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Comparisons of Returns Between Randomly Chosen Portfolios from Indexes and Returns of Best Performing Equity Funds; Determining Whether Investors Should Pay Management Fees to Equity Funds' Managers

A dissertation submitted in partial fulfilment of the requirements of the Royal Docks Business School, University of East London for the degree of **MSc Finance and Risk [Full Programme Title]**

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I declare that no material contained in the thesis has been used in any other submission for an academic award

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Abstract

In the extremely unpredictable stock market, especially in the period following the financial crisis, it has become very common that investors are willing to pay fund managers to make investment decisions for them and to build certain portfolios that will bring investors best possible returns. On the other hand, investors have options of building their own portfolios or investing in some existing indexes and getting the benchmark return.

This paper examines and evaluates the possible returns of randomly chosen portfolios from different countries' indexes and compares them with the best equity funds' returns and with the benchmark return.

In other words, this paper is answering the question: Should investors pay the fund managers' fee to make investments for them? Is this management fee going to bring them enough of extra profit so that it will pay off?

Key steps in these evaluations and comparisons will include gathering data for most popular Indexes' returns of two different countries including United Kingdom and United States of America. This information will be used in building the random portfolios by using Monte Carlo Simulation method. Final results will show the mean as well as the minimum return and they will be compared with returns of best equity funds from these countries.

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1. Introduction

1.1. Background of the situation

In order to become shareholders of some successful equity fund company, investors have to pay additional management fee to the professional investment managers who are in charge of buying and selling shares of common stocks with an objective to make profit or the fund growth. This fee is also called “load” and it represents the charge for the commission and the payment for the managers’ services of researching.

Equity funds, as the mutual funds that consist only of investments on common stock, are mostly well diversified. This means that they include various investments from different sectors, which lowers the risk of investors. However, it is questionable whether the investors should rely on managers’ choices and pay them the fee that can go up to 8.5 percent of the selling price. So the next important questions arise: Is the price of this load charge low enough to compensate the extra profit that the investors are hoping to get by choosing to invest in certain equity fund? Or should the investors build their own portfolios of investments and save the management fee?

Among other issues, this paper will focus on answering these questions. Main goal of this research will be to evaluate the differences in average returns between randomly chosen portfolios from most popular Indexes and the average returns of the best equity funds. It will also compare these

results with the average returns of the Indexes themselves that represent the benchmark return.

The methodological approach will include Monte Carlo Simulation, which will be used to build randomly chosen portfolios of investments in stocks from Indexes and to evaluate the mean and the minimum average return of these portfolios.

After evaluating these returns and comparing them with most popular equity funds and indexes, results will be thoroughly examined. The main purpose of this study then will be to determine the reasons why particular funds or indexes performed better than the randomly chosen portfolios, or vice versa. More specifically, aim will be to conclude whether the higher returns were accomplished through better assets allocation or the sector selection.

In the one case scenario, if the results show the higher average returns of equity funds, the goal will be to find out how to establish better returns by using the improved asset allocation strategy or by using better choices for selecting the specific sector of investments.

Should the results show that average returns of randomly chosen are close to or even higher than the average returns of best equity funds, many doubts may arise against the purpose of existing professional investment managers.

1.2. Justification for the research

As mentioned above, in the fast moving market following the financial crisis, many investors are willing to give their money in the hands of professional investment managers who will then direct it into specific investments. Furthermore, investors have an obligation of paying a management fee, also called the load charge, which serves as the admission and the award for

investor's research services. Very often, these managers, who work for various funds, will achieve a return on their investments higher than the benchmark return. However, in certain occasions, this might not be the case. This research study investigates best performing equity funds and compares them with randomly chosen portfolios in order to determine whether investors should pay fees to professional managers of equity funds or they should build their own portfolios.

2. Literature Review

In this section of the paper, previous researches on this subject will be critically evaluated and discussed. In addition, various opinions, results and conclusions will be presented in order to bring a bigger picture on the topic. Main goal of this chapter is to evaluate current knowledge on the topic and to construct an academically important question of the research. In addition, potential gaps in the existing studies on the subject will be identified as well as the possible solutions or ways to fill those gaps. Also some key words will be emphasized through different literature researches. Finally, the Monte Carlo Simulation method will be introduced by presenting its definition and distinctive ways and fields in which it can be applied. Multiple studies involving Monte Carlo Simulation will be examined and used as guidance for applying this particular method in this paper.

Many arguments and discussions have been made about mutual equity funds and indexes' benchmark return and whether the equity funds, with their

professional investment managers as leaders, have advantage over indexes and benchmark return. Some researches have shown that managers underperformed the market; others have confirmed that, excluding management fees, mutual funds' performances were placed randomly around the CAPM market line (Jensen, 1968). On that note, many researches have found that fund managers do not have any type of private information that might help them to earn some extra returns and beat the market (Jensen, 1968). Furthermore, Ippolito (1989) concluded that fund managers are compensated for their research process and that risk-adjusted net performance¹ of some US mutual funds is similar to that of particular benchmark. Grossman and Stiglitz (1980) defined the costly information in the market efficiency as the fact that mutual funds can overperform the market only before expenses, that include management fees and turnover costs, have been taken into account. Similar conclusions have been made by Grinblatt and Titman (1989) and Droms and Walker (1996). On the other hand, Elton et al. (1993) stated that comparisons between the performances of mutual funds and the benchmark are only possible due to selection of inefficient benchmark and that, if fund managers would not take any investments in S&P 500 index for example, their portfolios would underperform that chosen benchmark.

Again, there are many journals that favour the equity funds and professional managers decisions. Sensoy B.A. et al. (2014) argued that in the recent years public market's return is outperformed on average by private equity investments of all types of investors. In their paper about investing in equity mutual funds, Pastor L. and Stambaugh R.F (2002), conclude that investors who think that managers cannot beat the returns of benchmark indexes are wrong because active mutual funds can be the most favourable choice for investing. They also argue that if the investments in the benchmarks are not accessible, investors who favour pricing models and do not have faith in manager skills should incorporate active funds as part of their portfolios because these can be enhanced alternative for the benchmarks.

¹ Risk-adjusted net performance in essence represents the net of fees and expenses.

Main method that will be used in this research study involves the Monte Carlo simulation. This method includes sampling the model by the means of probability distribution functions of the parameters by which it can generate parameters values (Xiao and Vien, 2003). These distribution functions include normal, binomial, Poisson distribution, etc. A function of computer-generated random number is used to achieve value of a parameter that is based on its probability distribution function. After the calculation of each parameter's value, final results are obtained by quantifying the model (Xiao and Vien, 2003). These results can then be positioned in the frequency table that can give a better understanding of the probability occurrences. Monte Carlo simulation, as a method that combines distributions, is used for more than just promoting statistical uncertainties. Instead of applying analytic calculations, this method uses the function of random number generator in order to simulate the random variables' values. Nowadays it became extremely popular due to emergence of high-speed computers and special programs. Furthermore, Herrador M.A. and Gonzalez A.G. (2004) agreed that there are many advantages in using Monte Carlo simulation in comparison with the GUM approach², which represents the method of estimating the complete uncertainty.

As pointed by Hull (2012), Monte Carlo simulation can be used as an alternative procedure for implementing the model-building approach in order to achieve the generation of the probability distribution for ΔP (change in price). Hull (2012) also introduces the concept of VaR³ (Value at Risk) as the very important process of calculating the correct percentile of the probability distribution of ΔP . Results of this process enable the analysts to make a statement like: "We are 99% certain that we will not lose more than \$100,000 dollars in the next 10 days". The percentage here represents the

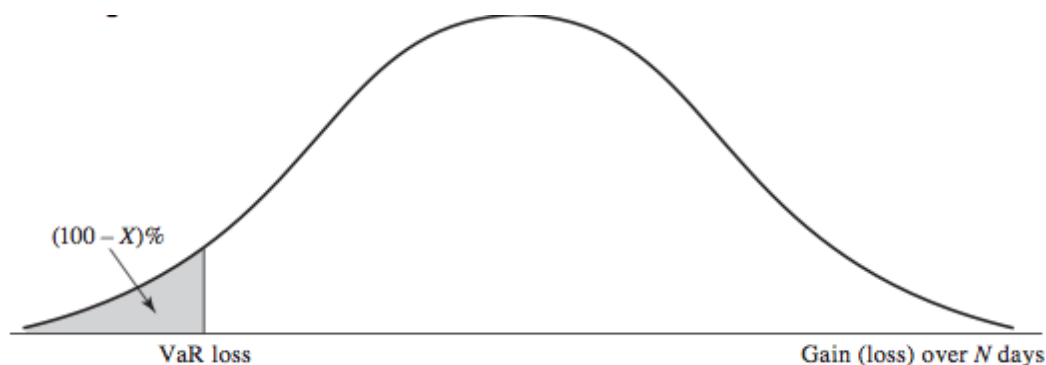
² GUM approach stands for 'Guide to the expression of Uncertainty Measurement'. It involves the processes of identification and quantification of uncertainties in individual sources and the evaluation of the total uncertainty (Herrador M.A. and Gonzalez A.G., 2004).

³

confidence level, the amount in dollars is an actual Var and the number of days is the time horizon. Therefore, The VaR is a function of two parameters that include the confidence level ($X\%$) and the time horizon (N days) and it represents worst potential loss. According to Hull (2012), VaR can be estimated by considering the actual changes in a portfolio and relating them to market variables' percentage changes. Following is the procedure for calculating 1-day Var for a specific portfolio:

- 1) Estimate the value of the portfolio today by using the market variables' current values
- 2) Take one sample of the values of Δx_i from the multivariate normal probability distribution
- 3) Estimate the value of variable of each market at the end of the day by using the sampled values of the Δx_i
- 4) Do another valuation of the portfolio at the end of the day
- 5) Subtract the first value of the portfolio from the second value calculated in the previous step
- 6) Generate a probability distribution for ΔP by repeating steps from 2 to 5 which will give many different results

Example of the Var presented on the probability distribution graph is shown in the figure bellow:



Hull (2012) concluded that one of the disadvantages of the Monte Carlo simulation is that in some cases it takes too much time to revalue many

times the complete portfolio of particular company, especially if the portfolio consists of thousands of different instruments. When considered as a model-building approach, Monte Carlo's biggest drawback is that it takes the market variables in such a way as they a multivariate normal distribution, whereas in real life this is usually not the case because daily changes of market variables often don't generate the normal distribution. Another disadvantage is that this kind of approach has a tendency to find poor results for portfolios with low deltas (Hull, 2012). Along the lines of the limitations, E. Borgonovo and S. Gatti (2013) made a conclusion that the net present value (NPV) distribution generated by Monte Carlo simulation does not capture the circumstance of borrowers defaulting on their loans even though they have enough cash that is available to them. On the other side, the main advantage of the Monte Carlo simulation as the model-building approach is that the results can be generated very quickly and that it can be applied in the combination with schemes of volatility updating (Hull, 2012).

Key debates in the literature researches regarding Monte Carlo Simulation involve detailed explanations and definitions of the Monte Carlo Simulations, its different variations and applications in many different fields apart from finance. For instance, S. R. Cheng (2008) mentioned in her journal that by using Monte Carlo simulations founded on the Euler-Maruyama method we are able to calculate the predicted payoff of financial options. Boyie P. et. al. (1997) wrote about applications of Monte Carlo method within the problems of security pricing and tried to stress the possibilities of improvement in effectiveness. Montero M. and Kohatsu-Higa A. (2003) mentioned in their journal that through Monte Carlo simulation we can compute Greeks which represent derivatives of option prices with respect to a parameter. This kind of quantity is widely used in finance and its primary function is to measure stability of a portfolio considering changes in parameters. On the other hand we have papers dealing with the use of Monte Carlo simulation in different disciplines. For example, Meng X. H. et. al. (2013) claimed that this method can be very successfully applied in many different fields of medicine. In this particular case, Monte Carlo simulation was used in evaluation of effects of

certain reimbursements that lead to an optimization of the China's Medical System reimbursement scheme. One of the many other applications of Monte Carlo simulation was shown by Bjornsdotter M. et. al. (2011), where the authors proved that this simulation outperformed the general linear method (GLM) in the process of multivariate brain mapping. There are many other applications of Monte Carlo like: electric utility resource planning (Spinney J. and Watkins C., 1996), computation of optimal portfolios (Cvitanic J. et. al., 2003), risk management in windfarm projects (Montes G. et. al., 2011), pi estimation, immune system simulation and HIV infection modelling (Hecquet D. et. al., 2006), computation of the mortgage rates (Goncharov Y. et. al., 2006), stochastic volatility models (Chib S. et. al., 2002, Sandmann G. and Koopman S. J., 1998), evaluation of an undeveloped oil field and optimal timing of investment (Cortazar G., 1998) etc. One specific type of the Monte Carlo simulation called quasi-Monte Carlo simulation uses more consistently distributed sequences and as such, shows potential for faster computational time and for gain in various applications of simulation methods for complex problems in finance (Li J. X. and Mullen G. L., 2000).

