Modern Portfolio Theory.....	7
2.4 Portfolio Performance Measurement.....	13
Summary.....	14
3. Methodology.....	15
3.1 Understanding the problem's statement of the research.....	15
3.2 Observation of the qualified literature.....	16
3.3 Philosophical issue of the research.....	19
3.4 Formulation of the research design.....	21
3.5 Access and collection of data.....	23
3.6 Validity of the Research.....	24
3.7 Limitations.....	26
Summary.....	27
4. Results.....	28
4.1 Selection of assets for Developed Markets' portfolios.....	28
4.2 Selection of the market portfolio.....	36
4.3 Data Selection for Emerging Market 's portfolios.....	37
4.4 The Calculations' Logic .....	39
4.4.1 Portfolios 1 and 1' for Developed Market.....	39
4.4.2 Portfolios 2 and 2' for the USA.....	47
4.4.3 Portfolios for Emerging Markets.....	52

4.5 The Beta- coefficient.....	58
4.5.1 Beta -coefficients for Portfolios 1 and 1'.....	59
4.5.2 Beta-coefficient for Portfolios 2 and 2'.....	60
4.5.3 Beta -coefficients for Portfolios 3 and 3'.....	61
4.6 Selection of the risk free rate ( $r_f$ ).....	62
4.7 Sharpe- , Treynor - indices and Jensen's Alfa.....	62
Summary.....	66
5. Analysis.....	67
5.1 Comparative Analysis of Portfolios 1 and 1'.....	67
5.2 Comparative Analysis for Portfolios 2 and 2'.....	70
5.3 Comparative Analysis for Portfolios 3 and 3'.....	72
Summary.....	75
Conclusion.....	77
Reference.....	80
Appendices.....	88
Appendix A.....	88
A1 The gemstone's market value development.....	88
A2 The world market of diamonds.....	88
A3 Diamonds pricing.....	92
A4 The market of sapphires.....	96
A5 The market of rubies.....	98
A6 The market of emeralds.....	99
Appendix B: Prices of stocks for each portfolio for the period 2005-2013.....	102
Appendix B1: Portfolio 1 and 1'.....	102
Appendix B2: Portfolio 2 and 2'.....	110
Appendix B3: Portfolio 3 and 3'.....	120
B4: Table of returns.....	128
The Returns of companies for portfolios 1,1'.....	128
The Returns of companies for portfolios 2,2'.....	128
The Returns of companies for portfolios 3,3'.....	129
B5: Returns for diamonds.....	130
B6: MSCI World Index.....	131
B7: MSCI EM Index.....	133
Appendix C: Iterations for portfolios.....	135
C1: The iterations for Portfolio 1.....	135

C2: The iterations for Portfolio 1'	136
C3: The iterations for Portfolio 2	137
C4: The iterations for Portfolio 2'	139
C5: The iterations for Portfolio 3	140
C6: The iterations for Portfolio 3'	142

## List of tables

Table 4.1.1: Ratings of countries in 2005	28
Table 4.1.2: Ratings of countries in 2013	29
Table 4.1.3 : Luxembourg - Oil & Gas Industry - Tenaris S.A	33
Table 4.1.4: Luxembourg - Media industry - SES S.A	33
Table 4.1.5: Comparison of two ratings' lists	34
Table 4.3.1: Countries, Industries and Firms for Emerging Markets	38
Table 4.4.1.1: Singapore - Semiconductors and Other Electronic Components - Flextronics International Ltd	39
Table 4.4.1.2: Norway - Oil & Gas Industry - Statoil	40
Table 4.4.1.3: Diamond Round 4/4 (1.00-1,49) D-K IF-II	40
Table 4.4.1.4: MSCI World	40
Table 4.4.1.5: Covariance matrix for portfolios 1 and 1'	40
Table 4.4.1.6: Correlation matrix for the portfolios 1 and 1'	41
Table 4.4.1.7: Characteristics of the Portfolio 1	45
Table 4.4.1.8: Characteristic of the Portfolio 1'	46
Table 4.4.2.1: Characteristics of Citigroup Inc	47
Table 4.4.2.2: Characteristics of Wal-Mart Stores Inc	47
Table 4.4.2.3: Characteristics of Exxon Mobil Corp	47
Table 4.4.2.4: Characteristics of Berkshire Hathaway BRK -A	48
Table 4.4.2.5: Characteristics of Verizon Communications Inc	48
Table 4.4.2.6: The Covariance Matrix for portfolios 2 and 2'	48
Table 4.4.2.7: Correlation matrix for portfolios 2 and 2'	49
Table 4.4.2.8: Characteristics of the Portfolio 2	50
Table 4.4.2.9 : Characteristics of Portfolio 2'	51
Table 4.4.3.1.: Characteristics of PetroChina Co. Ltd. ADS	52
Table 4.4.3.2 Characteristics of Petrobras Argentina SA (PZE)	53
Table 4.4.3.3: Characteristics of Sberbank	53

Table 4.4.3.4: Characteristics of Oil & Natural Gas Corporation Ltd. (ONGC.NS).....	53
Table 4.4.3.5: Characteristics of MSCI EM.....	53
Table 4.4.3.6: Covariance Matrix for portfolios 3 and 3'.....	54
Table 4.4.3.7: Correlation matrix for portfolios 3 and 3'.....	54
Table 4.4.3.8: Characteristics of the portfolio 3.....	56
Table 4.4.3.9: Characteristics of the Portfolio 3'.....	57
Table 4.5.1.1: Beta -coefficients for Assets of Portfolios 1 and 1'.....	59
Table 4.5.1.2: Beta-coefficients for Portfolios 1 and 1'.....	59
Table 4.5.2.1: Beta- coefficients for assets of portfolios 2, 2'.....	60
Table 4.5.2.2: Beta- coefficients for the portfolios 2 and 2'.....	60
Table 4.5.3.1: Beta- coefficients for the portfolios 3 and 3'.....	61
Table 4.5.3.2: Beta -coefficients for the portfolios 3 and 3'.....	61
Table 4.7.1: Sharpe index for Portfolios 1 and 1'.....	63
Table 4.7.2: Sharpe index for MSCI World.....	63
Table 4.7.3: Sharpe index for Portfolios 2 and 2'.....	63
Table 4.7.4: Sharpe index for Portfolios 3, 3' and MSCI EM .....	63
Table 4.7.5: Treynor indices for portfolios 1,1',2,2', 3,3'.....	64
Table 4.7.6: Treynor indices for the market portfolios.....	64
Table 4.7.7: The Jensen Alfa for Portfolios 1,1'.....	65
Table 4.6.8: The Jensen Alfa for Portfolios 2, 2'.....	65
Table 4.7.9: The Jensen Alfa for Portfolios 3 and 3'.....	66

## **List of figures**

Figure 2.1: The process of selection the firm for investments.....	7
Figure 2.2: The efficient portfolio set.....	9
Figure 2.3: Capital Market Line (CML).....	10
Figure 2.4: Traditional & Alternative Investments.....	10
Figure 2.5: How the slope of the Capital Market Line changes.....	14
Figure 3.1: The Research Onion.....	19
Figure 3.2: The research algorithm.....	22
Figure 4.1: GDP per capita of countries.....	30
Figure 4.2: GDP per capita of countries.....	31
Figure 4.3: The Ranking of Industries According to Forbes Global 2000 in 2006.....	32
Figure 4.4: Cumulative Index Performance,	

Gross Returns (December 1998-December 2013), USD.....	37
Figure 4.5: The table for calculations.....	42
Figure 4.6: Solver in MS Excel.....	43
Figure 4.7: Possible variants of weights' distribution.....	44
Figure 4.8: Weights of stocks for the portfolio 1.....	45
Figure 4.9: Weights of assets in the portfolio 1'.....	46
Figure 4.10 : Weight of stocks in the Portfolio 2.....	51
Figure 4.11: Weight of stocks in the Portfolio 2'.....	52
Figure 4.12: The table for calculations.....	55
Figure 4.13: Weights of assets in the portfolio 3.....	57
Figure 4.14: Weights of assets in the portfolio 3'.....	58
Figure 5.1.1: Comparison of Portfolios 1, 1' with MSCI World.....	68
Figure 5.1.2: Annual returns of Flextronics International Ltd.....	69
Figure 5.2.1: The Comparison between Portfolios 2,2' and MSCI World Index.....	71
Figure 5.3.1: Comparison between Portfolios 3,3' and MSCI EM Index.....	73
Figure 5.3.2: Annual returns of Russian Sberbank.....	74
Figure 5.1: Distribution of portfolios.....	75



## **List of Acronyms**

AGL - American Gemological Laboratory

CML - Capital Market Line

FinCib - Financial Corporate Investment Business Holding

GIA - Gemology Institute of America

ICBC - Industrial and Commercial Bank of China

IGI - International Gemological Institute

MPT - Modern Portfolio Theory

MSCI ACWI - Morgan Stanley Capital International Investable Market Index

MSCI EM - Morgan Stanley Capital International Emerging Markets Index

MSCI World - Morgan Stanley Capital International World Index

SC -Social Constructionism

SES S.A. - Societe Europeene des Satellites

# 1. Introduction

When someone pronounces the word "gemstones", the first association that comes to one's mind is a place of shining and beautiful diamonds together with emeralds, rubies and sapphires of various shapes and colors that attract and look good for the eye. From ancient times people have estimated the variety of these gemstones. Beginning with pharaohs of Egypt till modern Royal families, gems have been the compulsory attribute of demonstrating the luxury and fortune. The desire of people to possess the rare stones drove the development of the gems recovery and then the jewelry industry as a whole.

Nowadays Jeweler's art is one of the well-developed and profitable industries. Its general profitability appeared to be more than 29% after the World Financial Crisis 2008 in 2009 (FinCib, 2013). During the last World Financial Crisis of 2008 the reduction in the industry was 17%, the lowest percentage of decreasing among all other luxury goods (FinCib, 2013). It is a well-organized business where huge amounts of money are spent by extractive industry companies to find the new recovery. Longstanding experience of the jeweler is referred to the figuration of the right shape to the gem and create a fabulous jewelry with it which are delivered to the jewelry salons for selling. Popularity of auctions is growing very fast where rich people are trying to gain the rarest diamond into their collections or for their business.

In the situation of the world changes as globalization, financial crisis and economic uncertainty, the financial market has been playing an important role. Private investors have been committing more and more money in stocks and precious metals markets for saving and increasing their profits, big companies have their own investment portfolios in the Stock Exchange for this purpose, the financial derivatives as options, futures, forwards and swaps became very popular among firms. Economists, traders all over the world are looking for a new financial tool in order to invest in. One of the possible ways is the opportunity to invest in gemstones and create the portfolio including both financial assets as stocks and gems. Indeed, the markets of gemstones and the jewelry included them can become a very attractive object of capital expenditures for subjects of financial market if new created investment tools are competitive with the supply of the capital market, especially in cases of liquidity that can play its important role in the period of economic uncertainty.

The reader has already noticed that one speaks about gemstones whereas the topic for the Master Thesis sounds "Diamonds as an alternative asset for investing in the financial markets". The case is that initially there should be examined the effect of including all first class of gemstones as diamonds, sapphires, rubies and emeralds in the investment portfolios. Though

there were decided to focus only on diamonds. Consequently the reader needs to get acquainted with the way how the researcher came to this final topic.

## **1.1 The background of the research**

The market of gemstones represents the great variety of gemstones of different categories with various shapes, colors, polished and rough stones, but one will focus only on the first class gemstones as a diamond, a sapphire, a ruby and an emerald. Why this market is paid so is attention by traders, investors, economists? The reason lays in high investment attractiveness with the constant liquidity level of investor's assets while the rest segments of financial market are straggling with shocks and showing its insecurity (Strelnikov, 2009).

Gemstones are specific minerals with or without color, which usually used in jewelry industry and have splendid luster, smooth, moderate tones, high transparence, hardness of 8 to 10 on the Mohs scale, and capability to dissipate light ( Alden, 2014). At first the main object of the research was presented by the precious stones of the first order that includes diamonds, rubies, emeralds, sapphires according to the classification of Professor Kievlenko E.Y. (Pshenichnyi, 2010). That is why the market of gemstones was regarded in terms of market of diamonds, emeralds, sapphires and rubies separately.

However during preliminary investigations of the field of study it was found that all these gemstones have bullish trend in the values development that are differs of constantly growth. This fact allows to think that these four gemstones are positively correlated (Appendix A). It is hard to say how closely they correlate to each other, however, including all them in the investment portfolio can be risky. Therefore it would be unwise to invest in all four gemstones for obtaining well diversified portfolio and reaching its risk reduction, certainly, if a person was not a collector or connoisseur of art.

The observation of previous research papers in the field of alternative investments showed that they are perceived as protection of risk of losses (Management, 2013; Rose, 2014). Non-traditional assets are real estate, private equity, commodities, precious metals (gold, silver, platinum), currencies, derivatives contracts, gemstones (Management, 2013). However in terms of gemstones there is lack of investigations that can prove the efficiency of their inclusions in the investment portfolio.

As this theme is not well-observed and is relevant, the researcher came up with the decision to include gemstones in the portfolio, and make the investigation whether such investments are efficient or not by the example of diamonds.

## 1.2. Problem statement

This section describes how the research problem has been developed over time and what is still remaining behind (Easterby-Smith, Thrope, & Jackson, 2012). Determination of research location can be made by learning the previous studies. Hence one should understand clearly what has already been investigated, has someone conducted the same research as the author wanted to examine (Saunders, Lewis, & Thornhill, 2012).

At present time more and more people started paying their attention to this way of investments. Chris Blacklock, from Blacklock Jewellery maintains that taking into account the Financial Crisis 2008 and its consequences the alternative assets can become a good field for making profit (Wilson, 2012). Thus the International Diamond Exchange (IDEX) offers to buy diamonds and provides all necessary information for trading, for example publications of monthly price report (Harding, 2013). Meanwhile the Singapore Diamond Exchange together with IDEX provides their clients to create a diamond portfolio beginning with \$250 000 of primary investments (Martel, 2013; Freeburn, 2012). Harry Winston<sup>1</sup> founded the diamond investment fund in amount \$ 100 million in 2011 (Freeburn, 2012). In the same time Rapaport Diamond Group<sup>2</sup> and Index IQ<sup>3</sup> have already declared that they are going to establish 'the investment funds or trust for diamond trading' (Harding, 2013).

The absence or weak correlations between gemstones and other financial assets protects the portfolio from the inflation. Indeed, prices are independent on the changes of oil, stock markets, therefore, the returns of gemstones have so called inflation hedge (FinCib Report, 2013, Appendix A). Moreover the investor should not pay any tax for possessing the gemstone (FinCib, 2013).

That's why the topic "Diamonds as assets for investing on the financial market" was chosen for the Master Thesis. Consequently the research problem can be formulated as "What is the effect of including such alternative asset class as diamonds in the investment portfolio additionally to another asset as stocks?".

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<sup>1</sup> Harry Winston - the founder of recovery company Harry Winston Diamond which nowadays is known as Canadian Dominion Diamond (Domonion Diamonds Corporation:History, 2013).

<sup>2</sup> Rapaport Diamond Group is established service that provides 'electronic information services, trading networks as RapNet@ Diamond Trading, materials as Rapaport Price Report and Rapaport Magazine for developing diamonds and jewelry markets (About Rapaport, 2014).

<sup>3</sup> Index IQ - an investment advisor which provides the index-based, liquid alternatives for investing based on 'absolute return, real assets, and international strategies' (Index IQ: About Us, 2014) .

### 1.3 Sub goals of the research

In order to answer the main issues described above there should be highlighted the special goals:

- ❖ to describe the current situation of the diamonds' market during the particular period of 7 years;
- ❖ to find out the diversification effect of including alternative asset as diamonds in the investment portfolio;
- ❖ to find the optimal shares of assets for each portfolio;
- ❖ to compare risk and return of portfolios with and without the diamond;
- ❖ to describe problems that one could face with if he decided to use diamonds for increasing his profit;
- ❖ to make the Master Thesis as a guide for investors and the basis for future research.

For the investigation in this Paper the researcher will use the quantitative method, Markowitz Modern Portfolio theory and Microsoft Excel as the software for calculations. The objects of study are stocks as the representative of traditional investment tools and diamonds as alternative asset class. The investments will be done for the long-term period from 2005 to 2013.

### 1.4 The structure of the Master Thesis

The Master Thesis includes the following sections as introduction, theory, methodology, results, analysis and finally conclusion.

**Introduction** defines the reasons for conducting the research in this particular field, the background, determination of the research problem and sub goals.

**Theory** describes the methods that will be used in the Empirical part for reaching the primary goal.

**Methodology** focuses mainly on the composing the research plan, philosophical aspect of the research, literature review.

**Results** represents the algorithm of calculations, the results themselves and preliminary analysis of the obtained results.

**Analysis** gives more detailed analysis of the results that are demonstrated in previous section in terms of the main issue of the Master Thesis.

**Conclusion** sums up all confirmations and evidence for investing in diamonds, critical views and possible topics for developing the investigations further.

## 2. Theory

The purpose of this section is to overview of theoretical claims and approaches that allow the investigator to answer the research question.

The information presented in the Theoretical Chapter is based on different professional points of view that were stated in the academic journals, articles and books. There will be discussed the term 'investment portfolio', the types of portfolios, process of choosing the exact stock, and the portfolio formation due to Markowitz Modern Portfolio Theory, different additional measure for evaluation of portfolio performance.

### 2.1 What is an investment portfolio?

An investment portfolio is a set of financial assets such as stocks, bonds, options, gold, platinum and gemstones, held by companies, privet investors, financial institutions and hedge funds (Fabozzi, 2000).

There are the following types of portfolios based on the ratio of income and risk (Chavis, 2011):

1. Short-term portfolio is formed for short-term investment horizon, and they can consist of cash, bonds, Treasury bills and money market funds (Chavis, 2011). As a rule such portfolios are characterized by low value of expected return.
2. The Patient Portfolio consists from blue chips (stocks of well-known companies). Usually such portfolio has been holding for a long period of time.
3. An Aggressive Portfolio is based on high risky stocks which provide the significant income at a high level of the risk.
4. The Conservative Portfolio is characterized by including safe securities with minimum risk and slow growth of the market value. The portfolio is dominated by government securities, bonds and stocks of large issuers. This type suits to risk-averse person.
5. An Inefficient portfolio consists from the randomly selected securities and provides low return and low risk.

The choice of the portfolio's type usually depends on the personal attitude to risk, time frame and investment objectives, hence, based on these factors one can create his own trading strategy of portfolio managing.

Besides portfolios can be ranged according to the type of asset included. Thus the V. Tvardovsky and S. Parshikov (2009) represents their own classification of portfolios:

- ❖ Portfolio of money market funds. The goal is to complete preservation of capital by including Quick assets in conjunction with cash in its membership.

- ❖ Portfolio of securities exempted from taxes, consists mainly of government bonds and suggests preservation of capital with a high degree of liquidity.
- ❖ Portfolio of state structures includes mainly of state and municipal securities and obligations. It provides the income from the ownership of these securities, which generally is not taxed, and capital investment in such assets which risk is minimal.
- ❖ Portfolio of securities of different industries collects securities issued by commercial organizations in various industries related to each other technologically, or any one industry;
- ❖ Portfolio of foreign securities includes investment in securities of foreign companies or other states.
- ❖ Convertible portfolio consists of convertible securities (preferred shares, convertible bonds) that can be exchanged for a fixed number of ordinary shares at a fixed price, starting from a given point in time. This type of portfolio provides an opportunity to earn additional income through conversion to favorable conditions for investors.

The person should make out the types of portfolio because these knowledge will help him to understand what portfolio he aims to create with respect to the investor's goals.

## **2.2 Formation of the investment portfolio**

The process of stocks selection is based on two professional's approaches: the fundamental and technical analysis that can make a notion about final combination of securities for the portfolio. Fundamental analysis focuses on learning the overall economic situation, state industries, situation of individual companies, whereas technical analysis is interested in its price moving tendency of financial asset and usually is made with the help of different software, for example, Quik5 and Transaq, (Bodie, Kane, & Marcus, 2011).

As our hypothetical investor is well-diversified, so he makes investments in different assets and different markets: Developed and Emerging markets. That's why the process of selecting stocks can be presented by the figure 2.1.

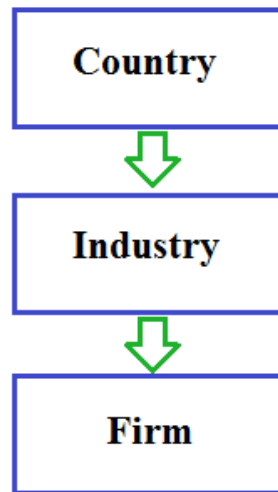


Figure 2.1: The process of selection the firm for investments

Source: developed by the author based on the lectures “ (Finam, 2007).

Therefore each following step can be described as:

- ❖ Step 1: selection of the country/countries. The decision-making about the country will be made according to the credit rating of agencies as Moody's Investors Services (Moody's), Standard & Poor's (S&P) and Fitch Ratings (Fitch) and value of gross domestic product (GDP) of a country.
- ❖ Step 2: selection of the industry sector/s will be based on comparison of global financial rating as Forbes Global 2000 and Fortune Global 500 for 2006 in terms of countries industries.
- ❖ Step 3: the most profitable companies in these sectors of economy will be also chosen from industries selected in the previous step.

## 2.3 Markowitz Modern Portfolio Theory

Today portfolio managers can offer a variety of different models that will help to form the portfolio according to the willing of a client. There are Markowitz Portfolio Selection Model, Black–Scholes Option Pricing Model, Sharpe index model, Tobin model with risk-free asset, Algorithm of Elton-Gruber-Pad berg, Capital Asset Pricing Model (CAMP), Arbitrage Pricing Model.

The traditional approach is considered to be Markowitz Portfolio Selection Model which is known as the Modern Portfolio Theory (MPT). MPT was developed by Harry Markowitz and published under the title "Portfolio Selection" in the 1952 *Journal of Finance*. The main idea is to find the most suitable proportion of the risk and return of various assets, in other words, to maximize portfolio's expected return for a given amount of portfolio risk (Brealey, Myers, & Allen, 2010). Modern Portfolio Theory have the following relevant assumptions (Fabozzi, 2000):



- 1) The investor behaves rationally and is a risk-averse person that means he will choose the portfolio with smallest risk level. That is known as assumption of risk aversion (Levišauskaite, 2010).
- 2) The investors aim is to minimize the risk and maximize the profit.
- 3) All investors have full access to all information about levels of risk and returns at the same time.
- 4) The investor's decision-making is based on the expected return and standard deviation for the period of investment.
- 5) There is a risk-free rate at which an investor can give loans or borrow money.
- 6) The taxes and transaction costs are not included.

The Theory states that the risk for individual stock returns has two components: systematic and unsystematic risks. Systematic risk (interest rates, wars) cannot be diversified away. However the investor can avoid the unsystematic risk which represents the specific risk of individual stocks that can be reduced by diversification.

Diversification is an approach that allows to minimize the portfolio's risk by distribution of investments over various set of assets (Bodie, Kane, & Marcus, 2011). For better understanding of the idea of diversification one can review the general aspects (Burenin, 2008, p. 43):

1. If the assets included in the portfolio have the correlation  $+1$  , then there can be achieved averaging out the risk, but not the reduction of the risk level.
2. If there were chosen the assets with a correlation coefficient less than 1 for portfolio formation, then the portfolio's risk would be reduced. Consequently the lower the correlation between assets' returns, the lower risk level can be reached at the same value of expected return.
3. If the portfolio consists of assets with a correlation of  $-1$  , then the investor can be able to create the portfolio without risk.
4. Therefore during the portfolio's formation it is necessary to include assets with lowest correlation.
5. The risk of the diversified portfolio will be lower than an average risk of its constituent assets (Preis, Kenett, Stanley, Helbing, & Eshel, 2012).

Moreover the theory foresees the determination of dominated portfolios which are characterized by the highest return at the given level of risk or with the lowest risk value for a particular level of return (Burenin, 2008). The set of dominated portfolios is presented by the efficient frontier in the figure 2.1 (Bodie, Kane, & Marcus, 2011). The portfolios located out of

the efficient frontier are unattainable, those portfolios that are 'inside' the curve are not efficient (Fabozzi, 2000).

The choice of the portfolio depends on the investor's strategy. Thus the investor can choose the portfolio from the big variety on the efficient frontier that will correspond to his preferred risk level (Figure 2.2). The conservative investor will hold the portfolios at the bottom of the curve (low return/ low risk), because he wants to save his money and get the constant profit. The situation with more aggressive investor is an opposite: he will prefer portfolios at the top of the curve (high risk/high return).



Figure 2.2: The efficient portfolio set

Source: (Fabozzi, 2000)

In the case when the investor wants to put the part of his money in risk-free assets, the one portfolio on the curve could be chosen for this purpose. It can be found by drawing the tangent line to the point S on the efficient frontier that corresponds the risk-free rate as it is shown by the figurer 2.2. The point S on the efficient frontier denotes the super-efficient portfolio, and the tangent line which is called the Capital Market Line (CML) shows the relationships between risk and return of the efficient portfolios (Burenin, 2008). The investor chooses the super-efficient portfolio included both risky and risk-free assets because it will provide higher expected return at the same risk level that risky portfolios have on the jog AS of the efficient frontier (Figure 2.3).

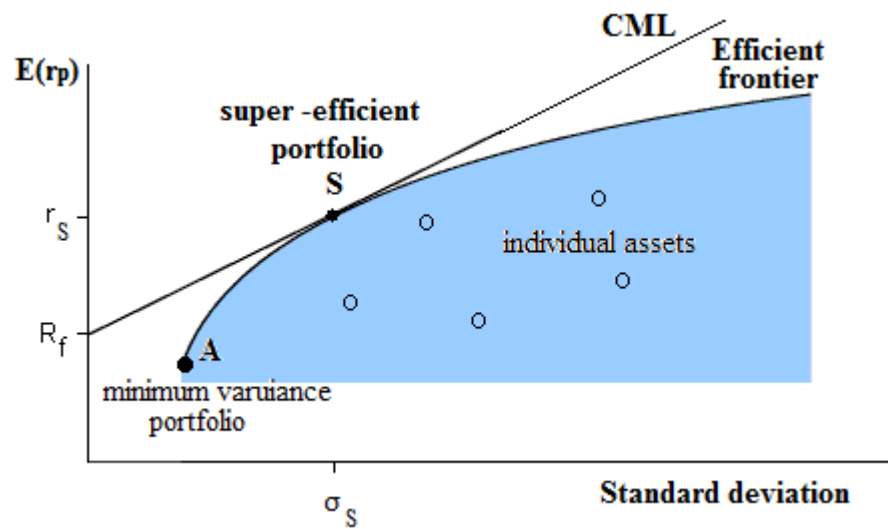
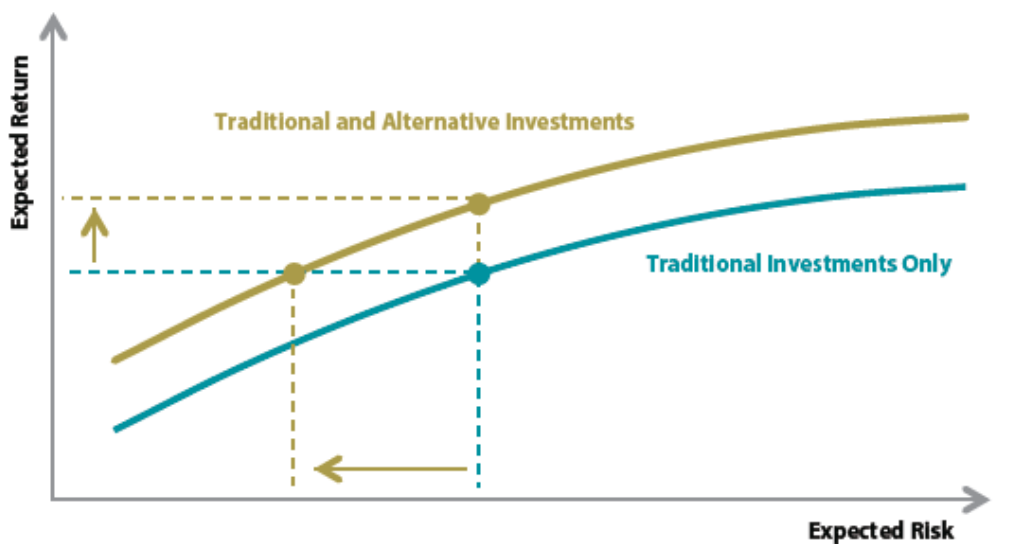


Figure 2.3: Capital Market Line (CML) (MoneyChimp, 2014)

Once created optimal investment portfolio should be reconsidered again and again by the investor, because stock prices are being changed every day, so the portfolio will not have stayed the same for a long time (Kas'ayanenko, 2009).

Though the systematic risk cannot be avoid by diversification, nevertheless this risk could be decreased including alternative asset class in the investment portfolio (Vetvitskiy, 2009), figure 2.4). Indeed, the returns of such assets have no or weak correlation with the market's return. Thus one can suppose that including gemstones in the investment portfolio will lay in increasing of the expected return and risk minimizing of the whole portfolio. That is what the researcher should find out in this Paper.



*For illustrative purposes only – not drawn to scale.*

Figure 2.4: Traditional & Alternative Investments (Robert W. Baird & Co. Incorporated, 2013)

With all that said above, the investor should compute the following measures:

1) **The expected return** is weighted - average return of the financial asset. According to Z. Bodie, A. Kane, A.J. Marcus (2013), it can be found using the following formula:

$$E (r_i) = \sum_{j=1}^n r_i \cdot p_j, \quad (1)$$

where  $r_i$  - the return of the asset  $i$ , and  $p_j$  - the probability of getting the return  $r_i$ .

The investor can not accurately determine the future dynamics of its profitability and risk on the creating a portfolio, that's why his investment choices are based on the expected values of profitability and risk.

Expected return of the portfolio is the sum of the intersections of the expected return of an asset  $R_i$  and weight  $w_i$  of component asset  $i$  (that is, the share of asset  $i$  in the portfolio).

$$E (r_p) = \sum_i w_i E(r_i) \quad (2)$$

2) **Variance ( $\sigma^2$ )** - a statistical measure used to assess amplitude oscillations, calculated as the square of the standard deviation (Bodie, Kane, & Marcus, 2011).

$$\sigma_i^2 = \sum_{j=1}^n [r_j - E (r_i)]^2 \cdot p_j \quad (3)$$

The asset with the high variance considered to be the risky one.

The formula of variance of the investment portfolio including two assets can be written as follows (Bodie, Kane, & Marcus, 2011):

$$\sigma_p^2 = w_1^2 \cdot \sigma_1^2 + (1 - w_1)^2 \cdot \sigma_2^2 + 2 \cdot w_1 \cdot (1 - w_1) \sigma_{12}, \quad (4)$$

where  $w_1$ ,  $1 - w_1$  are the weight of two assets in the portfolio;  $\sigma_{12}$  - covariance between these assets,  $\sigma_1^2$  and  $\sigma_2^2$  - its' variances.

For the investment portfolio consisted from three assets the formula of variance will be (Burenin, 2008):

$$\begin{aligned} \sigma_p^2 = & w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + w_3^2 \sigma_3^2 + 2w_1 w_2 \sigma_1 \sigma_2 \rho_{12} + \\ & + 2w_1 w_3 \sigma_1 \sigma_3 \rho_{13} + 2w_2 w_3 \sigma_2 \sigma_3 \rho_{23} \end{aligned} \quad (5)$$

3) **Correlation ( $\rho_{ij}$ )** is a statistical technique that can show how strongly pairs of variables are related to each other (Burenin, 2008). The correlation coefficient is a statistical measure of the correlation degree between the two rows of indexes. It ranges from -1.0 (full negative correlation) to +1,0 (complete positive correlation). The closer the meaning of the correlation coefficient is to + 1,0 or - 1,0, the closer two variables are related to each other.

$$\rho_{12} = \frac{Cov_{12}}{\sigma_1 \sigma_2}, \quad (6)$$

where  $Cov_{12}$  - covariance between assets 1 and 2 ,  $\sigma_1, \sigma_2$  - standard deviation of the same assets (Burenin, 2008, p. 28).

Z. Bodie, A. Kane, A.J.Marcus in their book "Investment and Portfolio Management" claim: "...portfolios of less than perfectly correlated assets always offer risk - return opportunities than the individual component securities on their own". The efficiency of the portfolio will be higher if the correlation between assets is lower (Bodie, Kane, & Marcus, 2011, p. 229).

4) **Covariance (Cov)** indicates in what extent two risky assets depend on each other. It can be positive when the value of one variable changes and the second variable has a tendency to be changed in the same direction, and negative when the variable values change in opposite directions, zero covariance means that variables are independent.

$$Cov(r_1 r_2) = \rho_{12} \cdot \sigma_1 \sigma_2, \quad (7)$$

where  $\rho_{12}$  - correlation between assets A and B, and  $\sigma_1, \sigma_2$  - standard deviations of the A and B (Burenin, 2008).

5)  **$\beta$  –coefficient** is the measure of the strength between return of the asset and return of the market portfolio (Brealey, Myers, & Allen, 2010). Though it is impossible to form the portfolio which will include all financial assets in the Stock market where the person is trading, that's why one can use the Index portfolio of the market. The examples of index portfolios are American S&P 500, Dow Jones, English FTS 100, Russian MICEX Index and RTSI.

$$\beta_a = \frac{cov(r_a r_m)}{var_m} = \rho_{am} \cdot \frac{\sigma_a}{\sigma_m}, \quad (8)$$

where  $r_a$  — return of an asset, also instead of it there the return of the portfolio can be;

$r_m$  — return of the market portfolio;

$var_m$  - variance of the market portfolio;

$\rho_{am}$  - correlation between an asset a and the market;

$\sigma_a$  - standard deviation of the asset a;

$\sigma_m$  - standard deviation of the market.

$\beta$  –coefficient can have positive or negative meanings ( $-1 \ll \rho_{ij} \ll +1$ ). Positive  $\beta$  –coefficient (assets  $> 1$ ) tells that return of asset and market return change in one direction when the situation on the Stock Exchange change; and vice versa, if there is a negative  $\beta$  –coefficient (assets  $< 1$ ) the returns will change in different directions (Burenin, 2008, p. 90).

## 2.4 Portfolio Performance Measurement

Investors can also be interested in calculating the excess return that usually appears in the situation of combining risky and risk-free assets. In order to find it out, the methods for evaluation of risk-adjusted performance as the Sharpe -, Treynor- and Jensen indexes are used. They show how well the created portfolio rewards the investor for the risk taking and rank portfolio managers' performance (Burenin, 2008, p. 361).

The Sharpe ratio which is also known as the Reward – to - Volatility ratio named by William F. Sharpe, helps to figure out what excess return of the average portfolio will be received by the investor for the extra volatility if he holds risky assets for the particular period of time (Bodie, Kane, & Marcus, 2011).

$$\text{Sharpe ratio} = \frac{(r_p - r_f)}{\sigma_p}, \quad (9)$$

where  $r_p$  - expected return of the portfolio;  $r_f$  - risk-free rate;  $\sigma_p$  - standard deviation (volatility) of the portfolio.

Traditional version of the ratio allows to make a decision between two or more possible investment assets. The higher value the Sharpe ratio has, the more excess return the investor can expect to get.

The Sharpe ratio Portfolio is closely connecting with the Capital Market Line (CML) in portfolio performance evaluation. The slope of the CML is determined by the Sharpe ratio of the market portfolio, consequently all portfolios lain on the CML have the same value of Sharpe ratio as the formula below demonstrates (Burenin, 2008, p. 363):

$$\frac{r_p - r_f}{\sigma_p} = \frac{E(r_m) - r_f}{\sigma_m} \quad (10)$$

The ratio can be improved by adding alternative asset as gemstones into the investment portfolio. Thus the new Sharpe index should be calculated for each new portfolio consisted from the set of initial assets and the additional new asset itself, the Sharpe ratio for the new class asset, correlation between this asset and the whole portfolio, for this purpose the correlation between the asset and each stock in that portfolio should be found out. Then if this correlation between portfolio and new asset is smaller than 1, then the risk of the new investment portfolio will be less than the risk of the initial portfolio. If the Sharpe ratio of the new asset is better than the ratio of the initial portfolio, this assets can be included in the portfolio.

