# Capturing factor premiums through the MSCI factor indexes

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**Abstract**

This paper investigates the performance of the MSCI factor indexes compared to their market weighted benchmark for the developed world and the USA. The factors that are investigated are size, value, momentum, quality, low volatility and high dividend yield. The alternative weighted indexes are subjected to a regression analysis to examine their factor exposure. The idea of weighting stocks based on their market capitalization is outdated according to many investors. The results show that the indexes that favor small firms, momentum stocks, quality stocks and minimum volatility outperform their market weighted counterparts. The regression analysis indicates that for the MSCI Small cap and the MSCI Momentum most of this outperformance is due to exposure towards its target factor. Results for the other indexes suggest that getting exposure solely to the target factor is hard. The results for the developed world slightly dominate those of the USA. Results indicate that some alpha can be captured by factor index investing, which will only encourage the debate about the efficiency of market capitalization weighted indexes.

## 1. Introduction

### *1.1. Background and Research Question*

For a long time market-cap weighted indexes have been the standard. Such indexes attempt to capture the equity market premium with low transaction costs and high liquidity (Bender, Briand, Melas, & Subramanian, 2013). The stocks are weighted based on their market capitalization. The largest firms have the largest weight. However, since the internet bubble and recent financial crisis investors experienced that following the market does not always produce satisfying returns. Index providers like Morgan Stanley Capital International (MSCI) started constructing indexes that apply alternative weighting methods. For example, an equally weighted index weights all the stocks the same, regardless of size. Such an approach reduces the overweighting of expensive stocks and underweighting of cheap stocks compared to the market-weighted index. Another alternative is the fundamentally weighted index. This index weights their stocks based on fundamental indicators. The basic idea behind this innovative approach is that market capitalization does not provide information about the performance of a firm. Combining these alternative weighting methods with risk premiums (factors) that have shown above average returns in the long-run results in factor investing. The increasing popularity of factor investing encouraged MSCI to offer highly liquid factor indexes. In turn, providers of exchange traded funds (ETF) and index funds provide funds that track these factor indexes, with reasonable fees. The providers claim that the factor indexes are able to outperform their market-weighted counterparts. An outperformance would mean that the factor indexes report active return or higher risk-adjusted returns compared to their market weighted counterparts. This draws down to the following research question:

"Do the MSCI World and MSCI USA factor indexes show outperformance (active return and/or risk-adjusted returns) towards their market weighted benchmarks?"

The factors that are employed in this study are small cap, value, momentum, quality, minimum volatility and high dividend yield. These factors (fundamentals) have realized above average returns in the historical data.

If there are any premiums in the MSCI factor indexes it will be possible to outperform the market by passive index investing, implemented through ETF's tracking these factor indexes (available from iShares, Lyxor and other ETF providers). Until recently, investors were convinced that only through active management and investing in mutual funds it was possible to generate better returns than the market index, but it seems that active performance in practice is often disappointing (Jones and Wermers, 2005). If the results in this thesis indicate that the MSCI factor indexes have significantly outperformed their market-weighted benchmarks, this would mean that private investors are able to realize better returns than the market with relatively low effort and low costs. Putting money in a

managed fund (mutual fund) costs more than investing in an index fund or ETF. This could lead to big changes in the investment world.

### *1.2. Method used*

To answer the research question, both the relative and absolute performance of the MSCI factor indexes will be examined. Not only the returns, but also the risk-adjusted returns are compared. Subsequently, the exposure towards the size, value and momentum effect is evaluated by regression analysis. This provides information about how large the exposure towards the target factor is. Similarly, it will show how the indexes are exposed towards other factors. On the indexes that show significant outperformance, additional regression analysis will be carried out. This regression analysis provides information about which factors are responsible for the outperformance. Throughout the entire study two different regions are investigated. It will be interesting to see whether the factor premiums can be captured in both the developed world and the USA.

### *1.3. Findings*

The empirical results in this research paper suggest that some of the MSCI factor indexes have significantly outperformed their market-weighted benchmark. Especially, the MSCI Momentum and MSCI Small cap for both regions display pleasing results. Both the return and risk-adjusted return are significantly higher than that of their counterparts. The regression analysis on these two indexes tells that most of the outperformance can be attributed to the target factor. The MSCI Quality also shows statistical outperformance. According to the regression analysis, most of this outperformance is due to alpha, thus potentially explained by alternative factors are not included in the model. For the remaining indexes that display outperformance, the contribution is the result of a combination of factors. Most of the factor indexes show equivalent results for both regions. Still, it can be concluded that the Quality index shows higher active return for the developed world than for the USA. The risk-adjusted performance suggests that the factor indexes of the developed world are slightly superior to the factor indexes of the USA.

The MSCI Value reports disappointing results, because it delivers no excess return compared to the benchmark. In short, by investing in the MSCI factor indexes it is possible to capture some factor premiums. However, the value premium is not present in the MSCI Value index for both the developed world and the USA.

Previous studies about factor indexes find varying results. Amenc (2008) shows that the fundamental indexes that he investigated do not significantly outperform their market weighted benchmark. However, Bender et al. (2014) and Plagge (2016) both report outperformance of the factor indexes.

Altogether these findings illustrate the dispersion found among investors. Does factor investing really deliver superior returns?

This study delivers evidence that some MSCI factor indexes outperform their market-weighted benchmark. For the many active managers and mutual funds that are not able to beat the market on a consistent basis, this potentially could mean bad news. Among the private investors, it is expected passive index investing will gain popularity and only the top asset managers will be able to survive. The factor indexes make it possible to beat the market in the long run by passive indexing against relatively low cost.

## 2. Theoretical framework

### *2.1. The evolution of explaining stock returns*

Since the beginning of the stock market people attempt to predict stock returns. The benefits of properly modeling price movements would be enormous. However, after all these years researchers still have not found a robust and perfect model. But gradually the model became more sophisticated and robust. The basic idea behind these models is that the expected returns are a reward for exposure towards (risk) factors. A factor is a stock characteristic that in theory should deliver above average returns, when portfolios are constructed to track this factor. The many research and widely accepted models about capital asset pricing are discussed below.