In this paper, Monte Carlo simulation will primarily be used to randomly choose different stocks among most popular indexes and to build up portfolios of 10 assets. This process will be repeated 1,000 times, so we will have 1,000 randomly chosen portfolios. Following that, average returns of these portfolios will be calculated and sorted out in a way to estimate what are minimum possible returns, what is the 95% confidence level that portfolio will not earn less return than a certain amount, what is the mean return of all portfolios, etc.

Another very significant factor in this research study includes the performance indicator called Sharpe ratio. This factor was taken into account when specific equity funds were chosen for the purpose of research. Sharpe ratio was introduced in 1966 by William Forsyth Sharpe. It is known as the "reward-to-variability ratio", Sharpe index or the Sharpe measure and it represents the indicator of investment performance. It estimates the

performance of an investment or a portfolio by relating the excess return (risk premium)⁴ to the standard deviation or risk of investment and portfolio (Sharpe 1966, Sharpe 1994, Chuang et al. 2008). Considering these characterizations, the Sharpe ratio can be presented as the following equation:

$$\text{Sharpe ratio} = (R_p - R_f) / \sigma_p,$$

Where: R_p stands for the expected average portfolio return, R_f stands for the Risk free rate (for example, the rate of the 10-year U.S. Treasury bond) and σ_p stands for the standard deviation of the portfolio returns

Sharpe ratio tells us how much of a reward portfolio gets per one unit of risk. Therefore, higher returns of a particular portfolio of an equity fund are good news only if those superior returns come with a reasonable amount of risk. By analyzing the Sharpe ratios, managers can conclude whether the returns of some portfolios are high due to well-directed investment choices or due to result of adjusted risk. General rule says that the higher the Sharpe ratio of a portfolio, the better is the risk-adjusted performance of the portfolio and better job by its managers. Alternative performance measures include: Treynor ratio, Information ratio, Jensen's alphas, Sortino ratio, Bias ratio, etc. These measures have their own advantages and disadvantages, but most managers and analysts prefer using the Sharpe ratio for few reasons: 1) It takes into account both the systematic and unsystematic or idiosyncratic risks while Treynor measure considers only the portfolio's systematic risk; therefore it generates better picture and the understanding of the risk taken by the investment. 2) It can also be measured directly from the sampled range of returns with no need for getting some extra data on the source of portfolio efficiency.

⁴ Excess return represents the difference between the average portfolio return and the risk-free return.

Sharpe ratio has its drawbacks as well. Main limitation of this measure is that it can only take into equation the portfolio returns that are normally distributed (Chuang et al., 2008). This limitation was particularly emphasized in the recent decades and it was considered as incompetent performance indicator, which brought up the increase in the number of other measures (Auer, 2014). Sharpe ratio particularly showed this weakness when evaluating returns of hedge funds because of the asymmetry in their returns and probability distributions that show fat tails⁵ (Bayley and Lopez de Prado 2012, Auer 2014). Bayley and Loped de Prado (2012) concluded that in the case of recently established hedge funds, Sharpe rations often show the overvalued numbers. They also introduced the “Sharpe ratio indifference curve” that explains that portfolio managers with very low or in some case even negative Sharpe ratios can still be considered as efficient managers as long as their work is not too much correlated with that of other managers (Bailey and Lopez de Prado, 2013). Still, there are many opinions that favour Sharpe ratio in spite of this limitation. For example, Eling and Schuhmacher (2007) and Schuhmacher and Eling (2011,2012) compared Sharpe ratio with all other performance indicators and concluded that all measures, including Sharpe ratio, generated approximately the same order of ranking across hedge funds. They also stated that returns that are normally distributed are not necessary in order to support the use of Sharpe ratio for ranking funds. Dowd (2000) also agreed that Sharpe ratio can be applied in the process of estimating hedge fund performance when hedge fund constitutes only a portion or even entire risky investment. Furthermore, another strength of the Sharpe ratio is that it is very easy to be applied because there are already many complicated statistical tests available for it (Ledoit and Wolf, 2008; Lo, 2002). Another fact that confirms why this performance indicator is preferred by most investors is that it is the standard and most used measure in the majority of empirical studies (Arnold et al., 2004; Huang and Lin, 2011; Hammami et al., 2013).

⁵ Fat tail is an expression that represents particular characteristic of the probability distribution with having wider range of possible outcomes that are less likely to occur.

Nevertheless, another disadvantage of Sharpe ratio that stands out is the fact that, by using the standard deviation as the measure of risk, it considers both the negative and positive volatility as unfavourable events. Therefore this indicator lacks the ability of capturing downside risk especially in the case when there is an asymmetric distribution of returns and when it is important to distinguish good and bad events (Chuang et al., 2008). This limitation was lessened by Dowd (1999) who revised the Sharpe ratio equation and replaced the standard deviation with VaR, which represents the probability of how big of a loss can that specific portfolio have over a given period of time. In other words, he put the downside risk in the equation and managed to consider it while evaluating the performance of the portfolio.

3. Research Methodology

In this chapter, the concept of the research approach will be explained, as well as the research philosophy used for writing this paper. Furthermore, research methods will be described and the research design of the study will be justified. This part of the paper will also include more details on how all the data have been collected, how the analysis has been done and how the interpretation of the data has been carried out. In this chapter, key words and phrases of the study will be explained and shown through analysis of other papers with similar topics. Lastly, some possible limitations of the research will be given as well as all the challenges that got in the way during the whole process of studying and research.

As stated earlier, the main topic of this paper includes comparisons between the average returns of best performing equity funds, randomly chosen and constructed portfolios and best performing indexes. Along the main topic, the key research questions can be formulated as follows: Should the investors pay management fees to the professional investment managers of profitable equity funds and rely completely on managers' selections of stocks? Will the investors gain enough profit above the benchmark return or the average return of indexes to compensate the fees paid to the fund managers or should they build their own portfolios of investments instead? Answering these questions requires a lot of research, data collection and analysis as well as the information interpretation with many different solutions and conclusions that will come out as the final result. Still, these answers will be, after all, only opinions and they will leave yet a significant amount of uncertainty regarding the research questions due to inconsistencies in the equity markets and the constant changes in funds' fees and regulations.

As the main approach methodology, the quantitative study approach is used. Primary and secondary data collection approaches are applied for gathering all the necessary data. Collected data includes mostly the historical data that is consisted of historical returns of all the equities within the FTSE 100 index and Dow Jones index for the period from 2010 to 2013. Historical data also includes the average returns and all other financial parameters including performance indicators, assets' sizes, characteristics, styles and management fees of top performing equity funds in the United Kingdom and in the United States for the same time period. All this data has been collected from the official Bloomberg terminal.

Once all the data has been collected, precisely sorted out and well organized, the next steps of using research methods can be applied. Monte Carlo Simulation, which will be explained in the following sections, represents the first step of the data interpretation and analysis. At this stage of the research, very important results will be generated. This will lead then

into further analysis that includes comparisons between these results and the data on equity funds collected via Bloomberg terminal.

In the following section of the chapter key phrases and factors will be introduced and explained through general definitions and analysis of journals dealing with similar topics. These key words include: Monte Carlo Simulation, equity funds, Sharpe ratio and Mean-variance approach.

3.1. Monte Carlo Simulation

Monte Carlo simulation was introduced for the first time back in 1940s when couple of mathematicians were working on the Manhattan Project that was dedicated to the worldwide popular Monte Carlo casino (Rezvani and Bolduc, 2014). Nowadays, professional investment managers and financial analysts use so-called multivariate models to find out the effects of their investments on overall performance and risk of the portfolio. Monte Carlo Simulation is a special type of multivariate models that enables managers to run multiple trials, and identify all possible results of an investment by creating probability distribution or the measurement of risk for that particular investment. It includes series of computational algorithms that repeatedly sample a wide range of possible values by calculating these series of probability distributions (Rezvani and Bolduc, 2014). The probability distributions in general can generate a picture of risk of the investment and they can help in interpretation of the data and making various types of conclusions. As the method that can simulate statistical systems, Monte Carlo simulation aims to produce a characteristic collection of configurations with accessing quantities without solving and analyzing the system, or without giving exact performance evaluation. Its main principles include ergodicity and detailed balance (Walter and Barkema, 2014). It is also considered as the numerical procedure that is used for calculating mathematical problems by generating simulations of random variables (Rubinstein 1981, Siepmann et al. 1999).

As there is a lot of risk and uncertainty implemented in the process of estimating future values of returns due to great range of possible outcomes, managers and analysts are often using Monte Carlo Simulation as a way to reduce that uncertainty. More precisely, one of the advantages of this method is that it allows managers to achieve greater accuracy by providing better understanding of the uncertainty in the variables that were used in the process. Therefore it is mostly applied when computing exact results is not feasible (Rezvani and Bolduc, 2014). In other words, Monte Carlo simulation is mostly used as the evaluation of measuring the uncertainty (Lepeck 2003, Cox and Harris 2001, and Siebert 2001). This technique can be used for building complex and non-linear models, for estimating the performance and precision of some other models, and for applying different kinds of simulations that include mathematical and physical systems. Because of its characteristics, Monte Carlo simulation finds its applications in the estimation of numerous risks assessments in the areas such as business, engineering, insurance, transportation, research and development, project management, manufacturing, space exploration, etc (Rezvani and Bolduc, 2014). It can be also applied in portfolio and risk management, pricing derivatives, project and strategic planning, cost modelling and many other fields outside finance.

Main characteristics of Monte Carlo Simulation include:

- 1) It generates the probability distribution of one or more outputs by allowing more inputs to be used for the same process
- 2) Various types of probability distributions can be implemented to the inputs of the model
- 3) It represents a stochastic method⁶ because the number it uses have to be random with no correlation between them
- 4) It creates an output in the form of a range of values and illustrates the chances of output's value occurring in that range

⁶ One of the methods in financial modelling where one or more variables that are used in the model are random

Even though the Monte Carlo simulation can be simply applied and it can provide detailed information about the distribution of the model, it has its drawbacks and disadvantages. One of these limitations is that runtime of the model simulation can be very long when working on some complex cases. In order to avoid this problem, it is necessary to use fast computers with programs that can generate pseudo-random numbers and solve the equation of the integral with the final aim to run the simulation of variables' values by providing a particular function of the probability distribution (Herrador and Gonzalez, 2004). Another disadvantage is that process of choosing the appropriate functions of probability distributions for the parameters within the model may be complex because of low levels of understanding of the fundamental physical processes or because of the incorrect data (Xiao and Vien, 2003). The accurateness of these numerical simulations is mostly depended on the characteristics and the quality of the random number generator (Locci et al., 2002).

3.2. Equity funds

Equity funds are types of mutual or private investment funds that invest money of shareholders by buying common stock and therefore grant the ownership of business that is publicly traded. There are many different categories of equity funds that are available for investing. Some of them include international equity funds, global equity funds, mega, large, mid, small and micro cap equity funds, private equity funds, equity income funds, index equity funds and sector or industry specific equity funds. Investing in equity funds can have many benefits:

- 1) Widespread diversification for a minor initial investment
- 2) Professional management of investors' money
- 3) Possibility of investing in specific sectors, industries and countries
- 4) Often there is no brokerage commissions fee

Nevertheless, investing in equity funds does not necessarily grant the highest possible return. Avramov and Wermers (2006) argued that on average, U.S. equity mutual funds that are actively managed, underperform passive benchmarks. Wermers (2000) also stated that in the period between 1975 and 1994, domestic equity funds in U.S. on average show worse performance than its market benchmarks by 1.2%/year. On the other hand, there is evidence that shows more positive results accomplished by active management skills within various equity funds. In their studies, Baks et al (2001) conclude that investors who use mean-variance approach and do not trust in active management skills can recognize mutual funds with actual positive alphas⁷. Furthermore, various stages of business cycle cause different values of active management, which was confirmed by Moskowitz (2000), who found that during recessions funds that are actively managed generate 6%/year than during expansions. There are many other studies that confirmed dependence of real-time profitability of funds' investment strategies on business cycle variables in order to make allocation of funds among portfolios of equities and individual stocks (Avramov 2004, Avramov and Chordia (2005). These researches bring a conclusion that business cycle variables can be very significant in the process of recognizing equity funds that are actively managed and that outperform benchmarks. Along these lines, Avramov and Wermers (2006) concluded that by taking advantage of business cycle variables, one can identify best fund managers who possess extraordinary investment skills during volatile market conditions. These investors are then able to achieve higher returns due to variation of their allocations to different industries and to individual mutual funds that are actively managed in the industries that are outperforming the market benchmark. Gompers et al. (2008) argued that only more established and experienced funds are able to gain superior returns by directing their investments to particular industries when there are favourable investment conditions.

⁷ Alpha represents one of five technical risk ratios; it is a measure of performance on basis that is risk-adjusted. This ratio compares the price risk of a fund to a benchmark index. Excess return of the fund in relation to the benchmark return is actual fund's alpha.