If the Sharpe ratio became higher, then the Capital Market Line would have steeper slope. As it is shown in the figure 2.5, the optimal portfolio P\* which has high Sharpe ratio, has higher expected return then the optimal portfolio P.

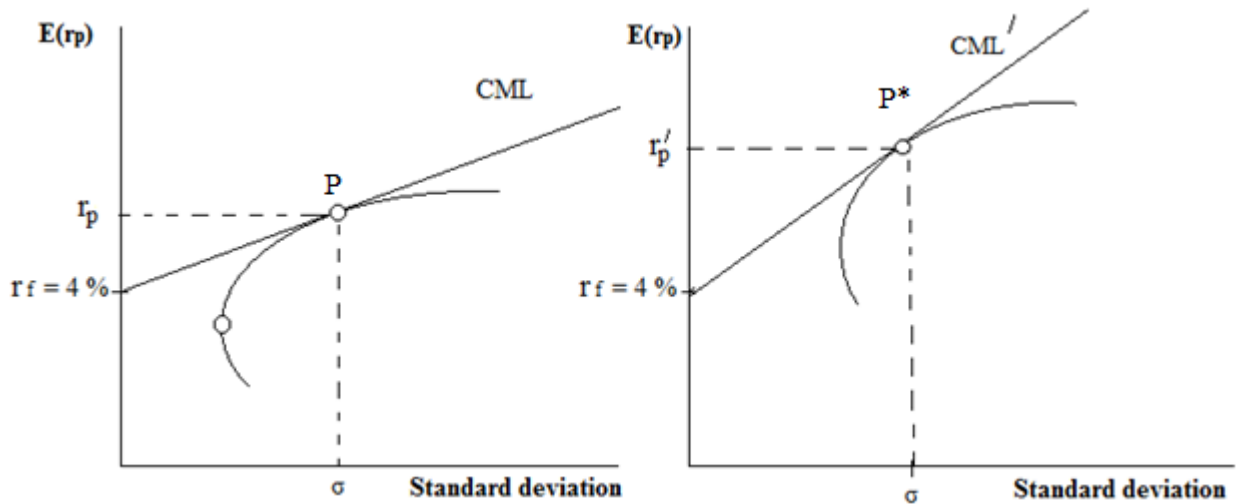


Figure 2.5: How the slope of the Capital Market Line changes

Source: developed by the author based on Portfolio Management by Burenin, 2008.

The changes in risk-free rate can also influence the optimal portfolio. Usually this index is used in the case of non-diversified portfolios which have high total risk.

2) The index developed by Jack L. Treynor evaluates the excess return of the investment portfolio per unit of risk by beta-coefficient as the systematic risk (Burenin, 2008, s. 363).

$$\text{Treynor's ratio} = \frac{(r_p - r_f)}{\beta_p} \quad (11)$$

As in the case of the Sharpe ratio, the higher the value of the Treynor index is, the greater expected return of the portfolio can be generated, so the investment portfolio will have better performance. This ratio is used in the case of fully or well-diversified portfolios.

3) The third way of the excess return's estimation was proposed by Michael Jensen and called the Jensen Alfa (Jensen measure). It evaluates the excess return of the portfolio over the expected return calculated according to Capital Asset Pricing Model (CAPM).

$$\alpha_p = r_p - (r_f + \beta_p(r_m - r_f)), \quad (12)$$

where  $\alpha_p$  - Alfa of the portfolio by the nonsystematic risk. The positive value of the Jensen index means that the investor will earn the excess return. This ratio will be also used by well-diversified investors.

### Summary

The chapter provide the theoretical framework involved the definition of the term "portfolio investments", description of the portfolio formation process, Markowitz portfolio theory and its assumptions. Moreover there were discussed the measurements that need to be computed for evaluation of performance efficiency. These information is used daily by professional traders and investors in the different Stock Exchange and is the basic of the calculations that are presented in the empirical chapter called Results.

### **3. Methodology**

The importance of this section of the Master Thesis consists in providing the links between theoretical framework, empirical results and analytical analysis of these results that allows a reader to understand how the researcher is going to achieve the goals of his investigation.

This chapter is devoted to the description of methods that lay in the basis of this investigation. Under methodology one can comprehend the characteristics of scientific activity, the means and methods of scientific research, the organization of the research process (Novikov & Novikov, 2007). Hence there will be discussed the reasoning of the research plan, data collection, literature review, philosophy of the research, research design, research strategy, and methods for data analysis.

The research plan is the interpretation how exactly the research will be carried out step by step (Surakka). It can be presented by the following steps:

- ❖ Understanding the problem's statement of the research.
- ❖ Observation of the qualified literature.
- ❖ Philosophical issue of the research.
- ❖ Developing the research design.
- ❖ Access and collection of data.
- ❖ Validity of the research.
- ❖ Limitations.

These steps will be described below for explaining the logic of the whole research.

#### **3.1 Understanding the problem's statement of the research**

The units of study are stocks and a diamond that will be used in the portfolio formation. According to the Markowitz Modern Portfolio Theory, portfolios can be made for a risk-averse investor, hence for such a person the passive strategy will be the most preferable. However in our case the investor is:

- ❖ well-diversified,
- ❖ is not liable for spontaneous decision making,
- ❖ has already had the past experience of working on Stock Exchanges,
- ❖ is looking for other possible alternatives for investing and risk minimizing tools.

That's why he will invest in different markets, in different countries, different industries and different companies. Consequently the subject is a person with the following investor's goals (Kennon, 2012):



1. To save the value of money from inflation and increase their sums if it is possible.
2. The portfolio should possess the acceptable risk and return.
3. The main reason of using alternative asset group as gemstones is the risk minimization of the whole portfolio.
4. The portfolio/s should be well-diversified.

Therefore the objectives of the Paper can be formulated as follow:

- ❖ To describe the cons and pros for investing in diamonds.
- ❖ To value development in the diamonds' market during the last 7 years.
- ❖ To create the portfolios with and without diamonds in order to find out the diversification effect of including alternative asset as diamonds in the investment portfolio.
- ❖ To make the Master Thesis as a guide for investors and the basis for future research.

### **3.2 Observation of the qualified literature**

This part of the Methodology guides to examination of the literature and previous investigations in the field of alternative assets.

The primary overview using library of the University of Nordland appeared the starting point in searching of valuable investigations in the field of alternative investments. Thus Fraser-Sampson Guy (2011) describes what knowledge should one operate in order to invest in non-traditional assets as real estate, energy, private equity, hedge funds, infrastructure, commodities and gold. The discussion about the possible strategies and performance for real estate, private equity, commodities and managed futures, hedge funds can be met in the book “Alternative Investments: Instruments, Performance, Benchmarks and Strategies” by Kent Baker & Filbeck, (2013). Kevin R. Mirabile (2013) focuses on hedge funds, mainly on investment's strategies. However none of these books has noticed gemstones as the possible alternative asset class, but it does not mean that no one has ever thought about it. Therefore there are different articles with professional opinions about such investments that were found in the Internet. The growth interest to this asset class can be explained by high demand and lack of supply (Carpenter, 2013). The research firm Wealth-X claims that the prices of diamonds have been increasing by one third since 2005 and is supposed to continue growing by 20% to 2017 (Martel, 2013). The same point was mentioned by Bain & Company Inc. (2013) that the increasing of diamonds sales in 2012 was 18% than in 2011. The same opinion was expressed by Julie Carpenter (2013) where she asserts that growth of demand has been supported by Emerging countries as Russia and China.

Meanwhile the supply of natural industrial diamonds will characterize with little grow by 1% to 2023 (Bain & Company, 2013). Martin Rapaport, the chairman of Rapaport Group, also

confirms that supply is expected to increase 2% to 3% per year, whereas demand grows 7% annually (Martel, 2013). Consequently the lack of supply can be the reason of the rarity of the stone that be reflected in the gems' price. This consideration can be proved by Karim Merchant, Chief Executive Officer and managing director of Pure Gold Jewellers, who confirms that diamonds as representative of gemstones are so attractive for investors because of three aspects: its rarity and timeless, the decreasing of diamonds' recovery based on the statistical evaluation, and absence of rivals that could compete with them (Harding, 2013). Among other diamonds' advantages as an asset experts highlight the comparative immunity of gems' return to both expected and unanticipated types of inflation, protection of currency rate changes, weak correlation with the basic investment assets (less 0,02), volatility of 9%, high and stable liquidity (FinCib, 2013; Harding, 2013).

As for the possible ways of investing in diamonds experts as Vashi Dominguez<sup>4</sup> and Warwick-Ching (2013) highlight three possible ways: to buy diamonds directly and sale them later, to buy shares of diamond mining companies as DeBeers and ALROSA, and finally invest in diamond funds. Therefore Mr. Dominguez recommends to buy diamonds directly as such investment well bring the highest return (Carpenter, 2013). That could be done with the help of diamond dealers in local firms that are specialized on it, the service of diamond brokers who will help to find the right gemstone in the market or various companies, for example Rapaport Diamond Group, International Diamond Exchange, Singapore Diamond Exchange which offer auctions, trading networks for investing and detailed monthly, weakly price lists. Many firms suggest to buy the gem Internet. As an example PriceScope, the premier diamond and jewelry community, gives an opportunity to choose diamonds according to 4C system included the color, clarity, and carat and cut (PriceScope, 2014). Financial Corporate Investment Business Holding (FinCib) proposes its clients the annual return in the rage of 12% - 36 % with the investment period from 2 years (FinCib, 2013).

However the problem of gems evaluation is raised. Each gemstone is unique, so it is hard to classify them. Jewelers did not establish what classification to choose as the general, because each country has its own classification. That's why one should be consulted at least twice by different diamond appraisers about the price of the stone (Rapaport, How to invest in diamonds, 2013). When the person wants to buy a natural diamond, it would be complicated for him to check the originality of his purchase, so the chances of buying a synthetic one that is usually has lower price, are increased. Consequently Mr. Rapaport and Adam Laird<sup>5</sup> claim that the diamond

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<sup>4</sup> Vashi Dominguez - chief executive of trading company Diamond Manufacturers, (Carpenter, 2013)

<sup>5</sup> Adam Laird - the investment manager at independent financial advice firm Hargreaves Lansdown ( Adam Laird , 2014).

should be evaluated by the Gemological Institute of America (GIA) and justified by the chosen expert. There are also American Gemological Laboratory (AGL), International Gemological Institute (IGI) which describe all characteristic of the stone and prove its identity. Moreover there are many synthetic diamonds either colored or colorless that have better quality than natural stones, but they can be sell instead the natural ones. That's why a person should make sure that his diamonds' advisor or trader has direct access to the global diamond markets even for controlling the real market price (Rapaport, How to Invest in Diamonds, 2012). These recommendations are useful for a person because they should have knowledge about the asset they are going to invest.

Another issue concerns the liquidity of diamonds. Unlike stocks and bonds that can be easily sold in daily trading, gemstones cannot be immediately sold, the rarity of color and its weight create problems to find the buyer for it. Thus they can be sold to the gem-cutter, to jewelry store, in the auction and even in the Internet, the last one is the most insecure way for doing this. Julian Knight (2013) argues that commission of a broker for searching of a buyer for a stone will be 10-15% of the whole amount.

It is necessary to turn attention to previous researches in the sphere alternative investments. There is a dissertation "Gemstone as an investment asset"(2009) by PhD student in economics Strelnikov Evgenii, where the author is discussing the economic side of investment process in gemstones in terms of instable financial markets. Therefore there are such goals as (Strelnokov, 2009):

- 1) to identify the economic content, the purpose of investing in precious stones ;
- 2) to determine the criteria of investment attractiveness characteristic of gemstones;
- 3) to theoretical justification of gemstone as the most suitable element for the investment process;
- 4) to assess the current state of the gemstone market in an unstable economy;
- 5) to describe the model of investment portfolios of precious stones, ensuring the profitability and liquidity of the investor taking into account the new investment and the quality of this type of financial assets.

However the researcher had an access only to the introduction part of Strelnikov research, not to all Paper. All in all it was important to find what has already been done in this area. The goals of this particular Thesis is to find evidences that the investments in diamonds added to portfolio with securities allow to diversify the portfolio by risk minimization or increasing of return. The literature for the theory and results of the Paper is presented mainly by Bodie Z., Kane A., Marcus A.J. *Investments and Portfolio Management* (2013), Brealey R. A., Myers S. C., Allen F. *Principles of Corporate Finance* (2010), Burenin A.N. *Portfolio Management*, 2d

edition (2008) and Fabozzi Frank J. *Investment Management* (2000). Certainly there were more additional articles, but those mentioned above are the basic sources.

### 3.3 Philosophical issue of the research

In terms of the research methods the philosophical issue should be described in this Paper. The research philosophy is the comprehensive term that refers to the evolution of knowledge and nature of their existence (Bandaranayake, 2012). It influences directly to the quality of the investigation, because the philosophy contains different presumptions of how one perceives the world (Saunders, Lewis, & Thornhill, 2012). Therefore these presumptions will be the basis of the research strategy and methods that one chooses as part of this strategy (Saunders, Lewis, & Thornhill, 2012).

The central terms in the research philosophy belong to ontology and epistemology that are usually used by investigators for developing the methodologies for research construction (Easterby-Smith, Thrope, & Jackson, 2012). Thus ontology defines the nature of reality and provides the assumptions that the researcher makes about how the world operates, whereas epistemology asks what exactly composes the receivable knowledge in the study field (Saunders, Lewis, & Thornhill, 2012). Moreover, there is a correspondence between these approaches and the methodology of the investigation: the decision - making about one philosophical principle implies the choice of methodology that coincides with this particular approach. This idea is illustrated by the figure 3.1

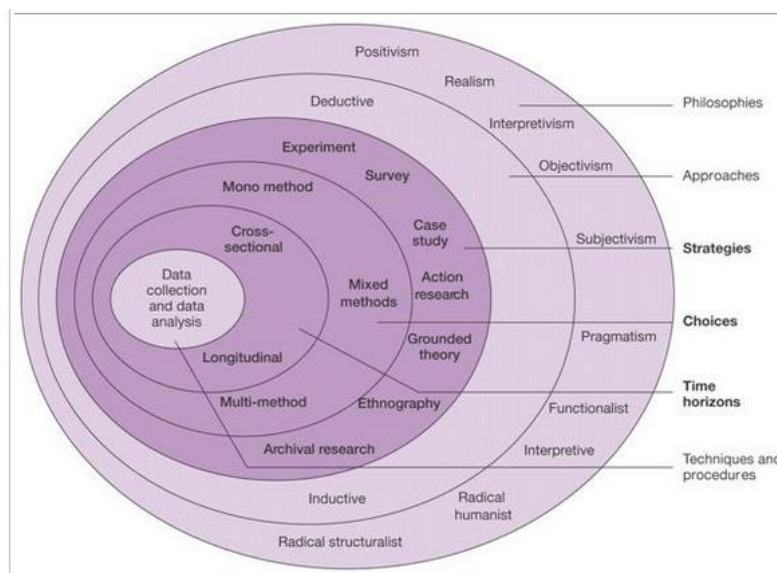


Figure 3.1: The Research Onion

Source: Saunders M.N.K., Lewis P., Thornhill A. *Research Methods for Business Students*, 6th edition, Pearson 2012.

Ontology is presented mainly by realism, relativism and nominalism. The realism understands the world as concrete and external. It is divided by transcendental realism supposed that the final cause of scientific issue carries and obtain independently of the researchers, and internal realism that believe in single reality confirms that it is impossible for a scientist to examine the truth directly, that's why he should collect the indirect arguments about the field of study (Easterby-Smith, Thrope, & Jackson, 2012). As to relativism, this philosophical stream asserts that scientific laws cannot be simply discovered, but created by the person, facts depends on observers' point of view, and therefore there are many truths. Nominalism also claims that facts are created by people, but unlike relativism, it considers that there is no truth (Saunders, Lewis, & Thornhill, 2012).

In its turn the epistemology is based on two philosophical approaches as social constructionism (SC) and positivism. The social constructionism perceives the reality as socially constructed and given meaning by people (Lindberg, 2013). That's why in terms of this approach the researcher will be a part of the reality which will be observed, and provide the general understanding of the situation (Easterby-Smith, Thrope, & Jackson, 2012). Consequently this approach belongs to the interpretive research, which starts from induction and comes to facts.

According to positivism the world exists externally, then in order to make an investigation one should be independent and abstracted from the reality (Lindberg, 2013). As a result the researcher should prove the causality of investigated event by describing the relationships between variables, after that these results should be generalized (Easterby-Smith, Thrope, & Jackson, 2012). For such type of the research one uses the cross-sectional analysis that allows comparing of results across sample (Easterby-Smith, Thrope, & Jackson, 2012). The positivism has the following assumptions as (Lindberg, 2013):

- ❖ The observer must be independent;
- ❖ Human interests should be irrelevant;
- ❖ Explanations must demonstrate causality;
- ❖ Research progresses through hypothesis and deduction;
- ❖ Concepts should be defined so that they can be measured.
- ❖ Units of analysis should be reduced to simplest terms.
- ❖ Sample should be resented by large number selected randomly.

Therefore positivism refers to hypothetic-deductive research that implies the creation of the hypothesis, its testing and generalization of the results (Lindberg, 2013).

In terms of the research question of the Master Thesis whether it is efficient or not to include such alternative asset class as diamonds in the investment portfolio additionally to stocks, and whether diamonds are the reason for diversification of the investment portfolio, it is

possible to consider the risk minimization of the portfolio (the effect of diversification) as a dependent variable, whereas the stocks and diamonds listed in the portfolio are independent variables. The researcher will not go in depth conducting interviews or surveys as it usually done in social constructionism. His goal is to observe and test the collected data with respect to research question. Hence this is the case of positivistic approach which is based on deductions and defines the relationships between dependent and independent variables (Easterby-Smith, Thrope, & Jackson, 2012). The investigation conducted in this Paper belongs to the quantitative research where the secondary data is used and the obtained results are generalized to the whole population from the sample size.

### **3.4 Formulation of the research design**

The research design is an organized plan of the research activity including methods, data collection, data analysis (Easterby-Smith, Thrope, & Jackson, 2012). There are known experimental, explanatory, descriptive and exploratory research designs (Wyk, 2011).

Experimental designs forecasts the random assignment of both subjects experimental or a control group (Easterby-Smith, Thrope, & Jackson, 2012). The investigator leads the experiment where during testing he can regard the incidence of different factors to the outputs, and then observes the obtained results (Van Vleet, 2011). The research in this case provides clarity about the subject of the investigation (Easterby-Smith, Thrope, & Jackson, 2012).

As to the explanatory research design, it aims to identify the effect of a particular event or a set of events to research problem by answering the "What" questions (Van Vleet, 2011). The results are obtained through the testing of hypothesis. It is conducted in order to learn about population or phenomena that is being observed. Such design assumes the usage of such tools as surveys, interviews.

Descriptive research design performs the interpretation of analyzed situation, but does not explain cause relationships (Hale, 2011). It is considered to be more organized comparing with exploratory research (Wyk, 2011).

The exploratory design is the most efficient research design in terms of high level of uncertainty and lack of information about the studied subject or in cases when this subject is not well defined (Saunders, Lewis, & Thornhill, 2012; Wyk, 2011). Then the goal of the exploratory research is to find out the scope of the problem field and determine the variables that will be involved in the investigation.

In respect to the research topic and the discussion above one should use experimental designs. There can be formed the hypotheses as:

1. **Hypothesis I:** Diamonds influence positively on the risk reduction of the portfolio, as a consequence on its diversification.
2. **Hypothesis II:** Diamonds influence negatively on the risk reduction of the portfolio, as a consequence on its diversification.

The important assumption should be mentioned: the presence of additional asset of the portfolio has an impact on risk and return of the whole portfolio, because the number of assets in its structure is also taken into account by traders (Tvardovsky & Parchikov, 2009). The hypotheses will be accepted or rejected based on the results of calculations. The econometrics analysis will not use in this case, because there will be used different tools and methods for calculations.

The general presentation of the research algorithm that will be used in the empirical part of the Paper is illustrated by the figure 3.2.

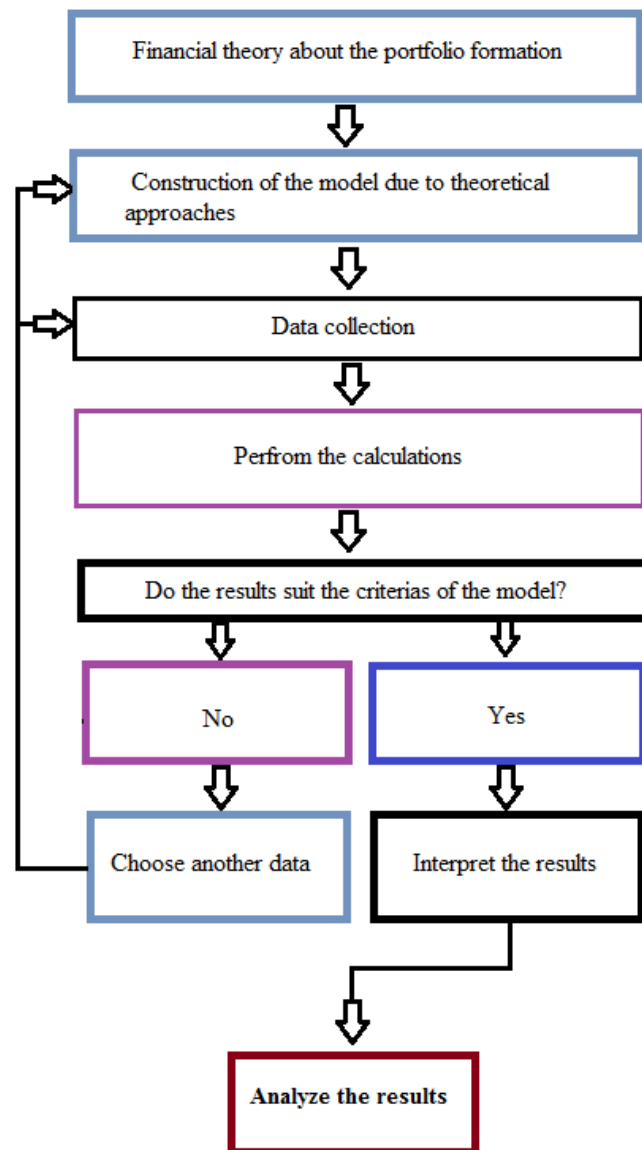


Figure 3.2: The research algorithm. Source: (Brooks, 2008).

First of all, the research process should be started with observation of available theoretical information connected with the research issue. In the case the theoretical aspect concerns portfolio's investments, particularly Markowitz Modern Portfolio Theory for portfolio creation, Performance measurements for analyzing the portfolios' efficiency.

The second step as 'Construction of the model due to theoretical approach' involves the detailed plan of calculations which will be demonstrated in the Results of the Paper:

- ❖ calculations of annual expected return for an asset and the market portfolios that are different for Developed and Emerging markets,
- ❖ expected return for each stock for the whole 7 years;
- ❖ variance and, consequently the standard deviation, that will present the risk of the security;
- ❖ correlation and covariance matrices;
- ❖ creation of portfolios for different markets;
- ❖ beta-coefficients for each particular asset and portfolios;
- ❖ Sharpe-, Treynor indices and Jensen Alfa for created portfolios and for the market.

As to the third and fourth points of the algorithm, data collection assumes the selection of stocks for the investment portfolio. As it is described in the Theory and Results such decision-making process will be started from choosing the most suitable country to the exact firm for investing in. The possible changes of the data will be made after calculations because one is looking for the most profitable firms in different industries for well – diversified portfolio, but the stocks of the chosen companies can have positively strong correlation between each other or did not match the investment period.

Afterwards the researcher can provide the detailed explanation of outputs, comparison analysis among all portfolios created and finally make reasonable conclusions with respect to the research problem and hypothesis.

### **3.5 Access and collection of data**

Before beginning the process of collecting the available data, primarily one should establish what type of data he needs for the investigation. First of all, the researcher should decide about the population and sample for the research. Hence the population is the total set of objects that is going to be studied, whereas a sample is a subset of the population that will be used in the research and from which the confirmations will be done due to research question (Brooks, 2008). Then the population is the various assets in the financial market, the sample is those stocks and type of diamonds that will be chosen specially for our portfolios.



Secondly, the researcher should make a decision about the kind of data, primary or secondary. According to the research problem and theoretical approaches there were chosen the secondary data (Easterby-Smith, Thrope, & Jackson, 2012, p. 345). Indeed, the portfolio formation is supposed to start with collecting monthly stocks' and diamond' prices that has already been presented. Thus the historical prices for Developed market's portfolios for the period 2005-2013 were taken from data portals as Yahoo Finance<sup>6</sup>, American Nasdaq<sup>7</sup>, New York Stock Exchange (NYSE)<sup>8</sup>, Market Watch Wall Street Journal<sup>9</sup>, and Investing.Com<sup>10</sup>, official web-site of Statoil<sup>11</sup>. For Emerging Markets there were used the sources as Russian Moscow Interbank Currency Exchange (MICEX), Investing. Com<sup>12</sup> for Brazilian companies, Yahoo Finance<sup>13</sup> for Indian firms, and Market Watch Wall Street Journal<sup>14</sup> for China. The historical quotes of market portfolios that will be presented by Morgan Stanley Capital International (MSCI) World and MSCI EM (Emerging Markets) indices were taken from the official web-site of [www.msci.com](http://www.msci.com) (MSCI, Additional terms of use). The information about GDP of countries were taken from the web-site of World Bank. As to the risk free rate, it was chosen using the statistic provided by U.S. Department of the Treasury (U.S. Department of Treasury -Resource Center, 2014).

The prices development of diamonds were provided by the International Diamond Stock Exchange (IDEX) by sending an e-mail to Tamar Katsav, the Chief Operations Officer in Israeli subsidiary.

Such number of sources can be explained for being convinced that the available information is correct if it was not able to find data in the official web-site of the company. Examination of all data collected and detailed decision-making about each asset, rate or value can be seen in the chapter Results.

### **3.6 Validity of the Research**

The term 'validity' means the degree to which presentation of the research results is achieved by measures and investigations of the research problem (Easterby-Smith, Thrope, & Jackson, 2012). Within the framework of positivistic approach there are distinguished two type of validity: internal and external.

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<sup>6</sup> <http://finance.yahoo.com/q?s=SESG.PA>

<sup>7</sup> <http://www.nasdaq.com/symbol/sgbaf/historical>

<sup>8</sup> <https://nyse.nyx.com/>

<sup>9</sup> <http://www.marketwatch.com/investing/stock/flex/historical>

<sup>10</sup> <http://www.investing.com/equities/statoil-historical-data>

<sup>11</sup> <http://www.statoil.com/en/investorcentre/share/pages/historicshareprices.aspx>

<sup>12</sup> <http://www.investing.com/equities/petrobras-argentina-adr-historical-data>

<sup>13</sup> <http://finance.yahoo.com/q/hp?s=ONGC.NS+Historical+Prices>.

<sup>14</sup> <http://www.marketwatch.com/investing/stock/ptr>

The *internal validity* is the concept that shows the extent of impact independent variable to dependent one (Easterby-Smith, Thrope, & Jackson, 2012).

There are different threats to internal validity that may happen during data selection, data analysis and treatment of results (Onwuegbuzie & R. Burke, 2006). Thus Gliner & Morgan (2000) provide the classification of threats previously identified by Campbell & Stanley in early 1963:

1. **History** belongs to events, for example weather changes, news, that can show up on the results of the investigation (Gilston, 2014);
2. **Maturation** refers to situations when subjects change over protracted period. It could be a significant threat only if one did not separate such subjects or process in the research design (Zelenka, 2010).
3. **Testing** is about the experimental or calculation performance that should be repeated. Therefore the test can affect the result of the second attempt (Gilston, 2014).
4. **Attrition** happens when the subject drops out of research (Gilston, 2014).
5. **Instrumentation** belongs to changes in measurement performance that can give different output (Zelenka, 2010).
6. **Statistical regression** refers to subjects with outside scores can have lower extreme scores during next testing (Zelenka, 2010).
7. **Differential selection** concerns the situation when interference into one group may influence to another one by chance (Gilston, 2014).
8. **Selection - maturation interaction** belongs to "difference between groups that are initially identified".

All these threats should be taken into account by the researcher during data collection and conducting the investigations. Thus historical threat, maturation, instrumentation and selection - maturation interaction can be avoided by control group that is not influenced by experimental variable (Key, 1997). The issues of the statistical regression and differential selection can be solved with the help of random selection of objects in the case of the research (Altermatt, 2014). Testing can be controlled by pre-test that provides understanding of the format and purpose of the research, develops strategy for better experiment performance (Altermatt, 2014).

The research goals are planned to be reached by calculations. The values as expected return, risk level presented by standard deviation, correlation and covariance coefficients for each asset are going to be compared with the same meanings of the market portfolios as benchmarks. This means that everything will be measured towards the characteristics of MSCI World and MSCI EM Indices.

In respect to *external validity*, this concept focuses to what extent the results of the particular research can be generalized to such situations in general. The threats for this type of validity were highlighted by Cook and Campbell and are as follow (Horan):

- ❖ interaction of selection and treatment: respondents who took part in the experiment are unlike those people who deny, consequently the results of the experiment cannot be generalized to them ;
- ❖ interaction of setting and treatment: mismatch of obtained results in different settings;
- ❖ interaction of history and treatment: causality found out in one particular period of time (a day) cannot correspond to ordinary conditions.

In order to avoid these threats the one can use the random sampling for getting the most representative sample from the population, conduct analysis to designate whether the causality is noticeable across results (Easterby-Smith, Thrope, & Jackson, 2012).

Another important term for devoting the quality of the research is the reliability. *Reliability* concerns the issue if the chosen measurements will give the same results in different efforts (Easterby-Smith, Thrope, & Jackson, 2012, p. 345).

The author considers that the research of this Master Thesis can be called reliable based on following reasons. At first, secondary data used in the calculations was provided by the professional economic resources. Statistics and ratings of S&P500, Fitch, Moody's, estimated rates for Treasury bills, GDP per capita by World bank, historical prices provided by NYSE, NASDAQ, Yahoo Finance, evaluation of firms performance are used by traders and economists for decision-making and therefore can be trusted. Besides all data included figures was carried into software Microsoft Excel where all necessary values and models were computed automatically. Hence the problems of bias and errors in the data collection can be passed.

### **3.7 Limitations**

As each research paper this Master Thesis has some assumptions. There are limitations that concern the computation aspect of the research, especially Markowitz Portfolio Theory that are discussed in such chapters as Theory and Results, so one is not going into details. However there is necessity to say a few words about the data selection process. The decision-making about securities and diamonds was based on technical and fundamental approaches including statistical estimations of countries, industries and companies. Certainly there are other possibilities of assets selection, for example one could make the general technical analysis using tools as moving averages, reversals patterns and oscillators, or provide more explicit fundamental analysis of each particular firm and country. Additionally there also could be done the statistical

stability test for improving the some results of computation. Though such details will make the process of data collection and computations time consuming, because there is a great variety of different firms, other assets among which traders and investors are able to choose and build big number of portfolios, whereas the researcher has a goal to show the effect of including alternative asset class in the investment portfolio.

### **Summary**

As a conclusion one can sum up the results of what have been done in this chapter. Therefore the research object was defined, the literature review clarified the situation in the area of research problem. There were found out that the investigation provided in this paper is quantitative and belongs to positivistic philosophical approach, which allow the author to use the empirical research design for the research process's creation for this particular investigation. Explanations and description of data collection, validity, reliability were aimed at proving the quality of the research and hence the consistency of the results, there also were mentioned limitations concerning the data selection process.

## 4. Results

The Empirical Part of the Master Thesis represents the explanations of how was found the effect of including a diamond in the investment portfolio and what decisions were made for that. In order to make the investigation more interesting it was decided to create portfolios both for Developed and Emerging Markets. The investment horizon is the period of 2005-2013, consequently the ratings, financial analytics and stock listings will be taken starting with 2006 when all analysis has already been done for the previous year. The chapter includes the detailed description about calculation logic, results of computations and primary conclusions about them.

### 4.1 Selection of assets for Developed Markets' portfolios

The process of selecting stocks begins with choosing the country or countries that are considered to be attractive for investments. The decision making in this case can be based on different factors as, for example, high P/E ratio, Dividend Yield, level of Gross Domestic Product (GDP), market capitalization and etc. The largest credit rating agencies as Moody's Investors Services (Moody's), Standard & Poor's (S&P) and Fitch Ratings (Fitch) developed their own methodologies for making out the credit ratings and researches among firms, industries, countries (Van R.P., 2005). The credit rating, based on the current situation in the country and the previous economic analysis, shows whether or not the country is liable for debt commitment. The high rank of a state is just one of factors that could be taken into account by an investor for the decision making. Traders monitor changes in the credit ratings of countries, as they have an impact on exchange rates, the share price of the largest organizations and corporations. Though none of agencies gives the guarantee that investments will be paid its way in this case, or there would not any default in the chosen country (Credit ratings of countries , 2011).

The table 4.1.1 shows the rating of countries by S&P, Moody's and Fitch in 2005, where such developed countries were chosen that have the highest grade credit or prime (AAA, Aaa) or very high grade credit (Aa1, Aa2, Aa3, AA+,AA, AA-) <sup>15</sup>. All countries had a stable outlook that made them to be mostly attractive for foreign investments.

Table 4.1.1: Ratings of countries in 2005

2005						
	S&P	outlook	Moody's	outlook	Fitch	outlook
Australia	AAA	Stable	Aaa	Stable	AA+	Stable

<sup>15</sup> (Credit Ratings Definitions & FAQs, 2014), (Moody's Symbols and Definitions, 2009), (Fitch Ratings:Definitions of Ratings and Other, 2014)

Austria	AAA	Stable	Aaa	Stable	AAA	Stable
Canada	AAA	Stable	Aaa	Stable	AAA	Stable
Finland	AAA	Stable	Aaa	Stable	AAA	Stable
France	AAA	Stable	Aaa	Stable	AAA	Stable
Germany	AAA	Stable	Aaa	Stable	AAA	Stable
Japan	AA-	Stable	AA-	Stable	AAA	Stable
Luxembourg	AAA	Stable	Aaa	Stable	AAA	Stable
Netherlands	AAA	Stable	Aaa	Stable	AAA	Stable
Norway	AAA	Stable	Aaa	Stable	AAA	Stable
Singapore	AAA	Stable	Aaa	Stable	AAA	Stable
Spain	AAA	Stable	Aaa	Stable	AAA	Stable
The United Kingdom	AAA	Stable	Aaa	Stable	AAA	Stable
The USA	AAA	Stable	Aaa	Stable	AAA	Stable

Sources: Afonso, Furceri, & Gomes (June 2011) and Steiner (2014).

However, the table 4.1.2 shows that the situation has changed after 9 years in 2013.

Table 4.1.2: Ratings of countries in 2013

2013						
	S&P	outlook	Moody's	outlook	Fitch	outlook
Australia	AAA	Stable	Aaa	Stable	AA+	Stable
Austria	AA+	Negative	Aaa	Negative	AAA	Stable
Canada	AAA	Stable	Aaa	Stable	AAA	Stable
Finland	AAA	Stable	Aaa	Stable	AAA	Stable
France	AAA	Stable	Aaa	Stable	AAA	Stable
Germany	AAA	Stable	Aaa	Stable	AAA	Stable
Japan	AA-	Negative	Aa3	Stable	A+	Negative
Luxembourg	AAA	Negative	Aaa	Negative	AAA	Stable
Netherlands	AAA	Negative	Aaa	Negative	AAA	Stable
Norway	AAA	Stable	Aaa	Stable	AAA	Stable
Singapore	AAA	Stable	Aaa	Stable	AAA	Stable
Spain	BBB-	Negative	Baa3	Negative	BBB	Negative
The United Kindon	AAA	Negative	Aaa	Negative	AAA	Negative
The USA	AA+	Negative	Aaa	Negative	-	-

Source: Credit ratings: how Fitch, Moody's and S&P rate each country, 2014.