#### *2.1.1. CAPM*

The capital asset pricing model (CAPM) of Sharpe (1964), Litner (1965) and Black (1972) has been the standard for explaining expected stock returns for a long time. The model is based on the assumption that there are two different kinds of risk. Systematic risk, which cannot be diversified away and unsystematic risk (also called firm specific risk), which can be diversified away by increasing the number of stocks in the portfolio. According to the CAPM the only explaining factor is beta, which represents the relative volatility of the security compared to the volatility of the market as a whole. The CAPM looks as follows:

$$Expected\ return = R_f + \beta_a(\bar{R}_m - R_f) \qquad (1)$$

Where:

$R_f$ = Risk *free rate*

$\beta_a$ = *Beta of the security*

$\bar{R}_m$ = *Expected market return*

*2.1.2. Three-factor model*

With the CAPM as starting point Fama and French (1992) found that the relation between the market beta and the average return became less strong over time. Research from Banz (1981) concludes that size is an explanatory variable for explaining expected return. Furthermore, Bhandari (1988) discovered a positive relation between leverage and expected returns. Stattman (1980) and Rosenberg, Reid and Lanstein (1985) reported a positive relation between average returns and a firm's book-to-market value (B/M). Given these results Fama and French (1992) introduced a three-factor model that aims at explaining the expected returns more accurate than the CAPM. The model looks as follows:

$$Expected\ return = R_f + \beta_a(\bar{R}_m - R_f) + \beta_b\, SMB + \beta_c\, HML \qquad (2)$$

$R_f$ = Risk free rate

$\beta_a$ = Sensitivity of the security to the market

$\bar{R}_m$ = Expected market return

$\beta_b$ = Sensitivity of the security to the size effect

$\beta_c$ = Sensitivity of the security to the value effect

The additions compared to the CAPM are the size effect and the value effect. The reason for introducing the two factors is that a small firm on average earns a higher return compared to a large firm. The value effect looks at the book-to-market ratio and suggests that a firm with a high book-to-market ratio on average outperforms a firm with a low book-to-market ratio. The three-factor model is widely accepted and finds his application worldwide nowadays. The discussion about whether the size and value factor is a result of market efficiencies or market inefficiencies is still open. On the market efficiency side the explanation lies within the fact that the additional returns are a reward for higher risk. The market inefficiency holds investors over-value to growth firms responsible for the value effect (Schwert, 2003).

*2.1.3. Four-factor model*

With the three-factor model being accepted, research evolved and people began to explore for additional factors that helped explaining stock returns. Jegadeesh and Titman (1993) investigated a trading strategy that buys past winners and sells past losers. They found that if one would buy the past 6-months winners and sell the 6-month losers (during the period 1965 to 1989) a yearly average excess return of 12.01% could have been realized. These findings motivated Carhart (1997) to advocate for a four-factor model, which includes the momentum effect. In his paper he concludes that funds with relative good performance in the previous year outperform the year after. After one year the outperformance vanishes.

### *2.2. A zoo of factors*

As described above, the model for explaining expected stock returns has been evolving over time. After the introduction of the Carthart four-factor model many so-called factors have been discussed and investigated. To indicate how many there are, some practitioners nowadays employ an 81-factor model to build their equity portfolio. With all this exotic and sexy factors introduced by young and bright researchers, it is hard to select the ones that continuously produce a premium. Still, time showed that not only size, value and momentum have a significant influence on the average expected returns. Other robust and widely accepted factors are quality, low volatility and high dividend.

Before attempting to exploit the factor premiums, it is important to know which factors are robust and substantial over time. Understanding what is the explanation behind the historical outperformance of the factor and how they are related to the other factors makes it easier to select the interesting ones. The part below will discuss and describe the relevant factors used in this study. Like mentioned above, the discussed factors are size, value, momentum, quality, low volatility (low risk) and high dividend yield.

#### *2.2.1. Size effect*

One of the oldest and well-known market factor is the size effect. Banz (1981) and Reinganum (1981) investigated stocks that listed on the New York Stock Exchange (NYSE) from 1936 to 1975. The results indicate that small-cap stocks outperformed larger firms for at least 40 years. Many research hereafter also confirmed the presents of a size effect during that period (Chan, Chen , & Hsieh, 1985). Attempts to highlight the size effect after 1982 are less successful. Horowitz, Loughran and Savin (2000) investigated both periods and identified an annualized return difference between small and large firms of 13% during the period 1963-1981 compared to a -2% return difference since 1982. The paper provides two possible explanations for the diminishing size effect in time. Firstly, the increasing popularity of passive indexation caused a tilt towards the large-cap firms. Secondly, the awareness after the publication of Banz (1981) and Reinganum (1981) led investors to exploit the size effect, which results in a diminishing effect. However, Amel-Zadeh (2010) confirms the existence of the size premium in the German stock market. He concludes that small firms underperform large firms during bear market periods, but small firms outperform large firms during bull market periods. Van Dijk (2011) reports that the size premium is still present in the US stock market and has been large in the recent years. From the above, the expectation is that the size effect is present in the developed world and the USA markets.

#### *2.2.2. Value effect*

Basu (1977, 1983) discovered that firms with high earnings to price ratios (E/P) outperform firms with low earnings to price ratios. Further research elaborated on these findings and provides evidence

for the value effect, which refers to the outperformance of firms with high book-to-market (B/M) ratios compared to firms with low book-to-market ratios. Fama and French (1998) found support for the value effect in 13 countries (including the USA) over the period 1975-1995. Studies that investigate earlier sample periods find ditto results (Jaffe , Keim, & Westerfield, 1989). The robust results for the value premium indicate that the premium is present in the develop world and USA.

*2.2.3. Momentum effect*

Jagedeesh and Titman (1993) published the first paper about the medium term momentum effect. They conduct research on the NYSE and AMEX stocks during the sample period from 1965 to 1989. The momentum effect is found in all the 32 investigated strategies. The best performing strategy is the 12-month/3-month strategy, which relates to a strategy of selecting the best performing 12-month stock and holding them for 3 subsequent months. The outperformance of this strategy is 1.49% per month. Even after accounting for risk and transaction costs the momentum strategy appears to remain profitable (Korajczyk and Sadka, 2004). The effect found for developed countries appears to be stronger than for emerging markets. Still the premium is found all over the world.

*2.2.4. Quality*

The quality effect is not a straightforward factor. It refers to the outperformance of high quality stock compared to low quality stocks. Many index providers and investment engineers have different definitions for quality stocks. For example, Novy-Marx (2013) describes quality as gross profitability and Grantham (2004) employs a combination of profitability, earnings quality and leverage variables to select quality stocks. Both studies find that high quality stocks outperform low quality stocks. However, due to use of these different definitions it is hard to link previous literature to this study. Research from Bender and Nielsen (2013) confirmed that stocks with high quality earnings earned a premium until 2000. During the period 2000-2008 the premium is not found, after which it remarkable recurred after 2008. Altogether the quality factor is expected to produce above average returns for both regions.