When considering performance of equity funds and their selection, it is very important to take into account couple of things. Prior beliefs and personal judgement can have great effects on the selection of equity funds. Pastor and Stambaugh (2002) demonstrated that prior beliefs about pricing models and managerial skill influence a lot optimal portfolios of mutual funds. Another significant factor to consider is the risk taken by the fund managers. Giot et al (2014) stated that the managers of new equity funds are opened for taking more risk when making their investments. According to Gompers (1996), novice equity funds are prepared to take excessive risk in the beginning because they want to build good reputation quickly. In the study of Ljungqvist et al. (2008), it is concluded that young funds make larger investments than more experienced funds, which makes their investments less diversified. They also confirmed that these novice funds direct their investment independently of market conditions, thus ignoring the market timing opportunities. Other research studies argued that fund managers in private equity industry take excessive risks because they get compensated for generating good results while they have no responsibility for taking the downside risk (Metrick and Yasuda, 2010; Robinson and Sensoy, 2012).

3.3. Sharpe Ratio

In the process of choosing a particular equity funds for the purpose of this research study, many factors were taken into account. One of the most important factors among them is the so-called Sharpe ratio. Introduced in 1966 by William Forsyth Sharpe, Sharpe ratio was first known as the “reward-to-variability ratio” and then in the following years it adopted its current name. It is also called the Sharpe index or the Sharpe measure and it represents the indicator of an investment performance. It estimates the performance of an investment or a portfolio by relating the excess return

(risk premium)⁸ to the standard deviation or risk of investment and portfolio (Sharpe 1966, Sharpe 1994, Chuang et al. 2008). Considering these characterizations, the Sharpe ratio can be presented as the following equation:

$$\text{Sharpe ratio} = (R_p - R_f) / \sigma_p,$$

Where: R_p stands for the expected average portfolio return, R_f stands for the Risk free rate (for example, the rate of the 10-year U.S. Treasury bond) and σ_p stands for the standard deviation of the portfolio returns

Therefore the Sharpe ratio shows us the how much of a reward is portfolio getting per one unit of risk. In other words, higher returns of a particular portfolio of an equity fund can be considered as a positive thing only if those superior returns come with a reasonable amount of risk. By analyzing the Sharpe ratios, managers can conclude whether the returns of some portfolios are high due to well-directed investment choices or due to result of adjusted risk. In general, the rule says that the higher the Sharpe ratio of a portfolio, the better is the risk-adjusted performance of the portfolio and better job by its managers.

There are many alternative performance measures to a Sharpe ratio. They include: Treynor ratio, Information ratio, Jensen's alphas, Sortino ratio, Bias ratio, etc. All these measures have their own advantages and disadvantages, but most managers and analysts prefer using the Sharpe ratio for more reasons. Firstly, it takes into account both the systematic and unsystematic or idiosyncratic risks while Treynor measure considers only the portfolio's

⁸ Excess return represents the difference between the average portfolio return and the risk-free return.

systematic risk. Therefore it generates better picture and the understanding of the risk taken by the investment. Secondly, Sharpe ratio can be measured directly from the sampled range of returns with no need for getting some extra data on the source of portfolio efficiency. However, like every other performance indicator, Sharpe ratio has its drawbacks. Main limitation of this measure is that it can only take into equation the portfolio returns that are normally distributed (Chuang et al., 2008). This limitation was particularly emphasized in the recent decades and it was considered as incompetent performance indicator, which brought up the increase in the number of other measures (Auer, 2014). Sharpe ratio particularly showed this weakness when evaluating returns of hedge funds because of the asymmetry in their returns and probability distributions that show fat tails⁹ (Bayley and Lopez de Prado 2012, Auer 2014). Bayley and Loped de Prado (2012) concluded that in the case of recently established hedge funds, Sharpe rations often show the overvalued numbers. They also introduced the “Sharpe ratio indifference curve” that explains that portfolio managers with very low or in some case even negative Sharpe ratios can still be considered as efficient managers as long as their work is not too much correlated with that of other managers (Bailey and Lopez de Prado, 2013). Still, there are many opinions that favour Sharpe ratio in spite of this limitation. For example, Eling and Schuhmacher (2007) and Schuhmacher and Eling (2011,2012) compared Sharpe ratio with all other performance indicators and concluded that all measures, including Sharpe ratio, generated approximately the same order of ranking across hedge funds. They also stated that returns that are normally distributed are not necessary in order to support the use of Sharpe ratio for ranking funds. Dowd (2000) also agreed that Sharpe ratio can be applied in the process of estimating hedge fund performance when hedge fund constitutes only a portion or even entire risky investment. Furthermore, another strength of the Sharpe ratio is that it is very easy to be applied because there are already many complicated statistical tests available for it (Ledoit and Wolf, 2008; Lo, 2002). Another fact that confirms why this performance indicator is

⁹ Fat tail is an expression that represents particular characteristic of the probability distribution with having wider range of possible outcomes that are less likely to occur.

preferred by most investors is that it is the standard and most used measure in the majority of empirical studies (Arnold et al., 2004; Huang and Lin, 2011; Hammami et al., 2013).

Nevertheless, another disadvantage of Sharpe ratio that stands out is the fact that, by using the standard deviation as the measure of risk, it considers both the negative and positive volatility as unfavourable events. Therefore this indicator lacks the ability of capturing downside risk especially in the case when there is an asymmetric distribution of returns and when it is important to distinguish good and bad events (Chuang et al., 2008). This limitation was lessened by Dowd (1999) who revised the Sharpe ratio equation and replaced the standard deviation with VaR, which represents the probability of how big of a loss can that specific portfolio have over a given period of time. In other words, he put the downside risk in the equation and managed to consider it while evaluating the performance of the portfolio.

3.4. Mean-Variance Approach

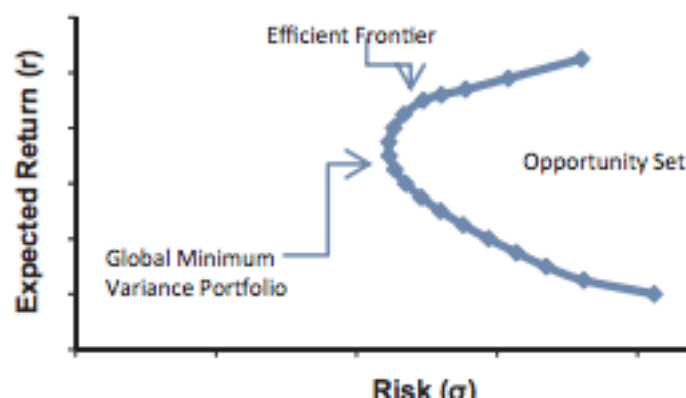
One of the most important difficulties in modern portfolio theory is to estimate the weight percentages of each asset within the portfolio (Gokgoz and Atmaca, 2012). This particular issue is also known as the portfolio selection problem. H. M. Markowitz (1952) in his well-known paper "Portfolio Selection", that is considered as the fundamental study of modern portfolio theory, stated that the portfolio selection process can be broken up into two phases: "The first stage starts with observation and experience and ends with beliefs about the future performances of available securities. The second stage starts with the relevant beliefs about future performances and ends with the choice of portfolio." This theory about the portfolio selection was later strengthened by Sharpe and Linther in their journals where they introduced the use of risk-free asset within the portfolio (Sharpe, 1964;

Linther, 1965). This newly adopted theory was then followed by the concepts of market line and CAMP¹⁰ (Cohen and Natoli, 2003).

These portfolio selection theories have their foundations grounded on a mean-variance approach. This kind of approach is an optimization process that aims to find the efficient portfolios that represent the portfolios that grant the minimum level of risk for a particular return level or the maximum level of return for a given risk level (Lecompte, 2008). According to Defusco et al. (2004), the key assumptions of the mean-variance approach are the following:

- 1) All investors are considered as risk averse and they aim to achieve as less risk as possible in relation to the fixed level of expected return
- 2) Information about the variances, covariance's and expected returns of the complete range of assets is available to the investors
- 3) In order to find out and estimate portfolios that are optimal, investors only need the information about variances, covariances and expected returns
- 4) There are no limitation on taxes or transaction costs

Graph of the efficient portfolios and efficient frontier is presented in the figure bellow:



¹⁰ CAPM or the capital asset pricing model represents the model that is used to estimate the required rate of return of an asset that would be added to certain portfolio, considering only the asset's sensitivity to the systematic or market risk.

In order to apply the mean-variance optimization approach, it is necessary to have the information previously mentioned: expected return of every asset within the portfolio, the variance of each specific asset and the covariance's between these assets within the portfolio (Gokgoz and Atmaca, 2012). In the case of normally distributed returns of an asset, only the mean-variance approach can be used to evaluate and analyze the distribution of the portfolio (Levy and Post, 2005). This approach introduced by Markowitz generates an efficient frontier that represents the part of the curve line on the graph shown above where the efficient portfolios are set on.

The expected return in the case of portfolio consisting of “n” assets can be defined in the following equation:

$$E(R_p) = x_1R_1 + x_2R_2 + x_3R_3 + \dots + x_nR_n,$$

Where “n” stands for the number of assets within the portfolio, “x” stands for the weight percentage of each particular asset in order and “R” stands for the expected return of each asset in order.

The mean-variance model focuses on minimizing the variance of the portfolio with considering following key assumptions:

- 1) Expected return of portfolio needs to be equivalent to the target return
- 2) When added together, the proportions of each asset within the portfolio need to equal “1”
- 3) There is a condition of non-negativity for proportions of these assets

One of the key problems for this mean-variance optimization model is to find out the most favourable proportional allocation “x” to each specific asset in the portfolio. After the efficient portfolios and efficient frontiers are

determined, it is of great importance to estimate the level of risk aversion of the investor (Gokgoz and Atmaca, 2012).

4. Data Analysis

In this chapter process of data collection will be explained which then will be followed by the full analysis of all the data collected. This analysis will help to identify the main patterns of the research that will be in the form of hypothesis testing. Data collected will be then explained and used for further analysis with taking into account main question of this research paper that was mentioned earlier and that can be stated as following: Should investors pay the fund managers' fee to make investments for them? Is this management fee going to bring them enough of extra profit so that it will pay off? Within this chapter, all the research results will be compared with the previously done studies on the similar topic. Also, the importance of the results will be critically evaluated and analysed. Lastly, an understandable argument or the thesis will be put together based on the data collected and its analysis.

4.1. Data Collection

In order to start the whole process of financial analysis, various data had to be collected in appropriate way. For the purpose of this research, data used included information on UK and US top indexes, as well as detailed information on UK and US best performing equity funds. Data collected for FTSE 100 and Dow Jones indexes included average annual returns of each equity within these indexes. Data collected for top equity funds included average annual returns, information on funds' holdings, performance

attribution, value at risk, fund styles and other characteristics. All this data was found on official Bloomberg terminal, where investors have access to a lot of detailed, reliable and valid information about all world indexes, funds, securities, etc. Data including returns of equities within indexes was directly imported to Excel program by using Bloomberg import option. Data regarding equity funds was collected directly from Bloomberg terminal, where funds' tickers were used to find all the necessary and required information.

When doing a research on the best performing equity funds in the UK and US, many characteristics and factors were considered in the process of choosing the final group of funds that will be included in the paper study. These characteristics included:

- 1) Values of Sharpe ratios (the funds with the highest Sharpe ratios were considered)
- 2) Assets size
- 3) Assets class (only the funds that are investing in equities were considered)
- 4) Current management fee
- 5) Access to funds' returns in the period between 2010 and 2013
- 6) Access to funds' first top 10 holdings
- 7) Access to funds' top industry group allocation
- 8) Access to funds' VAR (Value at Risk)¹¹
- 9) Access to funds' performance attribution data

With all these factors in mind, following are the groups of UK and US equity funds that were considered for the research:

UK equity funds:

¹¹ VAR or the Value at risk represents method of measuring and determining the financial risk level within the investment portfolio over a given time period.

- 1) Liontrust Special Situations Fund
- 2) Invesco Perpetual UK Investment Series – High Income Fund
- 3) Rathbone Income Fund
- 4) Standard Life Global Equity Trust
- 5) Aberdeen World Equity Income Fund
- 6) First State Investments ICVC – Global Emerging Markets Leaders Fund

US equity funds:

- 1) Fidelity Equity-Income Fund
- 2) Vanguard Equity Income Fund
- 3) Schroder Global Multi-Cap Equity Fund
- 4) Lazard Emerging Markets Equity Portfolio
- 5) Edgar Lomax Value Fund
- 6) Vulcan Value Partners Fund
- 7) Delaware Pooled Trust – The Large-Cap Value Equity Portfolio
- 8) SEI U.S. Managed Volatility Fund
- 9) Bridgeway Blue Chip 35 Index Fund
- 10) Oppenheimer Equity Income Fund
- 11) Oppenheimer Developing Markets Fund

With all these equity funds fulfilling all the above criteria, final group of equity funds for both UK and US was chosen mainly based on the value of their Sharpe ratios, because this ratio represents the best performance indicator as explained in the section about Sharpe ratio. Therefore, the final equity funds chosen for the purpose of this research study are listed below with a brief description of each fund:

UK equity funds:

- 1) Liontrust Special Situations Fund – Incorporated in the United Kingdom, this authorized unit trust aims to achieve long-term capital

growth. The investments of this fund are mostly directed towards portfolio of various types of shares within UK companies that have the largest opportunities to accomplish capital growth in the long-term (Bloomberg).