Such countries as Austria, Japan, Luxemburg, Netherlands, Spain, the United Kingdom, and the USA were got negative prognosis, though all of them except Spain, had the same Prime and very high credit ratings. Other states as Australia, Canada, Finland, France, Germany and Singapore had shown the stable result.

One of the criteria that has already been mentioned above, is the Gross Domestic Product (GDP). Being the ratio between gross domestic product and the number of population in the country the GDP per capita is quite important measure in comparison of relative performance countries. The figure 4.1 illustrates the dynamics of the GDP per capita based on purchasing power parity (PPP) of countries mentioned above and the world's GDP per capita during the period 2004 - 2012. The data was corrected by inflation and based on prices of 2005 using the source of the World Bank (GDP per capita (current US\$), 2014).

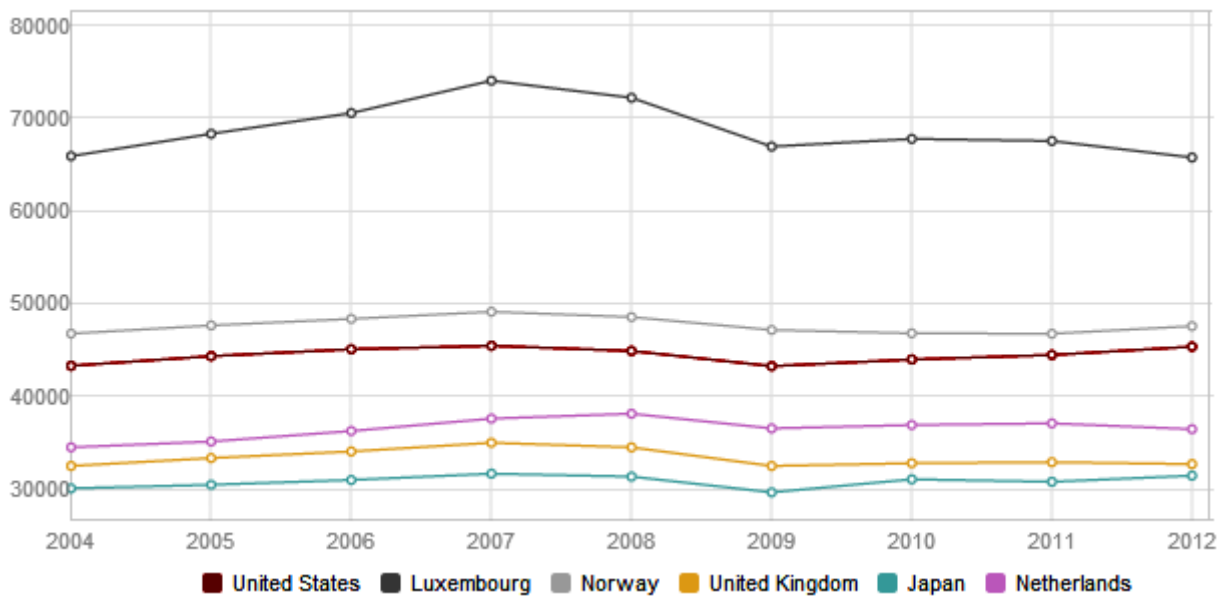


Figure 4.1: GDP per capita of countries

Source: the official web-site of the World Bank (GDP per capita, PPP (constant 2011 international \$), 2014)

The Luxembourg has had the highest GDP per capita among others, it had shown the constant growth from 2004 (\$65 882, 4) to 2007 (\$74 021,5), though it had been declining from 2007 to 2009 (GDP per capita = \$66 915,1), the following trend had remained mostly on the same level of \$ 67 500 in average and had a negative tendency afterwards (GDP per capita, PPP (constant 2011 international \$), 2014). Norway and the United States have had almost the same tendency in developing of GDP, though American GDP has been less than Norwegian: in 2004 the  $GDP_N = \$47\,741,6$  ( $GDP_N = \$47\,626,3$  in 2005),  $GDP_{USA} = \$43\,273,7$  ( $GDP_{USA} = \$44\,313,6$  in 2005), whereas in 2012  $GDP_N = \$47\,546,6$  and American  $GDP_{USA} = \$45\,339$ .

As to the UK, Japan and Netherland the GDP of the countries are as follows (GDP per capita (current US\$), 2014):

- ❖ 2004:  $GDP_{UK} = \$32\,471,9$  ( $GDP_{UK} = \$33\,323,9$  in 2005),  $GDP_{Holland} = \$34\,481$  ( $GDP_{Holland} = \$35\,104,5$  in 2005),  $GDP_{Japan} = \$30\,052,7$  ( $GDP_J = \$30\,441,3$  in 2005);
- ❖ 2012:  $GDP_{UK} = \$32\,671,2$ ;  $GDP_{Holland} = \$36\,438,3$ ;  $GDP_{Japan} = \$31\,425,5$ .

The figure 4.2 shows the situation with GDP per capita with other countries as Australia, Canada, Singapore, France, Germany and Finland.

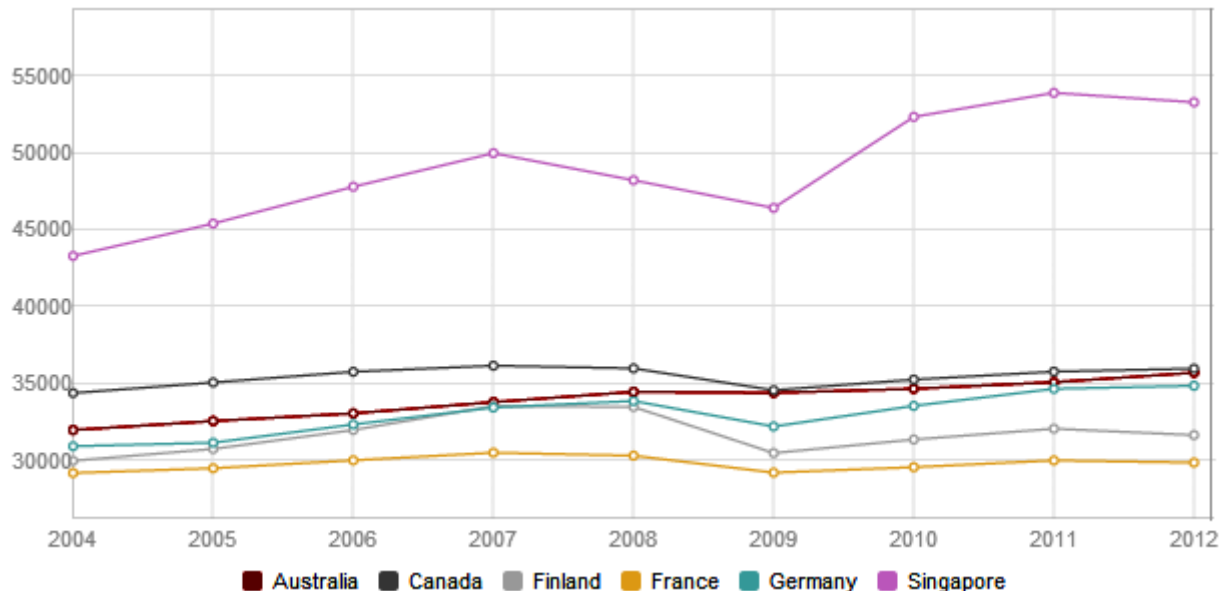


Figure 4.2: GDP per capita of countries

Source: the official web-site of the World Bank (GDP per capita (current US\$), 2014)

Singapore has had the positive tendency starting from \$43 264,2 in 2004 and being \$53 266,1 in 2012 in general. However, there was a reduction of its GDP in 2007-2009. The GDP of Canada, Finland, Australia, France and Finland have been on the same diapason \$29 000 - \$34 000:

- ❖ 2004:  $GDP_{Germany} = \$30\,885,6$  ( $GDP_{Germany} = \$31\,114,5$  in 2005);  $GDP_{Australia} = \$31\,939,8$  ( $GDP_{Australia} = \$32\,525,6$  in 2005);  $GDP_{Canada} = \$34\,343,7$  ( $GDP_{Canada} = \$30\,707,9$  in 2005);  $GDP_{France} = \$29\,142,9$  ( $GDP_{France} = \$29\,452,5$  in 2005);  $GDP_{Finland} = \$29\,940,2$  ( $GDP_{Finland} = \$30\,707,9$  in 2005).
- ❖ 2012:  $GDP_{Germany} = \$34\,819,2$ ;  $GDP_{Australia} = \$35\,668,8$ ;  $GDP_{Canada} = \$35\,936,3$ ;  $GDP_{France} = \$29\,819,1$ ;  $GDP_{Finland} = \$31\,609,5$ .

Thus, based on the estimation of the World Bank and ratings S&P, Moody's and Fitch in 2005 and 2013 the following countries can be chosen for foreign investments (GDP per capita, PPP (constant 2011 international \$), 2014):

- ❖ Luxembourg (Europe)
- ❖ Norway (Scandinavia)



- ❖ Singapore (Asia)
- ❖ The USA

The next step is to choose industry sectors and the company itself. The Global 2000 Forbes Report of 2006 can be used for this purpose. It is based on the analysis of "Interactive Data, Thomson Reuters Fundamentals and Worldscope databases via FactSet Research Systems" and includes 2000 biggest firms in each parameters as sales, profits, assets, market value (DeCarlo , Global 2000 Methodology: How We Crunch The Numbers, 2013). The Report was created at the beginning of 2006 and showed the results of firms' activity for the year 2005, so it seems logical to use this data for the selection of industries and firms. The figure 4.3 illustrates the industrial sectors ranked due to the number of employees and revenues in 2006.

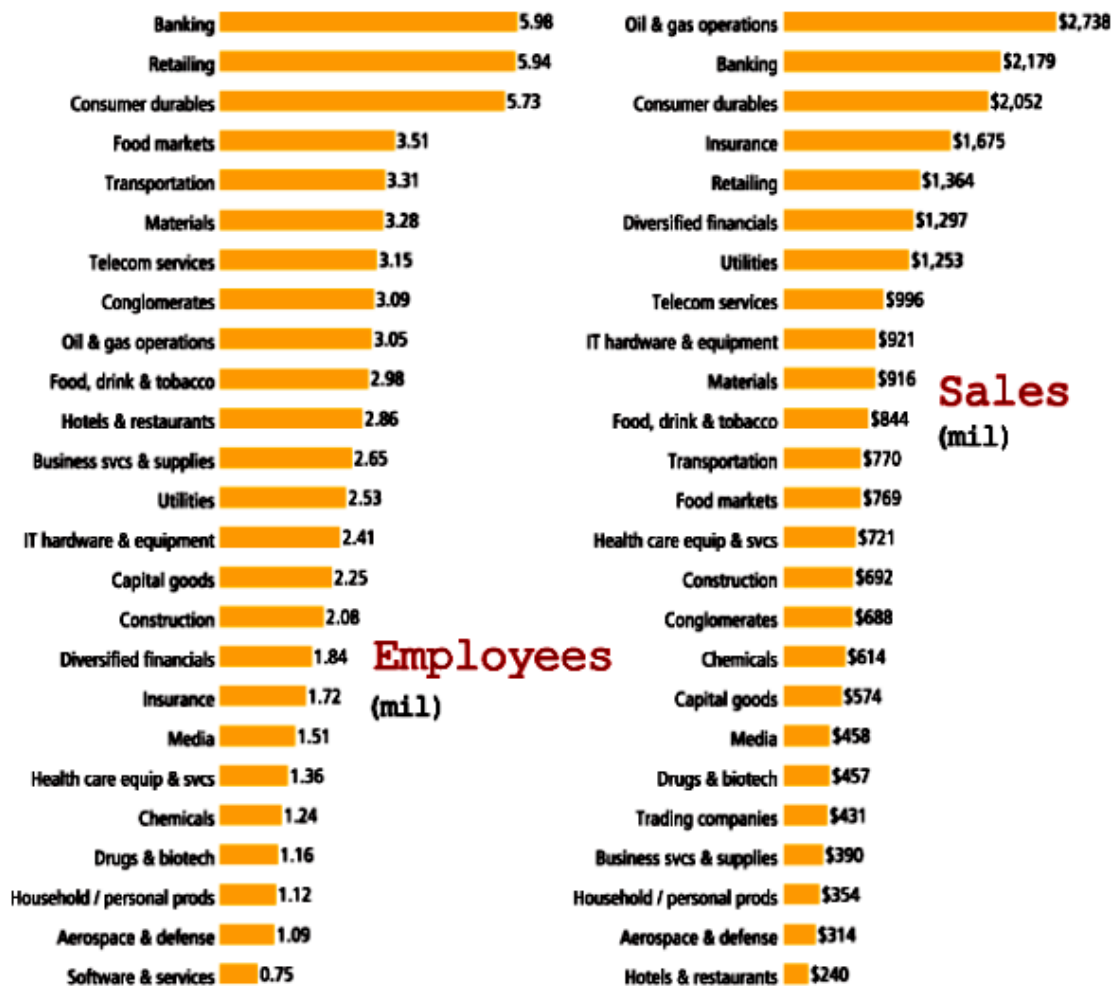


Figure 4.3: The Ranking of Industries According to Forbes Global 2000 in 2006.

Source: DeCarlo, The World's Largest Public Companies, 2006

Each rating is just the recommendation, but the recommendation that is better to take into account. With respect to the chosen countries, an investor can select those industries in which each country showed to the best advantage in that year.

Consequently for the first portfolio it would be chosen:

- ❖ Norway - Oil & Gas Operations industry - Statoil Group (rank 96);
- ❖ Luxembourg - Materials - Arcelor (rank 155); Tenaris S.A. (773) ;
- ❖ Singapore - Telecommunications Services - Singapore Telecom (rank 355).

According to the Forbes Global 2000, the U.S. were presented by various American companies that were leaders in most of sectors, that's why it was decided to create a separate portfolio for the States.

However using just one Report, even the Global one, is not enough. Therefore, previous findings will be compared with results of another report as Fortune Global 500 Report 2005 that ranked firms by their revenues and published (CNN, 2005). For Luxembourg it might have been possible to choose ArcelorMittal Company that was and still is the leader on the global steel markets, ranked 118 among 500 other corporations and the first in the industry Metals, but the firm was founded only in 2006, so its stocks had not been listed yet in 2005. The second choice can be to the advantage of Tenaris S.A. (Oilfield industry). The company has been supplier's leader of tubes and equipment for energy industry (Tenaris, 2003-2014). There is also SES S.A. (Societe Europeene des Satellites) - the world's largest satellite operator in communications that presents the Media industry (SES, 2014).

The decision making between two companies for Luxemburg can be made based on tables 4.1.3 and 4.1.4 that show expected returns and risks of Tenaris S.A. and SES S.A. Stocks of Tenaris S.A. are more risky than the securities of SES S.A. though the expected returns are equal (Tables 4.1.3 and 4.1.4).

Table 4.1.3: Luxembourg - Oil & Gas Industry - Tenaris S.A.

Expected return for the period 2005-2013	13%
Variance of the Tenaris SA (TS. MX)	42%
Standard deviation	65%

Source: developed by the author (Appendix B1)

Table 4.1.4: Luxembourg - Media industry - SES S.A.

Expected return for the period 2005-2013	13%
Variance of the SES S.A.	4%
Standard deviation	20%

Source: developed by the author (Appendix B1)

Besides Norwegian Statoil had demonstrated better results than Tenaris S.A. in the Oilfield industry based on ratings discussed above. Looking ahead SES S.A. has strong positive correlation with Tenaris S.A. ( $\rho = 0,7$ ) that could be found in the correlation matrix (Table 4.4.6). This fact eliminates the possibility of including both firms in the portfolio. In the same time correlation between Tenaris S.A. and Statoil appeared to be quite close to +1 ( $\rho = 0,881$ )

(Table 4.4.6). Both SES S.A. and Tenaris S.A. showed the negative correlation with a diamond, this means that both stocks are suitable to be in the same portfolio with a diamond (Table 4.4.6). Therefore, it was decided to take SES S.A. (Societe Europeene des Satellites) which is the world's largest satellite operator in communications, for the Portfolio 1 (SES, 2014).

- ❖ Singapore: Singapore Telecom did not come into the list of Global 500. Flextronics International was the only one company from Singapore in the list, it was a representative of Semiconductors and Other Electronic Components industry and ranked 433 in Global 500 (rank 2 place among companies in the industry) and 917 in Forbes Global 2000.
- ❖ Norwegian Statoil and Norsk Hydro were also in the list of the best in 2005. Statoil introduced the Petroleum Refining industry sector and was 70 in general rating (rank 12 in the industry with the revenue = \$ 45 440 mln.). Norsk Hydro was 216 among 500 firms (rank 5 in Metals industry with the revenue \$24 552,9 mln.).
- ❖ As to the USA the table 5 presents 10 firms from different industries with respect to each Report. Blue colored firms means that they were mentioned in both Ratings, so exactly these corporations will be included in the American Investment Portfolio.

Table 4.1.5: Comparison of two ratings' lists

№	Forbes Global 2000		Fortune Global 500	
	Company	Industry	Company	Industry
1	Citigroup	Banking	Exxon Mobil	Oil&Gas Operations
2	General Electric	Conglomerates	Wal-Mart Stores Inc	Retailing (Services)
3	American Intl. Group	Insurance	General Motors	Consumer Durables
4	Exxon Mobil	Oil&Gas Operations	Citigroup	Banking
5	Wal-Mart Stores Inc	Retailing (Services)	American Intl. Group	Insurance
6	Berkshire Hathaway	Diversified Financials	Intl. Business Machines	Computers, Office Equipment
7	Procter&Gamble	Household&Personal Product	McKesson	Healthcare
8	IBM	Technology Hardware&Equipment	Berkshire Hathaway	Diversified Financials
9	Verizon Communications	Telecommunications	Verizon Communications	Telecommunications
10	Altria Group	Food, Drink & Tobacco	U.S. Postal Service	Mail, Package, Freight Delivery

Source: (Forbes, 2006; CNN, 2005)

Companies could be changed to other firms with lower rank if it appeared that their stocks do not suit the investment horizon 2005-2013 and they have strong positive correlation.

Another constituent of the portfolio is a diamond. What diamonds should be chosen for the investments? The experts (Rapaport, How to invest in diamonds (2013), Chiara Cavagleri, Julian Knight (2013)) concur that one can start with investments in round diamonds with following characteristics: the weight of 1,01 to 1,49 carat, D-H color where D is pure colorless gem, and H - near colorless with yellow tone, with the clarity IF (Internally Flawness) - VS2 (Very Small Inclusions 2) according to the Gemology Institute of America (GIA) grading scale. Indeed, diamonds with not obvious inclusions and discoloration are easy to be sold, so their value will grow.

However there is another opinion about this issue. Edahn Golan (2012), expert from International Diamond Exchange IDEX, divides diamonds into two main categories that presents the interest for investors: high-end diamonds and, so called, "bread and butter white goods". Under the first class he understands the fancy colored diamonds with very small inclusions (VS), which includes quite large colorless stones (DEF)<sup>16</sup> of 10 carats with flawless (FL) to very-very small inclusions (VVS). This is not a new niche for investing in, but still it has the potential for growing (Golan, 23th of August 2012). The second group consists of standard stones that are characterized by 1,00 carat of weight, the color from colorless (D) to near colorless (J), the clarity from pure (Internally Flawless IF) to small inclusions (SI1) (Golan, 23th of August 2012). The diamonds of this category are ranging from 0,50 to 3 carats and are the most attractive for jewelry companies (Golan, 23th of August 2012).

The pieces of advice by Edahn Golan about the first group suit for very rich investor or collectors who take part in auction as Christie's. Moreover the one should think how to find the buyer for such a diamond, then the problem of liquidity raises. Indeed, the rarer the diamond is, then harder to sell it (PriceScope, 2014). The given characteristics of diamonds for the second group are broader, whereas the researcher needs to choose the particular stone, that's why the first recommendations are more preferable. Hence, the researcher chose:

- ❖ Shape/ cut - Round;
- ❖ Weight: 1, 00-1,49 carats;
- ❖ Clarity - Internally Flawness (IF) to Included, category 1(I1);
- ❖ Colour - D (colorless) – K (colorless with yellow tone).

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<sup>16</sup> DEF - thee types of colorless diamond with respect of the scale of GIA (John M. King & John M. King, 2008)

## 4.2 Selection of the market portfolio

The portfolios created in the Master Thesis are mostly global diversified. Usually for this reason most investors choose MSCI World Index as it presents complete situation of the activity in the global developed market (Tagliani, 2009). Consequently MSCI World Index will be used as a benchmark for Developed Market Portfolios. In the case of Emerging Markets there will be used MSCI EM Index for Developing (or Emerging) Market Portfolios. Both MSCI World and EM belong to the family of Morgan Stanley Capital International (MSCI) World indices that are calculated for 70 countries (MSCI Arabian Markets Index, MSCI Europe Index, MSCI EM Latin America Index), for group of countries (MSCI EM Europe, Middle East and Africa Index, MSCI BRIC Index), and even for different regions (MSCI Global Investable Market Indexes, MSCI Global Standard Indexes, MSCI Global Small Cap Indexes).<sup>17</sup> The indices retrace the activities of the stocks they consist of, serve as a base for the exchange trade fund, and the benchmark for comparing the mutual funds with themselves (Amadeo, 2014).

MSCI World Index shows the measure of the global situation in the stock market. Being calculated since 1969 the MSCI includes indices of 23 Developed Countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom, and the United States<sup>18</sup>.

MSCI EM (Emerging Markets) Index was created for measurement of the equity performance for the Developing economies. It consists from 800 stocks from 21 markets that is about 13% of the global market<sup>19</sup>. It includes<sup>20</sup>:

- ❖ Latin America (Brazil, Chile, Colombia, Mexico, Peru);
- ❖ Europe, Middle East & Africa (Czech Republic, Egypt, Greece, Hungary, Poland, Russia, South Africa, Turkey);
- ❖ Asia (China, India, Indonesia, Korea, Malaysia, Philippines, Taiwan, Thailand).

The calculations of both World and Emerging Markets indices rest upon the MSCI Global Investable Indices (GIMI) Methodology that finds in the investment possibilities with respect to liquidity index, investment attractiveness and reproductability.<sup>21</sup>

The dynamics of these indices since December 1998 is presented by the figure where the black line belongs to MSCI World, the green line - to MSCI Emerging Market, and the red line

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<sup>17</sup> (MSCI, Index Definitions, 2013)

<sup>18</sup> Official web-site of MSCI : (MSCI, Index Definitions, 2013)

<sup>19</sup> Official web-site of MSCI: (MSCI, MSCI Emerging Markets Index, 2014)

<sup>20</sup> (MSCI, MSCI Emerging Markets Indexes, 2014)

<sup>21</sup>. (MSCI, MSCI Index Calculation Methodology, Index Calculation Methodology for the MSCI Equity Indexes, 2013)

is for the MSCI ACWI Investable Market Index (IMI) that measures "large, mid and small cap" of countries of both Developed and Emerging Markets (MSCI, Index Definitions, 2013). Based in this figure one can say that the MSCI World and ACWI IMI have been trading in the same diapason 0-200 USD. Moreover their trends have had the similar development, where the trend of ACWI IMI is slightly higher than the World Index.

In general the tendency of the Emerging Markets has been substantially higher than trends of the rest two indices. The behavior of Emerging Markets had been characterized by the stable growth from September 2001 to December 2007. In March 2009 all three Indices were affected by the consequences of World Financial Crisis 2008, though the Emerging economies reacted in a greater extent than the Developed by large reduction of its value (Figure 4.4). This fact proves that such markets possess higher risk than the Developed. The situation after declining in March 2009 can be called as a bullish market for all indices.

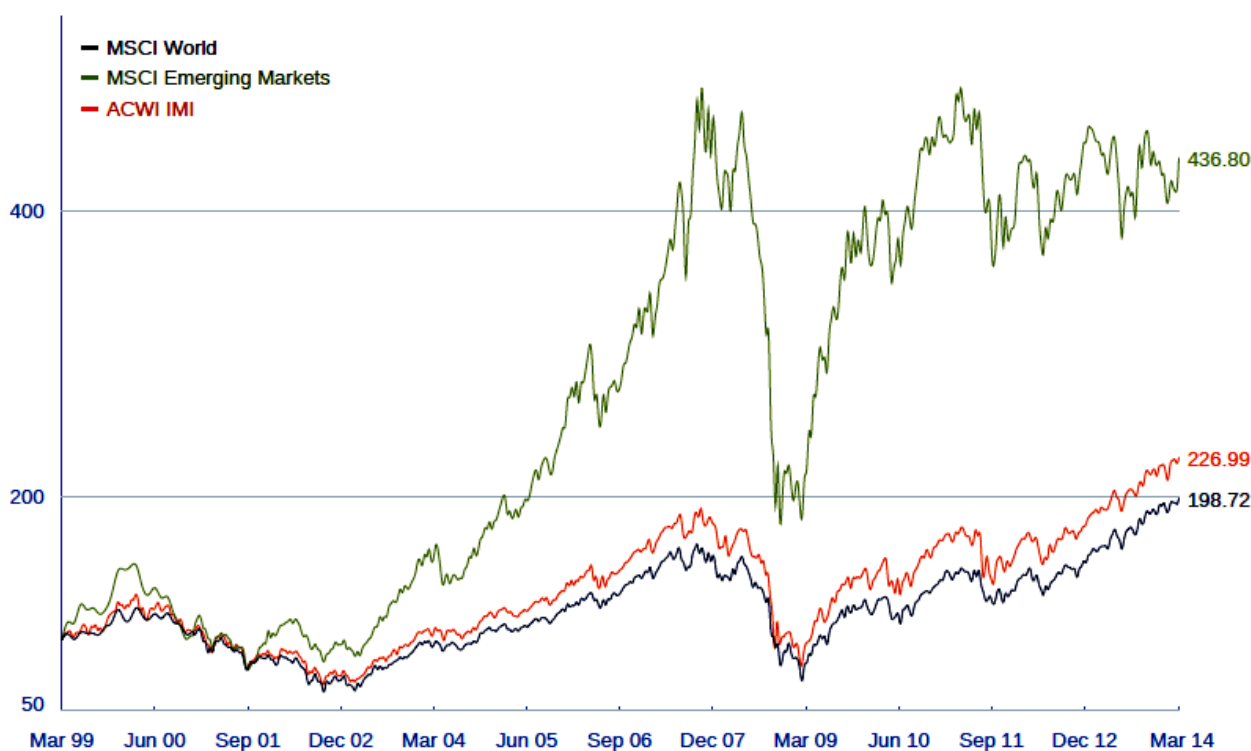


Figure 4.4: Cumulative Index Performance, Gross Returns (December 1998-December 2013), USD.

Source: (MSCI, MSCI Index Calculation Methodology, Index Calculation Methodology for the MSCI Equity Indexes, 2013)

### 4.3 Data Selection for Emerging Market's portfolios

It would have been unfair to ignore the Emerging markets in question of investing. According to the Boston agency Emerging Portfolio Fund Research, the volume of investments in stocks of developing countries reached a record 20,3 billion dollars in 2005, that was in five

times more than in 2004 ( Brown-Humes, 2006). At the beginning of 2000s the financial world started thinking about investments in the emerging markets. Thus the acronym BRIC was invented by the ex-Chief economist of Goldman Sachs Jim O'neil and was mentioned in his book "The Growth Map: Economic Opportunity in the BRICs and Beyond" (Grozovsky , 2013). The future economic growth was not to be late in coming. The Morgan Stanley Fund pulled the shares of these countries on the sum of 30 billion dollars (Grozovsky , 2013). The Foreign Direct Investment (FDI) in BRICS has been increasing has been increasing from 7 billion dollars in 2000 to 126 billion dollars in 2012 taking into consideration South Africa that joined in 2010 (Kanag , 2014). Therefore it was chosen these four countries (Brazil, China, India, Russia) for the representing the Emerging Market. Based on the same Global 2000 Forbes Report 2006 there were chosen the following firms for countries (Table 4.3.1).

Table 4.3.1: Countries, Industries and Firms for Emerging Markets

<b>Country</b>	<b>Industry</b>	<b>Firm</b>	<b>Brief information</b>
China	Oil and Gas	PetroChina Co. Ltd. ADS	An international company mines and trasportates the different products from natural gas and oil (more <a href="http://www.pertochina.com.cn">www.pertochina.com.cn</a> )
Brazil	Petroleum Refining	Petrobras Argentina SA (PZE)	Being a subsidiary of the Brazilian Federal Energy the company produces petrochemicals, asphalts, fuels. (more <a href="http://www.petrobrasenergia.com">www.petrobrasenergia.com</a> and <a href="http://www.bnamericas.com">www.bnamericas.com</a> )
India	Mining, Crude-Oil Production	Oil & Natural Gas Corporation Ltd. (ONGC.NS)	The firm promotes crude oil and gas ( <a href="http://www.bloomberg.com">www. bloomberg.com</a> )
Russia	Banking	Sberbank	The company is the leader of banking in Russia with wide set of banking options (more <a href="http://www.sberbank.com">www.sberbank.com</a> )

Source: developed by the author

If one decides to compare the Global 2000 of 2006 with Global 2000 of 2013, then he can find absolutely another list of firms that present these countries. However, most of them were not existed in 2005, for example Industrial and Commercial Bank of China (ICBC) that ranked 1 place, was founded only in 2006.

As for the benchmark portfolio it is valid to choose MSCI EM (Emerging Markets) as its return and risk will be compared with the portfolios of BRIC.

## 4.4 The Calculations' Logic

### 4.4.1 Portfolios 1 and 1' for Developed Market

In this section it would be explained step by step the logic of calculations on the example of the first portfolios. But before this the researcher should fill out the following assumptions that are general for all portfolios in the Paper as:

1. In the Markowitz Model are valid only standard briefcases, portfolios without short positions (no sales), that is, a portfolio consisting only of the purchased shares. Hence the first constraint that is imposed on the portfolio, it is a positive fraction of all securities ( $x_i$ )<sup>22</sup>.

$$x_i > 0$$

2. The sum of shares equals 1, this rule is the normalization of shares:

$$\sum_{i=1}^N x_i = 1$$

3. The portfolio risk should be less or equal the market risk (MSCI World  $\sigma = 13\%$ , MSCI EM  $\sigma = 36\%$  from tables 9).
4. Investment horizon is 9 years from 2005 to 2013.
5. The data of portfolio formation is the 1th of January 2005.
6. Costs of conducting the broker's account aren't taken into consideration.
7. All assets, all calculations are based on currency – USD (American dollars).

At first, there were collected all the necessary historical stock prices for the investment period 2005-2013 that can be seen in the Appendix B.1, 2, 3, 4. Then based on formulas in the theoretical part there were calculated annual expected return, expected return for 9 years and standard deviation for each asset, MSCI World and EM in the Microsoft Excel. The results are presented in the tables 4.1.4 (in the section 4.1), 4.4.1.1, 4.4.1.2, 4.4.1.3, 4.4.1.4.

Table 4.4.1.1: Singapore- Semiconductors and Other Electronic Components

- Flextronics International Ltd.

Expected return for the period 2005-2013	11%
Variance of the Flextronics	45%
Standard deviation	67%

Source: developed by the author (Appendix B1)

<sup>22</sup> V. Tvardovsky, S. Parshikov «The Secrets of Trading on Stock Exchange», Moscow, 2009



Table 4.4.1.2: Norway - Oil & Gas Industry - Statoil

Expected return for the period 2005-2013	7%
Variance of Statoil	5%
Standard deviation	22%

Source: developed by the author (Appendix B1)

Table 4.4.1.3: Diamond Round 4/4 (1.00-1,49) D-K IF-II

Expected return for the period 2005-2013	3%
Variance of a diamond	0,0041
Standard deviation for a diamond	6%

Source: developed by the author (Appendix B5 provides more detail)

Table 4.4.1.4: MSCI World

Expected Return fo2005-2013	7%
Variance	2%
Standard deviation	13,1%

Source: developed by the author (Appendix B6 provides more detail)

During portfolio formation an investor should know how one asset yield would change if there was a change in return of another one (Burenin, 2008, p. 25). The extent of interrelations between returns of two or more securities can be determined by correlation and covariance matrices (Burenin, 2008, p. 25). Thus the tables 11 and 12 shows the covariance matrix for the Portfolios 1 and 1'. They were obtained by Covariance P. function (array1, array2), Correlation (Pearson's r) and table of annual expected returns (Appendix B.1). The table 4.4.1.5 shows that the covariance between all assets is almost close to 0 that means there is not dependence between variables in general. The covariance and correlation matrices for the portfolios 2, 2', 3, 3' have been calculated by the same functions in Microsoft Excel.

Table 4.4.1.5: Covariance matrix portfolios 1 and 1'

	SES Global	Flextronics International Ltd.	Statoil	Diamonds	Tenaris S.A.
SES Global	0,042	0,004	0,035	0,002	0,093

Flextronics International Ltd.	0,004	0,448	0,031	-0,020	0,227
Statoil	0,035	0,031	0,048	0,002	0,124
Diamonds	0,002	-0,020	0,002	0,004	-0,008
Tenaris S.A.	0,093	0,227	0,124	-0,008	0,417

Source: developed by the author

Although the covariance has some disadvantages that make complicated for the researcher to get the objective picture about the extent of interrelations between stocks. Among all disadvantages experts (Burenin, 2008; Fabozzi, 2000) set aside the dimensionality of the covariance, which equals the intersection of two random variables. According to it the mean of the covariance depends on the unit of measure (Burenin A.N., 2008). In order to solve this problem, investment managers and traders additionally calculate the correlation which has no dimensionality.

According to Markowitz model the strong positive correlation between stocks do not help in the reduction of portfolio's risk (Burenin, 2008). Such values have red color in the table 12. For example, correlation coefficients of Statoil and SES Global ( $\rho = 0,78$ ), Statoil and Flextronics International Ltd. ( $\rho = 0,215$ ), Diamond and SES Global ( $\rho = 0,126$ ), Diamond and Statoil ( $\rho = 0,151$ ) can be interpreted as positively strong, so stocks and a diamond are dependent variables. The value of Flextronics International Ltd. and Tenaris S.A. is also positive, though Tenaris S.A. was not chosen for the portfolio, this data appeared to be quite useful for the decision making about the list of stocks. When it comes to Flextronics International Ltd. and SES Global, their correlation  $\rho$  of 0,027 is almost zero, that's why the researcher can conclude that these two assets are rather independent.

Table 4.4.1.6: Correlation matrix for the portfolios 1 and 1'

	SES Global	Flextronics International Ltd.	Statoil	Diamonds	Tenaris S.A.
SES Global	1	0,027	0,781	0,126	0,701
Flextronics International Ltd.	0,027	1	0,215	-0,444	0,524
Statoil	<b>0,781</b>	0,215	1	0,151	0,880
Diamonds	0,126	- 0,444	0,151	1	-0,196

Tenaris S.A.	<b>0,701</b>	0,524	<b>0,880</b>	<b>-0,196</b>	<b>1</b>
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Source: developed by the author

The next step is to get the portfolios' expected returns, risk and the weight of stocks that could be achieved by the same Microsoft Excel, but function 'Solver' (Tools/Add Ins) (Figure 4.6). But at first, one should prepare the following table as in the figure 4.5:

P38		Expected return						
	L	M	N	O	P	Q	R	S
30			<b>Portfolio 1</b>					
31			period	2005-2013				
32			Security	return	risk	Xi		
33			SES Global					
34			Flextronics International Ltd.					
35			Statoil					
36					$\Sigma(Xi)$			
37					Whole risk			
38					Expected return			

Figure 4.5: The table for calculations

Source: explanation in Burenin A.N." Management of the Investment Portfolio", Moscow, 2008.