*2.2.5. Low volatility*

The low volatility factor describes the outperformance of a portfolio with low volatility compared to one with high volatility. Haugen and Heins (1975) show that less volatile portfolios earn on average a higher return as their more volatile counterparts. Many research hereafter supported these findings. Blitz and van Vliet (2007) found an annual outperformance of 12% for the period 1986-2006. Clarke et al. (2006) investigate the low volatility anomaly in the US equity market. With a sample period from 1968 through 2005, they also find evidence for the low volatility effect. More recent research of Hsu et al. (2013) reports that low volatility strategies outperformed their cap-weighted counterparts. The empirical results appear to be robust across geographies and over time. However, in case of low

volatility portfolios with high turnover and low liquidity the outperformance can erode. In short, the low volatility effect delivers robust above average returns over time and is expected to be in the developed world and USA markets.

*2.2.6. High dividend yield*

The high dividend factor claims that there is a positive relationship between dividend yield and expected stock return. Litzenberger and Ramaswamy (1979) find that this statement is correct for NYSE stocks. More recently, Yao et al. (2006) investigated the performance of dividend paying stocks. They found that high dividend firms on average outperform those with low dividends. However, the best performing stocks were not the highest dividend yielding stocks, but the stocks ranking in decile 8 showed the best performance. They concluded that the 2003 tax reduction on dividends increased the dividend contribution to total return. This contribution increase will persist the coming years.

### *2.3 Factor investing*

All the above factors are already known for a long time. Still it is hard for private investors (even active managers) to capture the factor premiums. In most cases the excess returns do not compensate for the high efforts and high transaction costs that are necessary to construct and rebalance the stock portfolios. When during the 2000-2002 internet bubble and the recent financial crisis large cap and growth stocks have suffered significant losses, the market became more and more interested in non-market weighted strategies. Since research has shown that certain factors have earned higher average returns than the market, the desire for alternative weighted indexes/strategies grew. Arnott, Hsu and Moore (2005) investigated the performance of an equity portfolio that weighted stocks based on multiple fundamentals: book value, five-year average cash flow, five-year average revenues, five-year average sales, five-year average gross dividends and total employment. They found that for the sample period (1962-2004) the fundamentally weighted index produced annual returns that were, on average, 2.15% higher than the market-weighted counterpart. Amenc et al. (2008) also investigates the performance of characteristic-based indexes compared to their market weighted and equally weighted benchmark. The results show no significant outperformance compared to the market weighted benchmark. Compared to the equal weighted benchmark none of the characteristic-based indexes show significant superior returns and two of them show significant underperformance. These contradictive results give a good impression of the dispersion in literature about factor investing. Combining the alternative weighted approach with factors that have shown a history of outperforming the market results in factor investing. Bender et al. (2014) investigate how much of alpha can be captured by investing in MSCI factor indexes. The results show that up to 80% of alpha (active manager return) can be captured. They also show that most of the MSCI factor indexes outperform their benchmark, the MSCI World. These results look promising and are in favor of the research

question. In particular the MSCI Risk weighted and Small cap index show outstanding results. Plagge (2016) finds that the iSTOXX single factor indexes outperform their benchmark over a sample period of eleven years. In short, the literature about factor investing suggests that there is reasonable chance to find outperformance for the factor indexes.

## 3. Hypothesis development

The innovative approach of weighing indexes based on fundamental information led to the construction of factor indexes by index providers like MSCI. The literature review above provides enough evidence for the existence of factor premiums. Still the literature about factor investing shows dispersion in results. Therefore, it is hard to form clear expectations about the outcomes and formulate reasonable hypotheses. Still, below two hypotheses are formulated and linked to the existing literature. The statements will be discussed in the conclusion.

"The results found for the MSCI World and MSCI USA factor indexes show no substantial differences"

The literature mentioned about the different factors in section 2.2.1 – 2.2.7 is important to form expectations about this hypothesis. Most of the literature about the factor premiums is related to the US stock market. To fill this gap in the literature it is interesting to compare the findings of the developed world with the USA. To form expectations about the hypothesis a few important studies are mentioned below. Van Dijk (2011) finds that the size premium is still present in the US stock market. Amel-Zadeh (2010) investigated the German stock market and finds that the size premium also exists overseas. Literature about the momentum premium shows that the momentum effect is robust across regions, just like the low volatility premium (Chow, Hsu, Kuo, & Li, 2013). According to these findings the hypothesis is expected to be true.

"In case an MSCI factor index outperforms his benchmark, the outperformance is mainly due to exposure towards the intended factor"

The above hypothesis will be verified or falsified through the regression analysis at the end of the paper. Finding an answer for this hypothesis is important. If the results strongly favor the hypothesis the theory behind factor investing appears to be correct. The distinction between finding outperformance by exposure towards intended factors or finding outperformance due to exposure towards unintended factors is relevant. The literature in section 2.8 does not investigate the factor exposure. Their focus is on the performance and not the origin of the outperformance. Still, the expectation is that the factor indexes show high exposure towards their target factor. However, the

expectations are tempered by the long-only approach and the findings of Wermers (2005), which show how hard it is to capture a part of alpha.

## 4. Data

This study analyses the performance of several factor indexes provided by the MSCI. The sample consists of monthly returns from seven indexes during the period June 1994 until February 2016 (261 months). The sample period is from June 1994 till February 2016. The reason for this is that for some indexes no data were available prior to that date. The prices are gross which indicates that dividends are reinvested and taxes are not accounted for. The research focuses on developed markets only, using MSCI World[1] and MSCI USA indexes. Because most research concerning the existence of the factors relates to the US stock markets, it is interesting to investigate whether the results match for the two regions. The developed world is chosen as counter region due to available data. The data are obtained from the official website of MSCI[2]. The 1-month Treasury bill rate[3] is taken as risk-free rate. The following nine factor indexes are selected for both regions:

- MSCI Value
- MSCI Growth
- MSCI Small cap[4]
- MSCI Momentum
- MSCI Size tilt
- MSCI Minimum volatility
- MSCI Quality
- MSCI High dividend yield
- MSCI Value weighted

Besides the performance of the indexes, the exposure towards the factors is also examined, which demands for the average factor premiums for both regions during the sample period. The premiums are gathered from the website of Kenneth R. French. Table 1 shows information about the nine factor indexes, including the weighting methodology.

[1] World consists of the following developed markets: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the UK and the USA.

[2] The MSCI have a page where the historical returns of all the indexes are available. Some of this data are backward looking, because some of the used indexes were only introduced in 2014.

[3] The 1-month T-Bill is taken from the website of FRED Economic data St. Louis FED.