- 2) Invesco Perpetual UK Investment Series – High Income Fund is a UCITS certified¹² open-end investment fund with its headquarters in the United Kingdom. This fund aims to accomplish both high-income level and capital growth. Its investments are mostly shifted to UK listed companies while the balance is invested in international companies (Bloomberg).
- 3) Rathbone Income Fund is an unit trust that is authorized and incorporated in the United Kingdom. Fund's goal is to achieve income that is higher than the average return without overlooking the growth and capital security. Primary investments of the fund are directed towards common shares of UK companies (Bloomberg).
- 4) Aberdeen World Equity Income Fund is an OEIC¹³ established in the United Kingdom. This fund focuses on granting its investors capital and income appreciation over the long run in various international companies (Bloomberg).
- 5) Standard Life Global Equity Trust is a UCITS certified unit trust that is authorized and has its headquarters in the United Kingdom. Main goal of the fund is to achieve consistent capital growth. Most investments of this fund target the global portfolio consisted of equities of the main Global markets' companies (Bloomberg).

US equity funds:

¹² Undertakings for Collective Investment in Transferable Securities (UCITS) – directives that permit free collective investments operations throughout EU with the single authorisation from one member state.

¹³ Open Ended Investment Company (OEIC) – certain type of fund or company in the UK that is organized in such way that its investments are mostly directed towards other companies with the ability to regularly change its fund size and criteria for investments.

- 1) Fidelity Equity-Income Fund is an open-end fund established in the United States of America. This fund aims to achieve reasonable income and capital appreciation. Majority of fund's investments are shifted towards the income-producing equity securities, or the large cap "value" stocks (Bloomberg).
- 2) Vanguard Equity Income Fund is an open-end fund that is established in the United States. This fund aims to achieve a current income level that is above the average and the fair increase in value of the long-term capital. Fund's investments are mostly directed towards common stocks of well known medium and large-size companies that pay out reasonable dividends and that potentially can increase the value of their capital (Bloomberg).
- 3) Lazard Emerging Markets Equity Portfolio is also an open-end fund that has its main headquarters in the United States of America. Main goal of the fund is to achieve capital appreciation in the long run. Investments of the fund include equity securities, mostly common stocks, of the companies that are located outside of the U.S. and whose business operations are shifted towards the emerging market countries. Managers of this fund pick these companies after analyzing their asset values or earnings cash flow, which helps them to determine if they are undervalued (Bloomberg).
- 4) Edgar Lomax Value Fund is another open-end fund that is established in the United States of America. This fund seeks to obtain long-term capital appreciation by investing at least 85% of its total assets' value in equity securities that are potentially undervalued. Main target of the fund's investments are large and well-known companies that have low price-to-earnings and price-to-book ratios, high dividends and balance sheet ratios that are strong (Bloomberg).
- 5) Oppenheimer Equity Income Fund is also an open-end fund that is located in the United States of America. This fund is mainly focused on its total return and it invests mostly in common stocks of U.S. companies that fund's managers find out to be undervalued in the

market. Main target of the fund are the larger capitalization stocks (Bloomberg).

Prior to start of data analysis, information gathered needed to be well read and understood. Interpretation of data is very important step in the process because some key assumptions can be made which might help in further analyses of data. In this stage of process, data organization and interpretation included the following steps:

1) Annual returns of FTSE 100 equities from 2010 to 2013 were used to calculate the average annual return of each equity by using the following formula:

$$\text{Average annual return} = ((1 + r_1) * (1 + r_2) * (1 + r_3) * (1 + r_4))^{0.25},$$

Where r_1 , r_2 , r_3 and r_4 represent annual returns of each equity from year 2010 to 2013.

2) After obtaining these results, value of 1 was subtracted so the actual average annual returns (x) were found. These steps are represented in the figure below:

	A	B	C	D	E	F	G	H
1		1	2	3	4	5	6	7
2		AAL LN Equity						
3	Starting from £1	1	1	1	1	1	1	1
4	2010	0.236919	0.46891	0.332492	0.572222	0.610654	1.168993	0.640907
5	2011	-0.27283	-0.03937	-0.38291	0.094135	0.368619	0.326393	-0.20107
6	2012	-0.1808	0.441433	0.445227	0.791876	-0.12529	0.903491	0.112423
7	2013	-0.27041	0.586033	0.219732	0.410454	-0.00202	0.80233	-0.32975
8	(1+x)	0.86	1.34	1.10	1.44	1.18	1.77	0.99
9	x annual return	-0.14	0.34	0.10	0.44	0.18	0.77	-0.01
10								
11								

3) In order to achieve many randomly chosen portfolios consisting of 10 equities that are part of FTSE 100 index, command of Random Number Generation was used. Exactly 1000 simulations were done which generated 1000 different sets consisting of 10 randomly chosen numbers ranging from 1 to 99.99, because this particular FTSE 100 list included 99 companies. In order to assign equal weight to every company option Uniform was used. In this particular case, each number presented a specific equity on the list. Figure below shows small part of the long list of these sets of numbers:

◇	A	B	C	D	E	F	G	H
1	simulation	1	2	3	4	5	6	7
2	1	2.329252	51.44511	62.67125	75.14809	90.57648	84.4166	78.97876
3	2	58.55963	35.36721	15.31665	28.30102	80.44697	21.4735	18.39205
4	3	70.7102	51.26385	19.88746	38.8716	56.20021	6.480143	72.73731
5	4	40.58754	10.63406	36.34904	68.91571	68.32057	96.56113	27.2195
6	5	98.7695	34.71769	3.879039	35.5394	45.94986	53.69276	60.97645
7	6	10.86365	40.25825	74.67681	80.77325	30.23146	45.56619	63.30265
8	7	93.89357	90.67013	18.25309	11.10534	2.957626	81.41068	13.45872
9	8	99.72113	74.5167	35.66931	70.50477	39.46976	96.23486	32.24648
10	9	30.48523	45.60245	35.24636	47.1764	30.2224	55.85279	7.664386
11	10	85.78211	24.31931	52.8801	88.88772	12.4648	90.63086	27.97777

4) Since these numbers are not round and they represent numbers of specific equities in order, Rounddown function was used to round the numbers. The results after this step are shown below:

◇	A	B	C	D	E	F	G	H
1	simulation	1	2	3	4	5	6	7
2	1	2	51	62	75	90	84	78
3	2	58	35	15	28	80	21	18
4	3	70	51	19	38	56	6	72
5	4	40	10	36	68	68	96	27
6	5	98	34	3	35	45	53	60
7	6	10	40	74	80	30	45	63
8	7	93	90	18	11	2	81	13
9	8	99	74	35	70	39	96	32
10	9	30	45	35	47	30	55	7
11	10	85	24	52	88	12	90	27

- 5) In the next step, the average annual returns (x) from specific equities were assigned to the each number in the table shown above. For example, number 51 in the cell C2 represented the equity or the asset number 51 on the FTSE 100 index list used for this research. This step was done by using the function HLOOKUP, which gave an option of selecting a separate table of all 99 equities and their average annual returns and assigning them to the previous list of rounded numbers. The final results after this step can be find in the table bellow:

	A	B	C	D	E	F	G	H
1	simulation	1	2	3	4	5	6	7
2	1	0.340183	0.283645	0.306961	0.168281	-0.01904	0.109759	0.198113
3	2	0.324846	-0.04071	0.297812	0.012558	0.211344	0.286947	0.01913
4	3	0.02894	0.283645	0.246022	0.083144	0.324846	0.77247	-0.06306
5	4	0.210576	0.117198	0.110815	0.195487	0.195487	0.285005	0.117703
6	5	0.258111	0.367837	0.097244	-0.04071	0.410603	0.069691	0.086145
7	6	0.117198	0.210576	0.073307	0.211344	0.184086	0.410603	0.150476
8	7	0.140929	-0.01904	0.01913	0.111544	0.340183	0.143624	0.04269
9	8	0.309587	0.073307	-0.04071	0.02894	0.029803	0.285005	0.020107
10	9	0.184086	0.410603	-0.04071	0.172995	0.184086	0.324846	-0.00568
11	10	0.008036	0.070222	0.227236	-0.09182	0.2629	-0.01904	0.117703

- 6) Following step included averaging the returns of each randomly chosen portfolio that consisted of 10 different average annual returns. This was done by using the function Average and assigning particular cells in the equation. The results of average returns for each set can be found in the table bellow on the right side:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	simulation	1	2	3	4	5	6	7	8	9	10		simulation average return
2	1	0.340183	0.283645	0.306961	0.168281	-0.01904	0.109759	0.198113	0.211344	0.211021	0.097244		0.19075096
3	2	0.324846	-0.04071	0.297812	0.012558	0.211344	0.286947	0.01913	0.283645	0.123435	0.269447		0.178845093
4	3	0.02894	0.283645	0.246022	0.083144	0.324846	0.77247	-0.06306	-0.00503	0.082976	0.097315		0.185127342
5	4	0.210576	0.117198	0.110815	0.195487	0.195487	0.285005	0.117703	0.324846	0.324846	0.097933		0.197989704
6	5	0.258111	0.367837	0.097244	-0.04071	0.410603	0.069691	0.086145	0.335732	0.01913	0.008036		0.161181527
7	6	0.117198	0.210576	0.073307	0.211344	0.184086	0.410603	0.150476	0.443986	0.324846	0.211021		0.233744226
8	7	0.140929	-0.01904	0.01913	0.111544	0.340183	0.143624	0.04269	-0.00503	0.036924	0.097315		0.09082713
9	8	0.309587	0.073307	-0.04071	0.02894	0.029803	0.285005	0.020107	0.246022	0.244489	0.324846		0.152139424
10	9	0.184086	0.410603	-0.04071	0.172995	0.184086	0.324846	-0.00568	0.108869	0.145994	0.373943		0.18590288
11	10	0.008036	0.070222	0.227236	-0.09182	0.2629	-0.01904	0.117703	0.102713	0.009328	-0.09182		0.059544822
12	11	0.306961	0.285005	0.198113	0.168281	0.244489	0.145994	0.283645	-0.06306	0.351475	0.194863		0.211576907
13	12	0.097244	0.24366	0.070222	0.344688	0.324846	0.237898	-0.00568	0.070222	0.30099	0.123435		0.180752538
14	13	0.177564	0.277625	0.097933	0.04269	0.073307	0.184699	0.110347	0.110815	0.097933	0.145994		0.13189086
15	14	0.2629	0.200721	0.340283	0.30601	0.073307	0.110815	0.441489	0.30099	0.109759	0.150476		0.229674908
16	15	0.097315	0.286947	0.097244	0.191718	-0.06306	0.340183	0.02894	0.340283	0.110815	0.340183		0.177057111
17	16	0.324846	0.070222	0.177564	0.195487	0.441489	0.083144	0.286947	0.04269	0.211021	0.116892		0.195030218
18	17	0.140929	-0.09182	0.123435	0.367837	0.097315	0.143624	0.117703	0.283645	0.285005	0.297812		0.176547938
19	18	0.285005	0.237637	0.198113	0.244489	0.194863	0.211021	-0.09182	0.324846	0.410603	0.410603		0.242535391
20	19	0.285005	0.097244	0.198113	0.324846	0.184699	0.77247	0.324846	0.77247	0.145994	0.037327		0.314301382
21	20	0.168281	0.086574	0.189109	0.111544	0.109759	0.130953	0.02894	-0.09182	0.195487	0.194863		0.112368388

- 7) After getting the average returns of all 1000 randomly chosen portfolios, the next step was to sort these returns from the smallest to largest. This was accomplished with function SORT within the DATA options. The returns ranging from the smallest to largest are represented in the figure bellow, where only a small portion of the list is shown:

	A	B	C	D	E
1		Returns			
2		0.041056			
3		0.048737			
4		0.059545			
5		0.060083			
6		0.066691			
7		0.070663			
8		0.074704			
9		0.074811			
10		0.077414			
11		0.077786			
12		0.079735			
13		0.08743			
14		0.088029			

- 8) In order to determine what would be the worst 5% potential average return outcomes for these 1000 sets of randomly chosen 10 assets portfolios from FTSE100, the worst 50 average return values had to be considered¹⁴. The worst average return in this list equals 4.11%, while the 50th worst average return shows the value of 11.62%. Therefore the worst 5% possible return lies in the range between these two values. The 50th worst performance is shown in the figure bellow:

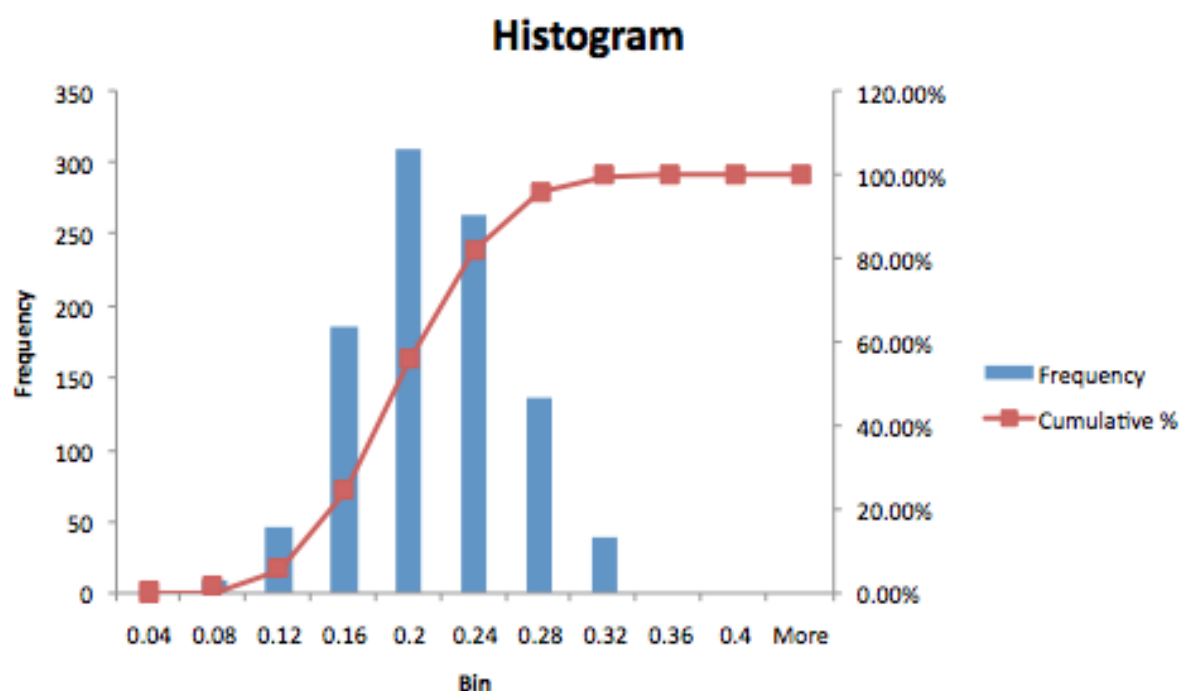
48		0.112963		
49		0.113292		
50		0.116199		
51		0.116853		
52		0.117012		

¹⁴ 5% of 1000 is equivalent to: $0.05 * 1000 = 50$

9) Before showing the probability distribution graph, Bin values had to be assigned in order to determine the margin between every group of return level that will be presented on the graph. Bin values used are shown in the figure bellow:

P	Q	R
	Bin Value	
	0.04	
	0.08	
	0.12	
	0.16	
	0.2	
	0.24	
	0.28	
	0.32	
	0.36	
	0.4	

10) Final step included the use of function Histogram, which generates the graph of all the probability distribution of average annual returns included in the list. This graph of the probability distributions is shown bellow and represents a very important step in the research methodology:



11) Extra information on this graph that helped in the further analysis can be found in the figure bellow. It represents numbers of average returns that fall into the certain group of return level:

◇	A	B	C
1	<i>Bin</i>	<i>Frequency</i>	<i>Cumulative %</i>
2	0.04	0	0.00%
3	0.08	11	1.10%
4	0.12	47	5.80%
5	0.16	187	24.50%
6	0.2	309	55.40%
7	0.24	264	81.80%
8	0.28	137	95.50%
9	0.32	40	99.50%
10	0.36	5	100.00%
11	0.4	0	100.00%
12	More	0	100.00%

All these steps were repeated in the process of generating the randomly selected portfolios of 10 assets from US Dow Jones index by using the Monte Carlo simulation. In this case, the range of asset selection was smaller since the Dow Jones index includes 30 equities while the FTSE100 included 99 equities in this particular case. All the steps of this process are shown bellow:

1) Annual returns of Dow Jones equities from 2010 to 2013 were used to calculate the average annual return of each equity by using the same formula for the average annual return in the case of FTSE100:

$$\text{Average annual return} = ((1 + r_1) * (1 + r_2) * (1 + r_3) * (1 + r_4))^{0.25},$$

Where r_1 , r_2 , r_3 and r_4 represent annual returns of each equity from year 2010 to 2013.

2) After obtaining these results, value of 1 was subtracted so the actual average annual returns (x) were found. These steps are represented in the figure below:

◇	A	B	C	D	E	F	G	H
1		1	2	3	4	5	6	7
2		AXP UN Equity						
3	Starting fro	1	1	1	1	1	1	1
4	2010	0.076999	0.236653	0.673627	-0.15497	0.222107	0.530146	0.175504
5	2011	0.115797	0.149709	-0.01345	-0.09738	0.19989	-0.04932	0.015729
6	2012	0.235107	0.051397	0.011038	0.111173	0.049342	0.019441	0.347733
7	2013	0.593424	0.836916	0.038736	0.175573	0.191141	0.484323	0.551717
8	(1+x)	1.24	1.29	1.15	1.00	1.16	1.22	1.26
9	x annual re	0.24	0.29	0.15	0.00	0.16	0.22	0.26
10								
11								

3) In the similar process of randomly choosing portfolios consisting of 10 equities that are part of Dow Jones 30 index, command of Random Number Generation was used. Exactly 1000 simulations were done which generated 1000 different sets consisting of 10 randomly chosen numbers ranging from 1 to 30.99, because this index list included exactly 30 companies. In order to assign equal weight to every company option Uniform was used. In this particular case, each number presented a specific equity on the list. Figure below shows small part of the long list of these sets of numbers:

◇	A	B	C	D	E	F	G	H
1	simulation	1	2	3	4	5	6	7
2	1	1.40271	16.28285	19.68392	23.4639	28.13808	26.27189	24.62444
3	2	18.43826	11.41189	5.33737	9.271115	25.06925	7.20265	6.269095
4	3	22.1194	16.22793	6.722144	12.47358	17.72345	2.660264	22.73353
5	4	12.99344	3.918733	11.70934	21.57574	21.39543	29.95119	8.943456
6	5	30.62024	11.21511	1.872233	11.46405	14.61801	16.96379	19.17046
7	6	3.988292	12.89368	23.32112	25.16809	9.85596	14.50177	19.8752
8	7	29.14303	28.16645	6.226993	4.061512	1.593082	25.36121	4.774491
9	8	30.90854	23.27261	11.50341	22.05716	12.65479	29.85234	10.46643
10	9	9.932841	14.51275	11.37528	14.9896	9.853214	17.6182	3.019042
11	10	26.68558	8.064816	16.71759	27.62646	4.473374	28.15456	9.173183

- 4) Like before, same function called Rounddown was used to round the numbers since they represent numbers of specific equities in order. The results after this step are shown bellow:

	A	B	C	D	E	F	G	H
1	simulation	1	2	3	4	5	6	7
2	1	1	16	19	23	28	26	24
3	2	18	11	5	9	25	7	6
4	3	22	16	6	12	17	2	22
5	4	12	3	11	21	21	29	8
6	5	30	11	1	11	14	16	19
7	6	3	12	23	25	9	14	19
8	7	29	28	6	4	1	25	4
9	8	30	23	11	22	12	29	10
10	9	9	14	11	14	9	17	3
11	10	26	8	16	27	4	28	9

- 5) In the next step, the average annual returns (x) from specific equities were assigned to the each number in the table shown above. For example, number 16 in the cell C2 represented the equity or the asset number 16 on the Dow Jones index list used for this research. This step was done like before by using the function HLOOKUP which enabled a selection of a separate table of all 30 equities and their average annual returns. These returns were then assigned to the previous list of rounded numbers. The final results after this step can be find in the table bellow:

	A	B	C	D	E	F	G	H
1	simulation	1	2	3	4	5	6	7
2	1	0.240107	0.149814	0.079665	0.115826	0.176095	0.157349	0.189496
3	2	0.124936	0.113177	0.163544	0.0247	0.270835	0.257056	0.218048
4	3	0.10923	0.149814	0.218048	0.099022	0.168307	0.28728	0.10923
5	4	0.099022	0.147525	0.113177	0.180294	0.180294	0.127424	0.201874
6	5	0.129981	0.113177	0.240107	0.113177	0.109653	0.149814	0.079665
7	6	0.147525	0.099022	0.115826	0.270835	0.0247	0.109653	0.079665
8	7	0.127424	0.176095	0.218048	-0.00092	0.240107	0.270835	-0.00092
9	8	0.129981	0.115826	0.113177	0.10923	0.099022	0.127424	0.327889
10	9	0.0247	0.109653	0.113177	0.109653	0.0247	0.168307	0.147525
11	10	0.157349	0.201874	0.149814	0.271661	-0.00092	0.176095	0.0247

- 6) In the following step, average returns of each randomly chosen portfolio that consisted of 10 different average annual returns is calculated by using the function Average and assigning particular cells in the equation. The results of average returns for each set can be found in the table bellow on the right side:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	simulation	1	2	3	4	5	6	7	8	9	10		simulation average return
2	1	0.240107	0.149814	0.079665	0.115826	0.176095	0.157349	0.189496	0.270835	0.189496	0.240107		0.180879023
3	2	0.124936	0.113177	0.163544	0.0247	0.270835	0.257056	0.218048	0.149814	0.218048	0.127746		0.166790432
4	3	0.10923	0.149814	0.218048	0.099022	0.168307	0.28728	0.10923	0.218048	0.115826	0.176095		0.165090044
5	4	0.099022	0.147525	0.113177	0.180294	0.180294	0.127424	0.201874	0.124936	0.168307	0.270835		0.161368632
6	5	0.129981	0.113177	0.240107	0.113177	0.109653	0.149814	0.079665	0.127424	0.218048	0.157349		0.143839633
7	6	0.147525	0.099022	0.115826	0.270835	0.0247	0.109653	0.079665	0.28728	0.168307	0.189496		0.149230834
8	7	0.127424	0.176095	0.218048	-0.00092	0.240107	0.270835	-0.00092	0.257056	0.327889	0.176095		0.179171651
9	8	0.129981	0.115826	0.113177	0.10923	0.099022	0.127424	0.327889	0.218048	0.189496	0.168307		0.159840038
10	9	0.0247	0.109653	0.113177	0.109653	0.0247	0.168307	0.147525	0.201874	0.257056	0.168307		0.132495166
11	10	0.157349	0.201874	0.149814	0.271661	-0.00092	0.176095	0.0247	0.147525	0.10923	0.271661		0.150899347
12	11	0.079665	0.127424	0.189496	0.115826	0.189496	0.257056	0.149814	0.10923	0.127109	0.180294		0.152540985
13	12	0.240107	0.079665	0.257056	0.127746	0.168307	0.109653	0.147525	0.201874	0.10923	0.218048		0.165921034
14	13	0.163544	0.109653	0.270835	-0.00092	0.115826	0.176095	0.180294	0.113177	0.270835	0.257056		0.165639816
15	14	-0.00092	0.0247	0.157349	0.129981	0.115826	0.113177	0.327889	0.10923	0.157349	0.258307		0.139289292
16	15	0.176095	0.257056	0.240107	0.127424	0.10923	0.240107	0.10923	0.157349	0.113177	0.240107		0.176988184
17	16	0.124936	0.201874	0.163544	0.180294	0.327889	0.099022	0.257056	-0.00092	0.189496	0.149814		0.169300773
18	17	0.127424	0.271661	0.218048	0.113177	0.176095	0.270835	0.201874	0.149814	0.127424	0.163544		0.181989646
19	18	0.127424	0.271661	0.189496	0.189496	0.180294	0.189496	0.271661	0.124936	0.109653	0.109653		0.176377019
20	19	0.127424	0.240107	0.189496	0.168307	0.176095	0.28728	0.124936	0.28728	0.257056	0.258307		0.211628705
21	20	0.115826	0.258307	0.271661	-0.00092	0.157349	0.127109	0.10923	0.271661	0.180294	0.180294		0.167081459

- 7) After getting the average returns of all 1000 randomly chosen portfolios, the next step involved arranging these returns from the smallest to largest by using the function SORT within the DATA options. The returns ranging from the smallest to largest are represented in the figure bellow, where only a small portion of the list is shown:

	A	B	C	D	E
1		Returns			
2		0.09573446			
3		0.096717537			
4		0.100081235			
5		0.106218824			
6		0.107672008			
7		0.107978369			
8		0.10914642			
9		0.109427142			
10		0.109683095			
11		0.110980168			