There should be written the following formulas:

- $\sigma^2 = (Q_{33}^2) * S_{21} + Q_{33}^2 * S_{22} + Q_{33}^2 * S_{23} + 2 * Q_{33} * Q_{34} * E_{11} + 2 * Q_{33} * Q_{35} * F_{11} + 2 * Q_{34} * Q_{35} * F_{12}$  in the "Whole risk", where  $Q_{33}, Q_{34}, Q_{35}$  - weight  $X_i$  of all stocks in the portfolio,  $E_{11}, F_{11}, F_{12}$  - covariance between assets taken from the covariance matrix for the portfolios 1,1';
- $\Sigma(X_i) = \text{SUM}(Q_{33}: Q_{36})$ ;
- the expected return should be equal  $\sigma = O_{33} * Q_{33} + O_{34} * Q_{34} + O_{35} * Q_{35}$ .

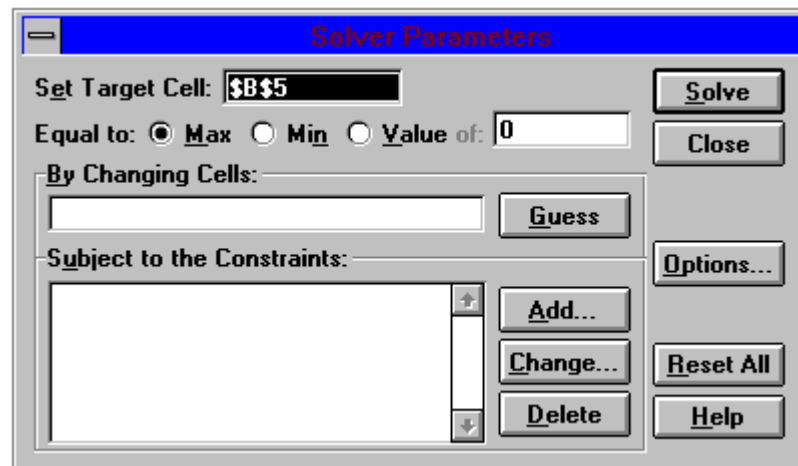


Figure 4.6: Solver in MS Excel

Source: (MacDonald, 1995)

The necessary parameter is filled in the target cell, it can be a return or risk. The investor can choose whatever he wants to get maximum return that should be more than the MCSI Index return, or to get minimum risk of the portfolio that should be less than the return of the market portfolio. In other word the researcher needs to calculate the specific shares of each asset in the portfolio that will give him the expected return more or equal the return of the MCSI World with the minimum standard deviation.

After that one should write the cells of shares in the field 'Changing cells' and fill the assumptions in 'Subject to the Constraints' such as (Figure 4.6):

- 1) All shares are more or equal than 0.
- 2) The sum of the specific weights ( $X_i$ ) is equal 1 or 100%.
- 3) The return of the portfolio should be more or equal the return of MCSI Index for maximization of the return. The level of risk should be less or equal the standard deviation of the market portfolio if an investor wants to minimize the risk. In our case the researcher will minimize the risk of the portfolio. These assumptions are fair for all portfolios that were created based on Markowitz Model in this Paper.

The next step is to choose "non- negative values" and "show the result of iterations" in the "Options" and click "Ok". The researcher will get the possible variants of weights distribution among all assets in the portfolio according to all assumptions above. They can be observed in the figure 4.7. In the case of portfolio 1 such shares give almost equal percentage of expected return and risk.

Variant 1			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	46%
Flextronics International Ltd.	11%	67%	15%
Statoil	7%	22%	39%
		$\Sigma(Xi)$	100%
		Whole risk	11%
		Expected return	10%

Variant 2			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	47%
Flextronics International Ltd.	11%	67%	14%
Statoil	7%	22%	39%
		$\Sigma(Xi)$	100%
		Whole risk	11%
		Expected return	10%

Variant 3			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	34%
Flextronics International Ltd.	11%	67%	34%
Statoil	7%	22%	32%
		$\Sigma(Xi)$	100%
		Whole risk	14%
		Expected return	10%

Variant 4			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	53%
Flextronics International Ltd.	11%	67%	16%
Statoil	7%	22%	31%
		$\Sigma(Xi)$	100%
		Whole risk	11%
		Expected return	11%

Variant 5			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	52%
Flextronics International Ltd.	11%	67%	16%
Statoil	7%	22%	32%
		$\Sigma(Xi)$	100%
		Whole risk	11%
		Expected return	11%

Figure 4.7: Possible variants of weights' distribution

Source: developed by the author

Among all iterations the results in table 4.4.1.7 appeared to be satisfied, because all other cases showed lower return of the portfolio.

Table 4.4.1.7: Characteristics of the Portfolio 1

<b>Portfolio 1</b>			
period	2005-2013		
Security	return	Risk	Xi
SES Global	13%	20%	52%
Flextronics International Ltd.	11%	67%	16%
Statoil	7%	22%	32%
			$\Sigma(X_i)$
			100%
			Whole risk
			11,0%
			Expected return
			11%

Source: developed by the author

The Portfolio 1 has the expected return of 11% (without rounding off 0,108) and the standard deviation  $\sigma_1$  of 11% (without rounding off 0,110) that is lower on 2 % than the market risk ( $\sigma_m = 13\%$ ). More demonstrably these results are illustrated by the figure 4.8. Thus the major part belongs to SES Global (52%), then to 32% of Statoil and 16% for Flextronics International Ltd.

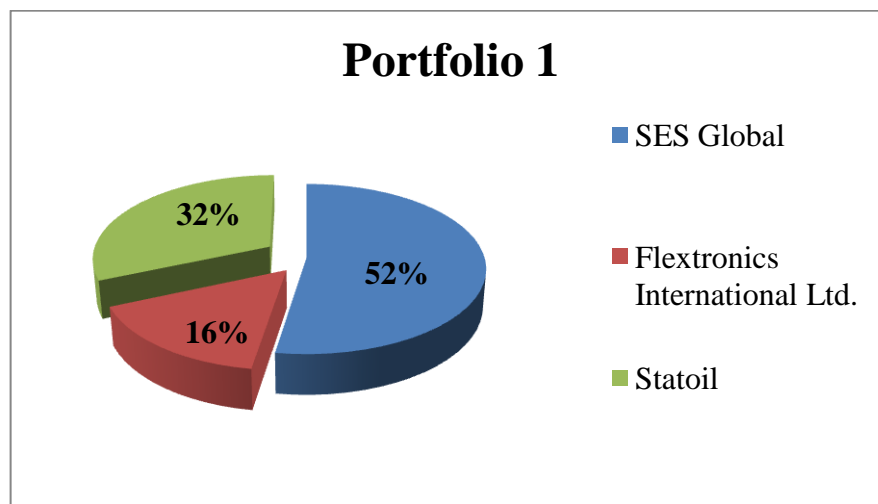


Figure 4.8: Weights of stocks for the portfolio1.

Source: developed by the author

If the person invests in the diamond than the situation will change. All iterations can be found in the Appendix C2. For the Paper the variant 1 was chosen for risk minimizing because it demonstrates the lower whole risk (standard deviation) than others (Table 4.4.1.8).

Table 4.4.1.8: Characteristic of the Portfolio 1'

<b>Portfolio 1'</b>				
period	2005-2013			
Security	return	risk	Xi	
SES Global	13%	20%	30%	
Flextronics International Ltd.	11%	67%	9%	
Statoil	7%	22%	8%	
Diamond	3%	6%	54%	
			$\Sigma(X_i)$	100%
			Whole risk	4,3%
			Expected return	7,00%

Source: developed by the author

Its expected return equals the market portfolio ( $E(r_m) = E(r_{p1'}) = 7\%$ ). However the risk of 4,3% is greatly less than Portfolio 1 that has 11% (Tables 4.4.1.7, 4.4.1.8). There are shares of each asset of the portfolio 1' in the figure 4.9: 54% of investments were made in the diamond, about 30% were given to SES Global, 8% and 9% belong to Statoil and Flextronics International Ltd. consequently.

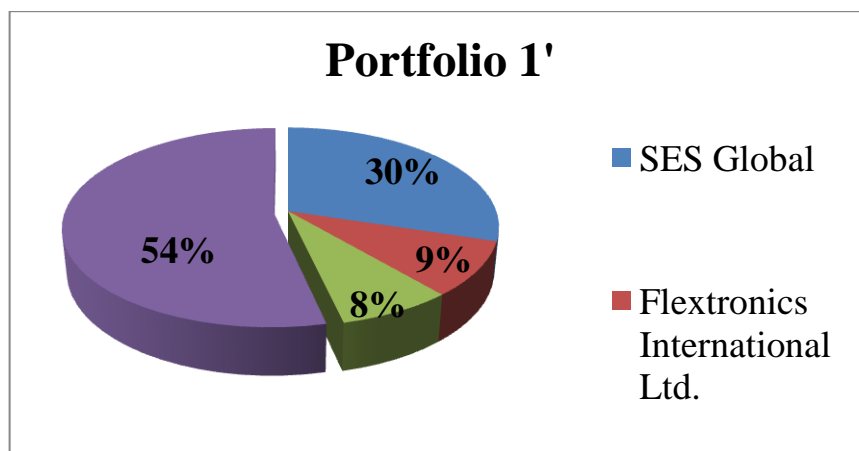


Figure 4.9: Weights of assets in the portfolio 1'.

Source: developed by the author

It is possible to consider that the existence the diamond and increasing of number of assets influenced positively the Portfolio 1' and became the reasons of the risk reduction. If one compare these portfolios, it could be said that portfolio 1' provides less risk, but lower return than Portfolio 1.

#### 4.4.2 Portfolios 2 and 2' for the USA

The same logic of calculations were used in the cases of Portfolios 2 and 2' that represent the USA. A list of included stocks were discussed in the Selection Data and can be seen in the table 5. These portfolios were created using stocks of four American firms and the diamond. Why only four stocks were included? Previously it was mentioned that stocks from five firms would be used there. The reason is that Citigroup Inc. has had the negative expected return for the period 2005-2013 during calculations, though this company showed best results among rivals in Banking industry (Table 4.4.2.1).

Table 4.4.2.1: Characteristics of Citigroup Inc.

Expected return for the period 2005-2013	-14%
Variance of Citigroup Inc.	13%
Standard deviation	36%

Source: developed by the author (Appendix B2 provides more details)

For these portfolio expected returns and standard deviations were calculated.

Table 4.4.2.2: Characteristics of Wal-Mart Stores Inc.

Expected return for the period 2005-2013	7%
Variance of the Wal-Mart Stores	1%
Standard deviation	8%

Source: developed by the author (Appendix B2 provides more details)

Table 4.4.2.3: Characteristics of Exxon Mobil Corp.

Expected return for the period 2005-2013	7%
Variance of Exxon Mobil Corp.	2%
Standard deviation	15%

Source: developed by the author (Appendix B2 provides more details)



Table 4.4.2.4: Characteristics of Berkshire Hathaway BRK -A

Expected return for the period 2005-2013	9%
Variance of Berkshire Hathaway BRK -A	3%
Standard deviation	17%

Source: developed by the author (Appendix B2 provides more details)

Table 4.4.2.5: Characteristics of Verizon Communications Inc.

Expected return for the period 2005-2013	2%
Variance of Verizon Communications Inc.	2%
Standard deviation	16%

Source: developed by the author (Appendix B2 provides more details)

The next step is covariance and correlation matrices (Tables 4.4.2.6 and 4.4.2.7). The first that one can say looking at the covariance matrix is that all covariance coefficients are close to 0 that means, the securities are independent and the value change of one stock does not influence the change of another. Thus Citigroup Inc. and Berkshire Hathaway BRK -A (0,044), Verizon Communications Inc. and a Diamond (0,003), Wal-Mart Stores Inc. has zero covariance with all presented assets, for example, Wal-Mart Stores Inc. and Citigroup Inc. (-0,006), Wal-Mart Inc. and Exxon Mobil Corp. (- 0,009). Covariance coefficients of Wal-Mart Stores Inc. have a minus, but figures are too small to confirm that there is weak negative covariance between stocks and a diamond, so the minus is insignificant in this case.

Table 4.4.2.6: The Covariance Matrix for portfolios 2 and 2'

	Wal-Mart Stores Inc.	CitiGroup Inc.	Exxon Mobil Corp.	Berkshire Hathaway BRK -A	Verizon Communications Inc.	Diamonds
Wal-Mart Stores Inc.	0,007	-0,006	-0,009	-0,005	-0,002	-0,003
CitiGroup Inc.	-0,006	0,129	0,022	0,044	0,046	-0,002
Exxon Mobil Corp.	-0,009	0,022	0,022	0,018	0,012	0,002
Berkshire Hathaway BRK -A	-0,005	0,044	0,018	0,031	0,028	0,000
Verizon Communications Inc.	-0,002	0,046	0,012	0,028	0,042	0,003

Diamonds	-0,003	-0,002	0,002	0,000	-0,005	0,004
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Source: developed by the author

As to the correlation matrix, it can be seen from the table 4.4.2.7 that Wal-Mart Stores Inc. has in all cases negative correlation of different extent: negatively strong correlation (green figures in the table 4.4.2.7) with Exxon Mobil Corp. ( $\rho = -0,711$ ) and the diamond ( $\rho = -0,524$ ), negatively weak correlation with CitiGroup Inc. ( $\rho = -0,202$ ), Berkshire Hathaway BRK -A ( $\rho = -0,321$ ) and Verizon Communications Inc. ( $\rho = -0,141$ ). However there are meanings of the coefficient that can be interpreted as positively strong (red colored figures in the table 21): Berkshire Hathaway BRK -A and CitiGroup Inc. ( $\rho = 0,693$ ), Berkshire Hathaway BRK -A and Exxon Mobil Corp. ( $\rho = 0,698$ ), Verizon Communications Inc. and CitiGroup Inc. ( $\rho = 0,626$ ), Verizon Communications Inc. and Berkshire Hathaway BRK -A ( $\rho = 0,774$ ). Assets with such correlation jointed in one portfolio do not lead to reduction of the whole risk. The rest correlation coefficients can be treated as positively weak, consequently in the case of increasing of one asset another variable will also increase in average.

Table 4.4.2.7: Correlation matrix for portfolios 2 and 2'

	Wal-Mart Stores Inc.	CitiGroup Inc.	Exxon Mobil Corp.	Berkshire Hathaway BRK -A	Verizon Communications Inc.	Diamond
Wal-Mart Stores Inc.	1	-0,202	-0,711	-0,321	-0,141	-0,524
CitiGroup Inc.	<b>-0,202</b>	1	0,414	0,693	0,627	-0,084
Exxon Mobil Corp.	<b>-0,711</b>	0,414	1	0,698	0,394	0,244
Berkshire Hathaway BRK -A	<b>-0,321</b>	<b>0,693</b>	<b>0,698</b>	1	0,774	-0,005
Verizon Communications Inc.	<b>-0,141</b>	<b>0,627</b>	0,394	<b>0,774</b>	1	0,240
Diamond	<b>-0,524</b>	<b>-0,084</b>	0,244	<b>-0,005</b>	0,240	1

Source: developed by the author

During the iterations it was found out that all variants of portfolio 2 have more or less similar values of the expected return and the risk (around  $E(r_{p2}) = 7\%$ ,  $\sigma_{p2} = 4\%$ ), the weights of stocks are different (Appendix C3). Therefore the table 4.4.2.8 defines the content and characteristics of the portfolio 2.

Table 4.4.2.8: Characteristics of the Portfolio 2

<b>Portfolio 2</b>			
period	2005-2013		
Security	return	Risk	Xi
Wal-Mart Stores Inc.	7%	8%	48%
Exxon Mobil Corp.	7%	15%	23%
Berkshire Hathaway BRK -A	9%	17%	21%
Verizon Communications Inc.	2%	16%	8%
<b><math>\Sigma</math> Xi</b>			<b>100%</b>
<b>Whole risk</b>			<b>3,5%</b>
<b>Expected return</b>			<b>7,00%</b>

Source: developed by the author

The standard deviation of the Portfolio 2 equals 3,5% as the Portfolio 1' has, but one the Portfolio 2 has lower risk than Portfolio 1. The researcher can claim that this portfolio provides less risk than the market at the same level of expected return.

The figure 4.10 presents the content and shares of the portfolio: the biggest weight of 48% belong to Wal -Mart Stores Inc., Exxon Mobil Corp. takes 23%, 21% is for Berkshire Hathaway BRK-A and Verizon Communications Inc. has 8% in the whole portfolio.

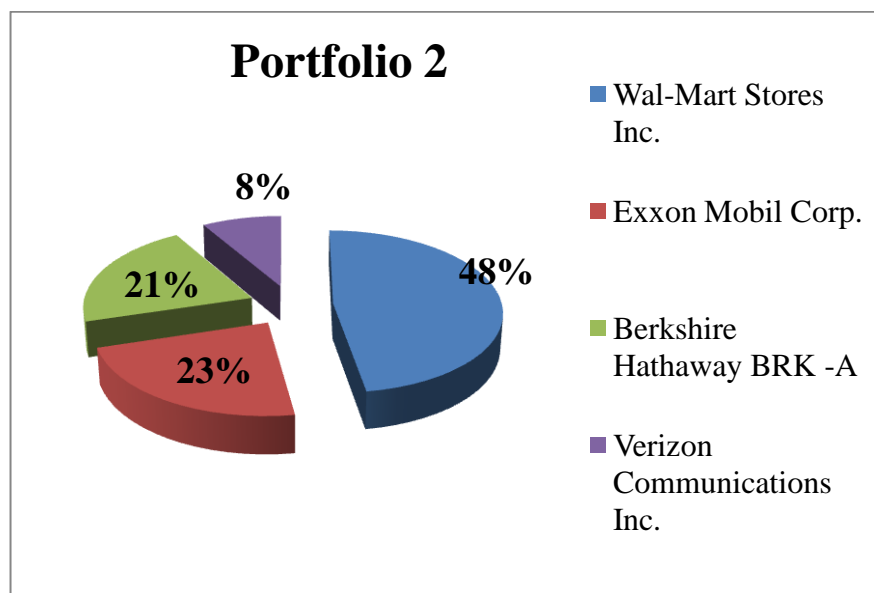


Figure 4.10: Weight of stocks in the Portfolio 2.

Source: developed by the author.

But what would happen if the investor added the diamond? The answer lies in the table 4.4.2.9.

Table 4.4.2.9: Characteristics of Portfolio 2'

<b>Portfolio 2'</b>			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	41%
Exxon Mobil Corp.	7%	15%	21%
Berkshire Hathaway BRK - A	9%	17%	26%
Verizon Communications Inc.	2%	16%	4%
Diamonds	3%	6%	9%
<b><math>\Sigma Xi</math></b>			<b>100%</b>
<b>Whole risk</b>			<b>3,2%</b>
<b>Expected return</b>			<b>7,00%</b>

Source: developed by the author

The portfolio 2' includes five assets where distribution of shares is as follows: 41 % of Wal - Mart Stores Inc., 26% of Berkshire Hathaway, 21% of Exxon Mobil Corp., 9% for the diamond and 4% for the Verizon Communication Inc. (Figure 4.11).

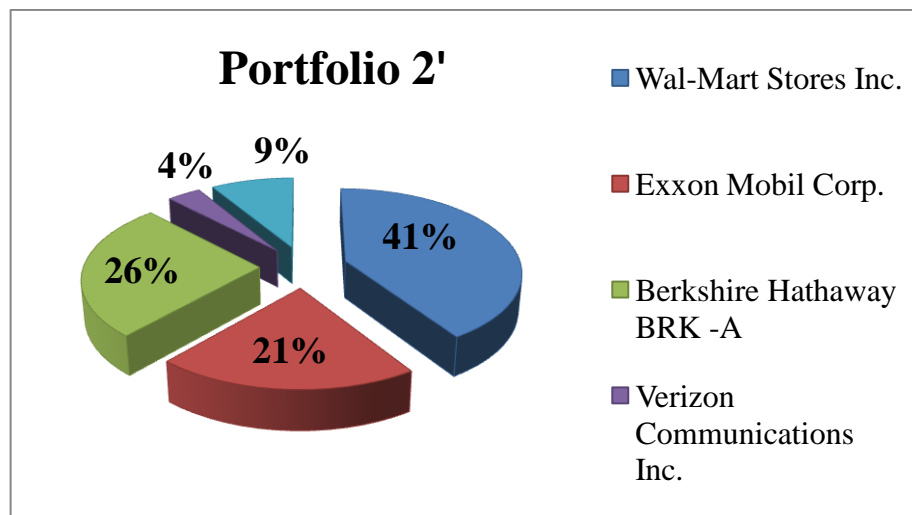


Figure 4.11: Weight of stocks in the Portfolio 2'.

Source: developed by the author.

Both portfolios 2 and 2' give the same expected return of 7% and almost equal level of the risk, 3,5% and 3,2% consequently (Table 4.4.4). These results can be interpreted as quite satisfied,

because the risk levels provided by portfolios 2, 2' are significantly lower than MSCI World index. Though the effect of including diamond in the portfolio had not been seen in this case.

### 4.4.3 Portfolios for Emerging Markets

Based on data selection for the portfolio represented Developing markets the following stocks were chosen:

- ❖ PetroChina Co. Ltd. ADS - China;
- ❖ Petrobras Argentina SA (PZE) - Brazil;
- ❖ Sberbank - Russia;
- ❖ Oil & Natural Gas Corporation Ltd- India.

Their expected returns and levels of risk one can observe in tables 4.4.3.1, 4.4.3.2, 4.4.3.3, 4.4.3.4.

Table 4.4.3.1.: Characteristics of PetroChina Co. Ltd. ADS

Expected return for the period 2005-2013	12%
Variance of the PetroChina Co. Ltd. ADS	12%
Standard deviation	34%

Source: developed by the author (Appendix B3 provides more details)

Table 4.4.3.2 Characteristics of Petrobras Argentina SA (PZE)

Expected return for the period 2005-2013	4%
Variance	34%
Standard deviation	58%

Source: developed by the author (Appendix B3 provides more details)

Table 4.4.3.3: Characteristics of Sberbank

Expected return for the period 2005-2013	58%
Variance	123%
Standard deviation	111%

Source: developed by the author (Appendix B3 provides more details)

Table 4.4.3.4: Characteristics of Oil & Natural Gas Corporation Ltd. (ONGC.NS)

Expected return for the period 2005-2013	3%
Variance	17%
Standard deviation	41%

Source: developed by the author (Appendix B3 provides more details)

All assets have standard deviations more than their expected returns. The most risky asset appeared to be Russian Sberbank ( $\sigma = 111\%$ ) because it has the biggest reduction of its stocks during World Financial Crisis 2008 (-77% from Appendix B3). The characteristics of the diamond stay unchanged and can be seen in the Table 4.4.3.

As these portfolios are for developing states, so the MCSI EM for Emerging Markets should be taken as the market portfolio (Table 4.4.3.5).

Table 4.4.3.5: Characteristics of MSCI EM

Expected return for the period 2005-2013	14%
Variance of the MSCI EM	13%
Standard deviation	36%

Source: developed by the author (Appendix B7 provides more details)

In the case of previous portfolios the covariance and correlation matrices were demonstrated. These portfolios 3 and 3' are not the exclusion. The covariance matrix was calculated using the well-known Covariance P. function (array1, array2) of Microsoft excel. The table 4.4.3.6 shows that stocks of Sberbank and Petrobras Argentina SA (PZE), Oil & Natural Gas Corporation and Sberbank, PetroChina Co. Ltd. ADS and Sberbank have positive covariance between each other. All other values of covariance between stocks are close to zero, though some of them have a negative sign, that could explained as potential negative tendency in relationships between assets.

Table 4.4.3.6: Covariance Matrix for portfolios 3 and 3'

	PetroChina Co. Ltd. ADS	Petrobras Argentina SA (PZE)	Sberbank	Oil & Natural Gas Corporation Ltd.(ONGC.NS)	Diamond
PetroChina Co. Ltd. ADS	0,115	0,087	0,251	0,075	0,000

Petrobras Argentina SA (PZE)	0,087	0,338	0,502	0,184	- 0,011
Sberbank	0,251	<b>0,502</b>	1,215	0,346	- 0,031
Oil & Natural Gas Corporation Ltd.(ONGC.NS)	0,075	0,184	<b>0,346</b>	0,167	- 0,012
Diamond	0,000	- 0,011	- 0,031	- 0,012	<b>0,004</b>

Source: developed by the author.

The correlation matrix below was obtained with the help of the Correlation (Pearson's r) function in the Excel (Table 4.4.3.7). Values of strong positive correlation were emphasized by red color because such close interrelation did not contribute the decreasing of the risk level of the portfolio. The green color shows the negatively strong correlation coefficients that are between the diamond and stocks.

Table 4.4.3.7: Correlation matrix for portfolios 3 and 3'

	PetroChina Co. Ltd. ADS	Petrobras Argentina SA (PZE)	Sberbank	Oil & Natural Gas Corporation Ltd.(ONGC.NS)	Diamond
PetroChina Co. Ltd. ADS	1	0,440	0,671	0,543	0,001
Petrobras Argentina SA (PZE)	0,440	1	0,784	0,775	- 0,281
Sberbank	<b>0,671</b>	<b>0,784</b>	1	0,769	- 0,421
Oil & Natural Gas Corporation Ltd.(ONGC.NS)	<b>0,543</b>	<b>0,775</b>	<b>0,769</b>	1	- 0,446
Diamond	0,001	- <b>0,281</b>	- <b>0,421</b>	- <b>0,446</b>	1

Source: developed by the author.

In general the correlation between all stocks can be interpreted as strongly positive, such values of the coefficients are not helpful along reduction of the portfolio risk, however, and the correlation coefficients between stocks and a diamond are mostly negative and equal 0.

For calculations the researcher uses the same logic as it was in the cases of portfolios 1,1',2,2', but the some conditions from that were discussed on the example of portfolios 1nad 1' should be changed:

- 1) The portfolio risk should be less or equal the market risk (MCSI EM  $\sigma_m = 36\%$ ).

2) One should put the following formula for the portfolio risk the cell 'Whole risk' (Figure 4.12):  
 $=N183^2*M169+N184^2*M170+N185^2*M171+N186^2*M172+2*N183*N184+2*N169*N171*E151+2*N169*N172*F151+2*N173*N169*G151+2*N170*E152+2*N170*N172*F152+2*N170*N173*G152+2*N171*N172*F153+2*N171*N173*G153+2*N172*N173*G154$ .

	J	K	L	M	N	O
180		<b>Portfolio 3'</b>				
181		period	2005-2013			
182		Security	return	risk	Xi	
183		PetroChina Co. Ltd. ADS	12%	34%		
184		Petrobras Argentina SA (PZE)	4%	58%		
185		Sberbank	58%	111%		
186		Oil & Natural Gas Corporation Ltd.(ONGC.NS)	3%	41%		
187		Diamond	3%	2%		
188					<b>Σ Xi</b>	<b>0%</b>
					<b>Whole risk</b>	<b>0%</b>
189					<b>Expected</b>	
190					<b>Return</b>	

Figure 4.12: The table for calculations

Source: explanation in Burenin A.N." Management of the Investment Portfolio", Moscow,2008.

Afterwards the researcher can get the following results the table 4.4.3.8. The optimal solution for the portfolio 3 is the expected return of 14% and the risk of the portfolio of 24%<sup>23</sup>.

Table 4.4.3.8: Characteristics of the portfolio 3

<b>Portfolio 3</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	53%
Petrobras Argentina SA (PZE)	4%	58%	10%
Sberbank	58%	111%	11%
Oil & Natural Gas Corporation Ltd.(ONGC.NS)	3%	41%	26%

<sup>23</sup> Other iterations can be seen in the Appendix C5.



$\Sigma X_i$	<b>100%</b>
<b>Whole risk</b>	<b>24%</b>
<b>Expected Return</b>	<b>14%</b>

Source: developed by the author.

If one have a look at all possible variants, he will be able to conclude that this solution could be the best among all other iterations. Indeed if a person invests in all four stocks with equal weights than the risk of the portfolio appeared to be 38% and the return of 24% (see Appendix C5).

The figure 12 illustrates the shares that stocks will have with respect to discussed return and risk. According to the table 4.4.3.8 and the figure 4.13 53% of the portfolio 3 belongs to PetroChina Ltd., 26% goes to Oil& Gas Corporation, Sberbank has 11% and Petrobras Argentina possess 10%.

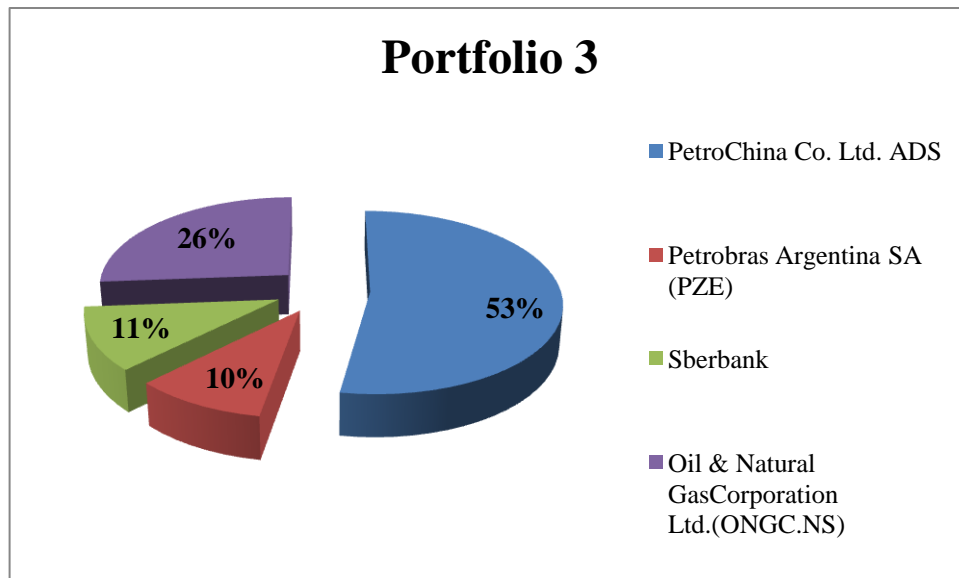


Figure 4.13: Weights of assets in the portfolio 3.

Source: developed by the author.

The portfolio 3' with a diamond can be seen in the table 4.4.3.9. It has expected return of 14% and risk of 7,2 % (rounding-off 7%).

Table 4.4.3.9: Characteristics of the Portfolio 3'

<b>Portfolio 3'</b>			
period	2005-2013		
Security	Return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	5%

Petrobras Argentina SA (PZE)	4%	58%	0%
Sberbank	58%	111%	19%
Oil & Natural Gas Corporation Ltd.(ONGC.NS)	3%	41%	0%
Diamond	3%	6%	76%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>7,2%</b>
		<b>Expected Return</b>	<b>14,00%</b>

Source: developed by the author

The iterations are also put in the Appendix C6. Some of them (Variants 3 - 6) demonstrated expected returns equal the market (14%), but their levels of the risk (14%, 10% and 7% consequently) were equal and lower than MSCI EM ( $\sigma_m = 36\%$ ) (Appendix C6). %. At the same time one can observe that the model did not include Brazilian Petrobras Argentina SA (PZE). The explanation is that the stock has higher risk of 58% while the expected return is only 4%. Moreover the asset has very strong positive correlation with Oil & Natural Gas Corporation Ltd. (ONGC.NS) Sberbank (Table 4.4.3.7). The graphical illustration of shares is in the figure 4.14.

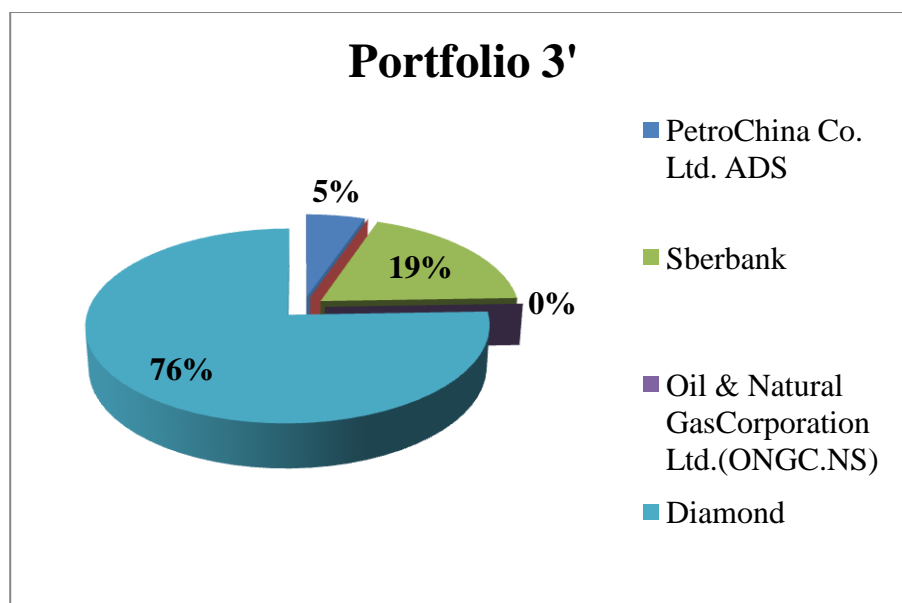


Figure 4.14: Weights of assets in the portfolio 3'.

Source: developed by the author

The Portfolio 3' consists of 5 of PetroChina Co., 76% of the round diamond, 19% of Russian Sberbank and 0% of Indian Oil& Natural Gas Corporation.

Comparing both portfolios, the researcher can claim that the portfolio 3' possesses lower risk of 7,2% than the portfolio 3 which risk presented by the standard deviation is 24%. Such risk reduction can be caused by including another asset class as gemstones (diamond) which takes 76% of the whole portfolio. At the same time the portfolio 3 has the same expected return of 14% as the portfolio 3'. As to the comparison with MCSI EM, both portfolios 3 and 3' provided less risk than the market, the returns of both portfolios are higher than the MSCI EM.

#### 4.5 The Beta- coefficient

A Beta –coefficient  $\beta$  is used for measurement the market risk of an asset. It shows to what extent the risk of the asset is higher or lower than the risk of the market portfolio (Burenin A.N., 2008). The beta-coefficient of the market portfolio equals 1 because the covariance between returns of the market portfolio itself is its variance (Brealey R. A., Myers S. C., Allen F., 2010). Based on the table 18 SES Global, Statoil and a diamond are riskless ( $\beta < 1$ ), whereas the beta of Flextronics International Ltd. is appeared riskiness with beta equaled 6,64 ( $\beta > 1$ ).

The beta-coefficient was calculated using the formula (8) and Microsoft Excel:

$$\beta_a = \frac{cov(r_a, r_m)}{var_m}$$

Where  $cov(r_a, r_m)$  - covariance between an asset and the market,  $var_m$  - variance of the market portfolio. The table of returns for all assets including the MCSI World and MCSI EM is in the Appendix B.

##### 4.5.1 Beta -coefficients for Portfolios 1 and 1'

The table 4.5.1.1 provides the values of beta-coefficients for the Portfolios 1 and 1'. As one can notice the values of beta for SES Global and the Diamond are less than 1, that can be interpreted as the less riskiness than the market portfolio has. The beta for Flextronics International Ltd. is extremely high that could be explained by the fact that the stocks has had strong up-and-down tendency in price development during the period 2005-2013.

Table 4.5.1.1: Beta -coefficients for Assets of Portfolios 1 and 1'

Asset	Beta
SES Global	0,74

Flextronics International Ltd.	6,64
Statoil	0,99
Diamond	- 0,27

Source: developed by the author

Afterwards the influence of these coefficients to betas of portfolios 1 and 1' can be regarded in the table 4.5.1.2. Taking into consideration results of the table 4.4.1.7 it can be said that Portfolio 1 is less risky as the market one, but it provides higher expected return (11% > 7%). The portfolio 1' (consists of 4 assets) is appeared to have the lowest value of the risk though it gives the same return as the index.