[4] The sample for the MSCI Small cap consists of data from January 2001 till February 2016.

| Index name | Launched[5] | No. Constituents | Rebalanced | Weighting |
|---|---|---|---|---|
| MSCI Value | Dec 08, 1997 | 872 | Semi-annually<br>May and November | Each security is given an overall value score, based on 8 historical and forward looking value or growth variables. Based on this score the security is placed in the value or growth (or partially in both) index. |
| MSCI Growth | Dec 08, 1997 | 973 | Semi-annually<br>May and November | Each security is given an overall value score, based on 8 historical and forward looking value or growth variables. Based on this score the security is placed in the value or growth (or partially in both) index. |
| MSCI Small cap | Jan 01, 2001 | 4333 | Quarterly | The index consists of small cap stocks and is based on the MSCI Global investable market indexes methodology. This methodology aims to deliver indexes that have high index liquidity, investability and replicability. |
| MSCI Momentum | Dec 11, 2013 | 347 | Semi-annually | A combination of the stock's recent 12-month and 6-month local price performance determines the momentum value. This momentum value is adjusted for risk, which leads to the stock's momentum score. The stocks with the highest momentum scores are included. The weighting is done according to the product of the momentum score and their market cap. Constituent weights are capped at 5%. |
| MSCI Minimum volatility | April 14, 2008 | 292 | Semi-annually<br>May and November | The MSCI Minimum volatility is constructed using Barra Optimizer that results in an index with the lowest absolute volatility with a certain set of constraints. These constrains are for maintaining the index replicability and investability. Examples of constraints are minimum and maximum constituents and sector and/or country weights relative to the parent index. |
| MSCI Quality | Dec 18, 2012 | 300 | Semi-annually<br>May and November | The quality index looks at three fundamental variables: Return on equity, Debt to equity and earnings variability. Each stock receives a z-score on how well they score per variable. After which an average z-score is determined. Based on this score the stocks are weighted. Constituent weights are capped at 5%. |
| MSCI High dividend yield | Oct 31, 2006 | 285 | Semi-annually<br>May and November | Securities are selected on above average dividend yields, but also screened on "quality" factors such as return on equity earnings variability, debt to equity, and recent 12-month price performance. This is to exclude stocks that have a high potential of cutting or reducing dividends in the (near) future. The security weights are capped at 5%. |
| MSCI Value weighted | Dec 07, 2010 | 1645 | Semi-annually<br>May and November | Four fundamental accounting variables: sales, book value, earnings and cash earnings. For each constituent independently, a 3-year average weight is calculated for each accounting variable. The average of all four variables determines the constituents-level value weight. |
| MSCI Size tilt | Dec 12, 2014 | 1644 | Semi-annually<br>May and November | The MSCI Size tilt index include all the parent index constituents and weight them using the square root of their market capitalization weight. The index aims to capture the low size premium while maintaining a simple and transparent methodology that show high trading liquidity, investment capacity and moderate index turnover. |

Table I: shows additional information about the nine MSCI factor indexes.

[5] Data prior to the launch date is back-tested data.

## 5. Methodology

The goal of this paper is to provide insight in the performance of the MSCI factor indexes. Performance can be measured on multiple levels. From an investor's side the risk-adjusted return is an important metric. However, it is not sufficient to investigate and compare the returns from an investor's perspective only. Also knowledge about the consistency of the returns and insight in the relative performance towards other indexes are valuable. This section discusses the methodology used to analyze the performance of the MSCI factor indexes.

### *5.1. Absolute performance*

The main goal of investing in a factor index is to realize a solid return. Therefore, the most important aspect for an investor is the realized average return. By comparing it to the market return or other indexes he or she should decide whether to invest or not. The geometric annualized return (also called the "compounded return") is calculated as follows:

$$R_i = \left(\frac{P_{end}}{P_{start}}\right)^{\frac{12}{T}} - 1 \tag{3}$$

Where $R_i$ is the annualized return on the index, $P_{end}$ is the price at the end, $P_{start}$ is the price at start and $T$ is the number of months between the end and start date.

To evaluate average returns, risk should be accounted for. Investors aim to maximize the risk-adjusted reward. Therefore, the volatility of the index needs to be calculated. The volatility indicates to what extend the returns will fluctuate and therefore suggests how risky the index is. The formula looks as follows:

$$\sigma_i = \sqrt{\frac{1}{n-1} \sum_{i=1}^{n} (u - \bar{u})^2} * \sqrt{12} \tag{4}$$

Where $\sigma_i$ is the annualized volatility of the index, $n$ is the number of months, $u$ is the return each month, $\bar{u}$ is the average return during the period.

By combining the annualized return and the annualized volatility, the return per unit risk will be calculated. This way it is fair to compare the indexes to each other, because there has been a correction for the differences in risk. For comparing the performance of indexes or mutual funds the Sharpe ratio is often applied. This paper will also compare the performances based on their realized Sharpe ratios. The formula for the Sharpe ratio looks as follows:

$$Sharpe\ ratio = \frac{r_i - r_f}{\sigma_i} \quad (5)$$

Where $r_i$ is the return of the index, $r_f$ is the risk-free rate and $\sigma_i$ is the volatility of the index.

### *5.2. Relative performance*

Performance should always be interpreted compared to a certain benchmark. The performance of the factor indexes will be compared to the performance of the MSCI Standard. This way the results can be placed in perspective. The most straightforward measure to do this is the active return. This shows the outperformance (or underperformance) of the MSCI factor index compared to the MSCI Standard. The formula is as follows:

$$Active\ return = Return\ MSCI\ factor\ index - Return\ MSCI\ Standard\ index \quad (6)$$

To investigate whether the outperformance is of statistical significance, a two-sample t-test is applied. When the t-statistic exceeds the critical value the average returns differ significantly. Furthermore, the percentage of months that the factor index exceeds the benchmark is calculated and called the hit ratio. In case of an outperformance the hit ratio is expected to be above 50%.

Two other measurements that are computed are the tracking error and the information ratio. The tracking error is the deviation between the price movements of a portfolio (or index) and that of a benchmark. The lower the tracking error, the more the portfolio (or index) replicates the benchmark. The tracking error is the standard deviation of the return differences (active returns). The information ratio combines the active return and the tracking error to describe how consistent an investor outperforms his benchmark. A high information ratio suggests positive active returns (outperformance) and high consistency due to the ability of following the price behavior of the benchmark. Because data for the MSCI Small cap is only available after 2000, the index is compared to a benchmark (MSCI Standard) with ditto time period.