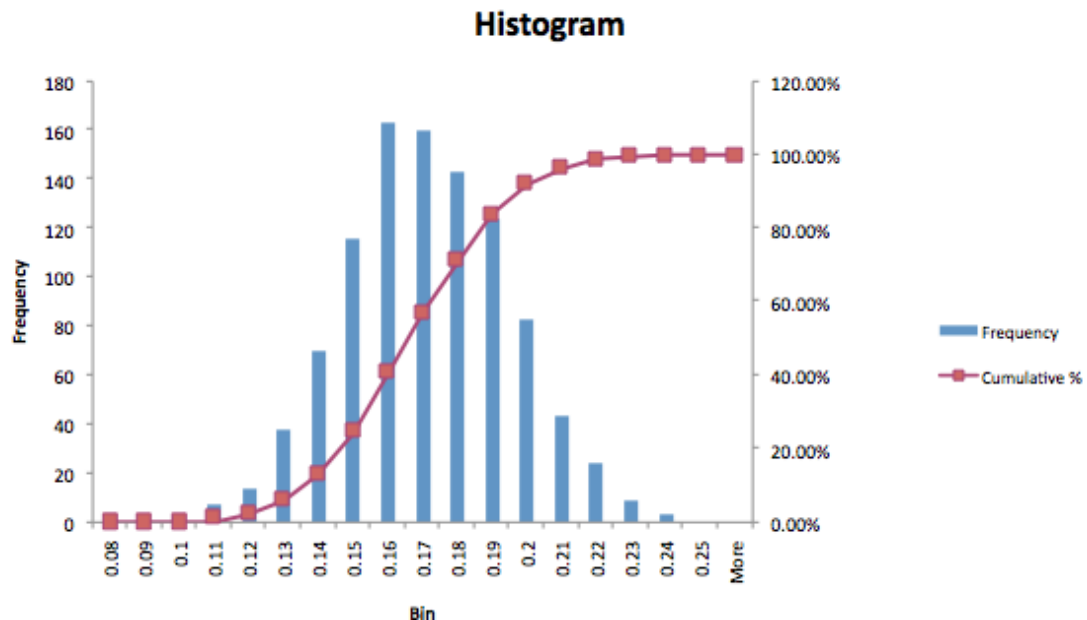
- 8) In order to determine what would be the worst 5% potential average return outcomes for these 1000 sets of randomly chosen 10 assets portfolios from Dow Jones 30 index, the worst 50 average return values had to be considered (similar to what was done in the case of FTSE100). The worst average return in this list equals 9.57%, while the 50th worst average return shows the value of 12.71%. Therefore the worst 5% possible return lies in the range between these two values. The 50th worst performance is shown in the figure bellow:

48	0.126646573
49	0.126839233
50	0.127092185
51	0.127116871
52	0.127117529

- 9) Before showing the probability distribution graph, Bin values had to be assigned in order to determine the margin between every group of return level that will be presented on the graph. Bin values used are shown in the figure bellow:

J	K	L	M	N
		Bin Value		
		0.08		
		0.09		
		0.1		
		0.11		
		0.12		
		0.13		
		0.14		
		0.15		
		0.16		
		0.17		
		0.18		
		0.19		
		0.2		
		0.21		
		0.22		
		0.23		
		0.24		
		0.25		

- 10) Final step included the use of function Histogram in order to generate the graph of all the probability distribution of average annual returns included in the list. This graph of the probability distributions is shown bellow and represents a very important step in the research methodology, like mentioned before:



- 11) Extra information on this graph that helped in the further analysis can be found in the figure bellow. It represents numbers of average returns that fall into the certain group of return level:

	A	B	C
1	Bin	Frequency	Cumulative %
2	0.08	0	0.00%
3	0.09	0	0.00%
4	0.1	2	0.20%
5	0.11	7	0.90%
6	0.12	14	2.30%
7	0.13	38	6.10%
8	0.14	70	13.10%
9	0.15	116	24.70%
10	0.16	163	41.00%
11	0.17	160	57.00%
12	0.18	143	71.30%
13	0.19	124	83.70%
14	0.2	83	92.00%
15	0.21	43	96.30%
16	0.22	24	98.70%
17	0.23	9	99.60%
18	0.24	3	99.90%
19	0.25	1	100.00%

After all these steps, calculations, analysis and given results, following conclusions can be made at this stage of the research:

- 1) In the case of randomly choosing the portfolio of 10 assets from the FTSE100 list of 99 companies (based on the 1,000 simulations), investors are guaranteed the return of at least 4.11%. They can also be 95% confident that they will not earn less than 11.62% of annual return, which represents the limit for 5% worst performance. Investors can also count on the average mean return in the range between 16% and 24% based on the frequency distribution layout that can be found in the Frequency table for FTSE100 random portfolios.
- 2) In the case of randomly choosing the portfolio of 10 assets from the Dow Jones list of 30 companies (based on the 1,000 simulations), investors are guaranteed the return of at least 9.57%, They can also be 95% confident that they will not earn less than 12.71% of annual return, which represents the limit for 5% worst performance. Investors can also count on the average mean return in the range between 15% and 19% based on the frequency distribution layout that can be found in the Frequency table for Dow Jones random portfolios.

4.2. Empirical Results

After running the Monte Carlo simulation and doing the process of data analysis, some important conclusions regarding the main research question have been made. In order to answer the question whether the investors should pay the management fees of professional managers of equity funds, many factors had to be taken into account. Most important factor is the average return of these equity funds. These average returns from a chosen UK and US equity funds have been calculated and compared with the average

return of 1,000 randomly chosen portfolios consisted of 10 assets from the best performing UK and US indexes. The results of these steps are shown in the table below:

Chosen UK Equity Funds	Liontrust	Invesco Perpetual	Rathbone	Aberdeen	Standard Life		UK random
Total return for 2010	36.11	11.1	18.68	15.3	16.78		
Total return for 2011	7.86	8.99	-0.15	0.53	-12.28		
Total return for 2012	22.16	7.68	14.94	6.59	17.05		
Total return for 2013	19.8	25.53	23.93	4.33	26.91		
Total Average Return from 2010 - 2013	21.4825	13.325	14.35	6.6875	12.115		19.42
Chosen US Equity Funds	Fidelity	Vanguard	Lazard	Edgar	Oppenheimer income		US random
Total return for 2010	15.13	14.88	22.81	13.34	20.86		
Total return for 2011	-4.68	10.61	-17.75	8.95	-6.43		
Total return for 2012	17.23	13.49	22.36	7.04	19.14		
Total return for 2013	27.68	30.07	-0.8	31.49	31.63		
Total Average Return from 2010 - 2013	13.84	17.2625	6.655	15.205	16.3		16.63

In the first part of the table, 5 UK equity funds are shown and their average returns (as percentages) for each year within the period between 2010 and 2013. Below that, total average return of these equity funds is calculated. On the right side of the table, average return of the randomly selected portfolio of 10 assets from FTSE 100 (generated by Monte Carlo simulation) is shown with the value of 19.42%. This return outperformed 4 out of 5 UK equity funds. Only the Liontrust equity fund outperformed the portfolio with the average return of 21.48%. According to Bloomberg, this fund invested 95.82% of its capital in equities, with evenly spread investments over the various industry groups. Its top industry group allocation is in the following order: Software (11.93%), Oil&Gas (11.20%), Commercial stocks (10.25%), Pharmaceutical (9.52%), Electronics (7.87%), Diversified Financial (7.17%), etc. Its geographical allocation is as following: United Kingdom (89.15%), Netherlands (3.82%), Ireland (2.85%), etc.

In the second part of the table, 5 US equity funds and their returns are shown in the same pattern. In the US scenario, it is the similar situation, where the randomly chosen portfolio outperformed 4 out of 5 US equity

funds by the return of 16.63%. However, only one US equity fund completely underperformed in relation to the portfolio, while all others were within 2-3% range away from the portfolio average return. The US equity fund that outperformed the portfolio the most is Vanguard equity fund with the average return of 17.26%. This fund invested 97.24% of its capital in equities with spread investments spread across the industry groups as following: Pharmaceutical (11.95%), Oil&Gas (10.75%), Banks (9.91%), Telecommunications (5.58%), Miscellaneous (5.41%), Retail (4.72%), etc. Its geographical allocation order looks like this: United States (85.97%), United Kingdom (3.53%), Switzerland (2.21%), Netherlands (1.95%), etc.

Sector allocation and security selection

For the purpose of this research, two most important performance attributions that are considered as the factors that affected the fund's return the most are sector allocation and security selection.

1) Sector allocation represents the practice of having investments in different industries or sectors within the same portfolio or a fund. Investing in wide range of industry sectors reduces the systematic risk, because the portfolio becomes more diversified. This kind of strategy makes the process of making profit more possible and enables the avoidance of loss. However, in normal market circumstances, the less risk the managers take, the less return their portfolios will get. Based on Global Industry Classification Standard (GICS)¹⁵, 10 main sectors include: Energy, Materials, Industrials, Consumer Discretionary, Consumer Staples, Health Care, Financials, Information Technology, Telecommunication Services and Utilities. Another popular classification is the Industry Classification Benchmark (ICB) and it includes system of ten industries: Oil & Gas, Basic Materials, Industrials, Consumer Goods, Health Care, Consumer Services, Telecommunications, Utilities, Financials and Technology.

¹⁵ Global Industry Classification Standard (GICS) is an industry classification set by Standard & Poor's and MSCI and it includes 10 different sectors, 24 industry groups and 68 industries.

In the case of Liontrust Special Situations Fund (UK), the managers built up the portfolio with the following sector allocation:

- 1) Information Technology (16.57%)
- 2) Financials (13.55%)
- 3) Health Care (9.06%)
- 4) Materials (8.94%)
- 5) Industrials (7.92%)
- 6) Consumer Staples (7.71%)
- 7) Cash (6.24%)
- 8) Telecommunication Services (4.30%)
- 9) Utilities (3.89%)
- 10) Consumer Discretionary (3.52%)
- 11) Funds (3.25%)
- 12) Energy (1.61%)

The most positive attribution was achieved in the sectors of Consumer Discretionary, Energy and Consumer Staples.

In the case of Vanguard Equity Income Fund (US), managers constructed the portfolio with the sector allocation as follows:

- 1) Financials (16.16%)
- 2) Information Technology (13.53%)
- 3) Health Care (12.68%)
- 4) Consumer Staples (12.61%)
- 5) Energy (12.23%)
- 6) Industrials (12.22%)
- 7) Utilities (6.6%)
- 8) Consumer Discretionary (5.69%)
- 9) Telecommunication Services (4.05%)
- 10) Materials (3.77%)
- 11) Funds (0.42%)

The most positive attribution was achieved in the sectors of: Health Care, Information Technology, Consumer Staples, Industrials and Financials.

2) Security selection is the process of choosing specific companies' stocks, derivatives or even other assets as investments within the portfolio. In order to make a security selection, more factors need to be considered. These factors include return, risk, ethics and factors that can have impact on both the individual securities and the total portfolio. Security selection can be represented as the list of fund's holdings.

For the Liontrust Special Situations Fund (UK), security selection list or the top holdings within its portfolio include:

- 1) Compass Group PLC (net 4.12%; value of 50.92 million)
- 2) BP PLC (net 3.85%; value of 47.51 million)
- 3) Royal Dutch Shell PLC (net 3.82%; value of 47.23 million)
- 4) BG Group PLC (net 3.53%; value of 43.63 million)
- 5) EMIS Group PLC (net 3.52%; value of 43.47 million)
- 6) Advanced Computer Soft (net 3.52%; value of 43.46 million)
- 7) AstraZeneca PLC (net 3.37%; value of 41.64 million)
- 8) GlaxoSmithKline PLC (net 3.31%; value of 40.86 million)
- 9) Unilever PLC (net 3.26%; value of 40.26 million)
- 10) Reed Elsevier PLC (net 3.18%; value of 39.28 million)

For the Vanguard Equity Income Fund (US), security selection list or the top holdings within its portfolio includes:

- 1) Johnson & Johnson (net 4.03%; value of 651.08 million)
- 2) Wells Fargo & Co (net 3.90%; value of 629.71 million)
- 3) Microsoft Corp (net 3.57%; value of 575.55 million)
- 4) Exxon Mobil Corp (net 3.39%; value of 548.10 million)
- 5) Verizon Communications Inc (net 3.03%; value of 488.43 million)

- 6) JPMorgan Chase & Co (net 2.98%; value of 482.37 million)
- 7) Chevron Corp (net 2.90%; value of 468.69 million)
- 8) Merck & Co Inc (net 2.85%; value of 459.97 million)
- 9) General Electric Co (net 2.23%; 359.34 million)
- 10) Marsh & McLennan Cos Inc (net 1.99%; value of 322.57 million)

As it can be seen in the lists above, the security selection is quite broad and it includes various companies from different sectors and industry groups. One of the reasons why these two particular equity funds outperformed the two randomly selected portfolios (one from UK FTSE100 and other from US Dow Jones index) is that these funds didn't assign equal weight for each particular asset within the portfolio as it was the case in the process of randomly selecting the portfolios by using Monte Carlo simulation. This can bring a conclusion that security selection is a critical part in the investment process and it has major effects on the expected return.