Table 4.5.1.2: Beta-coefficients for Portfolios 1 and 1'

<b>Beta -coefficient for portfolio 1(without diamonds)</b>	1,77
<b>Beta -coefficient for portfolio 1'(with diamonds)</b>	0,74

Source: developed by the author

#### 4.5.2 Beta -coefficients for Portfolios 2 and 2' (the USA)

Assets of portfolios for the USA demonstrated the following meanings of the coefficient: Wal-Mart Stores Inc., Exxon Mobil Corp., Verizon Communications Inc. have betas smaller than 1, so these securities are not so risky as the market portfolio. The opposite situation is with CitiGroup Inc. and Berkshire Hathaway BRK -A, they showed high meanings of the coefficient, though CitiGroup Inc. was included in no one portfolio as it has the negative return and its beta proves that the stocks is very risky to be invested in.

Table 4.5.2.1: Beta- coefficients for assets of portfolios 2, 2'

<b>Asset</b>	<b>Beta</b>
Wal-Mart Stores Inc.	- 0,08
CitiGroup Inc.	2,20
Exxon Mobil Corp.	0,59

Berkshire Hathaway BRK -A	1,26
Verizon Communications Inc.	0,97
Diamonds	- 0,27

Source: developed by the author

However the beta- coefficient in the table 4.5.2.2 proves that portfolios 2 and 2' are not riskiness compared with the MSCI World index. Comparing all portfolios the researcher can claim that portfolios 2 and 2' provide lower risk than portfolios 1 and 1' based on previous discussions.

Table 4.5.2.2: Beta- coefficients for the portfolios 2 and 2'

<b>Beta - coefficient for portfolio 2 (without diamonds)</b>	0,45
<b>Beta - coefficient for portfolio 2' (with diamonds)</b>	0,43

Source: developed by the author

### 4.5.3 Beta -coefficients for Portfolios 3 and 3'

As to the portfolios for Emerging markets, the values of the coefficient are presented in the table 4.5.3.1.

Table 4.5.3.1: Beta- coefficients for the portfolios 3 and 3'

<b>Firm</b>	<b>Beta - coefficient</b>
PetroChina Co. Ltd. ADS	0,71
Petrobras Argentina SA (PZE)	1,37
Sberbank	2,71

Oil & Natural Gas Corporation Ltd.(ONGC.NS)	1,00
Diamond	- 0,06

Source: developed by the author

The researcher can claim based on the table that assets as PetroChina Co. Ltd. ADS and the diamond have the beta lower than 1, so the assets are not risky as the MSCI EM that have  $\beta=1$ . In the same time beta- coefficients for stocks of Petrobras Argentina SA (PZE), Sberbank are more than 1, that makes them providing higher level of the risk than the market portfolio. Oil & Natural Gas Corporation Ltd. (ONGC.NS) has beta equal to the beta of the Index, so this stock possesses the same risk as the market.

Thus the beta-coefficient for the portfolios 3 and 3' will be as the table 4.5.3.2 presents:

Table 4.5.3.2: Beta -coefficients for the portfolios 3 and 3'

<b>Beta -coefficient for portfolio 3'(with diamonds)</b>	0,51
<b>Beta -coefficient for portfolio 3(without diamonds)</b>	1,07

Source: developed by the author

#### 4.6 Selection of the risk free rate ( $r_f$ )

There are great variety of rates that are used as a risk free rate, for example, interest rate of government stocks or interest rate on long-term bonds of a firm, current rate of return of American treasury bills and bonds (Damodaran A., 2008). The risk free rate equals the return of the security or the investment portfolio that are not proponed the default risk (Damodaran A., 2004). Theoretically the best measure of the risk free rate might become the return of the portfolio with zero beta. But the formation of such portfolio is quite expensive and time consuming process that is not the topic of this Paper. Consequently, the investor can take the following rates as the risk free ones<sup>24</sup>:

- ❖ 10-year U.S. Government Inflation-Indexed Treasury Bond;
- ❖ 10-year Treasury bill;
- ❖ 30 -years Treasury bill.

<sup>24</sup> Lecture notes : (Example: Selecting a Risk-Free Rate, 2014)

For this particular research it is convenient to choose the rate of 10-years Treasury bill, because investments, the researcher is dealing with, are the long-term, and this rate suits the investment horizon. Based on estimations of the U.S. Department of the Treasury, the average 10 Treasury rate is 2,75% (www.multip.com/10-year-treasury-rate). The decision making about the rate is important for calculations of Sharpe- , Treynor - and Jensen - indices.

#### 4.7 Sharpe- , Treynor - indices and Jensen's Alfa

Sharpe- , Treynor - indices and Jensen's Alfa are used as relative ratios for estimate the performance of the manager because they take into account both risk and return for valuation of efficiency of investments (Brealey, Myers, & Allen, 2010).

Sharpe - index makes allowances to the portfolio's return obtained over the risk free rate, and the whole risk (systematic and unsystematic) (Burenin, 2008). Therefore, the higher is the Sharpe index, the better is the performance of the manager.

The ratio has been computed for all portfolios by the Microsoft Excel and the risk free rate of 2,75% that was chosen above. In the table 4.7.1 one can see that the ratio of the portfolio 1' is higher than portfolio 1 has, that can be explained by including in the portfolio 1' more assets and a new asset class as diamonds.

Table 4.7.1: Sharpe index for Portfolios 1 and 1'

<b>Sharpe index 1</b>	0,750
<b>Sharpe index 1'</b>	1,063

Source: developed by the author

By the side of the Sharpe index for the market portfolio which is presented by the table 4.7.2, one can claim that both portfolios have value of the ratio higher than MSCI World Index.

Table 4.7.2: Sharpe index for MSCI World

<b>Sharpe index of MSCI World</b>	0,327
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Source: developed by the author

Portfolios 2 and 2' have higher values of Sharpe indices than three previous portfolios have, so the investor can get more excess return by investing in 2 and 2' (Table 4.7.3). The values of Sharpe index is the same because both portfolios have the same expected return of 7,00%.

Table 4.7.3: Sharpe index for Portfolios 2 and 2'

<b>Sharpe index 2</b>	1,417
<b>Sharpe index 2'</b>	1,417

Source: developed by the author

In terms of the value obtained for the MSCI EM the portfolio 3' for the Emerging markets shows the Sharpe index greater than others (Table 4.7.4).

Table 4.7.4: Sharpe index for Portfolios 3, 3' and MSCI EM

<b>Sharpe index 3</b>	0,469
<b>Sharpe index 3'</b>	1,607
<b>Sharpe index of MSCI EM</b>	0,313

Source: developed by the author

Unlike the Sharpe index, the Treynor ratio takes into account the beta coefficient as a measure of the risk (Burenin A.N., 2008). If the index appeared to be higher than the difference between risk premium ( $r_m - r_f$ ) then the investor has received more revenues for the taken risk comparing with the market requirements according to the passive strategy. Visa versa, the Treynor ratio lower than risk premium means that the investor performed worse than the market (Fabozzi, 2000).

In the case of our investigation the risk premium is 0,043 ( $= r_m - r_f$ ) Results of Treynor ratios for our portfolios are shown by the table. All ratios are higher than the risk premium, so the investor can generate high expected return of the portfolio, and based on the results of the computation in the table 4.7.5 one can claim that investment portfolios have been performed well.

Table 4.7.5: Treynor indices for portfolios 1, 1', 2, 2', 3,3'

<b>Treynor index 1</b>	0,05
<b>Treynor index 1'</b>	0,06
<b>Treynor index 2</b>	0,10



<b>Treynor index 2'</b>	0,10
<b>Treynor index 3</b>	0,10
<b>Treynor index 3'</b>	0,22

Source: developed by the author

For the market portfolios the following results were obtained:

Table 4.7.6: Treynor indices for the market portfolios

<b>Treynor index of MSCI World</b>	0,04
<b>Treynor index of MSCI EM</b>	0,11

Source: developed by the author

Consequently the observer can conclude that all portfolios for Developed Markets provide higher results of Treynor index than MSCI World. The value of Treynor index for the portfolio 3 is little less than the MSCI EM, that could be explained by the high value of its risk comparing with lower return. Though the portfolio 3' with the diamond shows the meaning of the index greater than the market portfolio has.

Treynor's and Sharpe ratio showed mostly the same rating of portfolios that means portfolios are well-diversified.

Another one measure of the excess return is the Jensen's Alfa. The index can be used in valuation of passive and active strategies. The positive value of the Alfa means that the created portfolio shows better results than the market one for the same level of risk, visa versa the index will be negative for the portfolio with worse performance than the market portfolio (Burenin A.N., 2008). Thus Alfa- coefficients of portfolios 1 and 1' are both negative and equal -1,73 and -0,74 consequently (Table 4.7.7).

Table 4.7.7: The Jensen Alfa for Portfolios 1, 1'

<b>Alfa of the P1</b>		<b>Alfa of the P1'</b>	
rf	3%	rf	3%
rp	11%	rp	7%
$\beta_p$	1,77	$\beta_p$	0,74
rm	7%	rm	7%
$\alpha_{p1}$	- 1,73	$\alpha_{p1}$	- 0,74

Source: developed by the author

The negative Alfa values are also in case portfolios 2 and 2' means that the investor has got smaller results comparing with the market.

Table 4.7.8: The Jensen Alfa for Portfolios 2, 2'

Alfa of the P2		Alfa of the P2'	
rf	3%	rf	3,00%
rp	7%	rp	7%
$\beta_p$	0,45	$\beta_p$	0,43
rm	7%	rm	7%
$\alpha_{p2}$	- 0,45	$\alpha_{p2'}$	- 0,43

Source: developed by the author

Table 4.7.9: The Jensen Alfa for Portfolios 3 and 3'

Alfa of the P3		Alfa of the P3'	
rf	3%	rf	3%
rp	19%	rp	14%
$\beta_p$	1,07	$\beta_p$	0,51
rm	14%	rm	14%
$\alpha_{p3}$	0,04	$\alpha_{p3'}$	0,06

Source: developed by the author

However the coefficients for portfolios 3 and 3' are positive, that might have been interpreted as well performed portfolios. Though as the theory said the Jensen's Alfa is used for comparing the performance of investment portfolios only if they have the equal beta-coefficients (Burenin, 2008). In our case similar beta-coefficients belong to portfolios 2 and 2', the difference is in hundredth part of numbers (0,43 vs. 0,45, tables 4.5.2.2). Is it the sufficient title for considering that these two portfolios can be analyzed by the Jensen's Alfa? It might be a significant difference that's why if one decides to make a comparison, then it should be done deliberately.

## **Summary**

There was explained the decision -making about countries, industries, companies and, finally, stocks by the researcher in the chapter of Results of the Master Thesis. Moreover, there was shown how the researcher can create an investment portfolio based on the Markowitz Modern Portfolio Theory and Excel software. As a result 6 portfolios were formed where the portfolios 1 and 1' included stocks from Development countries, portfolios 2 and 2' for the USA and portfolios 3 and 3' for the Emerging economies. In the addition to these there were also calculated beta-coefficients for each portfolio, Sharpe-, Treynor - indices and Jensen's Alfa, which values will be interpreted in the next analytical chapter called Analysis.

## 5. Analysis

The main purpose of this Master Thesis is to find out whether or not there is positive effect from including additional asset class as diamonds in the portfolio by interpreting the obtained results in the previous chapter. Consequently 6 created investment portfolios where 3 portfolios with stocks and 3 portfolios with securities and the diamond, were divided into two groups:

- ❖ Developed markets :
  - Luxemburg, Singapore, Norway - Portfolios 1 and 1'(with a diamond);
  - The USA - Portfolios 2 and 2'(with a diamond);
- ❖ Emerging markets - Brazil, Russia, India, China (BRIC) - Portfolio 3 and 3' (with a diamond).

According to the computations the results should be interpreted in terms of the main question of the Paper. Therefore one can find the detailed analysis and discussion of the results for all portfolios in this section of the Master Thesis.

### 5.1 Comparative Analysis of Portfolios 1 and 1'

Thus portfolios 1 and 1' consist of stocks of the following companies:

- ❖ Portfolio 1:
  - SES S.A. ( Luxembour),
  - Flextronics International Ltd. ( Singapore),
  - Statoil (Norway).
- ❖ Portfolio 1':
  - 30% -SES S.A. ( Luxembour),
  - 9% - Flextronics International Ltd. ( Singapore),
  - 8% -Statoil (Norway);
  - 54% -The diamond Round 4/4 (1.00-1,49) D-K IF-I1.

Based on calculations the researcher has got the portfolio 1 that possesses the same level of the expected return as the risk ( $E(r_1) = 11\%$ ,  $\sigma_{p1} = 11\%$  *table 4.4.1.7*), the portfolio 1' with the diamond demonstrates the standard deviation equaled 4,3% and the expected return of 7,00%.

The figure 5.1.1 illustrates the comparison of both portfolios with MSCI World Index. The expected return provided by the portfolio1 is higher than the return of the market  $E(r_1) =$

11%  $>$  ( $E(r_m) = 7%$ , table 4.4.1.4), whereas the level of portfolios risk is less than the Index has ( $\sigma_m = 13\% < \sigma_{p1} = 11\%$ ).

Meanwhile the whole risk of the portfolio 1' is impressively low comparing with the risk that is provided by the MSCI World ( $\sigma_{p1'} = 4,3\% < \sigma_m = 13%$ , tables 4.4.1.8,4.4.1.4). Such low levels of the risk can be explained by the fact that values of covariance between the diamond and securities, and between stocks themselves turned out to be close to zero (Table 4.4.5). However both portfolio 1' and the Index possess equaled expected returns( $E(r_{1'}) = E(r_m) = 7%$ , tables 4. 4.1.8, 4.4.1.4).

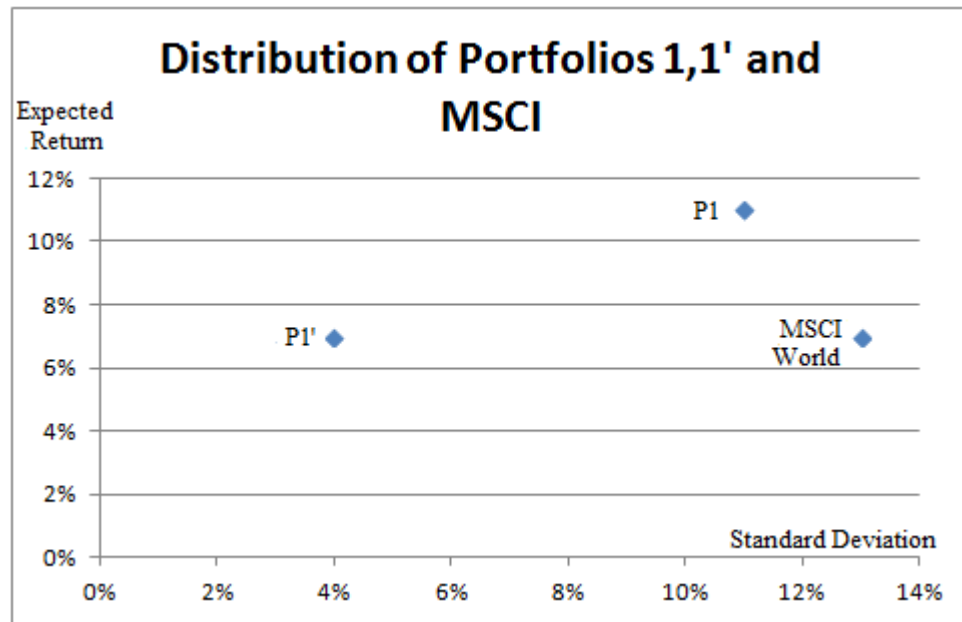


Figure 5.1.1: Comparison of Portfolios 1, 1' with MSCI World.

Source: developed by the author

Therefore the researcher can maintain that the portfolios 1 and 1' have better performance than the MSCI World Index with respect to their expected return and their risk. What would be better to invest in: portfolio 1 or portfolio 1'? In such situation one can give the preference to the portfolio with the lower risk (Grischenko , 2009). It is the case of the portfolio1' that provides 4% of the risk and includes additional asset as the diamond. Though the decision - making about the best performed portfolio can be additionally supported by the values of the beta coefficient, Treynor and Sharpe ratios, Jensen Alfa.

The beta coefficient of the portfolio 1' ( $\beta = 0,74$ ) is less than the meaning of the coefficient for the portfolio 1 ( $\beta =1,77$ ) and less than the beta of the market portfolio (Table 4.5.1.1). Hence the assets in the portfolio 1' are less risky comparing with the Index and the first portfolio. As the reader has already known, both portfolios 1 and 1' consist of the same stocks for the same time period and the values of beta for each asset are mainly less than 1( $\beta$  of SES Global

= 0,74) or close to it (Statoil's  $\beta=0,99$ ), except the value of Flextronics International Ltd which appeared to be high and the reasons for it will be discussed later (Table 4.5.1.1).

However the portfolio 1' also includes another asset class as gemstones which is presented by the diamond. If one has a look at the characteristics of this portfolio than he will find that this gemstone occupies 54% of the total weight. Moreover the beta of this asset is -0,27, that means the returns of the market and the diamond are changing in different directions (Table 4.5.1.1). Then the researcher can conclude that this is the evidence about positive effect of including the additional asset class in the investment portfolio that underlies in the reduction of the risk level.

As to the high meaning of beta for Flextronics International Ltd., it appeared to be equaled 6,64 (table 4.5.1.1). How could that be? If one has a look at the tables where the price dynamics of each stock during all 9 years is presented, he can find out that the trend of annual returns of the firm is not stable (Appendix B1). In order to make it more clear, one can observe this dynamics in the Figure 5.1.2, where OY - the values of the expected return, and OX - the years from 2005 to 2013. Though the value of this beta should be taking into account with carefully during the analysis because the stocks of this firm demonstrated an individual situation when the securities reacted by such great spread as the figure provided.

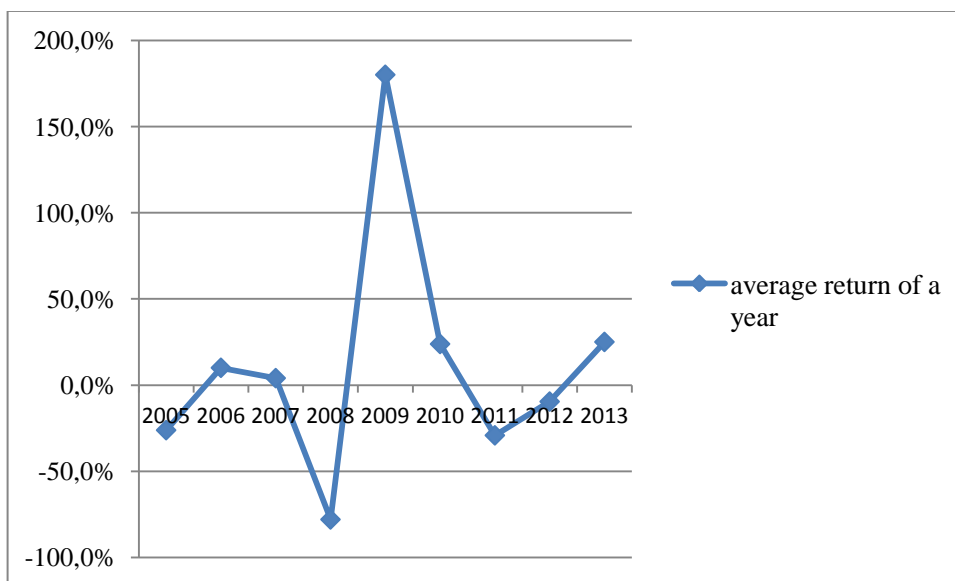


Figure 5.1.2: Annual returns of Flextronics International Ltd.

Source: developed by the author

According to the primary conclusions about the influence of the diamond on the portfolio risk level there are also other measures that could prove or not the first inference. Thus the Sharpe index for the portfolio 1 is less than the portfolio 1' has ( $Sh. ratio_{p1} = 0,750 < Sh. ratio_{p1'} = 1,063$  (Table 4.7.1). Furthermore the Sharpe ratio of the market is 0,327 that is less than both portfolios 1 and 1' possess (Table 4.7.2) As is known from the theory, the higher

the meaning of the ratio, the better is the performance of the portfolio. Therefore the value of index is another evidence that the performance of the portfolio 1' is better.

Treynor index of higher value allows the investor generate greater excess return per unit of risk. Thus in the case of the portfolio1, it is lower instead of the portfolio 1' has ( $0,05 < 0,06$ ), but higher than the MSCI World index provides ( $0,05 > 0,04$ ), consequently there could be made the confirmation that the portfolio 1' provides more excess return than the first portfolio(Table 4.7.5).

As to Jensen's Alfa, its meanings were also computed for these portfolios and equal -1,73 and -0,74 for portfolio1 and portfolio 1' consequently (Table 4.7.7). The value for the market portfolio is appeared to be 0. However as it has already been said this coefficient could not be used for comparison analysis of portfolios with different betas (Burenin, 2008). Moreover it is complicated to claim how stable these results are because they can be checked by the Hansen's stability test, but this is not the goal of the paper.

## 5.2 Comparative Analysis for Portfolios 2 and 2'

The portfolios 2 and 2' were made for the USA only. The portfolio 2 includes stocks of four companies with the following weights (Table 4.4.2.8, Figure 4.10):

- ❖ 48% of Wal -Mart Stores Inc.;
- ❖ 23% of Exxon Mobil Corp.;
- ❖ 21% of Berkshire Hathaway BRK-A;
- ❖ 8% of Verizon Communications Inc.

The portfolio 2' has five assets: the stocks listed above and alternative asset - the diamond. Consequently the proportions changed in this case (Table 4.4.2.9, Figure 4.11):

- ❖ 41 % of Wal - Mart Stores Inc.,
- ❖ 26% of Berkshire Hathaway,
- ❖ 21% of Exxon Mobil Corp.,
- ❖ 8% for the diamond;
- ❖ 4% for the Verizon Communication Inc.

Based on calculations both portfolios show the same values of expected return ( $E(r_{p2}) = E(r_{p2'}) = 7,00\%$ ), and approximately equal levels of the risk ( $\sigma_{p2} = 3,5$   $\sigma_{p2'} = 3,2\%$ ) at the different number of assets included (Tables 4.4.2.8, 4.4.2.9).

Such low level of the risk can be construed by the independence of the variables because all assets have zero covariance coefficients (Table 4.4.2.6). Besides that, the correlation

coefficients between Wal-Mart Stores Inc. and all other assets can be interpreted as strongly negative, that is the positive aspect for the portfolio diversification and risk reduction because values of assets will change in different directions. However there are strongly positive meanings of correlation between Verizon Communications Inc. and Berkshire Hathaway BRK - A ( $\rho = 0,774$ ), Berkshire Hathaway BRK - A and Exxon Mobil Corp. ( $\rho = 0,698$ ). The influence of Verizon Communication Inc. and Berkshire Hathaway BRK - A may not be so intense because the firms possess 4 % and 26% of the total shares in the portfolio, whereas Berkshire Hathaway BRK - A and Exxon Mobil Corp have 26% and 21% (Table 4.4.2.7).

The characteristics of portfolios 2 and 2' with equal risk and returns testify that the researcher was able to find the portfolios that could be alternatives to each other. Moreover, it makes the investor be indifferent in his choice among them, though for some investors the difference in a tenth might be significant. The comparison with the market portfolio is represented by the figure 5.2.1, and runs that these portfolios provide the same return as the Index, but they are not so risky as MSCI World Index.

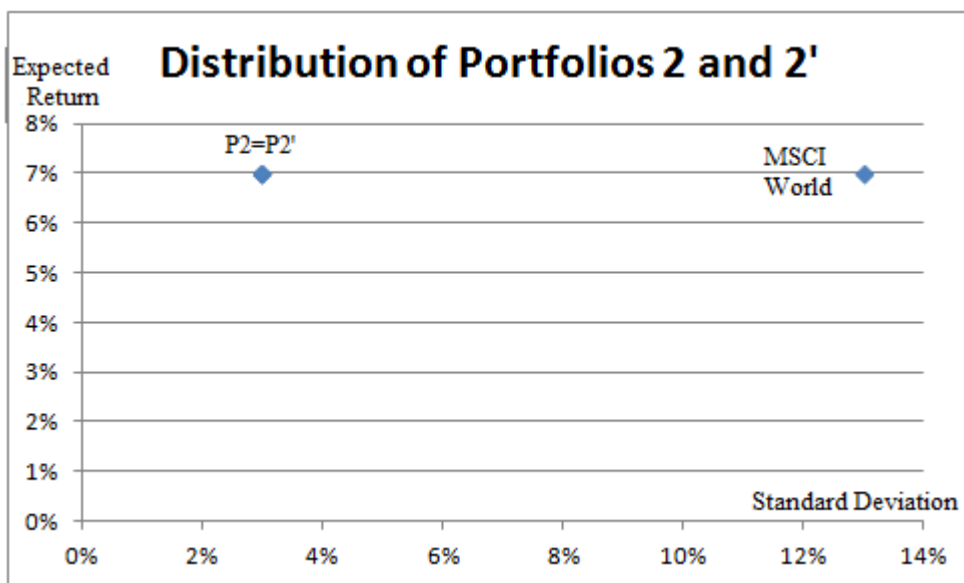


Figure 5.2.1: The Comparison between Portfolios 2, 2' and MSCI World Index.

Source: developed by the author

The beta coefficients of these portfolios are similar and less than 1 (0,45 and 0,43, table 4.5.2.2). Hence their assets can be called less risky as the market portfolio, then they suit well for a risk-averse investor. The structures of portfolios differ: they both include the same four stocks, but second portfolio 2' has also the diamond. Such values of beta are not unexpected, because the betas of included stocks are mainly less than 1, except Berkshire Hathaway BRK -A ( $\beta = 1,26$ ) that can be called more risky as the market, and CitiGroup Inc. ( $\beta = 2,20$ ) that was not included in the final list of assets for the portfolio (Table 4.5.2.1). The fact that these portfolios provide



the same characteristics allows to conclude that investor will be indifferent in regard to the most preferable.

As to their values of Sharpe index, they appeared to be equal because both portfolios showed the same meanings of expected return and the risk ( $Sh.Index_{p2} = Sh.Index_{p2'} = 1,417$ , table 4.7.3). Versus MSCI World that has 0,327 of the Sharpe ratio, investment in both portfolios can bring high excess return.

The values of Treynor index for these investment portfolios are also equal due to the same reason presented above ( $Treynor Index_{p2} = Treynor Index_{p2'} = 0,10$ , table 4.7.5). Consequently the values are higher than the market (0,04).

The comparison of the Jensen Alfa might become possible in these case because the betas are almost similar, though that is quite complicated to make any consideration weather this difference in figures significant or not without stability test.

### 5.3 Comparative Analysis for Portfolios 3 and 3'

The portfolios 3 and 3' were created for Emerging market and initially included all four countries:

- ❖ Brazil - Petrobras Argentina SA (PZE);
- ❖ Russia - Sberbank;
- ❖ India, Oil & Natural GasCorporation Ltd.(ONGC.NS);
- ❖ China - PetroChina Co. Ltd. ADS.

Especially for this category of portfolios the MSCI EM (Emerging Markets) was chosen as a benchmark. The index has the expected return  $E(r_m)$  of 14% and the standard deviation  $\sigma_m$  of 36% (Table 4.4.3.5). According to the computations in the Empirical chapter the portfolio 3 has 14% of expected return, 24% of the whole risk and the following distribution of the shares (table 4.4.3.8):

- ❖ 53% of PetroChina Co. Ltd. ADS;
- ❖ 26% of Oil & Natural GasCorporation Ltd.(ONGC.NS);
- ❖ 21% of Sberbank;
- ❖ 10% of Petrobras Argentina SA.

The situation has changed when the diamond was included. During calculations it appeared that the portfolio 3 will give better results if it does not include the stocks of Petrobras Argentina SA. The reason lays in too high risk level about 58% of Brazilian Petrobras Argentina SA (PZE) versus its too low expected return  $E(r_{Petrobras})$  of 4%, that's why the firm was excluded from the portfolio (Table 4.4.3.2). Moreover the correlation coefficients of the stock

have the highest positive values that will prevent to reach the risk reduction. The stocks of Oil & Natural Gas Corporation Ltd and Petrobras Argentina SA were eliminated during the computations. The company possesses the expected return of 3% whereas the value of the risk is 41% (Table 4.4.3.4). The standard deviation is 7% and the expected return appeared to be 14%. Comparing with the portfolio 3 one can say that portfolio 3' is not so risky than portfolio 3, though it possesses the same return of 14% as it is provided by the portfolio 3 (Figure 5.4, tables 4.4.3.8, 4.4.3.9). Consequently the number of assets and the structure were changed:

- ❖ 5% - PetroChina Co. Ltd. ADS;
- ❖ 19% - Sberbank;
- ❖ 76% - Diamond.

The figure 5.3.1 illustrates the comparison among portfolios 3, 3' and MSCI EM more graphically, where X-axis refers to the risk levels, the Y-axis belongs to the values of expected return. Therefore all portfolios give equaled expected return, however portfolio 3 has lower risk level instead of the MSCI EM Index, but in terms of portfolio 3' it has higher standard deviation.

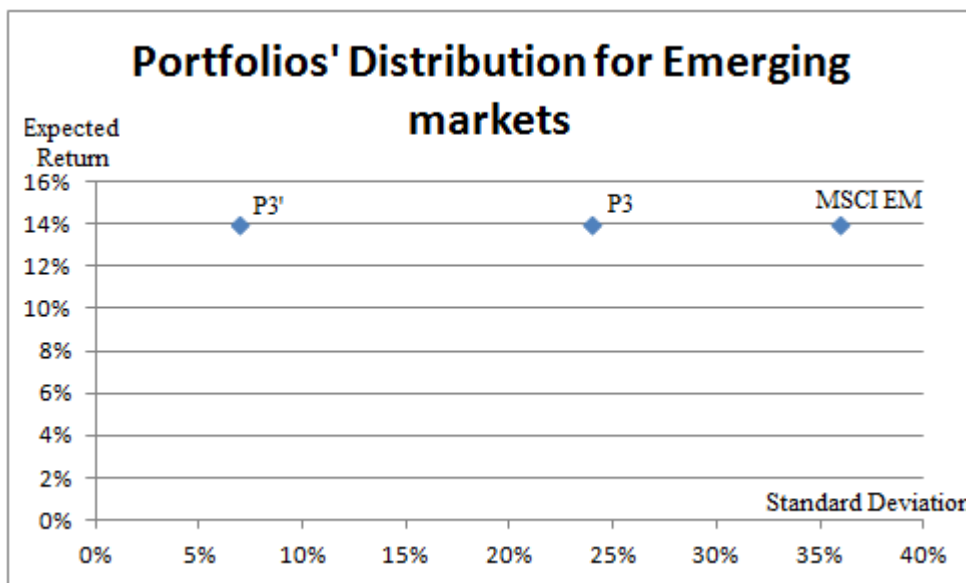


Figure 5.3.1: Comparison between Portfolios 3, 3' and MSCI EM Index.

Source: developed by the author

However in case of MSCI EM the portfolio 3' can be called better because it does not have such great gap in 22%<sup>25</sup> that is between the market return and the risk, in other words the expected return of the portfolio 3' prevails its level of the risk (see the Figure 5.3.1).

During analysis of the beta, the portfolio 3 demonstrated higher value of the coefficient towards for the portfolio 3' (1,07 > 0,51). Thus the portfolio 3 appeared to have more risky assets than MSCI EM Index, and it might be chosen by aggressive investor. Whereas the beta for the

<sup>25</sup>  $\sigma_m=36\%$  and  $E(r_m) = 14\%$ .

portfolio 3' is smaller than 1. The content of securities in the portfolio has changed based on the reasons explained above, so diamond appeared more preferable instead of Oil & Natural Gas Corporation Ltd. and Petrobras Argentina SA according to the model that was discussed in the empirical chapter Results. Is the beta so low because of the diamond? The researcher can confirm that it could be so, because this gemstone occupies 76% of total shares in the portfolio 3', it has its own beta of -0,06 less than 1. In the same time the portfolio 3 consists of assets that have the value of beta close to 1: PetroChina Co. Ltd. ADS ( $\beta = 0,71$ ), Oil & Natural Gas Corporation Ltd. ( $\beta = 1,00$ ).

As to the rest assets, value of beta of Petrobras Argentina is 1,37 ( $\beta > 1$ ), though beta for Sberbank equals 2.71, that could be represented by the unstable behavior of the stock during all investment horizon (Figure 5.3.2).

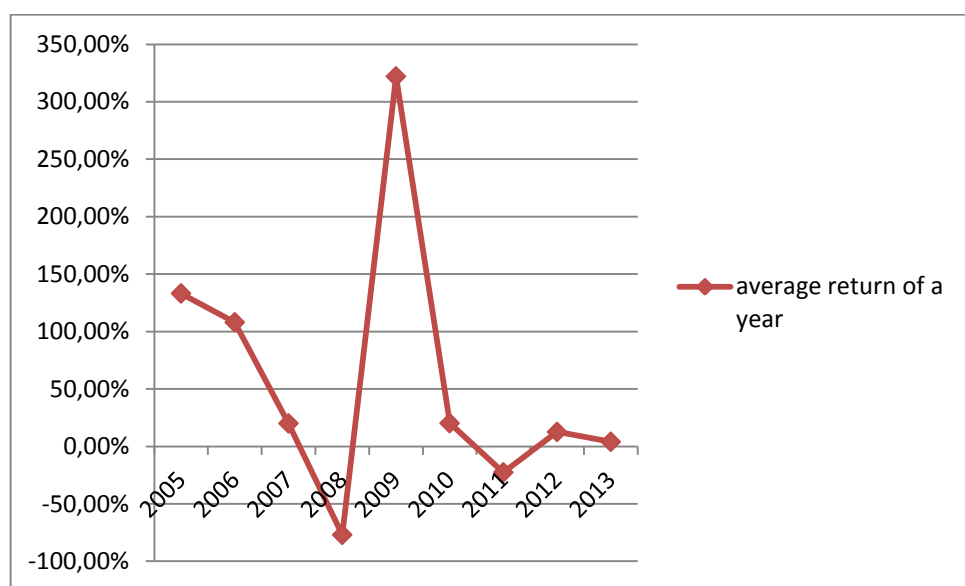


Figure 5.3.2: Annual returns of Russian Sberbank.

Source: developed by the author

The portfolios 3 and 3' for the Emerging markets have the Sharpe indices as 0,469 and 1,607 respectively, whereas the markets portfolio has just 0,313 (Table 4.7.4). In this situation the observer can claim that the analyzed assets in the portfolios for Emerging Markets perform better than the riskless asset.

The obtained values of Treynor index are also appeared to be higher than the index ( $Treynor Index_{p3} < Treynor Index_{p3'}$ ), that's why it would be reasonably to say that the investor would earn more money over the riskless asset by investing in these portfolios.

Though that would be wrong to compare the meanings of Alfa for both portfolios, nevertheless the observer has calculated them, but he has no arguments for trusting the results because beta of portfolios differs, and it is complicated to prove that the results are significant as it was discussed above.

## Summary

According to the results presented in Empirical part there were made the detailed analysis of portfolios for different markets. The figure 5.1 demonstrates how portfolios created in the Master Thesis perform relative to each other. The x-axis are for standard deviation and y-axis are for expected return. In our case the most efficient portfolios were obtained by the MS Excel Solver with respect to the constraints discussed in the Results of the Master Thesis.

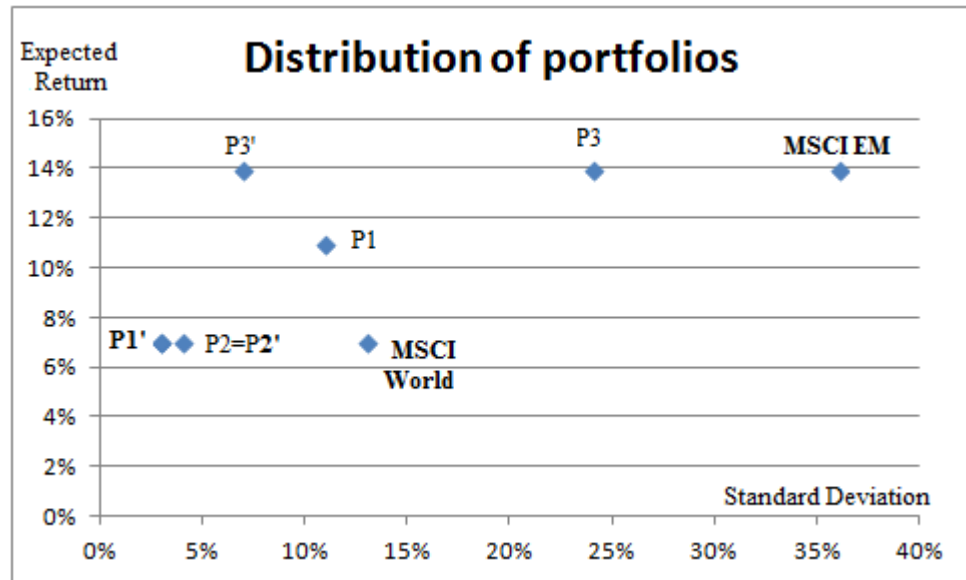


Figure 5.1.: Distribution of portfolios

Source: developed by the author.