### *5.3. Long-only versus long-short*

There are two different approaches for capturing factor premiums. The one applied in this study is the long-only method. Like the name suggests, this method aims to capture the factor premium by implementing a strategy that weights assets on their attractiveness towards the targeted factor. For example, in an attempt of capturing the value premium a higher weight is granted to value stocks compared to growth stocks. This should result in a portfolio that experiences higher exposure to the factor than the market-weighted cap portfolio. The long-short approach permits the use of leverage, shorting and derivatives. Although the long-short method in theory is superior to the long-only

method, Blitz et al. (2014) find that after practical issues like benchmark restrictions, implementation costs and factor decay, the long-only method is preferred in most cases.

### *5.4. Comparing Sharpe ratios*

To investigate whether the factor indexes are able to capture the factor premiums, the factor indexes should be compared to their parent index. The parent index aims to capture the market premium by composing a broadly diversified portfolio that represents the market as a whole. Apart from return, risk is also an aspect that is relevant for investors. To compare the risk-adjusted returns the Sharpe ratio is calculated. Because a simple t-test delivers no reliable results for comparing Sharpe ratios a different test is selected. This test is called the Jobson-Korkie[6] test and the formula looks as follows (Jobson & Korkie, 1981):

$$JK_{statistic} = \frac{Sh_{12}}{\sqrt{\theta}} \tag{7}$$

Also written as:

$$JK_{statistic} = \frac{\sigma_1 r_2 - \sigma_2 r_1}{\sqrt{\frac{1}{n}(2\sigma_1^2\sigma_2^2 - 2\sigma_1\sigma_2\sigma_{12} + 0.5r_2^2\sigma_1 + 0.5r_1^2\sigma_2 - \frac{r_2 r_1}{2\sigma_2\sigma_1}(\sigma_{12}^2 + \sigma_1^2\sigma_2^2))}} \tag{8}$$

For two indexes 1 and 2 it tests the hypotheses:

$$H0: SR_1 - SR_2 = 0 \tag{9}$$

### *5.5. Exposure*

Factor investors believe that a certain factor (e.g. size, value) will earn a premium above the market premium. When examining the historical performance of an index that favors that particular factor, it is interesting to investigate how high the exposure towards that factor is. This could confirm that the realized premium is actually due to the target factor.

An approach to calculate factor exposure is linear regression analysis. This method will explain the relationship between the dependent variable and several explanatory variables. It will provide insight in the relationship between the realized returns (index returns) and the risk factors responsible for these returns. The analysis can be carried out with as many factor as the index attempts to capture. To run the regressions the factor premiums are necessary. The website of Kenneth French provides the

[6] This test statistic follows an asymptotical normal distribution, hence the critical value for the Jobson-Korkie test is 1.96 (at the 5% level).

size, value and momentum premium. It is important to perform the analysis based on excess returns. This leads to the following regression model:

$$(r_{it} - r_{ft}) = \alpha + \beta_{mkt}\,(r_{mkt\,t} - r_{f\,t}) + \beta_{smb}\,(r_{smb\,t}) + \beta_{hml}\,(r_{hml\,t}) + \beta_{wml}\,(r_{wml\,t}) + \varepsilon_t \quad (10)$$

This paper investigates the exposure of the MSCI factor indexes towards the standard, size, value and momentum premiums. The expectation is that a substantial part of the factor premiums is captured by the indexes. Still, a substantial part will also be left out because it concerns long-only portfolios.

The exposure to a factor premium is indicated by the factor beta. A high beta indicates a high exposure towards the factor. The beta explains the economic reasoning behind the exposure. It can be positive, negative, high or low. However, to test whether our economic exposure is statistically significant, it is necessary to look at the t-statistic of the beta. In case of a t-statistic higher than 2, the beta is significantly different (at the 5% level) from zero. In other words, the index has significant exposure towards the factor. Shortly, the beta provides information about the direction and magnitude of the impact towards the index returns. On the other hand, the t-statistic says something about the reliability of these outcomes.

The factor indexes that have shown outperformance are regressed on the size, value and momentum premiums. The output of this regression clarifies which part of the outperformance is due to the factors and which is attributed to alpha (potential factors not included in the model). The time-series regression model looks as follows:

$$Outperformance\ factor\ index_{it} = \alpha + + \beta_{smb}\,(r_{smb\,t}) + \beta_{hml}\,(r_{hml\,t}) + \beta_{wml}\,(r_{wml\,t}) + \varepsilon_t \quad (11)$$

## 6. Results

This section provides an overview of the results. The results are first discussed for the developed world and USA separately, after which a brief comparison follows. The last part examines the indexes that somehow showed statistical outperformance (at least at the 10% level).

### *6.1. Relative performance*

#### *6.1.1. World*

The descriptive statistics and measures for the relative performance are presented in table II. According to the results, the MSCI Small cap, the MSCI Momentum and MSCI Quality show the biggest outperformance. The relatively low tracking error for the MSCI Quality index suggests that this index realized consistent returns. The only index that shows a negative active return

(underperformance) is the MSCI Growth. This result is consistent with the theory about the value effect. The MSCI value premium is a lot smaller than expected. With an active return of 0.07% and a 49% hit ratio, the results are disappointing. The MSCI Small cap realizes a 4.32% additional return on top of the return gained by the benchmark. The t-statistic suggests that the MSCI Small cap index earns a significant premium compared to the standard MSCI World benchmark. It must be taken into account that the sample period for the Small cap is different than for the other indexes (data since 2001, vs. since 1994). Therefore, a relative comparison between the Small Cap index and the other factor indexes cannot be made. The satisfying results found for the MSCI Small cap, MSCI Quality and MSCI momentum suggest that a passive, long-only investment in MSCI factor indexes can yield additional return compared to the MSCI World standard benchmark.

| **World** | Average Active return (%) | Tracking error (%) | t-statistic | Information ratio | Hit ratio (%) |
|---|---|---|---|---|---|
| MSCI Value | 0.07 | 3.58 | 0.05 | 0.02 | 49 |
| MSCI Growth | -0.28 | 3.60 | -0.21 | -0.08 | 52 |
| MSCI Small cap[7] | 4.32 | 6.47 | 2.61*** | 0.67 | 59 |
| MSCI Momentum | 3.37 | 7.93 | 2.50** | 0.43 | 57 |
| MSCI Minimum volatility | 1.84 | 7.08 | 1.60 | 0.26 | 51 |
| MSCI Quality | 3.71 | 4.65 | 2.94*** | 0.80 | 59 |
| MSCI High dividend yield | 2.31 | 5.66 | 1.77* | 0.41 | 52 |
| MSCI Value Weighted | 0.69 | 3.16 | 0.51 | 0.22 | 54 |
| MSCI Size tilt | 0.42 | 2.50 | 0.32 | 0.17 | 54 |