Another important factor that had to be taken into account when estimating the performance of randomly selected portfolios and equity funds is the Sharpe ratio. This ratio serves as an indicator of an investment performance because it estimates the performance of an investment or a portfolio by relating the excess return (risk premium) to the standard deviation or risk of investment and portfolio (Sharpe 1966, Sharpe 1994, Chuang et al. 2008). Following figure shows the calculated Sharpe ratios for UK equity funds and the randomly selected portfolio from UK index FTSE 100:

Chosen UK Equity Funds	Liontrust	Invesco Perpetual	Rathbone	Aberdeen	Standard Life		UK random portfolio
Total return for 2010	36.11	11.1	18.68	15.3	16.78		
Total return for 2011	7.86	8.99	-0.15	0.53	-12.28		
Total return for 2012	22.16	7.68	14.94	6.59	17.05		
Total return for 2013	19.8	25.53	23.93	4.33	26.91		
Total Average Return from 2010 - 2013	21.4825	13.325	14.35	6.6875	12.115	Return	19.4230103
Standard deviation(risk)	11.58772447	8.257741822	10.3460685	6.2625148	16.93245897	Std	4.95625982
Sharpe Ratio	1.85390152	1.613637274	1.38700029	1.06786175	0.715489701	Sharpe	3.91888461

Even though, the original equation for the Sharpe ratio includes the excess return or the risk premium, which is calculated by subtracting the risk-free rate (R_f) from the average portfolio return (R_p), in this case the risk-free return was taken out from the equation because it was the same for all the calculations due to the same time interval. Therefore the steps in finding the Sharpe ratio of each equity fund for the period between 2010 and 2013 were as follows:

- 1) Average returns were found by using the function AVERAGE and by including returns of 4 given years
- 2) Standard deviation of these returns was found by using the function STDEV and including the same returns of these 4 years
- 3) Finally, Sharpe ratio was calculated by dividing the average return by the standard deviation for a given equity fund

As it can be concluded from the table, the highest Sharpe ratio was found in the case of Liontrust Fund with the value of 1.85.

Same process was done for calculation of the Sharpe ratio for the randomly selected portfolio from FTSE100. The difference here is that 1,000 returns were used for calculating the average return and the standard deviation. Final result is shown in the figure bellow:

996		0.317819695	
997		0.320346963	
998		0.323634153	
999		0.32662059	
1000		0.335429816	
1001		0.338215078	
1002			
1003	Average return	0.194230103	
1004			
1005			
1006			
1007	Standard deviation (risk)	0.049562598	
1008			
1009	Sharpe ratio	3.918884612	

Even though the Liontrust fund was the only equity fund from the list that outperformed the random portfolio, Sharpe ratio calculated for the random portfolio was higher than fund's ratio and it shows the value of 3.91.

Similar process was done in the case of US equity funds and US randomly selected portfolio from Dow Jones index. Final results from the funds' Sharpe ratios calculations can be found in the figure bellow:

Chosen US Equity Funds	Fidelity	Vanguard	Lazard	Edgar	Oppenheimer income		US random portfolio
Total return for 2010	15.13	14.88	22.81	13.34	20.86		
Total return for 2011	-4.68	10.61	-17.75	8.95	-6.43		
Total return for 2012	17.23	13.49	22.36	7.04	19.14		
Total return for 2013	27.68	30.07	-0.8	31.49	31.63		
Total Average Return from 2010 - 2013	13.84	17.2625	6.655	15.205	16.3	Return	16.634113
Standard deviation(risk)	13.51162709	8.721541817	19.6537706	11.1724617	16.12989977	Std	2.37272111
Sharpe Ratio	1.024302988	1.979294529	0.33861187	1.36093552	1.010545647	Sharpe	7.01056392

In this case, as expected, the highest ratio was found for the Vanguard fund with the value of 1.98. In spite of the fact that this fund outperformed the random portfolio, it had a much lower average Sharpe ratio, based on the calculations. Random portfolio from US index Dow Jones shows the Sharpe ratio of 7.01. This final result can be found in the following figure:

	0.225469268
	0.226349712
	0.229882905
	0.232218402
	0.232225377
	0.232595765
	0.249622888
Average return of randomly selected portfolios	0.16634113
Standard deviation (risk)	0.023727211
Sharpe ratio	7.010563915

All this results can bring a conclusion that randomly selected portfolios will bring much more return than the equity funds given the same amount of risk. In other words, random portfolios will give higher reward per one unit of risk, comparing to selected funds.

Management fees and minimum investment

Of course, another important factor that has to be taken into account when comparing the randomly selected portfolios of 10 assets from FTSE100 and Dow Jones indexes and the chosen equity funds are the management fees and the minimum investment that is required to invest in a particular equity fund.

1) Management fee represents a charge collected by a professional investment manager for supervising and controlling an investment fund. By paying this fee, investors compensate the managers for selecting particular securities, for doing all the necessary paperwork, for providing all the information about fund's performance and its holdings and overall for their time and knowledge. Even though management fees are different for every fund, they usually represent the percentage of investments that are taken by the investor and are under fund managers' control. Management fees of 10 chosen equity funds for the year 2013 are shown in the figure below:

Chosen UK Equity Funds	Liontrust	Invesco Perpetual	Rathbone	Aberdeen	Standard Life
Current management fee (2013)	1.75%	1.67%	0.49%	1.50%	0.13%
Chosen US Equity Funds	Fidelity	Vanguard	Lazard	Edgar	Oppenheimer income
Management fee (2013)	0.45%	0.27%	1%	0.80%	0.59%

As it can be seen in the figure, highlighted are the management fees of the 2 equity funds that outperformed the random portfolios: Liontrust Special Situations Fund (UK) and Vanguard Equity Income Fund (US). In the case of

the Liontrust fund, the fee of 1.75% of the investments is the highest among all the other chosen equity funds, including both the UK and US market. In the case of Vanguard fund, the management fee of 0.27% is the lowest from the US chosen funds and second to lowest from both UK and US selected equity funds.

2) Minimum investment represents the smallest amount of money that can be invested in a certain investment fund. One of the factors that determine the volume of the minimum investment is the fund's strategy and liquidity demand. With high minimum investment required, managers are able to set aside short-term investors and control the fund's cash flows. Minimum investments for the selected 10 equity funds are shown in the figure below:

Chosen UK Equity Funds	Liontrust	Invesco Perpetual	Rathbone	Aberdeen	Standard Life
Minimum investment (2013)	2,500 pounds	500 pounds	30 million pounds	500 pounds	100,000 pounds
Chosen US Equity Funds	Fidelity	Vanguard	Lazard	Edgar	Oppenheimer income
Minimum investment (2013)	2,500 dollars	3,000 dollars	100,000 dollars	2,500 dollars	1,000 dollars

As it can be seen from the figure, the highlighted are the minimum investments for the Liontrust Special Situations Fund (UK) and Vanguard Equity Income Fund (US). Both funds have a reasonable minimum investment: Liontrust fund requires 2,500 pounds and Vanguard fund requires the minimum investment of 3,000 pounds.

For investors who will not exceed these amounts by much, the management fees of 1.75% (in the case of Liontrust fund) and 0.27% (in the case of Vanguard fund) will not turn into a great amounts and therefore there are quite reasonable. However, for the investors who want to invest millions in the equity fund, differences between these two management fees do matter a lot. For example, if the investor plans to put 10 million pounds/dollars in the fund, he will have to pay the following management fees:

1) If he invests in Liontrust Special Situations Fund (UK), management fee will equal to:

Management fee = $1.75\% \times 10 \text{ million pounds} = 175,000 \text{ pounds}$

2) If he invests in Vanguard Equity Income Fund (US), management fee will equal to:

Management fee = $0.27\% \times 10 \text{ million dollars} = 27,000 \text{ dollars}$

Therefore, it can be concluded that bigger investors should pay attention to these management fees because they can turn into hundreds of pounds/dollars, like in the case of Liontrust fund.

With considering the average returns of these two funds in the period between 2010 and 2013 (Liontrust: 21.48% and Vanguard: 17.26%), their management fees and minimum investments, couple of conclusions can be made. Firstly, for the bigger investors it would be better to invest in the Vanguard fund because of the lower management fee. Secondly, smaller investors would make a good choice in picking any of these two funds because of their low minimum investments and the fact that they both outperformed the market and the randomly selected portfolios.

Scenarios of investing

In order to make a final conclusion and give an answer to the main research question (Are the professional investment managers making enough excess return above the benchmark and randomly selected portfolios?), we will create a following scenario:

An investor A is willing to invest 1 million pounds in any type of investments available on the UK market. He is not interested in what type or format of investments he makes as long as he gets the highest possible return available out there. In this case, we will give him two options: 1) He can build up his own portfolio by randomly selecting 10 assets from FTSE 100 or 2) He can invest in one of the best performing UK equity funds: Liontrust. An

investor B is in the exactly same position except that he is looking to invest 1 million dollars on the US market. His options are to randomly choose 10 assets from Dow Jones index or to invest in the Vanguard equity fund.

Investor A

Case 1: He chooses to build his own portfolio so he randomly selects 10 assets from FTSE100 index. Based on previous research and calculations, he gets the return of 19.42%, so his annual profit equals to: 1 million pounds \times 19.42% = 194,200 pounds.

Case 2: He chooses to invest in Liontrust equity fund. Based on the research and data collection, he gets the average annual return of 21.48%, so his annual return equals to: 1 million pounds \times 21.48% = 214,800 pounds. However, in this case investor had to pay management fee of 1.75%, so his total annual profit equals to: 214,800 pounds - 1 million pounds \times 1.75% = 197,300 pounds.

For investor A, the better option would be to invest in Liontrust fund where he could get 3,100 pounds higher profit.

Investor B

Case 1: He chooses to build his own portfolio so he randomly selects 10 assets from Dow Jones index. Based on previous research and calculations, he gets the return of 16.63%, so his annual profit equals to: 1 million dollars \times 16.63% = 166,300 dollars.

Case 2: He chooses to invest in Vanguard equity fund. Based on the research and data collection, he gets the average annual return of 17.26%, so his annual return equals to: 1 million dollars \times 17.26% = 172,600 dollars. However, in this case investor had to pay management fee of 0.27%, so his total annual profit equals to: 172,600 dollars - 1 million dollars \times 0.27% = 169,900 dollars.

For investor B, the better option would be to invest in Vanguard fund where he could get 3,600 dollars higher profit.

After analyzing these two scenarios it can be concluded that in the case of Liontrust and Vanguard fund, professional investment managers are able to make profit that is higher enough above the benchmark or random portfolios' return in order to compensate for their management fees. In the scenarios where other 8 equity funds are considered, this is not the case, simply because they earn lower return than the randomly chosen portfolios.

5. Conclusion

With many investors looking for a good opportunity for earning high returns on their investments, it has become very common practice that they pay professional managers of particular equity funds to choose investments and build portfolio out of assets from various sectors and industry groups. Now the question arises: Should these investors pay these fees or should they make their own portfolios of investments? Are these equity funds' managers able to make enough extra profit above the average benchmark return in order to compensate for the management fees? This research study was mainly focused on these questions. Based on the analysis of 2 randomly chosen portfolios of 10 assets from FTSE100 and Dow Jones index (by using Monte Carlo simulation), average returns on these portfolios are estimated for the particular period (from 2010 to 2013). On the other side, the average returns, Sharpe ratios and other information were taken from 10 top performing equity funds from UK and US (5 funds from each country). Comparing the randomly chosen portfolios and the top performing equity funds, the following results were concluded:

- 1) In both cases, including UK and US, random portfolios outperformed 4 out of 5 equity funds.
- 2) Randomly choosing assets from the top performing indexes on average will give better results than the equity funds.
- 3) Among the 10 chosen equity funds from UK and US, only the Liontrust Special Situations Fund (UK) and Vanguard Equity Income Fund (US) outperformed the random portfolios with the average returns of 21.48% and 17.26% respectively.
- 4) These two particular equity funds outperformed the two randomly selected portfolios (one from UK FTSE100 and other from US Dow Jones index) because they used the approaches of specific sector allocation and security selection.
- 5) When considering performance attribution of sector allocation, Liontrust fund invested the most in the sectors of Information Technology (16.57 %) and Financials (13.55 %) while the most positive attribution was achieved in the sectors of Consumer Discretionary, Energy and Consumer Staples.
- 6) In the case of Vanguard fund, most investments were done in the sectors of Financials (16.16%) and Information Technology (13.53%) while the most positive attribution was achieved in the sectors of Health Care, Information Technology, Consumer Staples, Industrials and Financials.
- 7) One of the main reasons for outperforming the two randomly selected portfolios (one from UK FTSE100 and other from US Dow Jones index) is that these funds (Liontrust and Vanguard) didn't assign equal weight for each particular asset within the portfolio as it was the case in the process of randomly selecting the portfolios by using Monte Carlo simulation (where portfolios of 10 assets were randomly chosen by assigning 10% of portfolios' weight to each asset). This brings a conclusion that security selection is critical part in the investment process and it has major effects on the expected return.
- 8) In the case of Sharpe ratio, which represents the investment performance indicator because it relates the excess return (risk

premium) to the standard deviation or risk of investment and portfolio, the higher the ratio, the better the performance. Calculated Sharpe ratios for randomly selected portfolios for both FTSE 100 and Dow Jones index showed higher values than Sharpe ratios of best performing equity funds (Liontrust and Vanguard). For the UK market, random portfolios chosen from FTSE 100 showed the Sharpe ratio of 3.91 while the Liontrust equity fund had the ratio of 1.85. For the US market on the other hand, random portfolios chosen from Dow Jones index showed the calculated Sharpe ratio of 7.01 while the Vanguard equity fund had the ratio of 1.98. In both cases, randomly chosen portfolios showed higher Sharpe ratios even though these two particular equity funds outperformed the random portfolios.