Portfolios for Developed markets (1, 1', 2, 2') provide the returns which are not below the market's expected return, moreover they possess the level of risk lower than the market portfolio. This circumstance proves that these portfolios give equal returns at the lower risk level than the MSCI World.

The portfolios with the diamond are located in the left hand side of the graph behind the portfolios without this asset. Hence the researcher can claim that all of them (1', 2', and 3') can be called conservative and be used by the risk-averse person.

The same situation is with portfolios for Emerging markets. The investment in the market portfolio as MSCI EM is quite risky. However there were found the alternative portfolios that have equal return of 14% that can be provided by the portfolios 3, 3'. The same effect of including the diamond can be observed in the case of Emerging markets. The portfolio 3' with the gemstone offers the same return as the MSCI EM but at lower standard deviation. The portfolio 3 also performs better than the market portfolio proving lower risk at the same value of the expected return. However its risk level is not as low as the portfolio 3'. Can the researcher make a confirmation that this additional asset class in the portfolio's structure lays in the risk

minimization? Based on the calculations one could answer that the diamond is the reason of risk reduction.

The ratios that were demonstrated in both Empirical and Analytical Chapters are presented as additional computations that could give more detailed analysis about portfolios' efficiency. Additionally their values can be proved by other stability tests as Hansen test using RATS or MS Excel softwares.

Though the portfolios with the diamond have the values of Sharpe- and Treynor- indices higher than the portfolios without this asset and market portfolios have. As to Jensen Alfa, the researcher cannot compare its values because the portfolios have different betas. All in all the researcher can say that the positive effect of including gemstone in the investment portfolio was able to be found.

Usually in practice the decision-making about the most preferable portfolios can be done by construction of efficient frontier and the utility function, but the frontier is made for a portfolio which consists of two assets only. The efficient frontier represents a number of efficient portfolios included these assets in terms of different values of expected return and risk. The utility function is done for each particular type of investor usually.

## Conclusion

This Master Thesis refers to find out the evidences that there is an effect from investing in diamonds together with stocks for getting higher return or lower risk level than the market has. Consequently for this purpose there were examined three pair of investment portfolios with and without this alternative asset. In order to demonstrate the reliability of the results one built the portfolios for both developed and emerging markets and compared their characteristics between each other and with market portfolios.

Criteria of attractiveness can differ for each investor but there are two main parameters as the risk and return on investments based on which one can make the final decision. Therefore the author can make the following main inferences.

The portfolio 1 included stocks of Singapore, Luxembourg and Norway and presented the Developed market gives the expected return higher and the risk level lower than MSCI World index. These results can be explained that investments were made in three countries, and in three firms from different industries, such kind of investments promotes to reach the diversification of the portfolio. Meanwhile the portfolio 1' with the same three stocks and the diamond shows the risk reduction expressed by the lower standard deviation instead of portfolio 1 and the Index have. Though the value of expected return appeared to be lower than the value for portfolio 1, but equal the return of the market. The meaning of beta- coefficient for portfolio 1 comes short of the meaning for portfolio 1' with the diamond. Thus taking into consideration the values of this coefficient portfolio 1 can be called aggressive, whereas portfolio 1' is more conservative and will bring the investor the same return as the market providing less risk. That allows to confirm that the investigator was able to obtained portfolios with characteristics better than the market, and portfolio 1' appeared to be preferable among the portfolios 1 and the Index. The high beta coefficient of stocks Flextronics International Ltd included in both portoflios might make one thinking that the results may not be so representative, however the fact that even in this case there was the risk reduction mainly because of additional asset class can be hardly contested.

Another pair of portfolios was created especially for the USA as the well-developed country. At this time portfolio 2 includes stocks of four American companies that were estimated as well performed at the beginning of investment horizon. The characteristics of this portfolio coincide with results for portfolio 2' with the diamond. The other measurements appeared to be equal. Both portfolios give the same return but the lowest risk instead of market and can be regarded as good alternatives for each other.

The portfolios 3 and 3' included BRIC have another benchmark as MSCI EM with higher value of risk. The obtained computations show that portfolio 3 with Brazilian, Russian, Chinese

and Indian firms demonstrates lower value of risk comparing with MSCI EM, though it has higher risk level over the previous portfolios, in the same time its return is the same as the market and portfolio 3' possess. Nevertheless the portfolio 3 appeared to be profitable and less risky than the market.

In its turn portfolio 3' should consisted of Russian, Chinese companies and the diamond. That fact does not mean that it is impossible to find the suitable Brazilian or Indian firm, it tells that the one that was chosen did not perform its best afterwards. Moreover the portfolio's risk is lower than both market and portfolio 3. As in the case of the first portfolios mentioned above the portfolio 3 is more aggressive, because its beta bigger than 1, whereas portfolio 3' with diamond has lower meaning of the coefficient. Hence the researcher relied on these facts is able to conclude that portfolio with alternative asset class provides the expected return equal the market one. During further calculations the performance measurements as Sharpe- and Treynor indices showed the tendency to be higher in the case of portfolios with the diamond. This evidence allow to think that these portfolio can be called more efficient in relation to portfolios without the diamond. The comparison of Jensen Alfa's values is avoid because of conditions explained in Results and Analysis sections.

Based on the results of the current Paper one can make a consideration that the diamond as alternative asset has a positive influence on the portfolio in terms of risk minimization. This inference corresponds to hypothesis I that was discussed in the Methodology. There were achieved the sub goals defined in the introduction, specifically there were founded of the optimal shares of assets for each portfolio; comparison analysis of portfolio's characteristics as expected return and risk and the analysis of the performance measurments. All these allow the researcher to answer the main question of the investigation.

The Paper gives the understanding of the situation on the market of diamonds for the last 7 years and describes problems that one can face if he decided to use diamonds for increasing his profit. One could get acquainted with other gemstones of the first order in the Appendix A. Besides the Master Thesis describes the mechanism of portfolio formation step by step and the decision making about data collection that makes the current reseach to be useful for those who once decided that 'diamonds can be also good investors' friends' (Cavagleri & Knight, 2013).

Additionaly this research gives the impulse for future investigations because the field is not well-observed. Thus one can generate different portfolios with other assets as bonds, options, gold and compare them with the portfolio included another gemstone and the market index. The researcher can use not only gems of the first order as diamonds, rubies, emeralds and sapphires, but other gems that are also popular (opal, tanzanite, and spinel). Furthermore he can conduct the investigation about investing in objects of art and find out if they could be the good alternative to

paper assets. Certainly it is not all possible researches that one can make. The topic of gemstones as alternative investments opens the great field for investigations that can be used by economists, traders and investors all over the world.



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# Appendices

## APPENDIX A.

### A1: The gemstone's market value development

The market of gemstones is characterized by the high investment attractiveness with the constant liquidity level of investor's assets while the rest segments of financial market are straggling with shocks and showing its insecurity (Strelnikov E.V., 2009). For example Figure 1 shows the situation in the rough and polished diamonds markets as diamonds are the most popular gemstone to be invested in. One can see the strong increasing of the diamonds index after the Crisis in 2008.

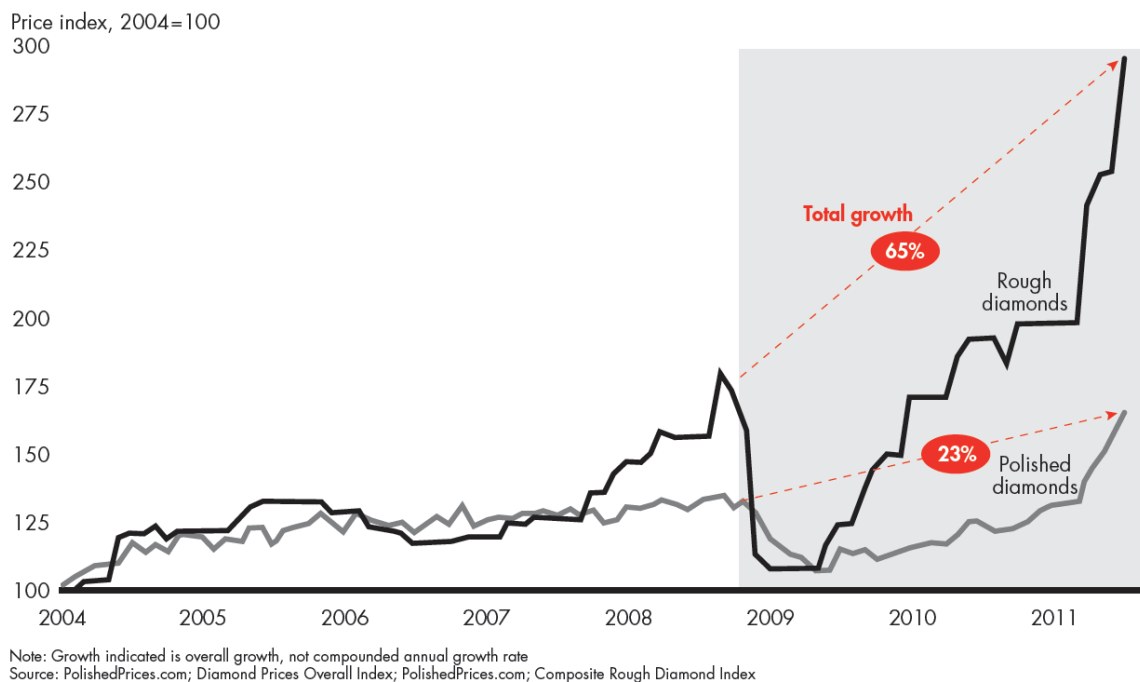


Figure 1: Roughed and Polished Diamonds (The Global Diamond Report 2013 Bain & Company, Inc.)

### A2: The world market of diamonds

The world market of diamonds can be divided by the market of stones for jewelry and for technical purposes. One can focus on the first direction of diamonds usage. The market offers colorless and colored diamonds, rough diamonds and polished.

The gems with no color are the most common in the world, whereas the colored or, speaking professional language, fancy color diamonds are worth more. They can be brown, yellow, light blue, pink, violet, orange and even black. The price of them is defined by their

rarity. Colored diamonds compose only 2 % from the whole quantity of diamonds in the world (FinCib Report, 2013).

Diamond's recovery is conducted in more than 26 countries, but the main centers of the recovery are (<http://www.fine-minerals.ru>):

- Botswana - 24%
- Russia - 20%
- Canada - 15%
- Angola - 12%
- Republic of South Africa (RSA) - 11%
- Congo - 8%
- Namibia - 6%
- Australia - 2%

The biggest players on the market of diamonds till 2012 were the big 5 recovery firms as international company De Beers, Russian ALROSA, British-Australians Rio Tinto and BHP Billiton, American Dominion Diamond (earlier Harry Winston Diamond till 2013) (Wall Street journal, 2013). In a whole these companies generated 78% of world production revenue (The Global Diamond Report 2013, Bain & Company).

As the table 2.1.1 shows us the dynamics of rough - diamond annual shares. Therefore the company De Beers has been the world leader in rough diamonds selling, though its share has had the tendency of declining from the year 2006 to 2012. Russian ALROSA has been catching up the leader and takes the second rank in rough diamonds recovery in carats having 30% at the end of 2012. It mines diamonds approximately in the sum of 34,4 million carats, that is about 27% of world production (ALROSA, 2013). Rio Tinto has been demonstrating 6% share in average for the period 6 years. Dominion Diamond has been showing approximately the same level of 2 - 3% during the same period.

**Table 2.1.1**

	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
De Beers	47 %	42 %	42 %	45 %	41 %	36 %	37 %
ALROSA	24 %	22 %	22 %	29 %	27 %	24 %	30 %
Rio Tinto	6 %	7 %	6 %	6 %	6 %	4 %	5 %
BHP Billiton	4 %	4 %	4 %	10 %	8 %	5 %	4 %
Dominion Diamond	3 %	3 %	2 %	3 %	2 %	2 %	2 %

However, the year 2012 became crucial for BHP Billiton that left the diamond business by selling the Ekati mine and all other diamond- marketing operations to Dominion (Bain & Company Inc. *The Global Diamond Report*; 2013). So the big 5 appeared to be big 4. Some changes happened in Harry Winston Diamond Corporation. At the beginning of January 2013 it was bought by the Swedish Swatch for 1 billion dollars, and as a result the company was renamed into Dominion Diamond, but it continues its business (Swatch Group acquires the jewelry and watch brand Harry Winston Inc., 2013).

As for the marketing outlets, the largest consumer of diamonds is still the USA, which had 35-45% of the world selling in 2012 (www.rbc.ru, RBC news). Economists named the reason in the American traditions of presenting the engagement rings (Samofalofa O., 2012). Though, the demand on diamond jewelry reacted to the financial crisis of 2008 - 2009 by decreasing 18 % during this year. In 2012 the level of revenues returned to the level of 2000 (Bain & Company, article, 2013).

The second world consumer of diamonds is China. Including Hong Kong, it had demand growth of 18% during 2010 -2011 (Nyaungwa, 2013). Such situation could be explained by the fast-paced growth of the populations' welfare and the widespread influences of Western cultures in the country. The Bain & Company shows an effect of such "adoption of Western culture traditions in their Figure 2 form the annual report "Global Diamond Industry" 2013. As it can be seen about 60% of Chinese women have already been presented such ring during the proposal.

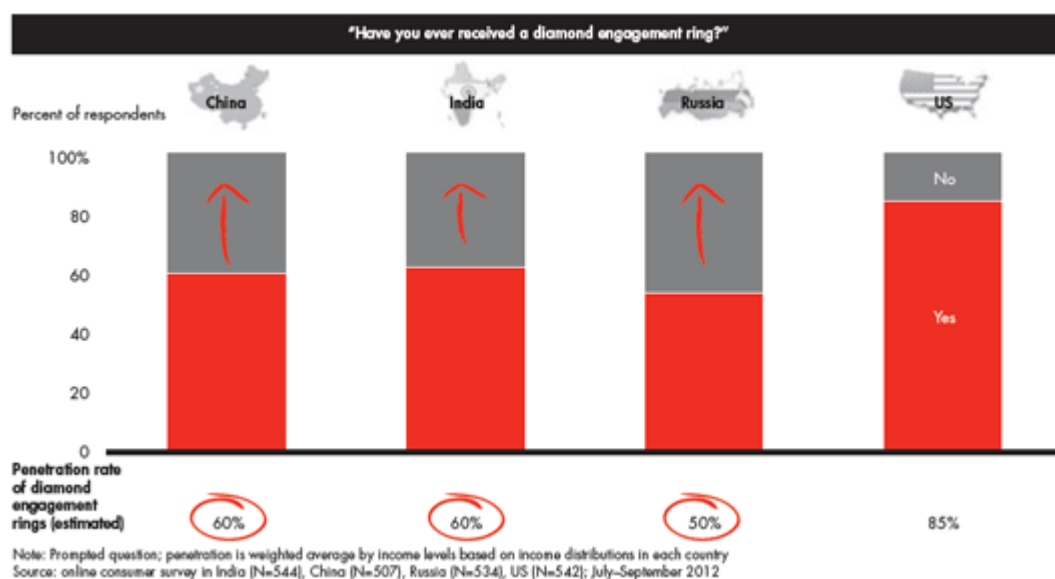


Figure 2 (The Global Diamond Report 2013, Bain & Company, Inc.)

The significant factors as the growing interest of Chinese investors to buy gemstones as an asset for investments, low taxations and tariffs contributed and will facilitate the further growth of diamonds' import to the country. Mathew Nyaungwa (2013) highlighted that there were exported 9,28 million carats of rough and polished diamonds with total value of 5,09 billion dollar in China in 2011.

India was named the third largest importer of diamonds. Its demand was 17% in 2011. 90% of the affluent women possess diamonds. Interesting to know that there are 300 thousand of jewelry stores that is more than in the USA in 7 times and in China in 6 times (Samofalova, 2012). Today India is becoming the monopolist in gem-cutting industry. Many companies among which well-known De Beers, ALROSA and Rio Tinto, prefer to send their rough diamonds for the future cutting and polishing to India because of the availability of the cheap labor. During 2012 the import of rough diamonds to India was \$11 billion whereas the export of polished gemstones was estimated about 28 billion (INDIAN DIAMOND INDUSTRY AT A GLANCE IN 2012 - 2013, 2014). The Figure 3 illustrates the prognosis about the share of China and India in 2020.

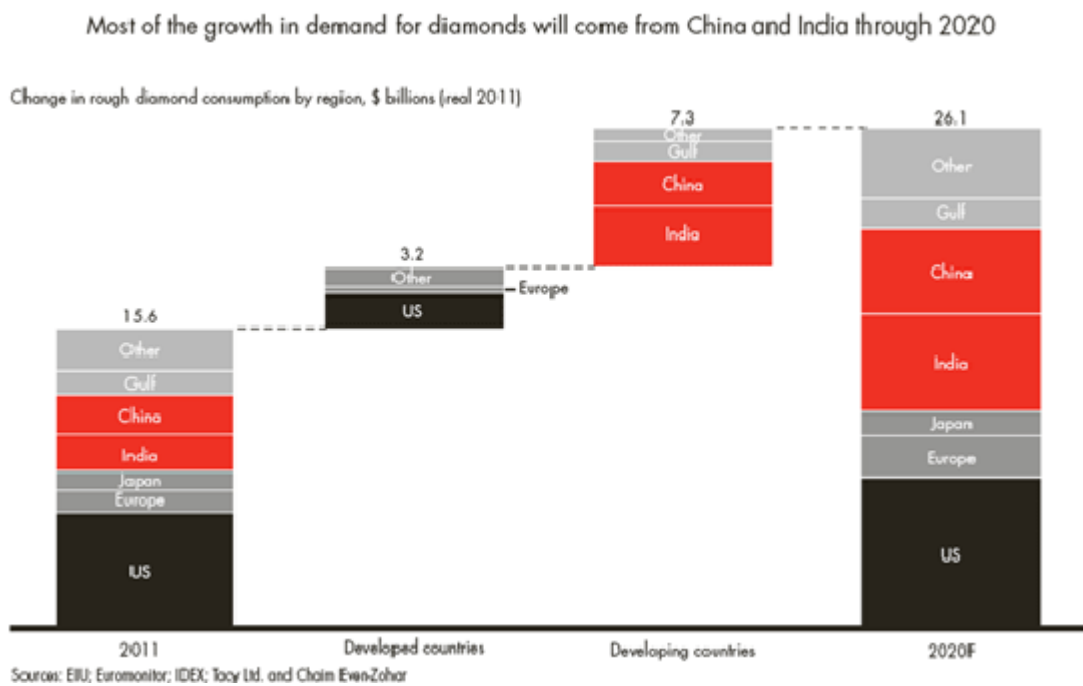


Figure 3: Prognosis about the market in 2020 (The Global Diamond Report 2013 Bain & Company, Inc.)

### A3: Diamonds pricing

In order to calculate the value of a diamond one can use such industry standard as internationally Rapaport Price List (PRL) that is published at the beginning of each year, each month and even weekly, presents the review of price development of diamonds for different periods: annually, monthly, weekly. Rapaport Price List is the primary source of established diamond prices and market information used by dealers. Also it is important to mention that the RPL is used for pricing mostly polished diamonds both colored and colorless as single individual stones. For evaluating the investment attractiveness of diamonds the economists conduct the comparative analysis of the dynamics of value changes with other financial criteria such as inflation of the currency of the country which market is going to be observed; interest rates of deposits and the growth of market value of the diamond in USD (Krawitz, 2013). This information could be relevant for the practical part of the Master Thesis.

One can focus on the mechanism of estimating the investment practicability of diamonds. In order to do it, the experts establish the lowest level of the return - the limit of prices on which the investments start being profitable - for example, the level of inflation can be taken as such level. If the price of the stone increased above this level than the investments could be profitable.

It is necessary to notice that the prices of diamonds depend on different factors. The diamonds' classification developed by Gem Institute of America (GIA) is used for this purpose. It presents the system 4C: carat (weight in carats, 1 carat = 0,2 grams), color, clarity and cut.

Diamonds are classified by intensity of color. The following grades of color are only for colorless diamonds (GIA official web-site: [www.gia.edu](http://www.gia.edu)):

- D E F – colorless
- G H – near Colorless
- I J – white
- K L M – very faint yellow
- N O P Q R – faint yellow
- S T U V W X Y Z – light yellow.


The colored diamonds are estimated by other "by determining the hue, saturation, tones, from light to dark (FinCib, 2013)



Figure 4: Color (GIA 4Cs Color, 2014).

The weight of a diamond is usually ranged from 0,50 to 5,00 carats, but, certainly, a gem of higher weight might be meet in mature (GIA 4Cs Carat Weight, 2014).

As to the clarity of diamonds the scale consists from 11 grades where gems are ranked from Flawless (FL) to Included (I1, I2, I3) categories (Figure 5).



Flawless	Internally Flawless	VVS-1	VVS-2	VS-1	VS-2	SI-1	SI-2	I-1	I-2	I-3
Pure		Very Very Small Inclusions		Very Small Inclusions		Small Inclusions		Included		

Figure 5: Clarity (GIA 4Cs Clarity, 2014)

The GIA cut scale ranges the shapes of the stones from the excellent to poor. The types of cuts are illustrated by the Figure 6.



Figure 6: Cut (Reuschel, 2014)

The experts of Rapaport evaluate only carat, color and clarity. The Figure 7 presents the example of the Price List that could be easily found in the official web-site of Rapaport Group. It is composed as a comparative table of established prices and clarity. An investor is suggested to choose the cut or shape of the diamond first, than to choose its weight, only after that he can see the price table for the diamonds of the particular weight and shape.

# RAPAPORT DIAMOND REPORT

Tel: 877-987-3400

www.RAPAPORT.com

Info@RAPAPORT.com

March 5, 2010 : Volume 33 No. 10: APPROXIMATE HIGH CASH ASKING PRICE INDICATIONS : Page 2

NEW YORK ASKING PRICES: Round Diamonds in hundreds US\$ Per Carat: THIS IS NOT AN OFFERING TO SELL

We grade SI3 as a split SI2/I1 clarity. Price changes are in **Bold**. Price decreases are in **Italics**.

Rapaport welcomes confidential price information and comments. Please email prices@Diamonds.Net.

0.95-0.99 may trade at 5% to 10% premiums over 0.90

1.25 to 1.49 Ct. may trade at 5% to 10% premiums over 4/4 prices.

RAPAPORT : (.90 - .99 CT.) : 03/05/10													RAPAPORT : (1.00 - 1.49 CT.) : 03/05/10												
	IF	VVS1	VVS2	VS1	VS2	SI1	SI2	SI3	I1	I2	I3		IF	VVS1	VVS2	VS1	VS2	SI1	SI2	SI3	I1	I2	I3		
<b>D</b>	135	111	97	73	66	62	53	41	33	23	14	<b>D</b>	238	175	149	115	90	73	61	48	41	28	16	<b>D</b>	
<b>E</b>	107	99	84	68	63	58	51	39	32	22	13	<b>E</b>	165	154	128	105	85	68	58	45	39	27	15	<b>E</b>	
<b>F</b>	99	94	78	64	60	55	49	38	31	21	13	<b>F</b>	144	131	116	95	80	65	55	43	37	26	14	<b>F</b>	
<b>G</b>	84	77	66	59	55	51	45	36	30	20	12	<b>G</b>	107	101	95	82	73	61	53	41	36	25	13	<b>G</b>	
<b>H</b>	68	64	60	56	52	47	43	34	28	19	12	<b>H</b>	87	83	78	70	63	58	51	40	34	24	13	<b>H</b>	
<b>I</b>	57	54	50	48	44	42	38	31	26	18	11	<b>I</b>	74	71	66	59	55	52	46	37	31	22	12	<b>I</b>	
<b>J</b>	47	45	43	41	38	37	34	28	24	17	11	<b>J</b>	60	58	56	53	48	46	43	33	27	20	12	<b>J</b>	
<b>K</b>	39	38	36	34	32	31	28	24	19	15	10	<b>K</b>	54	52	50	48	41	40	36	30	25	18	11	<b>K</b>	
<b>L</b>	33	32	31	29	28	27	25	22	18	14	9	<b>L</b>	48	46	45	43	38	36	32	28	23	16	10	<b>L</b>	
<b>M</b>	30	29	28	27	26	25	23	20	17	13	9	<b>M</b>	40	39	37	35	31	29	26	22	20	15	10	<b>M</b>	

W: 77.56 = 0.00%

T: 41.54 = 0.00%

W: 112.36 = 0.00%

T: 55.20 = 0.00%

1.70 to 1.99 may trade at 7% to 12% premiums over 6/4.

2.50+ may trade at 5% to 10% premium over 2 ct.

RAPAPORT : (1.50 - 1.99 CT.) : 03/05/10													RAPAPORT : (2.00 - 2.99 CT.) : 03/05/10												
	IF	VVS1	VVS2	VS1	VS2	SI1	SI2	SI3	I1	I2	I3		IF	VVS1	VVS2	VS1	VS2	SI1	SI2	SI3	I1	I2	I3		
<b>D</b>	281	228	210	158	127	99	81	62	49	31	18	<b>D</b>	412	333	300	238	173	132	108	74	58	34	19	<b>D</b>	
<b>E</b>	218	209	175	148	121	95	77	59	47	30	17	<b>E</b>	313	293	250	213	166	129	105	72	56	33	18	<b>E</b>	
<b>F</b>	186	173	165	136	115	90	72	57	45	29	16	<b>F</b>	275	248	223	188	159	122	98	69	54	32	17	<b>F</b>	
<b>G</b>	133	128	122	111	100	82	67	53	43	28	15	<b>G</b>	203	187	171	152	139	114	94	65	51	31	17	<b>G</b>	
<b>H</b>	108	104	100	91	85	76	64	49	41	27	15	<b>H</b>	160	148	138	127	118	102	88	60	48	30	16	<b>H</b>	
<b>I</b>	95	91	88	78	72	67	57	45	39	25	14	<b>I</b>	125	121	114	105	97	88	80	55	46	28	15	<b>I</b>	
<b>J</b>	77	75	72	65	59	57	50	40	33	23	14	<b>J</b>	100	96	92	86	80	73	68	50	42	25	15	<b>J</b>	
<b>K</b>	62	60	58	57	51	47	43	36	30	21	13	<b>K</b>	90	87	84	78	73	66	61	48	36	24	14	<b>K</b>	
<b>L</b>	56	54	52	49	45	43	39	33	27	20	12	<b>L</b>	70	68	66	63	57	52	47	40	31	23	13	<b>L</b>	
<b>M</b>	47	46	44	43	38	36	33	28	24	18	12	<b>M</b>	60	59	58	57	49	44	40	35	26	21	13	<b>M</b>	

W: 149.28 = 0.00%

T: 70.72 = 0.00%

W: 213.08 = 0.00%

T: 95.70 = 0.00%

Figure 7 (Features of the Rapaport Diamond Report, 2014)

Another tool that is used for the current market price observation is the IDEX Diamond Price Report. This Price Report is published weekly on the official web-page of the International Diamond Exchange and shows the estimated review of the high asking prices of high quality diamonds according to the well-known system 4C. About 400 000 certified diamonds are in the list of IDEX Online trading platform (Guide to IDEX Diamond Price Report, 2013). This Index is very sensitive to the market price changes.

Here are the principles mentioned in the Report:

- 1) The higher the quality of the gem is, then the closer its price will be to the Index established price.
- 2) The lower the quality, the higher discount the diamond has.

One of the possible tools for analysis is offered by the Premier Diamond & Jewelry Community. The Diamond Price Chart has shown the changes in prices for diamonds of different size since 2007 (Figure 8). It includes 450 000 listed diamonds in the PriceScope and updates the information each month.



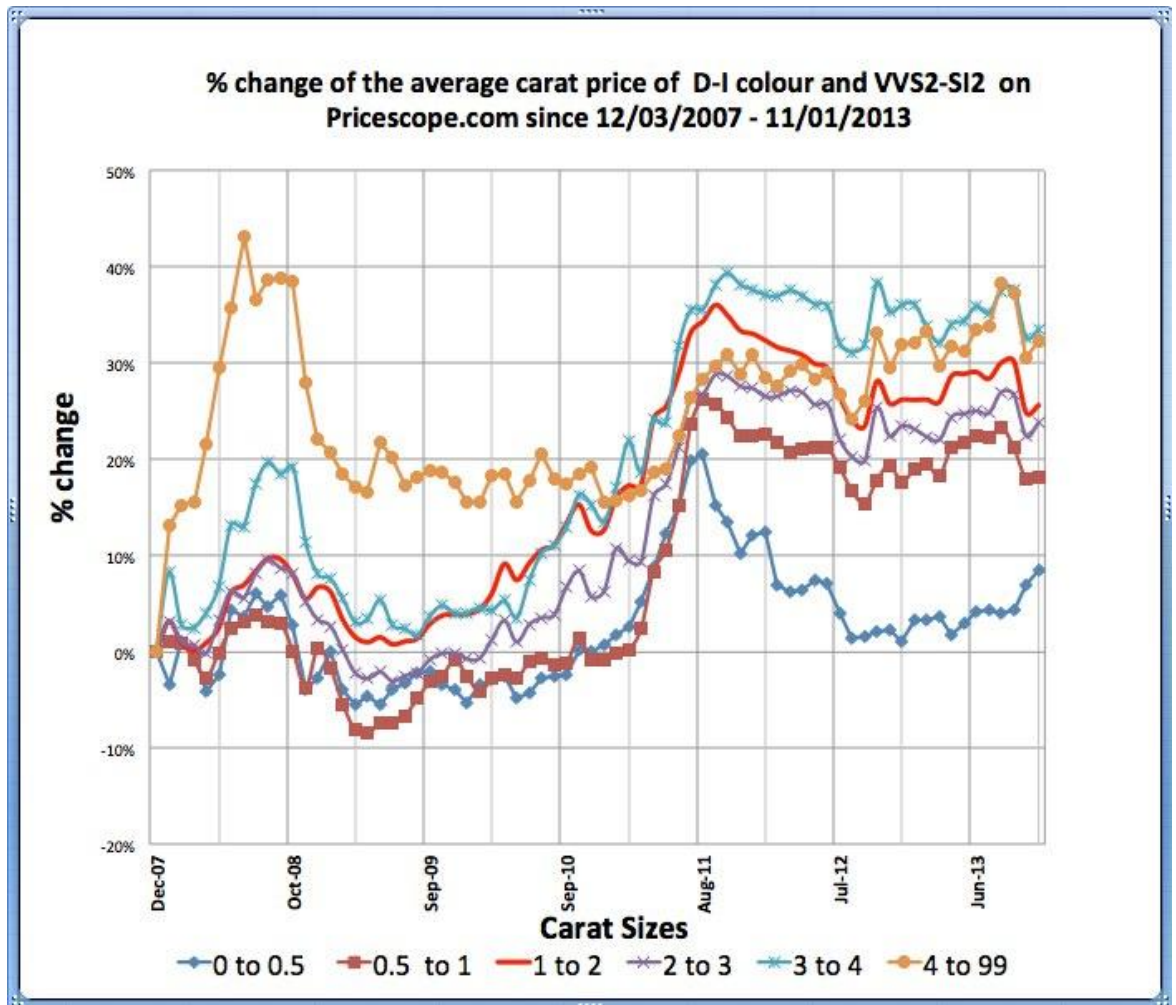


Figure 8: Diamond Monthly Price Chart (Diamonds Price Chart, 2014)

The figure 8 illustrates the dynamics of the price changes during the last 7 years. Though data in the figure 8 was last updated in 11<sup>th</sup> of January 2013, one may say that the colorless diamonds with the weight 0,5 – 1, 1 - 2 carats, 2- 3, 3-4 carats have been having the positive development, whereas diamonds of 0 to 0,5 carats have had the negative tendency.

As to the fancy colored diamonds, they are evaluated by such characteristics as hue, tone and saturation. The hue describes the color of the stone, the tone is estimated by the lightness/darkness of the diamond with respect to the basic color, and saturation is about the intensity of the color (FinCib, 2013). Among all characteristics the last one is the most important for the diamond evaluation because the more saturated the color of a gem is, the higher value it will have. According to it diamonds are ranged with the intense increasing: Faint, Very Light, Fancy Light, Fancy, Fancy Intense, Fancy Vivid, Fancy Dark, Fancy Deep (FinCib, 2013). It has already been mentioned that colored diamonds are very rare; this availability will also influence



the value of the stone: colored diamonds are more expensive than colorless, that is why the news about selling some colored gem in the auction cause a stir among the amateurs and investors.

Recently, the rarest pink diamond named The Pink Star with parameters 2,69cm by 2,06 cm was sold for the record price of \$ 83 million in the auction in Geneva (Milligan B. , 2013). Pink color rather than yellow are considered to be the most popular colors among fancy gemstones. There is also the tendency of increasing demand of blue, orange and blue colored diamonds, these colors can be hardly found in nature that is why the supply is limited. The rarest color for this type of stones is red. Eden Rachminov, the founder of manufacturing and marketing company Rachminov Diamonds, argues on the example of blue diamonds that though the demand on the gems has been increasing, the supply has been diminishing, that situation leads in prices break records in the auctions.

The world market trend has a positive dynamic, the prices for rough and polished fancy colored diamonds are growing with the investors' willing to buy them. Especially, such situation refers to Asian countries as Singapore, China, and India.

In such a manner the following conclusion can be made:

1) It is hard to say how much the investor should pay for the diamond because a lot factors influence to its value, for example, color, clarity, cut and weight. For checking the price one can use the Rapaport Price List. The following pricing conforms the rule: the diamond in 2 carats will be in 3 times expensive than one carat's diamond, the diamonds of 3 carats will be more expensive the diamond of one carat in 10 times (Features of the Rapaport Damond Report, 2014).

2) During the 2012 the revenues from selling the rough diamonds had decreased by 18% and became \$14,5 billion, the opposite situation was with polished diamonds the value on which had growth by 1,8% (to \$72.1 billion). (The Global Diamonds Report, 2013).

3) The prices of polished and rough diamonds returned to the pre-crisis level, according to the partner of Bain & Company Yury Spektorov (2013).

4) Big 5 Diamond companies generated 78% of the world production of diamonds in 2012.

5) Big 5 Diamonds companies became at the beginning of the 2013 the Big 4 Diamonds companies, the BHP Billiton is out of diamond business. De Beers and ALROSA are still the most profitable suppliers of diamonds.

#### **A 4: The market of sapphires**

The blue sapphire is on the second rank among the gemstones for its popularity. This stone can have many colors, however, only the sapphire of blue color deserves to be in the category of

first grade's precious gemstones because natural blue sapphires are very rare and as a consequence, quite expensive. These stones are evaluated according the categories hue, saturation, tone, and carat. The sapphire belongs to the second scale of clarity beginning with Very Small Inclusions. Such inclusions can be seen with the help of the magnifying glass. The pure sapphires cannot be met in nature. There can be such situation when the investor is offered to buy the sapphire without any inclusions (pure) telling that it is a natural gem whereas this stone is synthetic. Synthetic sapphires are human-made gemstones which are well - developed nowadays, they are very cheap. Therefore their existence does not have bad influence to the value of natural stones, vice versa, the prices of natural sapphires are being very high. Still it is necessary to know that point in order to buy sapphire.