*Table II: *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.*

### *6.1.2. USA*

Table III presents the relative performance of the indexes for the USA. The active returns tell that the MSCI Small cap and the MSCI Momentum show statistical outperformance. The MSCI Momentum index presents a 59% hit ratio and realizes active return (3.46%) which is significantly different from zero at the 1% level. Looking at the information ratio, the MSCI Quality index shows the best results due to the relative low tracking error (3.93%). The t-statistic for the MSCI Small cap (2.61) proves that some additional premiums can be earned by investing in this index. Before making any conclusions about the source of this premium the regression analysis should be analyzed. It is possible

[7] The sample for the MSCI Small cap consists of data from January 2001 till February 2016. The corresponding average yearly return for the benchmark is 4.04% and the yearly volatility is15.75%. However, the active return cannot be compared to the active return of the other indexes, for which the data starts in 1994.

that the active return is due to exposure towards other factors. The index that aims to capture the value premium realizes a lower return than the standard MSCI USA benchmark. The MSCI Growth index, that in theory should show underperformance to the benchmark, shows a small positive active return. This contradicts the value effect that argues that value firms earn a higher premium compared to growth firms. None of these results are statistically significant.

| **USA** | Average Active return (%) | Tracking error (%) | t-statistic | Information ratio | Hit ratio (%) |
|---|---|---|---|---|---|
| MSCI Value | -0.68 | 4.73 | -0.52 | -0.14 | 49 |
| MSCI Growth | 0.34 | 4.79 | 0.25 | 0.07 | 52 |
| MSCI Small cap[8] | 3.80 | 8.86 | 2.23** | 0.43 | 52 |
| MSCI Momentum | 3.46 | 7.59 | 2.53*** | 0.46 | 59 |
| MSCI Minimum volatility | 0.82 | 6.11 | 0.70 | 0.13 | 46 |
| MSCI Quality | 2.18 | 3.93 | 1.70* | 0.56 | 54 |
| MSCI High dividend yield | 0.97 | 8.31 | 0.78 | 0.12 | 48 |
| MSCI Value Weighted | 0.31 | 4.03 | 0.23 | 0.08 | 49 |
| MSCI Size tilt | 0.60 | 2.86 | 0.45 | 0.21 | 49 |

*Table III:* *** *significant at the 1% level, ** significant at the 5% level, * significant at the 10% level*

The results for both regions are quite in line with each other. The Small cap and Momentum indexes both show statistical outperformance at the 95% confidence level. That the momentum effect was robust over time and for different regions was already mentioned in the literature review. However, the results found for the Small cap are a bit more surprisingly, because many research claimed that the small firm premium had disappeared over time. Like mentioned before, the results should be interpreted carefully before the regression analysis is conducted. The value indexes perform poorly in both regions. This could be a result of a low value premium or because of low exposure towards the value effect. The section about exposure will elaborate more on this. In short, the MSCI Small cap, MSCI Momentum and MSCI Quality have delivered, on average, better returns than their market weighted counterpart. The other indexes show no statistical outperformance looking at the relative performance. Because this section does not adjust for risk, the results of the MSCI minimum volatility may be undervalued.

[8] The sample for the MSCI Small cap consists of data from January 2001 till February 2016. The corresponding average yearly return for the benchmark is 4.57% and the yearly volatility is15.03%. However, the active return cannot be compared to the active return of the other indexes, for which the data starts in 1994.

### *6.2 Absolute performance*

#### *6.2.1. World*

This section evaluates the absolute performance of the MSCI factor indexes related to the world region. The Sharpe ratios provide for a comparison based on the risk-adjusted performance. Table IV shows the returns, volatilities and Sharpe ratios of all ten indexes concerning the developed world region. The MSCI Growth index obtains the lowest Sharpe ratio during the period June 1994 and February 2016. The best performing index has been the MSCI Quality. Favoring constituents based on how well they score on ratios such as return on equity, debt to equity and earnings variability appears to deliver good risk-adjusted returns. The Jobson-Korkie statistic of 2.45 indicates that the Sharpe ratio of the MSCI World Quality index significantly (at the 5% level) differs from that of the parent index. This also applies for the MSCI Minimum volatility and the MSCI Small cap. The good results of the MSCI Minimum volatility are not only due to higher returns, but also due to lower volatility. The MSCI World Momentum shows significant risk-adjusted outperformance at the 10% level. For the value index the Sharpe ratio is practically the same as for the benchmark, which indicates that investing in the MSCI Value index does not result in better risk-adjusted returns. The MSCI Growth index delivers a lower Sharpe ratio than the benchmark.

| **World** | Average Return (%) | Volatility (%) | Sharpe ratio | JK statistic |
|---|---|---|---|---|
| MSCI Standard | 6.65 | 15.03 | 0.35 | - |
| MSCI Standard (Small cap period) | 4.04 | 15.75 | 0.25 | - |
| MSCI Value | 6.72 | 15.28 | 0.35 | 0.02 |
| MSCI Growth | 6.37 | 15.66 | 0.32 | -0.26 |
| MSCI Small cap[9] | 8.35 | 18.06 | 0.48 | 2.29** |
| MSCI Momentum | 10.03 | 15.77 | 0.55 | 1.85* |
| MSCI Minimum volatility | 8.49 | 10.78 | 0.60 | 2.16** |
| MSCI Quality | 10.36 | 13.76 | 0.63 | 2.45** |
| MSCI High dividend yield | 8.96 | 14.73 | 0.51 | 1.48 |
| MSCI Value Weighted | 7.34 | 15.73 | 0.38 | 0.35 |
| MSCI Size Tilt | 7.07 | 15.25 | 0.37 | 0.25 |

*Table IV: The calculations for the Sharpe ratio and Jobson-Korkie statistic are executed using excess returns and the volatility of these excess returns. All the Sharpe ratios are compared to that of the parent index (MSCI Standard). *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.*

[9] The Sharpe ratio of the MSCI Small cap is compared the performance of the MSCI Standard that matches the Small cap period.