- 9) When choosing a particular equity fund, it is important to consider the management fees and the required minimum investment. In the case of Liontrust equity fund, management fee equals 1.75% of the investment, while the minimum investment equals 2,500 pounds. In the case of Vanguard equity fund, management fee equals 0.27% of the investment, while the minimum investment equals \$ 3,000. If the intelligent investors are looking to invest a lot of their money in the fund, they should probably pick the Vanguard fund because the management fee is much lower than for the Liontrust fund. If on the other hand, investors are going to invest amount closer to the minimum investment, they could pick either of these two funds because on that scale differences in the management fees are insignificant.
- 10) Finally, after analyzing two investment scenarios it can be concluded that in the case of Liontrust and Vanguard fund, professional investment managers are able to make profit that is high enough above the random portfolios' return in order to compensate for their management fees. In the scenarios where other 8 equity funds are considered, this is not the case, simply because they earn lower return than the randomly chosen portfolios.

6. Recommendations

With many investors looking for the perfect way of investing, a lot of them decide to give their money in the hands of professional investment managers who can then manage it by investing in particular equities that are part of the their fund's current portfolio. This option can be quite reasonable for investors who are seeking for professional investment services and who are willing to rely on professionals' decisions. They are expecting promised returns even though there is always a lot of uncertainty involved in the process of investing in equity funds. On the other hand, there are investors who are willing to get in charge of their own money and build up their own investment portfolios out of various assets. These investors don't want to depend on other people's decisions and they want to have full control of their money. They are often somewhat more familiar with the investment practices, as well as with the risk and portfolio management.

Main topic of this research study was to investigate whether investors should pay professional investment managers of equity funds to make investments for them or they should build their own portfolios. In the sample of 5 chosen equity funds from UK and 5 from US, only one equity fund from UK and one from US outperformed the randomly selected portfolios consisted of 10 assets (one portfolio was selected from FTSE100 and one from Dow Jones index). This kind of finding brings a general conclusion that, based on these sample equity funds and random portfolios in given time period (2010 – 2013), investors should feel free to build their own portfolios, particularly if they choose the assets from the top performing indexes like FTSE100 and Dow Jones because the randomly chosen portfolios outperformed majority of selected equity funds.

Going into more depth of the research study, only two equity funds that outperformed the random portfolios are Liontrust and Vanguard equity fund.

With the average return of 21.48% and a management fee of 1.75%, Liontrust fund is a better option for a UK investor because even including this fee, it brings higher return than the random portfolio, as calculated in previous sections. Its minimum investment of 2,500 pounds is quite reasonable so it is suitable for various types of investors. On the other hand, Vanguard showed the average return of 17.26% while charging its investors with the management fee of 0.27%. For the US investor, this fund is also better choice than the random portfolio because even after calculating the management fee, it brings the higher return to the investors, as estimated earlier.

Should some foreign investor decide to invest in one of these two funds, he should of course first consider the current exchange rates. More importantly, he should make his decision based on the amount of his investment because of the difference in management fees. If an investor plans to invest smaller amount, then these fees wouldn't make much of difference. However, if an investor plans to invest millions in the fund, he should definitely consider the fund with lower management fee, in this case, the Vanguard equity fund.

What can also be concluded and taken as a lesson after all the data analysis is the fact that these two equity funds outperformed the randomly chosen portfolios due to their specific sector allocation and security selection.

As mentioned before, Liontrust fund invested the highest percentage of its capital in the sectors of Information Technology and Financials, even though it achieved to most positive attribution from the sectors of Consumer Discretionary, Energy and Consumer Staples. Therefore UK investors who are willing to build their own portfolios might consider these particular sectors within the FTSE100 to choose their assets from. On the other hand, Vanguard equity fund invested mostly in the same two sectors like Liontrust fund but in the opposite order. However, in this case, the most positive attribution was achieved in the sectors of Health Care, Information Technology, Consumer Staples, Industrials and Financials. For that reason, US investors should pay closer attention to these sectors when selecting the

potentially most profitable assets out of Dow Jones index at that particular point in time.

Regarding the security selection part of the investment decisions, it can be concluded that in general equal weights on different assets shouldn't be assigned. This process of assigning equal weight on each of 10 assets within the portfolio was done in randomly selecting the portfolios from FTSE100 and Dow Jones index. Results showed that these portfolios outperformed majority of the equity funds taken as samples, but didn't achieve the highest returns. Highest returns were achieved by Liontrust fund (21.48%) and Vanguard (17.26%). Top three assets on the security selection top list of Liontrust include: Compass Group PLC (4.12%), BP PLC (3.85%) and Royal Dutch Shell PLC (3.82%). In the case of Vanguard fund, these top three assets include: Johnson & Johnson (4.03%), Wells Fargo & Co (3.90%) and Microsoft Corp (3.57%). When selecting assets for building their portfolios, investors should deeply analyze these security selection top lists and come up with a conclusion or even an investing strategy for building their own portfolios.

From all said, one of the main recommendations for all the investors is to carefully determine what kind of investment strategy they want to pursue with. If they decide to invest in equity funds, they should especially consider their Sharpe ratios, management fees, average expected returns and all other factors mentioned in this study. They should also compare funds' returns with the benchmark return and the best performing indexes. Should they decide to build their own portfolio, which is highly recommended after doing this research study, they should use best performing indexes to choose their assets from. They should also use best performing equity funds and their available financial data as their guide in selecting particular securities and for directing the focus to sectors of investments that contributed the most for the funds' returns. All these steps are extremely important because security selection and sector allocation represent the critical part in the investment process and have major effects on the expected return.

7. Appendices and References

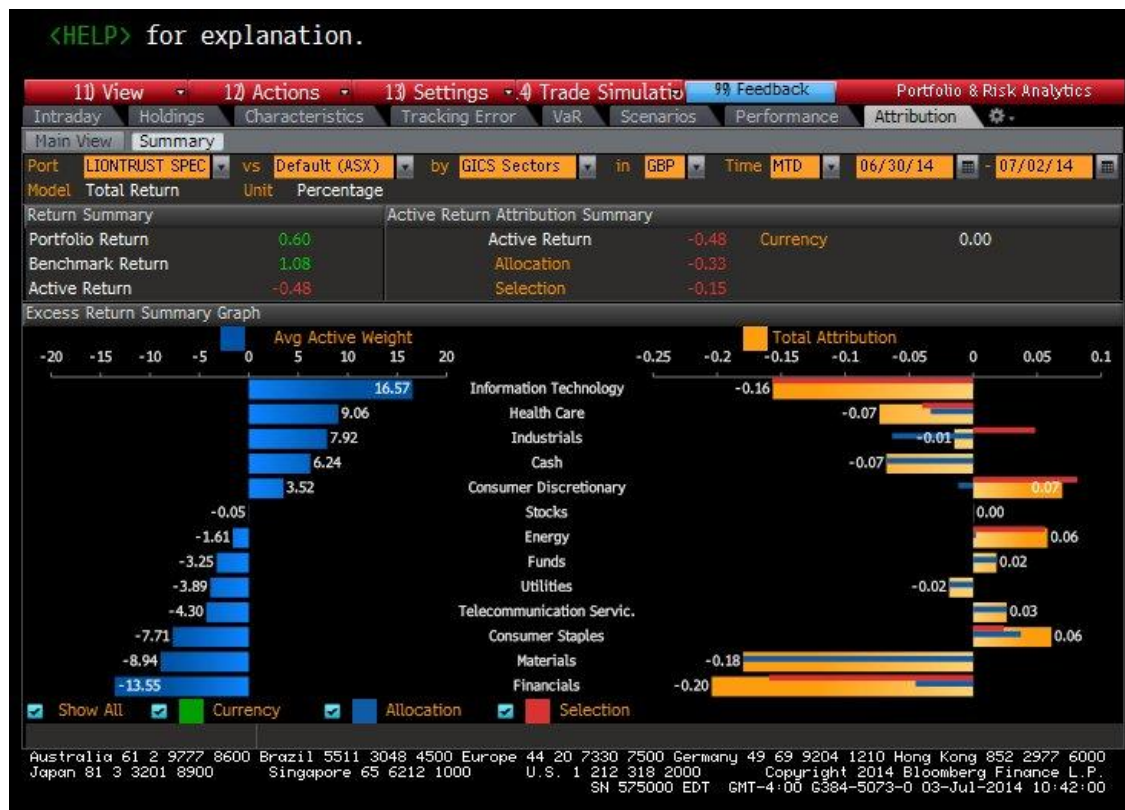
7.1. Appendices

Liontrust's and Vanguard's top holdings, asset and industry group allocation

LIONFIO LN 274.07001 / 291.35999			
On 02 Jul Cancel Price 274.07			
LIONFIO LN Equity	98 Report	99 Feedback	Page 3/4 Description
1) Profile	2) Performance	3) Holdings	4) Organizational
Holdings As Of	6/30/14	Portfolio Stats As Of	6/30/14 Alloc As Of 6/30/14
6) Top Holdings (MHD)			
Name	Position	% Net	Value
Compass Group PLC	5.06M	4.121%	50.92M
BP PLC	9.25M	3.845%	47.51M
Royal Dutch Shell PLC	1.86M	3.822%	47.23M
BG Group PLC	3.52M	3.531%	43.63M
EMIS Group PLC	5.99M	3.518%	43.47M
Advanced Computer Soft	37.87M	3.517%	43.46M
AstraZeneca PLC	962.52k	3.370%	41.64M
GlaxoSmithKline PLC	2.61M	3.307%	40.86M
Unilever PLC	1.52M	3.258%	40.26M
Reed Elsevier PLC	4.21M	3.179%	39.28M
Top Asset Allocation			
Equity			95.82%
Cash and Other			4.18%
Top Ind. Group Allocation			
Software			11.93%
Oil&Gas			11.20%
Commercial S...			10.25%
Pharmaceutic...			9.52%
Electronics			7.87%
Diversified Fin...			7.17%
Top Geo. Allocation			
U.K.			89.15%
Netherlands			3.82%
Ireland			2.85%
7) Holdings Analysis			
Top 10 Hldings % Port	35.47	Average P/C	12.19
Median Mkt Cap	2.12B	Average P/S	1.67
Avg Wtd Mkt Cap	23.17B	Average P/E	22.92
Avg Div Yield	2.86	Average P/B	3.59
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000			
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2014 Bloomberg Finance L.P.			
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VEIPX US NAV 31.87 +.14 Purch Prc 31.87			
On 03 Jul			
VEIPX US Equity	98 Report	99 Feedback	Page 3/4 Description
1) Profile	2) Performance	3) Holdings	4) Organizational
Holdings As Of	3/31/14	Portfolio Stats As Of	3/31/14 Alloc As Of 3/31/14
6) Top Holdings (MHD)			
Name	Position	% Net	Value
Johnson & Johnson	6.63M	4.034%	651.08M
Wells Fargo & Co	12.66M	3.902%	629.71M
Microsoft Corp	14.04M	3.566%	575.55M
Exxon Mobil Corp	5.61M	3.396%	548.10M
Verizon Communications Inc	10.27M	3.026%	488.43M
JPMorgan Chase & Co	7.95M	2.989%	482.37M
Chevron Corp	3.94M	2.904%	468.69M
Merck & Co Inc	8.10M	2.850%	459.97M
General Electric Co	13.88M	2.226%	359.34M
Marsh & McLennan Cos Inc	6.54M	1.999%	322.57M
Top Asset Allocation			
Equity			97.24%
Cash and Other			2.65%
Government			.11%
Top Ind. Group Allocation			
Pharmaceutic...			11.95%
Oil&Gas			10.75%
Banks			9.91%
Telecommunic...			5.58%
Miscellaneous...			5.41%
Retail			4.72%
Top Geo. Allocation			
U.S.			85.97%
U.K.			3.53%
Switzerland			2.21%
Netherlands			1.95%
7) Holdings Analysis			
Top 10 Hldings % Port	30.89	Average P/C	8.25
Median Mkt Cap	107.08B	Average P/S	1.74
Avg Wtd Mkt Cap	141.07B	Average P/E	15.77
Avg Div Yield	2.90	Average P/B	2.58
Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000			
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2014 Bloomberg Finance L.P.			
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Liontrust's and Vanguard's performance attribution: allocation and selection



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