The hue, intensity of the color play the main role in its valuation. The blue color can have gradations as light blue, royal blue, navy blue and even have violet and green tints. The really good sapphire should be royal blue without any additional tint. Therefore, sapphires of navy color or light blue have less value in spite to the weight in carats.

The weight of the sapphire is not so important because if the color of the stone is royal blue and the clarity is high, even the smallest stones in 0,29 carat will be worth more than the same stone with worsen characteristics.

Sapphires can be divided into heated stones and stones without heating. The process of heating influences the color of the stone: it helps to turn the light blue stone into royal blue, and the same with the navy stones. The price of such sapphire is \$ 10 000 - 50 000 per carat. In the situation with stones without heating, they worth more: \$20 000 - 100 000 per carat (**FinCib, 2013**). The main recoveries of high quality gems are situated in Kashmir (Pakistan) and Burma. The most famous blue sapphires from Kashmir are being sold for \$ 200 000 - 300 000 per carat in the auction Christi's (**FinCib, 2013**). There are also mines in Australia where are recovered dark blue stones, and in Sri-Lanka, where sapphires of light blue color can be found, but they are not so popular among jewelers because of the quality, though even this problem can be solved by heating.

The Figure 9 represents the historical value beginning with 2005 year. The dynamics as in the case of diamonds is positive, the high jump in 15,1 points of the value had been mentioned during 2012 - 2013.

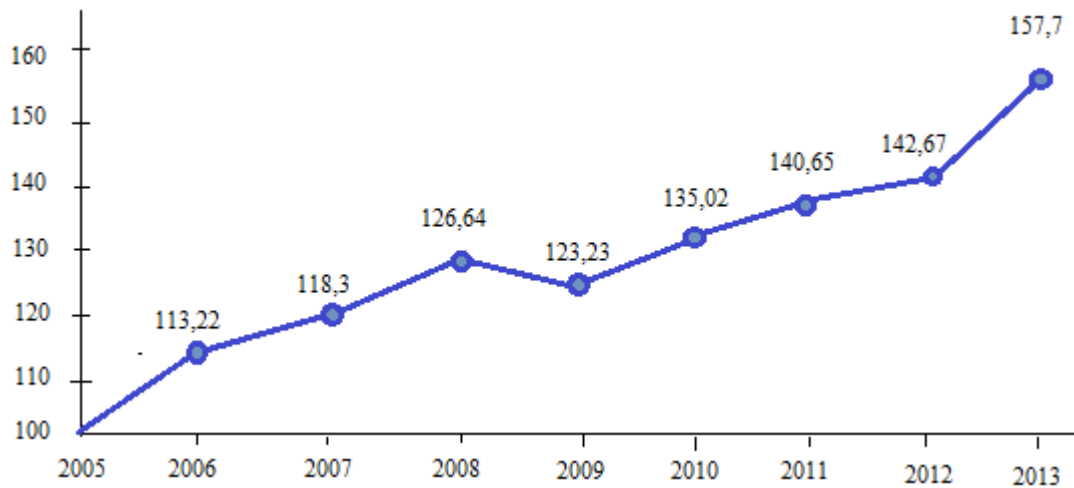


Figure 9: Historical average value index for sapphires (Historical values, 2014).

### **A5: The market of rubies**

The next gemstone will be spoken about is a ruby. Some people call it a pink sapphire, because both sapphire and ruby represent the mineral corundum of different colors. Rubies can be found in Afghanistan, Kenya, Tanzania, India; the main suppliers of the stone are Thailand, Burma, Mozambique and Sri-Lanka. As in the case with sapphires, the rubies are estimated by the same factors: intensity of color, hue, clarity and cut. The key role is played by saturation. The diapason of color is from pink to orange. Richard W. Hughes in his book "Rubies and sapphires" (1997) argues that the ideal ruby should have rich crimson color, and the stone should not be too dark and too light. Also there is an opinion that the perfect color of the stone is Pigeon's Blood - clean red with blue tint (Hughes, 1997).

Rubies do not possess the high clarity, and even yield sapphires in it. Inclusions can often be met, but it is not necessary that they would mean the bad quality of the gem. Looking at the inclusions an expert may say in which origin the stone was found.

As to the cut, the most popular among jewelers is cabochon-cut. This cut solves the problem of not clean stones.

According to the FinCib holding Report 2013, today's value of natural Burma's rubies in the world market is \$ 100 000 - 1 200 000 per carat. Chemical treatment and high temperature heat treating are also common in jeweler's work with rubies. About 90% of all gems that are being sold in the world market went through these processes. Usually the note about such treatments can be found in the certificates of the stones, the price in this case will range from \$ 20 000 to \$ 100 000 per carat (FinCib, 2013). The Figure 10 illustrates the positive dynamics of rubies' value development, based on it one may claim that the future value of the gemstone will grow.

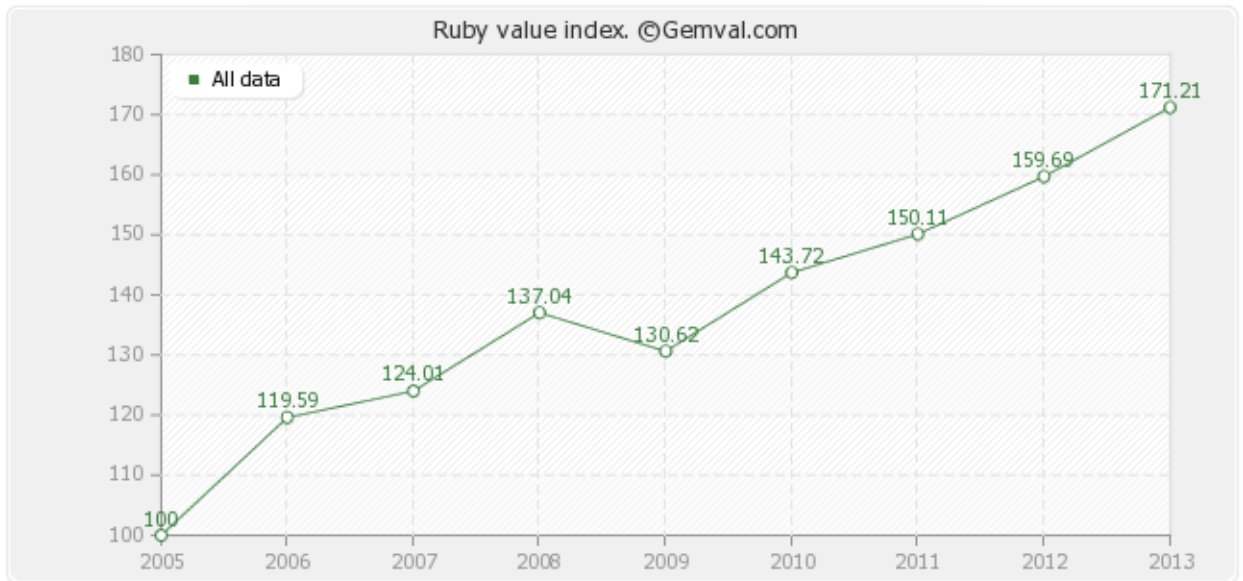


Figure 10: Historical value development of rubies since 2005 ( (Historical values, 2014).

## A6: The market of emeralds

Finally, the last one kind of precious gemstone is the emerald. It is the most well-known variety of Beryl, there are also Aquamarine (green and blue colored stone) and pink Morganite.

Rare natural green stones with some inclusions that are very similar to babbles have the recoveries in Indian, Colombia, Australia, Brazil, South Africa, Pakistan, and Zimbabwe. The gems of high quality are usually supplied by Colombia and Brazil. The factors of evaluation are the same as sapphire and ruby have. The hue helps to identify whether or not it is a natural emerald, because it should have dark green color. Natural emeralds are almost often have splits and even secessions, for improving its quality the stone is usually covered by palm oil, and that's why these stones are estimated by eye, and jewelers look at fist at the color of the stone.

Emeralds of high quality and high clarity (sometimes they can be met in nature) with the weight more than 5 carats are cost more than diamonds. The prices for this stones are \$ 100 000 - 200 000 (sometimes to USD 300 000) per carat, such stones are usually sold by the world famous jewelry companies. As to the palm oiled emeralds, their prices can rich the level of \$20 000 - 60 000 per carat (FinCib, 2013).

It is interesting to note that there are synthetic emeralds as in cases of others precious gemstones. They can be worth more than synthetic sapphires because jewelers need a lot of expensive equipments and a long time for creating of such gem.



Figure 11: Historical value of emeralds during the last 8 years (Historical Values, 2014).

The Figure 11 shows how the value of emeralds has been developed since 2005. As one can see, the quite big increase of value by 22,4 points happened in the period 2005-2006, which can closely connected with increasing of the demand, the following dynamics has been staying approximately at the same level of 125 after the growth. Such trend denotes the stability of emeralds' value for a long time.

As a conclusion it could be said that the interest to the gemstones as an asset has been increasing during the last 7 years. Based on the figures of value development of each stone, one can argue that all four gemstones are positively correlated. It is hard to say how closely they correlate to each other, however, including all them in the investment portfolio can be risky, because as it will be said in the Chapter 3, so the portfolio cannot be well-diversified. For solving this problem only diamonds as their market is the most well - developed, will be included in the portfolio.

The following figure 12 represents the comparison of the polished and rough diamonds growth with the growth of silver, gold, platinum and palladium for the period 2004 - 2011. This figure is interested from the standpoint of the correlation. As one can see silver, platinum, platinum are strongly positively correlated, whereas less strong correlation can be traced between gold, rough and polished diamonds.

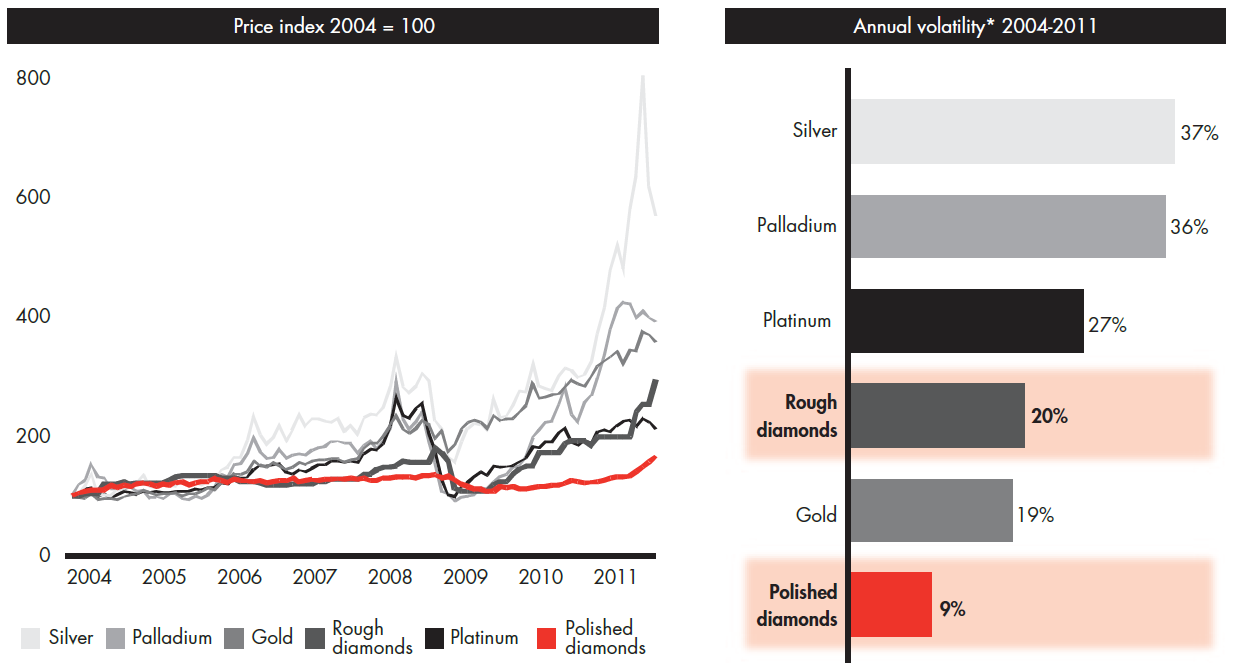


Figure 12: Comparison among rough, polished diamonds and silver, gold, palladium and platinum value developments (Bain & Company, 2013).

**Appendix B: Prices of stocks for each portfolio for the period 2005-2013**

**Appendix B1: Portfolio 1 and 1'**

Luxembourg - SES Global S.A

2005		2006		2007		2008		2009		
month	close	return	close	return	close	return	close	return	close	return
january	9,58		15,2		13,35		16,24		14,370	
february	10,53	0,099165	13,17	-0,13355	14,1	0,05618	16,37	0,008005	14,620	0,017397
march	9,99	-0,05128	13,14	-0,00228	14,29	0,013475	13,37	-0,18326	14,380	-0,01642
april	10,6	0,061061	12,99	-0,01142	14,4	0,007698	15,81	0,182498	13,710	-0,04659
may	11,25	0,061321	10,84	-0,16551	16,2	0,125	17	0,075269	14,070	0,026258
june	12,45	0,106667	11,15	0,028598	15,98	-0,01358	16,1	-0,05294	13,590	-0,03412
july	12,94	0,039357	10,6	-0,04933	15,6	-0,02378	15,71	-0,02422	13,860	0,019868
august	13,84	0,069552	10,67	0,006604	16,23	0,040385	16,5	0,050286	13,660	-0,01443
september	13,05	-0,05708	11,83	0,108716	16,53	0,018484	14,55	-0,11818	15,500	0,1347
october	13,19	0,010728	12,01	0,015216	17,04	0,030853	14,04	-0,03505	14,760	-0,04774
november	13,25	0,004549	12,6	0,049126	17,15	0,006455	13,8	-0,01709	14,160	-0,04065
december	14,79	0,116226	13,49	0,070635	18	0,049563	13,82	0,001449	15,760	0,112994
average return of a year		<b>54,4%</b> (0,543841)		<b>-11%</b> (-0,1125)		<b>35%</b> (0,348315)		<b>-15%</b> (-0,14901)		<b>10%</b> (0,0967293)

\* The monthly and annual returns was calculated using the formula:

$$r_i = \frac{P}{P_0} - 1 \text{ or the same for the values } r_i = \frac{V_1 - V_0}{V_0}, \text{ where } V_0 - \text{ initial value of the asset, } V_1 - \text{ finite value (Burenin, 2008).}$$

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	15,890		17,600		18,050		22,550	
february	17,800	0,120201	18,660	0,060227	18,100	0,00277	23,580	0,045676
march	18,690	0,05	18,170	-0,02626	18,600	0,027624	24,450	0,036896
april	17,270	-0,07598	17,730	-0,02422	18,090	-0,02742	23,710	-0,03027
may	17,080	-0,011	18,690	0,054146	18,080	-0,00055	22,840	-0,03669
june	17,110	0,001756	19,350	0,035313	18,640	0,030973	22,000	-0,03678
july	18,950	0,107539	18,830	-0,02687	19,570	0,049893	22,100	0,004545
august	18,110	-0,04433	19,020	0,01009	20,460	0,045478	22,230	0,005882
september	17,640	-0,02595	18,270	-0,03943	21,170	0,034702	21,150	-0,04858
october	18,420	0,044218	18,500	0,012589	21,350	0,008503	21,440	0,013712
november	17,830	-0,03203	18,300	-0,01081	21,750	0,018735	21,810	0,017257
december	17,820	-0,00056	18,550	0,013661	21,700	-0,0023	23,530	0,078863
average return of a year		<b>12,1%</b> (0,12146)		<b>5,4%</b> (0,053977)		<b>20,2%</b> (0,202216)		<b>4%</b> (0,043459)



Luxembourg - Tenaris SA (TS. MX)

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	49,3		162,45		47,47		44,45		19,790	
february	65,75	0,333671	160,15	-0,01416	45,45	-0,04255	49,85	0,121485	17,550	-0,11319
march	61,51	-0,06449	180,67	0,12813	45,9	0,009901	53,01	0,06339	20,170	0,149288
april	57,15	-0,07088	45,9	-0,74595	46,36	0,010022	61,3	0,156386	25,020	0,240456
may	69,75	0,220472	36,9	-0,19608	49,65	0,070966	74,5	0,215334	30,570	0,221823
june	78,27	0,122151	40,49	0,09729	48,96	-0,0139	60,25	-0,19128	27,040	-0,11547
july	93,87	0,19931	39,54	-0,02346	48,17	-0,01614	54,69	-0,09228	30,320	0,121302
august	114,48	0,219559	36,71	-0,07157	46,93	-0,02574	54,69	0	28,980	-0,0442
september	137,84	0,204053	35,38	-0,03623	52,62	0,121244	37,29	-0,31816	35,620	0,229124
october	109,85	-0,20306	38,59	0,090729	53,8	0,022425	20,59	-0,44784	35,620	0
november	111,8	0,017751	47,01	0,218191	47,18	-0,12305	21,03	0,02137	39,460	0,107805
december	114,5	0,02415	49,89	0,061264	44,73	-0,05193	20,98	-0,00238	42,650	0,080841
average return of a year		<b>132,3%</b> (1,322515)		<b>-69%</b> (-0,6929)		<b>-6%</b> (-0,05772)		<b>-53%</b> (-0,52801)		<b>116%</b> (1,15512885)

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	44,000		47,170		39,260		42,070	
february	41,430	-0,05841	45,380	-0,03795	38,680	-0,01477	41,240	-0,01973
march	42,940	0,036447	49,460	0,089907	38,230	-0,01163	40,780	-0,01115
april	40,610	-0,05426	50,790	0,02689	39,190	0,025111	44,490	0,090976
may	37,120	-0,08594	48,690	-0,04135	31,180	-0,20439	42,060	-0,05462
june	34,610	-0,06762	45,730	-0,06079	34,970	0,121552	40,270	-0,04256
july	40,050	0,15718	44,200	-0,03346	38,280	0,094653	44,450	0,103799
august	33,650	-0,1598	33,200	-0,24887	41,710	0,089603	44,220	-0,00517
september	38,420	0,141753	25,450	-0,23343	40,770	-0,02254	46,780	0,057892
october	41,430	0,078345	31,810	0,249902	37,620	-0,07726	46,810	0,000641
november	42,580	0,027758	37,280	0,171959	39,940	0,061669	44,810	-0,04273
december	48,980	0,150305	37,180	-0,00268	41,920	0,049574	43,690	-0,02499
average return of a year		<b>11,3%</b>		<b>-21,2%</b>		<b>6,8%</b>		<b>4%</b>

Singapore - Flextronics International Ltd.

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	14,15		10,46		11,63		11,7		2,610	
february	13,35	-0,05654	10,79	0,031549	10,93	-0,06019	10,14	-0,13333	2,060	-0,21073
march	12,04	-0,09813	10,35	-0,04078	10,94	0,000915	9,39	-0,07396	2,890	0,402913
april	11,15	-0,07392	11,36	0,097585	11,15	0,019196	10,39	0,106496	3,880	0,342561
may	12,78	0,146188	11,26	-0,0088	11,55	0,035874	10,71	0,030799	3,960	0,020619
june	13,21	0,033646	10,62	-0,05684	10,8	-0,06494	9,4	-0,12232	4,150	0,04798
july	13,54	0,024981	11,34	0,067797	11,17	0,034259	8,93	-0,05	5,320	0,281928
august	13,06	-0,03545	11,79	0,039683	11,39	0,019696	8,92	-0,00112	5,930	0,114662
september	12,85	-0,01608	12,64	0,072095	11,18	-0,01844	7,08	-0,20628	7,470	0,259696
october	9,27	-0,2786	11,6	-0,08228	12,31	0,101073	4,18	-0,4096	6,480	-0,13253
november	10,32	0,113269	11,25	-0,03017	11,96	-0,02843	2,34	-0,44019	7,070	0,091049
december	10,44	0,011628	11,48	0,020444	12,06	0,008361	2,56	0,094017	7,310	0,033946
average return of a year		<b>-26,2%</b> (-0,26219)		<b>10%</b> (0,097514)		<b>4%</b> (0,036973)		<b>-78%</b> (-0,7812)		<b>180%</b> (1,800766)

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	6,340		7,990		6,870		6,210	
february	6,960	0,097792	8,090	0,012516	7,050	0,026201	6,650	0,070853
march	7,840	0,126437	7,470	-0,07664	7,220	0,024113	6,760	0,016541
april	7,740	-0,01276	6,970	-0,06693	6,680	-0,07479	7,150	0,057692
may	6,560	-0,15245	7,240	0,038737	6,420	-0,03892	7,460	0,043357
june	5,600	-0,14634	6,420	-0,11326	6,200	-0,03427	7,740	0,037534
july	6,220	0,110714	6,450	0,004673	6,410	0,033871	8,660	0,118863
august	4,930	-0,2074	5,750	-0,10853	6,730	0,049922	8,980	0,036952
september	6,040	0,225152	5,630	-0,02087	6,000	-0,10847	9,090	0,012249
october	7,170	0,187086	6,570	0,166963	5,770	-0,03833	7,890	-0,13201
november	7,220	0,006974	5,970	-0,09132	5,800	0,005199	7,580	-0,03929
december	7,850	0,087258	5,660	-0,05193	6,210	0,07069	7,770	0,025066
average return of a year		<b>23,8%</b> (0,23817)		<b>-29,2%</b> (-0,29161)		<b>-9,6%</b> (-0,09607)		<b>25%</b> (0,251208)

Norway - Statoil

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	96,5		183		166,5		139,2		119,700	
february	112,75	0,168394	172	-0,06011	156,5	-0,06006	160,9	0,155891	118,000	-0,0142
march	108	-0,04213	189	0,098837	165,5	0,057508	152,6	-0,05158	118,900	0,007627
april	111	0,027778	203	0,074074	168,75	0,019637	184,5	0,209043	124,800	0,049622
may	113	0,018018	176	-0,133	164,75	-0,0237	198	0,073171	132,200	0,059295
june	133,5	0,181416	176,5	0,002841	183,5	0,113809	189,9	-0,04091	126,600	-0,04236
july	141	0,05618	182,5	0,033994	174	-0,05177	168,8	-0,11111	131,000	0,034755
august	155,5	0,102837	170,5	-0,06575	168	-0,03448	167,5	-0,0077	131,100	0,000763
september	162,5	0,045016	154,25	-0,09531	183,75	0,09375	138,9	-0,17075	130,800	-0,00229
october	145,5	-0,10462	165,25	0,071313	181,6	-0,0117	130,8	-0,05832	139,300	0,064985
november	147	0,010309	171	0,034796	180	-0,00881	118,1	-0,09709	139,000	-0,00215
december	155	0,054422	165,25	-0,03363	169	-0,06111	113,9	-0,03556	146,500	0,053957
average return of a year		<b>61%</b> (0,606218)		<b>-10%</b> (-0,09699)		<b>2%</b> (0,015015)		<b>-18%</b> (-0,18175)		<b>22%</b> (0,223893)

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	134,000		140,200		147,100		145,500	
february	132,500	-0,01119	146,700	0,046362	160,000	0,087695	142,700	-0,01924
march	137,600	0,038491	153,300	0,04499	152,800	-0,045	141,200	-0,01051
april	143,100	0,039971	153,500	0,001305	152,800	0	140,700	-0,00354
may	127,900	-0,10622	142,000	-0,07492	137,900	-0,09751	133,700	-0,04975
june	126,400	-0,01173	136,600	-0,03803	141,400	0,025381	125,300	-0,06283
july	122,800	-0,02848	133,100	-0,02562	143,900	0,01768	127,800	0,019952
august	118,500	-0,03502	126,400	-0,05034	148,800	0,034051	134,400	0,051643
september	122,700	0,035443	127,000	0,004747	147,900	-0,00605	136,500	0,015625
october	127,900	0,04238	142,100	0,118898	140,900	-0,04733	141,000	0,032967
november	123,100	-0,03753	149,100	0,049261	138,500	-0,01703	138,400	-0,01844
december	138,600	0,125914	153,500	0,02951	139,000	0,00361	147,000	0,062139
average return of a year		<b>3,4%</b> (0,034328)		<b>9,5%</b> (0,094864)		<b>-5,5%</b> (-0,05506)		<b>1%</b> (0,010309)

**Appendix B2 :Portfolio 2 and 2'**

Wal-Mart Stores Inc.

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	53,42		45,81		47,80		48,04		51,211	
february	52,45	-0,01802	45,72	-0,00207	48,65	0,017812	49,98	0,040267	48,588	-0,05121
march	51,45	-0,01918	46,60	0,019221	47,20	-0,02984	51,18	0,024076	49,973	0,028488
april	48,02	-0,06667	46,01	-0,01256	48,20	0,021238	56,11	0,096408	50,672	0,014003
may	47,84	-0,00362	47,62	0,034827	47,56	-0,01332	56,84	0,012962	49,772	-0,01778
june	48,31	0,009852	47,87	0,005325	49,12	0,032903	57,96	0,019623	49,287	-0,00974
july	49,78	0,030269	44,75	-0,06517	47,83	-0,02625	57,37	-0,01018	48,598	-0,01397
august	47,43	-0,04714	44,48	-0,00592	44,72	-0,06509	58,83	0,02554	50,818	0,045683
september	44,23	-0,06758	48,02	0,079481	43,42	-0,02905	60,47	0,027835	50,396	-0,00831
october	45,13	0,020371	49,22	0,024926	45,25	0,042132	54,12	-0,10507	50,189	-0,00411
november	48,89	0,083508	47,22	-0,04063	45,32	0,001526	53,82	-0,00542	53,096	0,057934
december	48,27	-0,01272	46,14	-0,02289	48,33	0,066439	55,42	0,029646	58,928	0,109828
average return of a year		<b>-9,6%</b> (-0,09628)		<b>1%</b> (0,007039)		<b>1%</b> (0,011139)		<b>15%</b> (0,153529)		<b>15%</b> (0,150683)

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	53,671		55,402		60,328		69,158	
february	53,561	-0,00206	54,594	-0,01458	60,730	0,006662	70,689	0,022134
march	54,983	0,026567	52,111	-0,04548	60,273	-0,00753	73,621	0,041478
april	54,540	-0,00807	53,486	0,026376	59,689	-0,00969	77,809	0,056886
may	52,182	-0,04323	55,189	0,031837	61,143	0,024353	77,805	-5,5E-05
june	50,521	-0,03183	53,067	-0,03844	74,590	0,219934	74,960	-0,03657
july	50,197	-0,00642	53,704	0,011989	78,220	0,048666	74,280	-0,00906
august	51,055	0,017088	51,535	-0,04038	72,506	-0,07305	75,081	0,010783
september	52,926	0,036655	51,831	0,005738	74,175	0,023019	74,399	-0,00909
october	53,973	0,019776	55,370	0,068281	75,273	0,014798	75,130	0,009831
november	54,380	0,007552	57,685	0,041814	70,992	-0,05686	77,605	0,032937
december	54,177	-0,00375	58,722	0,017972	69,711	-0,01805	78,775	0,015079
average return of a year		<b>0,9%</b> (0,009422)		<b>6,0%</b> (0,059918)		<b>15,6%</b> (0,155531)		<b>14%</b> (0,139059)



CitiGroup Inc.

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	482,7		492,9		552,5		289,2		71,400	
february	494,8	0,025067	463,3	-0,06005	547,3	-0,00941	296,9	0,026625	36,500	-0,4888
march	478,8	-0,03234	465,3	0,004317	510,8	-0,06669	230,9	-0,2223	12,000	-0,67123
april	446,2	-0,06809	474,1	0,018913	510,5	-0,00059	238,4	0,032482	26,800	1,233333
may	465,3	0,042806	494,6	0,04324	542	0,061704	259,9	0,090185	29,700	0,108209
june	477,2	0,025575	498,3	0,007481	545,1	0,00572	214,6	-0,1743	36,900	0,242424
july	461,6	-0,03269	489,7	-0,01726	516,4	-0,05265	171,3	-0,20177	29,700	-0,19512
august	437	-0,05329	485,1	-0,00939	468,5	-0,09276	188,7	0,101576	31,800	0,070707
september	437,1	0,000229	493,7	0,017728	472,1	0,007684	191,1	0,012719	45,400	0,427673
october	455,1	0,041181	494,9	0,002431	477,2	0,010803	230	0,203558	45,300	-0,0022
november	454	-0,00242	500,9	0,012124	385,1	-0,193	139,9	-0,39174	39,900	-0,11921
december	488,5	0,075991	493,8	-0,01417	330,6	-0,14152	64,5	-0,53896	41,000	0,027569
average return of a year		<b>1,2%</b> (0,012016)		<b>0%</b> (0,001826)		<b>-40%</b> (-0,40163)		<b>-78%</b> (-0,77697)		<b>-43%</b> (-0,42577)

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	34,000		49,000		28,330		41,250	
february	33,400	-0,01765	49,000	0	31,600	0,115425	43,020	0,042909
march	33,900	0,01497	45,700	-0,06735	34,130	0,080063	42,110	-0,02115
april	41,800	0,233038	44,500	-0,02626	36,870	0,080281	43,790	0,039896
may	44,100	0,055024	44,900	0,008989	33,600	-0,08869	45,870	0,047499
june	38,500	-0,12698	39,650	-0,11693	25,390	-0,24435	51,960	0,132767
july	37,800	-0,01818	42,880	0,081463	27,460	0,081528	48,250	-0,0714
august	41,900	0,108466	38,480	-0,10261	26,780	-0,02476	52,860	0,095544
september	38,480	-0,08162	30,000	-0,22037	29,700	0,109037	49,370	-0,06602
october	40,900	0,06289	23,110	-0,22967	32,750	0,102694	48,600	-0,0156
november	41,500	0,01467	29,170	0,262224	37,950	0,158779	48,740	0,002881
december	43,000	0,036145	26,990	-0,07473	34,220	-0,09829	52,620	0,079606
average return of a year		<b>26,5%</b> (0,264706)		<b>-44,9%</b> (-0,44918)		<b>20,8%</b> (0,207907)		<b>28%</b> (0,275636)

Exxon Mobil Corp.

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	50,09		58,47		74,11		93,51		81,640	
february	53,27	0,063486	61,95	0,059518	75,08	0,013089	85,95	-0,08085	76,690	-0,06063
march	62,1	0,165759	60,34	-0,02599	70,99	-0,05448	87,75	0,020942	64,910	-0,15361
april	60,55	-0,02496	61,03	0,011435	76,16	0,072827	87,02	-0,00832	69,230	0,066554
may	57,74	-0,04641	63,42	0,039161	79,66	0,045956	89,7	0,030798	68,010	-0,01762
june	57,15	-0,01022	61,11	-0,03642	84,22	0,057243	87,81	-0,02107	71,760	0,055139
july	58,31	0,020297	62,15	0,017018	84,82	0,007124	88,35	0,00615	70,560	-0,01672
august	59,23	0,015778	68,18	0,097023	85,84	0,012025	79,72	-0,09768	70,650	0,001276
september	61,68	0,041364	68,1	-0,00117	87,23	0,016193	77,32	-0,03011	68,410	-0,03171
october	62,49	0,013132	67	-0,01615	93,95	0,077038	78,58	0,016296	67,270	-0,01666
november	56,4	-0,09746	71,06	0,060597	88,5	-0,05801	74,29	-0,05459	72,150	0,072543
december	59,35	0,052305	77,2	0,086406	88,85	0,003955	74,31	0,000269	76,040	0,053915
average return of a year		<b>18,5%</b> (0,184867)		<b>32%</b> (0,320335)		<b>20%</b> (0,198894)		<b>-21%</b> (-0,20533)		<b>-7%</b> (-0,06859)

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	69,150		74,550		86,000		88,710	
february	66,180	-0,04295	83,910	0,125553	83,970	-0,0236	90,040	0,014993
march	65,400	-0,01179	84,800	0,010607	86,830	0,03406	89,430	-0,00677
april	67,610	0,033792	84,680	-0,00142	87,070	0,002764	90,770	0,014984
may	67,840	0,003402	86,970	0,027043	87,040	-0,00034	87,510	-0,03591
june	59,250	-0,12662	82,030	-0,0568	77,920	-0,10478	91,460	0,045138
july	56,610	-0,04456	82,010	-0,00024	85,340	0,095226	90,300	-0,01268
august	61,940	0,094153	79,600	-0,02939	86,910	0,018397	92,730	0,02691
september	60,910	-0,01663	73,490	-0,07676	87,120	0,002416	87,150	-0,06017
october	62,540	0,026761	71,150	-0,03184	91,800	0,053719	86,000	-0,0132
november	66,950	0,070515	75,940	0,067323	91,600	-0,00218	89,820	0,044419
december	71,330	0,065422	79,790	0,050698	87,610	-0,04356	93,520	0,041193
average return of a year		<b>3,2%</b> (0,031526)		<b>7,0%</b> (0,070288)		<b>1,9%</b> (0,018721)		<b>5%</b> (0,054222)

Berkshire Hathaway BRK -A

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	87100		89300		109000		139300		99 990,000	
february	90850	0,043054	88990	-0,00347	110600	0,014679	135700	-0,02584	89 400,000	-0,10591
march	90800	-0,00055	86900	-0,02349	106600	-0,03617	136500	0,005895	75 750,000	-0,15268
april	85000	-0,06388	90490	0,041312	108000	0,013133	132900	-0,02637	87 600,000	0,156436
may	84900	-0,00118	89650	-0,00928	108301	0,002787	133900	0,007524	92 005,000	0,050285
june	84350	-0,00648	91990	0,026102	109255	0,008809	132350	-0,01158	91 880,000	-0,00136
july	83840	-0,00605	91600	-0,00424	110000	0,006819	120100	-0,09256	90 490,000	-0,01513
august	84100	0,003101	91501	-0,00108	109550	-0,00409	116500	-0,02998	100 000,000	0,105094
september	82700	-0,01665	96000	0,049169	119300	0,089	119999	0,030034	98 600,000	-0,014
october	82400	-0,00363	95800	-0,00208	118790	-0,00427	137000	0,141676	99 850,000	0,012677
november	86600	0,050971	104790	0,093841	131250	0,104891	117500	-0,14234	98 750,000	-0,01102
december	90880	0,049423	106900	0,020136	143200	0,091048	98000	-0,16596	100 450,000	0,017215
average return of a year		<b>4,3%</b> (0,043398)		<b>20%</b> (0,197088)		<b>31%</b> (0,313761)		<b>-30%</b> (-0,29648)		<b>0%</b> (0,0046)

Continue

year	2010		2011		2012		2013	
	close	return	close	return	close	return	close	return
january	99 600,000		120 498,000		116 320,000		139 610,000	
february	113 138,000	0,135924	125 200,000	0,039021	117 800,000	0,012724	147 086,000	0,053549
march	122 801,000	0,085409	128 050,000	0,022764	118 360,000	0,004754	152 750,000	0,038508
april	122 420,000	-0,0031	125 360,000	-0,02101	122 693,000	0,036609	155 253,000	0,016386
may	117 430,000	-0,04076	122 832,000	-0,02017	122 185,000	-0,00414	159 699,000	0,028637
june	105 131,000	-0,10473	115 705,000	-0,05802	119 845,000	-0,01915	170 911,000	0,070207
july	118 095,000	0,123313	117 050,000	0,011624	125 495,000	0,047144	169 622,000	-0,00754
august	119 900,000	0,015284	112 250,000	-0,04101	127 400,000	0,01518	175 700,000	0,035833
september	121 300,000	0,011676	107 228,000	-0,04474	126 279,000	-0,0088	167 993,000	-0,04386
october	123 914,000	0,02155	105 800,000	-0,01332	133 000,000	0,053223	171 028,000	0,018066
november	119 700,000	-0,03401	113 649,000	0,074187	131 400,000	-0,01203	173 123,000	0,012249
december	121 100,000	0,011696	116 925,000	0,028826	131 890,000	0,003729	172 940,000	-0,00106
average return of a year		<b>21,6%</b> (0,215863)		<b>-3,0%</b> (- 0,02965)		<b>13,4%</b> (0,133855)		<b>24%</b> (0,238736)

Verizon Communications Inc.