*6.2.2. USA*

The absolute performances of the indexes of the USA are discussed in this section. The same calculations are made for the USA as for the World. Only the MSCI Small cap shows a statistical risk-adjusted outperformance (at the 10% level) compared to the standard MSCI USA index. The question is whether these disappointing results are due to low factor exposure or low factor premiums in the USA. The next section will answer this question. Without any significant evidence, the Momentum, Quality and Minimum volatility indexes show the best Sharpe ratios. The lower Sharpe ratio for the Small cap is because the sample period for this index is different and returns during this period were relatively small.

| **USA** | Average Return (%) | Volatility (%) | Sharpe ratio | JK statistic |
|---|---|---|---|---|
| MSCI Standard | 9.00 | 15.02 | 0.50 | - |
| MSCI Standard (Small cap period) | 4.57 | 15.03 | 0.29 | - |
| MSCI Value | 8.32 | 15.01 | 0.46 | -0.40 |
| MSCI Growth | 9.34 | 16.52 | 0.49 | -0.09 |
| MSCI Small cap[10] | 8.37 | 19.29 | 0.46 | 1.72* |
| MSCI Momentum | 12.46 | 16.18 | 0.69 | 1.51 |
| MSCI Minimum volatility | 9.82 | 11.60 | 0.68 | 1.36 |
| MSCI Quality | 11.18 | 14.21 | 0.67 | 1.37 |
| MSCI High dividend yield | 9.98 | 13.48 | 0.61 | 0.90 |
| MSCI Value Weighted | 9.31 | 15.42 | 0.51 | 0.10 |
| MSCI Size Tilt | 9.60 | 15.38 | 0.53 | 0.27 |

*Table V: The calculations for the Sharpe ratio and Jobson-Korkie statistic are executed using excess returns and the volatility of these excess returns. All the Sharpe ratios are compared to that of the parent index (MSCI Standard). *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.*

The world factor indexes produce more significantly different Sharpe ratios compared to their benchmark than the USA factor indexes. Unlike with the relative performance, the MSCI World Minimum volatility now statistically dominates the benchmark based on the Sharpe ratio. Looking at the results so far the Small cap, Momentum and Quality show the highest average active returns. When the returns are adjusted for the risk the Minimum volatility also outperforms the MSCI Standard.

[10] The Sharpe ratio of the MSCI Small cap is compared the performance of the MSCI Standard Sharpe ratio that matches the Small cap period.

### *6.3. Exposure*

#### *6.3.1. World*

This part will clarify to what and to what extend the factor indexes are exposed towards the four factors. Table VI provides an overview of the descriptive statistics of the factor premiums issued from the website of Kenneth French. All the factor premiums are on average positive. However, the yearly size premium of 0.13% is almost negligible. It does correspond with the literature saying that the small firm premium has disappeared over time. The returns given are annually and the figures between the brackets are monthly. A one-sample t-test shows if the premiums are significant different from zero. For the MSCI Small cap index the correct premiums are included[11].

| **World** | Market-Rf | Size | Value | Momentum |
|---|---|---|---|---|
| Average premium (%) | 5.41 (0.44) | 0.13 (0.01) | 3.54 (0.29) | 8.32 (0.67) |
| Average premium (%) (Small cap period) | 4.58 (0.37) | 2.29 (0.19) | 3.79 (0.31) | 6.70 (0.54) |
| Volatility (%) | 15.08 (4.35) | 7.29 (2.10) | 8.28 (2.39) | 14.27 (4.12) |
| t-statistic | 1.63 | 0.07 | 1.95* | 2.63*** |
| Hit ratio (%) | 59 | 47 | 54 | 64 |

*Table VI: The data are obtained from the website of Kenneth French. The market premium is the return on a value-weight market portfolio minus the U.S. one month T-bill rate. The size premium is the equal weighted average return on the three small stock portfolios minus the equal weighted average return on the big stock portfolio. The value premium is the equal weighted average return for the two high B/M portfolios minus the equal average return on the low B/M portfolios. The momentum premium is defined as the equal weighted average return on the winner portfolios minus the average return of the two loser portfolios.*** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level*

MSCI allege that the factor indexes have shown outperformance relative to the market-cap weighted benchmark. To create a better view on where these extra returns come from, a cross-sectional analysis is executed. This will provide insight in the exposure towards the factors. Table VII shows the results of the regressions. Looking at the standard index, almost all of the return is explained by the market factor. This is line with the expectations, because the MSCI Standard is designed to mimic the entire market as much as possible. The other significant coefficient belongs to the size effect, which can be translated into exposure towards large-cap firms. All the indexes, except for the Small cap, are constructed with large- and midcap firms and thus explain the many negative coefficients for the size effect. Therefore, the MSCI Standard succeeds in replicating the total market. To stick with the size factor, the MSCI Small cap performed well in the previous section. Now table V confirms that many

[11] The sample period for the MSCI Small cap is shorter. Simultaneously the factor premiums are different and properly adjusted for.

of the outperformance is due to exposure towards the size premium. Figure 1 illustrates that the contribution of the size effect is 1.68% per year, while the total average annual return is 8.42%. This is extremely high compared to the size contribution for the other indexes. Two reasons for this are the high exposure and the higher average size premium in the sample period for the MSCI Small cap. These results indicate that it is possible to capture the size premium for the world region. The other index that focuses on the size premium is the MSCI Size tilt. This index attempts to capture the size premium by investing in large- and midcap firms (accessible for institutional investors). The significant positive coefficient in table V indicates that exposure is present, but relatively low. Together with the low size premium this has not resulted in satisfying returns.

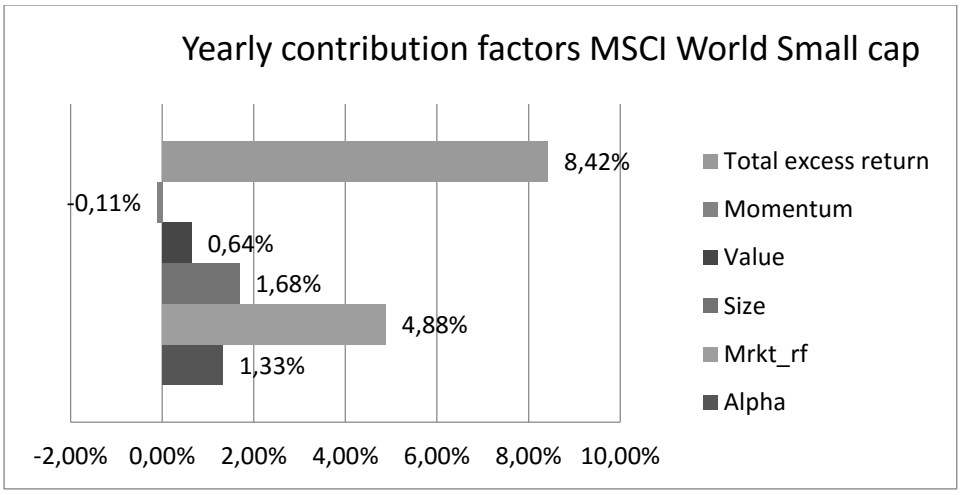


*Figure 1: Contribution MSCI World Small cap*

The Value and Growth indexes both have the desired value coefficient. Growth aims to experience exposure towards growth stock (negative coefficient) and Value aims to be exposed towards value stocks (positive coefficients). The MSCI Value index captures on average 29.22% of the value premium. Apart from that, the index is negatively exposed to the momentum and size effect. The MSCI Growth index endures significant exposure towards the momentum (positive) and size (negative) factor. It seems to be hard to construct an index that is only exposed towards the factor index.