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	33,92		25,45		32,88		37,56		30,250	
february	30,06	-0,1138	26,64	0,046758	33,03	0,004562	33,69	-0,10304	26,720	-0,11669
march	30,37	0,010313	28,65	0,07545	32,25	-0,02361	31,55	-0,06352	24,040	-0,1003
april	29,48	-0,02931	28,83	0,006283	32,89	0,019845	33,01	0,046276	27,270	0,134359
may	29,29	-0,00645	27,47	-0,04717	33,48	0,017939	34,34	0,040291	26,680	-0,02164
june	29,62	0,011267	26,77	-0,02548	37,39	0,116786	33,07	-0,03698	25,550	-0,04235
july	28,96	-0,02228	28,1	0,049682	36,15	-0,03316	31,03	-0,06169	26,920	0,05362
august	28,46	-0,01727	27,87	-0,00819	37,59	0,039834	29,7	-0,04286	27,970	0,039004
september	27,32	-0,04006	29,8	0,06925	37,09	-0,0133	31,29	0,053535	26,520	-0,05184
october	27,14	-0,00659	31,11	0,04396	39,47	0,064168	27,43	-0,12336	26,210	-0,01169
november	26,25	-0,03279	30,97	-0,0045	38,89	-0,01469	26,86	-0,02078	25,690	-0,01984
december	26,92	0,025524	30,11	-0,02777	37,46	-0,03677	26,79	-0,00261	28,250	0,09965
average return of a year		<b>-20,6%</b> (-0,20637)		<b>18%</b> (0,183104)		<b>14%</b> (0,139294)		<b>-29%</b> (-0,28674)		<b>-7%</b> (-0,06612)

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	29,070		36,430		39,730		44,270	
february	25,860	-0,11042	36,270	-0,00439	37,800	-0,04858	44,560	0,006551
march	25,320	-0,02088	36,020	-0,00689	38,430	0,016667	47,110	0,057226
april	27,320	0,078989	38,470	0,068018	38,520	0,002342	49,220	0,044789
may	25,580	-0,06369	37,560	-0,02365	40,560	0,05296	52,400	0,064608
june	23,770	-0,07076	36,270	-0,03435	41,030	0,011588	48,660	-0,07137
july	24,570	0,033656	37,800	0,042184	44,930	0,095052	50,360	0,034936
august	29,560	0,203093	35,870	-0,05106	45,210	0,006232	50,010	-0,00695
september	30,260	0,023681	35,880	0,000279	43,700	-0,0334	46,010	-0,07998
october	32,890	0,086913	36,340	0,012821	45,810	0,048284	46,990	0,0213
november	32,400	-0,0149	36,470	0,003577	45,140	-0,01463	50,490	0,074484
december	32,350	-0,00154	37,770	0,035646	44,100	-0,02304	49,260	-0,02436
average return of a year		<b>11,3%</b> (0,112831)		<b>3,7%</b> (0,036783)		<b>11,0%</b> (0,109992)		<b>11%</b> (0,112717)



**Appendix B 3 :Portfolio 3 and 3'****China - PetroChina Co. Ltd. ADS**

2005			2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	53,13		83,5		137,9		173,65		95,660	
february	55,76	0,049501223	99,6	0,192814371	123,4	-0,105149	149,75	-0,1376332	73,800	-0,2285177
march	62,12	0,114060258	99,57	-0,000301205	113,3	-0,081848	144,44	-0,0354591	64,090	-0,1315718
april	64,76	0,04249839	108,44	0,089083057	118,38	0,0448367	131,88	-0,0869565	80,980	0,26353565
may	60,85	-0,060376776	112,85	0,04066765	113	-0,045447	152,85	0,1590082	88,950	0,09841936
june	65,11	0,070008217	106,45	-0,05671245	130,7	0,1566372	144,1	-0,0572457	122,130	0,37301855
july	74,95	0,151128859	110,15	0,034758102	150,9	0,1545524	128,08	-0,1111728	112,670	-0,0774584
august	92,67	0,236424283	112,13	0,017975488	143,94	-0,046123	133,64	0,0434104	122,340	0,08582586
september	83,3	-0,101111471	111,83	-0,002675466	146,51	0,0178547	127,55	-0,0455702	109,150	-0,1078143
october	83,7	0,004801921	106,41	-0,048466422	189,83	0,2956795	104,3	-0,1822815	109,930	0,00714613
november	76,95	-0,080645161	110,74	0,040691664	249	0,3116999	76,23	-0,2691275	121,550	0,10570363
december	81,08	0,053671215	128,1	0,15676359	190,6	-0,234538	77,42	0,0156107	128,010	0,05314685
average return of a year		<b>52,6%</b> (0,526068135)		<b>53%</b> (0,534131737)		<b>38%</b> (0,382161)		<b>-55%</b> (-0,5541607)		<b>34%</b> (0,33817688)

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	122,450		132,790		131,380		145,790	
february	114,280	-0,0667211	143,530	0,080879584	148,220	0,1281778	143,840	-0,0133754
march	113,720	-0,0049002	135,220	-0,057897304	152,020	0,0256376	135,880	-0,0553393
april	119,130	0,04757299	154,270	0,140881526	141,690	-0,067952	130,470	-0,0398145
may	115,740	-0,0284563	144,650	-0,062358203	150,990	0,0656362	125,610	-0,0372499
june	105,660	-0,0870918	141,650	-0,020739717	125,270	-0,170342	117,070	-0,0679882
july	110,060	0,04164301	147,620	0,042146135	129,290	0,0320907	110,010	-0,0603058
august	117,730	0,06968926	142,390	-0,035428804	125,560	-0,02885	119,110	0,0827198
september	111,580	-0,0522382	128,250	-0,099304726	117,860	-0,061325	111,080	-0,0674167
october	117,550	0,05350421	119,160	-0,070877193	130,450	0,1068217	111,470	0,003511
november	124,210	0,05665674	127,370	0,068898959	136,480	0,0462246	113,440	0,0176729
december	127,380	0,02552129	129,580	0,017351025	131,900	-0,033558	117,680	0,0373766
average return of a year		<b>4,0%</b> (0,04026133)		<b>-2,4%</b> (-0,02417351)		<b>0,4%</b> (0,003958)		<b>-19%</b> (-0,1928116)

### Brazil - Petrobras Argentina SA (PZE)

2005			2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	11,78		12,68		11,45		11,99		6,800	
february	13,95	0,18421053	12,05	-0,049684543	10,58	-0,075983	11,91	-0,0066722	5,020	-0,2617647
march	12,2	-0,125448	11,25	-0,066390041	10,4	-0,017013	11,35	-0,0470193	5,690	0,13346614
april	11,48	-0,0590164	11,77	0,046222222	10,62	0,0211538	12,11	0,0669604	6,440	0,13181019
may	12,02	0,04703833	10,08	-0,143585387	11,55	0,0875706	13,63	0,1255161	5,080	-0,2111801
june	11,4	-0,0515807	11,2	0,111111111	10,85	-0,060606	12	-0,1195891	5,940	0,16929134
july	13,69	0,20087719	11,29	0,008035714	10,99	0,0129032	10,71	-0,1075	6,940	0,16835017
august	14,8	0,08108108	10,47	-0,072630647	9,27	-0,156506	11,34	0,0588235	6,630	-0,0446686
september	16,14	0,09054054	10,07	-0,038204394	10,05	0,0841424	9,84	-0,1322751	17,910	1,70135747
october	14,81	-0,082404	11,4	0,132075472	11,95	0,1890547	6,21	-0,3689024	17,130	-0,0435511
november	13,08	-0,116813	11,2	-0,01754386	11,29	-0,05523	6,65	0,0708535	16,760	-0,0215995
december	12,34	-0,0565749	12,19	0,088392857	13,95	0,2356067	6,09	-0,0842105	15,630	-0,0674224
average return of a year		<b>4,8%</b> (0,0475382)		<b>-4%</b> (-0,038643533)		<b>22%</b> (0,2183406)		<b>-49%</b> (-0,4920767)		<b>130%</b> (1,29852941)

Continue

year	2010		2011		2012		2013	
	close	return	close	return	close	return	close	return
january	17,040		26,450		16,240		5,380	
february	16,170	-0,0510563	23,010	-0,130056711	14,480	-0,108374	4,640	-0,1375465
march	16,680	0,03153989	22,090	-0,039982616	13,460	-0,070442	4,730	0,0193966
april	16,220	-0,0275779	22,810	0,032593934	11,390	-0,153789	4,920	0,0401691
may	14,100	-0,1307028	20,870	-0,085050416	8,570	-0,247586	4,220	-0,1422764
june	14,410	0,02198582	19,370	-0,071873503	7,600	-0,113186	3,620	-0,1421801
july	14,630	0,01526718	19,600	0,011874032	8,430	0,1092105	4,160	0,1491713
august	14,960	0,02255639	17,140	-0,125510204	8,060	-0,043891	4,540	0,0913462
september	16,530	0,10494652	13,750	-0,197782964	9,190	0,1401985	5,640	0,2422907
october	17,990	0,08832426	14,030	0,020363636	4,380	-0,523395	6,180	0,0957447
november	19,870	0,1045025	13,200	-0,059158945	4,450	0,0159817	7,160	0,1585761
december	26,380	0,32762959	12,620	-0,043939394	4,750	0,0674157	5,550	-0,2248603
average return of a year		<b>54,8%</b> (0,54812207)		<b>-52,3%</b> (-0,522873346)		<b>-70,8%</b> (-0,707512)		<b>3%</b> (0,0315985)

### Russia - Sberbank

2005			2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	14,16		40,08		87,37		96,7644		18,4894	
february	14,56	0,02824859	42,47	0,059630739	95,88	0,0974019	84,989	-0,1216914	15,9221	-0,1388525
march	16,22	0,11401099	42,8	0,007770191	92,27	-0,037651	75,5376	-0,1112073	19,7827	0,24246802
april	17,05	0,05117139	41,35	-0,033878505	101,51	0,1001409	75,9141	0,0049843	26,5114	0,34013052
may	18,27	0,07155425	51,59	0,24764208	91,8	-0,095656	84,2789	0,1101877	36,2735	0,36822273
june	18,46	0,01039956	45,29	-0,122116689	100,15	0,0909586	79,09	-0,0615682	44,109	0,21601169
july	19,23	0,04171181	46	0,01567675	105,5	0,0534199	72,8504	-0,0788924	38,6618	-0,1234941
august	22,09	0,14872595	51,45	0,118478261	96,5539	-0,084797	62,3255	-0,1444728	47,2595	0,2223823
september	25,5	0,15436849	56,3	0,094266278	98,3176	0,0182665	45,56	-0,268999	57,9055	0,22526688
october	27,57	0,08117647	59,28	0,052930728	105,8875	0,0769944	28,8814	-0,3660799	66,721	0,15223942
november	25,38	-0,0794342	61,12	0,031039136	103,4076	-0,02342	25,3461	-0,1224075	69,3976	0,04011631
december	33	0,30023641	83,53	0,366655759	104,944	0,0148577	22,0845	-0,1286825	78,0395	0,12452736
average return of a year		<b>133,1%</b> (1,33050847)		<b>108%</b> (1,084081836)		<b>20%</b> (0,2011446)		<b>-77%</b> (-0,771770)		<b>322%</b> (3,22076974)

Source: developed by the author

Continue

year	2010		2011		2012		2013	
month	close	return	close	return	close	return	close	return
january	87,9194		106,6744		82,410		98,370	
february	80,8026	-0,0809469	100,7595	-0,055448168	92,750	0,1254702	108,360	0,1015554
march	86,6364	0,07219817	101,7491	0,009821406	100,250	0,0808625	103,090	-0,0486342
april	85,5152	-0,0129414	104,3525	0,025586467	95,130	-0,051072	98,030	-0,0490833
may	73,0825	-0,1453858	96,3548	-0,076641192	93,060	-0,02176	100,860	0,0288687
june	75,9895	0,03977696	97,2381	0,009167161	78,860	-0,15259	98,700	-0,0214158
july	80,6148	0,06086762	103,281	0,062145394	87,650	0,1114634	95,420	-0,033232
august	80,4674	-0,0018284	85,9835	-0,167479982	89,390	0,0198517	96,840	0,0148816
september	83,4895	0,03755682	78,2667	-0,089747452	94,080	0,0524667	89,480	-0,0760017
october	95,7681	0,1470676	76,3105	-0,024994027	92,330	-0,018601	99,160	0,1081806
november	100,2986	0,04730698	80,5367	0,055381632	91,840	-0,005307	103,650	0,0452804
december	105,6543	0,05339755	82,5367	0,024833399	92,800	0,010453	102,360	-0,0124457
average return of a year		<b>20,2%</b> (0,20171771)		<b>-22,6%</b> (-0,22627453)		<b>12,6%</b> (0,1260769)		<b>4%</b> (0,0405611)

Source: developed by the author

**India - Oil & Natural Gas Corporation Ltd. (ONGC.NS)**

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	409,3		618,65		455,7		509		328	
february	426,35	0,04165649	568,2	-0,081548533	394,02	-0,13535	506	-0,0058939	345	0,05182927
march	442,65	0,0382315	655,67	0,153942274	440,4	0,11771	493	-0,0256917	389,1	0,12782609
april	405,6	-0,0837004	651,73	-0,00600912	456,92	0,037511	515,65	0,0459432	434	0,1153945
may	461,38	0,13752465	589,57	-0,09537692	461,15	0,009258	430,8	-0,1645496	591,47	0,3628341
june	513,73	0,11346396	554,03	-0,060281222	452,77	-0,01817	402	-0,0668524	532,62	-0,0994979
july	469,25	-0,0865824	586,57	0,058733282	457,27	0,009939	496	0,2338308	585	0,09834404
august	490,93	0,04620139	608,8	0,03789829	430	-0,05964	511,88	0,0320161	594,5	0,01623932
september	530,5	0,08060212	584,93	-0,039208279	485,5	0,12907	517,4	0,0107838	583,53	-0,0184525
october	464,53	-0,1243544	407,88	-0,302685791	625	0,287333	342	-0,3390027	566,97	-0,028379
november	514,82	0,10825996	431,17	0,057100127	584,12	-0,06541	343,52	0,0044444	599	0,05649329
december	587,12	0,14043743	435,65	0,010390333	619	0,059714	334	-0,0277131	591	-0,0133556
average return of a year		<b>43,4%</b> (0,43444906)		<b>-30%</b> (- 0,295805383)		<b>36%</b> (0,35835)		<b>-34%</b> (- 0,3438114)		<b>80%</b> (0,80182927)

Source: developed by the author

Continue

year	2010		2011		2012		2013	
	close	return	close	return	close	return	close	return
january	599		588,9		276,050		339,700	
february	558,8	-0,0671119	270,35	-0,540923756	293,200	0,062126	313,450	-0,0772741
march	549,35	-0,0169112	291,3	0,07749214	268,350	-0,08475	311,400	-0,0065401
april	527,4	-0,0399563	307,8	0,056642636	270,050	0,006335	326,700	0,0491329
may	583,85	0,10703451	281,05	-0,086907083	253,200	-0,0624	327,900	0,0036731
june	660,4	0,13111244	274,25	-0,024194983	284,850	0,125	331,100	0,0097591
july	620,35	-0,0606451	269,25	-0,018231541	286,050	0,004213	290,700	-0,1220175
august	668,8	0,07810107	263,7	-0,020612813	275,900	-0,03548	249,150	-0,1429309
september	702,05	0,04971591	266,1	0,009101251	280,850	0,017941	267,850	0,0750552
october	652,03	-0,0712485	277,65	0,043404735	268,500	-0,04397	293,700	0,0965092
november	622,65	-0,0450593	266,75	-0,039258059	264,950	-0,01322	299,100	0,0183861
december	644,1	0,03444953	256,6	-0,038050609	268,500	0,013399	288,900	-0,0341023
average return of a year		<b>7,5%</b> (0,07529215)		<b>-56,4%</b> (-0,56427237)		<b>-2,7%</b> (-0,02735)		<b>-15%</b> (-0,1495437)

Source: developed by the author



**B4 : Table of returns****The Returns of companies for portfolios 1,1'**

	2005	2006	2007	2008	2009	2010	2011	2012	2013
SES Global	54,40%	-11%	35%	-15%	10%	12,10%	5,40%	20,20%	4%
Flextronics International Ltd.	-26,20%	10%	4%	-78%	180%	24%	-29%	-10%	25%
Statoil	61%	-10%	2%	-18%	22%	3%	10%	-6%	1%
Diamonds	5%	1%	4%	0%	-6%	9%	17%	-3%	-2%
Tenaris S.A.	132,30%	-69%	-6%	-53%	116%	11%	-21%	7%	4%

Source: developed by the author

**The Returns of companies for portfolios 2,2'**

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Wal-Mart	-9,60%	1%	1%	15%	15%	0,90%	6%	15,60%	14%
CitiGroup Inc.	1%	0%	-40%	-78%	-43%	27%	-45%	21%	28%
Exxon Mobil Corp.	19%	32%	20%	-21%	-7%	3%	7%	2%	5%
Berkshire Hathaway BRK -A	4%	20%	31%	-30%	0%	22%	-3%	13%	24%
Verizon Communications Inc.	-21%	18%	14%	-29%	-7%	44%	4%	11%	11%

Source: developed by the author

**The Returns of companies for portfolios 3,3'**

	2005	2006	2007	2008	2009	2010	2011	2012	2013
PetroChina Co. Ltd. ADS	52,60%	53%	38%	-55%	34%	4%	-2,40%	0,40%	-19%
Petrobras Argentina SA (PZE)	4,80%	-4%	22%	-49%	130%	54,80%	-52,30%	-70,80%	3%
Sberbank	133,10%	108%	20%	-77%	320%	20,20%	-22,60%	12,60%	4%
Oil & Natural Gas Corporation Ltd.(ONGC.NS)	43,40%	-30%	36%	-34%	80%	7,50%	-56,40%	-2,70%	-15%
Diamonds	5%	1%	4%	0%	-6%	9%	17%	-3%	-2%
<b>MSCI World</b>	10%	13%	6%	-37%	39%	14%	-10%	8%	18%
<b>MSCI EM</b>	30,30%	16%	38%	-48%	87%	23%	-18%	4%	-6%

Source: developed by the author

**B5: Returns for diamonds:**

<b>month</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
january	0,001682	0,002634	-0,00137	0,001558	-0,03316	-0,19222	0,012573	0,006672	-0,01974
february	-0,00342	-0,00401	0,002181	0,00388	-0,01399	0,016238	0,028927	-0,00153	0,017754
march	0,012585	0	0,008589	0,036407	-0,01	0,012509	0,039123	0,001729	0,013224
april	0,001894	-0,0075	0,002681	0,003388	-0,00108	0,003495	0,011614	-0,00789	-0,00437
may	0,006545	0,007617	0,000719	0,063584	0,001023	0,013932	0,024048	0,007458	0,003302
june	0,005668	-0,01139	0,004324	-0,01379	0,002929	0,009978	0,091005	-0,01085	-0,01172
july	0,022756	0,003015	0,010031	0,005311	0,001887	-0,00189	0,02192	-0,03401	-0,00481
august	0,0092	-0,00469	-0,00268	0	-0,00146	0,005652	-0,01272	0,00054	0,009836
september	-0,00053	0,000628	0,00146	-0,00194	-0,00648	-0,00094	-0,02744	-0,00407	-0,0001
october	0,001875	-0,0018	0,001067	-0,01855	-0,00265	-0,00532	0,012233	-0,01206	-0,00075
november	-0,00618	0,000722	0,003643	-0,04767	0,009828	0,011677	-0,02382	0,004409	0,001155
december	-0,00464	0,008638	0,007972	-0,01648	0,001641	0,002338	-0,00347	0,011725	0,000914
average return of a year	<b>5%</b>	<b>-1%</b>	<b>4%</b>	<b>0%</b>	<b>-6%</b>	<b>9%</b>	<b>17%</b>	<b>-3%</b>	<b>-2%</b>

Source: developed by the author based on the data provided by IDEX

\* The author has the agreement with International Diamond Exchange (IDEX) about confidentiality of obtained data. That's why the table above shows the results of calculations, but not the initial data received from IDEX.

## B6:MSCI World

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	1142,35		1313,214		1500,232		1466,346		838,827	
february	1176,703	0,03007222	1309,451	-0,00287	1490,44	-0,00653	1455,56	-0,0073557	750,863	-0,10487
march	1151,184	-0,02168687	1335,069	0,019564	1514,181	0,015929	1437,403	-0,0124742	805,216	0,072387
april	1123,642	-0,02392493	1373,384	0,028699	1577,86	0,042055	1508,988	0,04980162	893,025	0,10905
may	1140,677	0,01516052	1322,246	-0,03724	1616,871	0,024724	1525,726	0,0110922	970,004	0,0862
june	1148,813	0,00713261	1319,934	-0,00175	1602,36	-0,00897	1402,129	-0,0810086	964,048	-0,00614
july	1188,165	0,03425449	1327,233	0,00553	1565,811	-0,02281	1366,699	-0,0252687	1 044,753	0,083715
august	1194,807	0,00559013	1358,872	0,023838	1561,585	-0,0027	1344,865	-0,0159757	1 085,599	0,039096
september	1224,314	0,02469604	1373,368	0,010668	1633,576	0,046101	1182,443	-0,120772	1 126,985	0,038123
october	1193,88	-0,024858	1422,926	0,036085	1682,351	0,029858	957,245	-0,1904515	1 106,170	-0,01847
november	1231,412	0,031437	1455,166	0,022658	1610,942	-0,04245	892,926	-0,0671918	1 149,007	0,038726
december	1257,775	0,02140876	1483,578	0,019525	1588,803	-0,01374	920,226	0,03057364	1 168,468	0,016937
average return of a year		<b>10,1%</b> (0,10104171)		<b>13%</b> (0,129731)		<b>6%</b> (0,059038)		<b>-37%</b> (-0,37244)		<b>39%</b> (0,392979)

The data was provided by MSCI Inc., the returns were calculated by the author

Continue

<b>year</b>	<b>2010</b>		<b>2011</b>		<b>2012</b>		<b>2013</b>	
<b>month</b>	close		close		close		close	
january	1 119,537		1 308,083		1 240,894		1 405,466	
february	1 133,348	0,01233635	1 351,647	0,033304	1 298,720	0,0466	1 405,180	-0,0002035
march	1 200,530	0,05927747	1 334,925	-0,01237	1 312,011	0,010234	1 434,515	0,02087633
april	1 198,564	-0,00163761	1 388,620	0,040223	1 293,991	-0,01373	1 476,139	0,02901608
may	1 079,801	-0,09908774	1 354,607	-0,02449	1 177,645	-0,08991	1 471,933	-0,0028493
june	1 041,323	-0,03563434	1 331,182	-0,01729	1 235,716	0,049311	1 433,548	-0,026078
july	1 124,826	0,08018934	1 306,054	-0,01888	1 250,569	0,01202	1 507,913	0,05187479
august	1 080,699	-0,03923007	1 211,224	-0,07261	1 279,208	0,022901	1 472,738	-0,0233269
september	1 179,194	0,09114009	1 104,065	-0,08847	1 311,504	0,025247	1 543,672	0,04816471
october	1 222,226	0,03649272	1 217,296	0,102558	1 301,522	-0,00761	1 602,860	0,03834234
november	1 193,558	-0,02345556	1 184,604	-0,02686	1 315,493	0,010734	1 628,424	0,01594899
december	1 280,071	0,07248328	1 182,595	-0,0017	1 338,500	0,017489	1 661,069	0,02004699
average return of a year		<b>14,3%</b> (0,14339321)		<b>-9,6%</b> (-0,09593)		<b>7,9%</b> (0,078658)		<b>18%</b> (0,18186352)

The data was provided by MSCI Inc., the returns were calculated by the author

**B7: MSCI EM**

	2005		2006		2007		2008		2009	
month	close	return	close	return	close	return	close	return	close	return
january	542,282		783,771		901,477		1 088,570		529,532	
february	588,681	0,085562	782,106	-0,00212	895,542	-0,00658	1 167,497	0,072505	499,304	-0,05708
march	548,689	-0,06793	787,802	0,007283	928,903	0,037252	1 104,430	-0,05402	569,967	0,141523
april	531,990	-0,03043	841,580	0,068263	970,856	0,045164	1 191,365	0,078715	662,730	0,162752
may	548,155	0,030386	750,996	-0,10764	1 014,641	0,045099	1 209,870	0,015533	773,121	0,16657
june	565,168	0,031037	747,539	-0,0046	1 059,544	0,044255	1 087,119	-0,10146	761,295	-0,0153
july	602,564	0,066168	755,836	0,011099	1 112,614	0,050088	1 041,856	-0,04164	844,024	0,108669
august	606,230	0,006084	773,124	0,022873	1 086,825	-0,02318	956,253	-0,08216	839,460	-0,00541
september	661,318	0,09087	778,161	0,006515	1 204,740	0,108495	786,924	-0,17708	914,045	0,088849
october	617,412	-0,06639	814,438	0,046619	1 337,448	0,110155	570,521	-0,275	914,259	0,000234
november	667,994	0,081926	874,080	0,073231	1 241,869	-0,07146	526,972	-0,07633	953,128	0,042514
december	706,483	0,057619	912,648	0,044124	1 245,422	0,002861	567,042	0,076038	989,469	0,038128
average return of a year		<b>30,3%</b> (0,302796)		<b>16%</b> (0,164432)		<b>38%</b> (0,381535)		<b>-48%</b> (-0,47909)		<b>87%</b> (0,868573)

The data was provided by MSCI Inc., the returns were calculated by the author

Continue

year	2010		2011		2012		2013	
month	close		close		close		close	
january	933,590		1 119,079		1 019,394		1 069,010	
february	935,929	0,002505	1 107,767	-0,01011	1 079,443	0,058907	1 054,616	-0,01346
march	1 010,334	0,079499	1 170,870	0,056964	1 041,447	-0,0352	1 034,904	-0,01869
april	1 020,033	0,0096	1 204,028	0,028319	1 026,016	-0,01482	1 039,452	0,004395
may	926,404	-0,09179	1 167,972	-0,02995	906,296	-0,11668	1 008,878	-0,02941
june	917,985	-0,00909	1 146,219	-0,01862	937,354	0,034269	940,330	-0,06794
july	991,410	0,079985	1 137,731	-0,00741	952,488	0,016145	947,553	0,007681
august	970,046	-0,02155	1 033,150	-0,09192	947,328	-0,00542	929,536	-0,01901
september	1 075,529	0,10874	880,434	-0,14782	1 002,656	0,058404	987,458	0,062313
october	1 105,754	0,028102	995,562	0,130763	995,326	-0,00731	1 034,420	0,047558
november	1 075,853	-0,02704	928,325	-0,06754	1 007,022	0,011751	1 018,284	-0,0156
december	1 151,385	0,070207	916,387	-0,01286	1 055,196	0,047838	1 002,693	-0,01531
average return of a year		<b>23,3%</b> (0,233288)		<b>-18,1%</b> (-0,18112)		<b>3,5%</b> (0,035121)		<b>-6%</b> (-0,06204)

The data was provided by MSCI Inc., the returns were calculated by the author

**Appendix C: Iterations for portfolios**

**C1: The iterations for Portfolio 1**

<b>Variant 1</b>			
period	2005-2013		
Security	return	risk	$X_i$
SES Global	13%	20%	46%
Flextronics International Ltd.	11%	67%	15%
Statoil	7%	22%	39%
		$\Sigma(X_i)$	100%
		Whole risk	11%
		Expected return	10%

<b>Variant 2</b>			
period	2005-2013		
Security	return	risk	$X_i$
SES Global	13%	20%	47%
Flextronics International Ltd.	11%	67%	14%
Statoil	7%	22%	39%
		$\Sigma(X_i)$	100%
		Whole risk	11%
		Expected return	10%

<b>Variant 3</b>			
period	2005-2013		
Security	return	risk	$X_i$
SES Global	13%	20%	34%
Flextronics International Ltd.	11%	67%	34%
Statoil	7%	22%	32%
		$\Sigma(X_i)$	100%
		Whole risk	14%
		Expected return	10%

<b>Variant 4</b>			
period	2005-2013		
Security	return	risk	$X_i$
SES Global	13%	20%	53%
Flextronics International Ltd.	11%	67%	16%
Statoil	7%	22%	31%
		$\Sigma(X_i)$	100%
		Whole risk	11%
		Expected return	11%



<b>Variant 5</b>			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	52%
Flextronics International Ltd.	11%	67%	16%
Statoil	7%	22%	32%
		$\Sigma(X_i)$	100%
		Whole risk	11%
		Expected return	11%

### C2: The iterations for Portfolio 1'

<b>Variant 1</b>			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	30%
Flextronics International Ltd.	11%	67%	9%
Statoil	7%	22%	8%
Diamonds	3%	6%	54%
		$\Sigma(X_i)$	100%
		Whole risk	4%
		Expected return	7%

<b>Variant 2</b>			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	26%
Flextronics International Ltd.	11%	67%	26%
Statoil	7%	22%	25%
Diamonds	3%	6%	24%
		$\Sigma(X_i)$	100%
		Whole risk	8%
		Expected return	9%

<b>Variant 3</b>			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	37%
Flextronics International Ltd.	11%	67%	8%
Statoil	7%	22%	23%
Diamonds	3%	6%	32%
		$\Sigma(X_i)$	100%
		Whole risk	6%
		Expected return	8%

<b>Variant 4</b>			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	20%
Flextronics International Ltd.	11%	67%	12%
Statoil	7%	22%	26%
Diamonds	3%	6%	42%
		$\Sigma(X_i)$	100%
		Whole risk	5%
		Expected return	7%

<b>Variant 5</b>			
period	2005-2013		
Security	return	risk	Xi
SES Global	13%	20%	27%
Flextronics International Ltd.	11%	67%	6%
Statoil	7%	22%	20%
Diamonds	3%	6%	46%
		$\Sigma(Xi)$	100%
		Whole risk	4%
		Expected return	7%

### C3: The iterations for Portfolio 2

<b>Variant 1</b>			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	55%
Exxon Mobil Corp.	7%	15%	19%
Berkshire Hathaway BRK -A	9%	17%	18%
Verizon Communications Inc.	2%	16%	7%
		$\Sigma Xi$	100%
		Whole risk	4%
		Expected return	7%

<b>Variant 2</b>			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	37%
Exxon Mobil Corp.	7%	15%	25%
Berkshire Hathaway BRK -A	9%	17%	34%
Verizon Communications Inc.	2%	16%	4%
		$\Sigma Xi$	100%
		Whole risk	4%
		Expected return	7%

<b>Variant 3</b>			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	48%
Exxon Mobil Corp.	7%	15%	22%
Berkshire Hathaway BRK -A	9%	17%	22%
Verizon Communications Inc.	2%	16%	9%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>3%</b>
		<b>Expected return</b>	<b>7%</b>

<b>Variant 4</b>			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	48%
Exxon Mobil Corp.	7%	15%	23%
Berkshire Hathaway BRK -A	9%	17%	21%
Verizon Communications Inc.	2%	16%	8%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>3%</b>
		<b>Expected return</b>	<b>7%</b>

<b>Variant 5</b>			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	25%
Exxon Mobil Corp.	7%	15%	25%
Berkshire Hathaway BRK -A	9%	17%	26%
Verizon Communications Inc.	2%	16%	24%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>4%</b>
		<b>Expected return</b>	<b>6%</b>

#### C4: The iterations for Portfolio 2'

Variant 1			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	47%
Exxon Mobil Corp.	7%	15%	20%
Berkshire Hathaway BRK -A	9%	17%	28%
Verizon Communications Inc.	2%	16%	0%
Diamonds	3%	13%	4%
		<b><math>\Sigma</math> Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>3%</b>
		<b>Expected return</b>	<b>7%</b>

Variant 2			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	20%
Exxon Mobil Corp.	7%	15%	20%
Berkshire Hathaway BRK -A	9%	17%	21%
Verizon Communications Inc.	2%	16%	19%
Diamonds	3%	13%	20%
		<b><math>\Sigma</math> Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>3%</b>
		<b>Expected return</b>	<b>6%</b>

Variant 3			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	41%
Exxon Mobil Corp.	7%	15%	21%
Berkshire Hathaway BRK -A	9%	17%	26%
Verizon Communications Inc.	2%	16%	4%
Diamonds	3%	13%	8%
		<b><math>\Sigma</math> Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>3%</b>
		<b>Expected return</b>	<b>7%</b>

Variant 4			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	43%
Exxon Mobil Corp.	7%	15%	20%
Berkshire Hathaway BRK -A	9%	17%	24%
Verizon Communications Inc.	2%	16%	0%
Diamonds	3%	13%	12%
		<b><math>\Sigma</math> Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>3%</b>
		<b>Expected return</b>	<b>7%</b>

<b>Variant 5</b>			
period	2005-2013		
Security	return	risk	Xi
Wal-Mart Stores Inc.	7%	8%	45%
Exxon Mobil Corp.	7%	15%	20%
Berkshire Hathaway BRK -A	9%	17%	23%
Verizon Communications Inc.	2%	16%	0%
Diamonds	3%	6%	12%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>3%</b>
		<b>Expected return</b>	<b>7%</b>

### C5: The iterations for Portfolio 3

<b>Variant 1</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	23%
Petrobras Argentina SA (PZE)	4%	58%	22%
Sberbank	58%	111%	33%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	22%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>38%</b>
		<b>Expected Return</b>	<b>24%</b>

<b>Variant 2</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	59%
Petrobras Argentina SA (PZE)	4%	58%	13%
Sberbank	58%	111%	10%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	18%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>25%</b>
		<b>Expected Return</b>	<b>14%</b>

<b>Variant 3</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	52%
Petrobras Argentina SA (PZE)	4%	58%	14%
Sberbank	58%	111%	11%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	22%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>24%</b>
		<b>Expected Return</b>	<b>14%</b>

<b>Variant 4</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	55%
Petrobras Argentina SA (PZE)	4%	58%	11%
Sberbank	58%	111%	11%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	23%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>24%</b>
		<b>Expected Return</b>	<b>14%</b>

<b>Variant 5</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	53%
Petrobras Argentina SA (PZE)	4%	58%	12%
Sberbank	58%	111%	11%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	25%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>24%</b>
		<b>Expected Return</b>	<b>14%</b>

<b>Variant 6</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	53%
Petrobras Argentina SA (PZE)	4%	58%	10%
Sberbank	58%	111%	11%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	26%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>24%</b>
		<b>Expected Return</b>	<b>14%</b>

**C6: The iterations for Portfolio 3'**

<b>Variant 1</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	42%
Petrobras Argentina SA (PZE)	4%	58%	0%
Sberbank	58%	111%	18%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	16%
Diamond	3%	6%	24%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>18%</b>
		<b>Expected Return</b>	<b>17%</b>

<b>Variant 2</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	19%
Petrobras Argentina SA (PZE)	4%	58%	18%
Sberbank	58%	111%	27%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	18%
Diamond	3%	6%	18%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>39%</b>
		<b>Expected Return</b>	<b>20%</b>

<b>Variant 3</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	39%
Petrobras Argentina SA (PZE)	4%	58%	0%
Sberbank	58%	111%	14%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	17%
Diamond	3%	6%	30%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>14%</b>
		<b>Expected Return</b>	<b>14%</b>

<b>Variant 4</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	0%
Petrobras Argentina SA (PZE)	4%	58%	0%
Sberbank	58%	111%	20%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	20%
Diamond	3%	6%	60%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>10%</b>
		<b>Expected Return</b>	<b>14%</b>

<b>Variant 5</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	0%
Petrobras Argentina SA (PZE)	4%	58%	0%
Sberbank	58%	111%	20%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	0%
Diamond	3%	6%	80%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>7%</b>
		<b>Expected Return</b>	<b>14%</b>

<b>Variant 6</b>			
period	2005-2013		
Security	return	risk	Xi
PetroChina Co. Ltd. ADS	12%	34%	5%
Petrobras Argentina SA (PZE)	4%	58%	0%
Sberbank	58%	111%	19%
Oil & Natural Gas Corporation Ltd.(ONGC .NS)	3%	41%	0%
Diamond	3%	6%	76%
		<b>Σ Xi</b>	<b>100%</b>
		<b>Whole risk</b>	<b>7%</b>
		<b>Expected Return</b>	<b>14%</b>