The alphas of many indexes are not significantly different from zero, which together with the high adjusted $R^2$ indicates that most of the variance of the returns is explained by the four risk factors.

The MSCI Momentum index manages to have a substantial focus on the momentum effect. Figure 2 illustrates that 3.49% of the total excess return (8.52%) is due to tilt towards past winners. Practically all the other return comes from the market. This index succeeds in providing exposure mainly towards its target factor. The MSCI Quality index is one of the two indexes that has a significant alpha, probably gaining returns from exposure to alternative factors other than the ones taken into account in

this four factor model. The alpha (0.0037) corresponds with a yearly return of 4.53%[12]. The alpha for the MSCI Minimum volatility index is of a lower magnitude, but also provides evidence for alternative factors. When evaluating the results it appears to be hard to construct a portfolio (index) that only experiences exposure towards its target factor. These findings could be an explanation why it is so hard to fully capture a factor premium. For example, the focus on realizing the value premium could result in exposure towards past losers (negative momentum coefficient), which will decrease the average return.

The figures 5-18 in the appendix deliver an overview of the average contribution per factor per index.

| **World** | Alpha | Market | Size | Value | Momentum | Adjusted $R^2$ |
|---|---|---|---|---|---|---|
| MSCI Standard | 5.98E-06 | 0.9873*** | -0.1929*** | -0.0015 | -0.0075 | 0.996 |
| MSCI Value | -0.0002 | 0.9764*** | -0.1654*** | 0.2922*** | -0.0863*** | 0.979 |
| MSCI Growth | 0.0002 | 0.9978*** | -0.2251*** | -0.3026*** | 0.0632*** | 0.977 |
| MSCI Small cap[13] | 0.0011 | 1.0651*** | 0.7352*** | 0.1772*** | -0.0170*** | 0.970 |
| MSCI Momentum | -0.0003 | 1.005*** | -0.1499*** | 0.0055 | 0.4288*** | 0.896 |
| MSCI Minimum volatility | 0.0017** | 0.6542*** | -0.1949*** | -0.1801*** | 0.02877 | 0.826 |
| MSCI Quality | 0.0037*** | 0.8410*** | -0.3925*** | -0.2153*** | 0.0406** | 0.921 |
| MSCI high dividend yield | 0.0011 | 0.9105*** | -0.2545*** | 0.3790*** | -0.0323 | 0.910 |
| MSCI Value weighted | 0.0004 | 1.011*** | -0.1013*** | 0.2641*** | -0.1025*** | 0.989 |
| MSCI Size tilt | 0.0001 | 0.9980*** | 0.0396*** | 0.1518*** | -0.0578*** | 0.988 |

Table VII: **** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level*

Further notable findings are that the MSCI Quality and the MSCI High dividend yield show relatively high tilt towards large cap firms. The strong relationship between dividends, the Quality fundamentals and a company's size could be an explanation for this. The MSCI Value and MSCI Value weighted appear have practically the same exposure.

[12] (1.0037)^12-1 ≈ 4.53%

[13] The regression analysis for the MSCI Small cap has another sample period.

*6.3.2. USA*

This section conducts a regression analysis to investigate what factors are responsible for the factor index returns in the USA. The data are gathered from the website of Kenneth French. Compared to the premiums for the developed world region, the size and market premium are more pronounced for the USA. The opposite applies for the momentum and value effect. Table VIII presents the descriptive statistics of the factor premiums. For the MSCI Small cap index the correct premiums are included[14]. The findings are presented in the following table:

| **USA** | Market-Rf | Size | Value | Momentum |
|---|---|---|---|---|
| Average premium | 7.57 (0.61) | 1.81 (0.15) | 1.94 (0.16) | 6.29 (0.51) |
| Average premium (%) (Small cap period) | 4.82 (0.39) | 3.86 (0.32) | 2.51 (0.21) | 1.90 (0.16) |
| Volatility (%) | 15.35 (4.43) | 11.85 (3.42) | 11.09 (3.20) | 17.49 (5.18) |
| t-statistic | 2.22** | 0.71 | 0.81 | 1.59 |
| Hit ratio (%) | 62 | 49 | 51 | 62 |

Table VIII: The data are obtained from the website of Kenneth French. The market premium is the return on a value-weight market portfolio minus the U.S. one month T-bill rate. The size premium is the equal weighted average return on the three small stock portfolios minus the equal weighted average return on the big stock portfolio. The value premium is the equal weighted average return for the two high B/M portfolios minus the equal average return on the low B/M portfolios. The momentum premium is defined as the equal weighted average return on the winner portfolios minus the average return of the two loser portfolios. *** Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

The results of the regressions are summarized in Table IX. The MSCI Standard shows some small exposure towards the size, value and momentum factor, but is mainly exposed towards the market factor. For the Value and Growth indexes the direction of the value coefficients are in line with expectation. However, figure X in the appendix illustrates that the yearly contribution of the value effect (0.54%) is marginal compared to the yearly total return (6.88%). The Value and Growth indexes are not only exposed to their target factor. All the other coefficients appear to be significant at least at the 5% level. That only large- and midcap firms are included explains the negative size coefficients. The exposure towards the momentum factor is positive for the Growth index and negative for the Value index. This could imply that favoring value stocks lead to exposure towards past losers and favoring growth stocks lead to exposure towards past winners.

The MSCI Value weighted shows practically the same value contribution as the MSCI Value. The only difference between the indexes is that the MSCI Value weighted shows a significant alpha. The other results are almost identical.

[14] The sample period for the MSCI Small cap is shorter. Simultaneously the factor premiums are different and properly adjusted for.

| **USA** | Alpha | Market | Size | Value | Momentum | Adjusted $R^2$ |
|---|---|---|---|---|---|---|
| MSCI Standard | 3.82E-04 | 0.9938*** | -0.1858*** | 0.0146* | -0.0169*** | 0.992 |
| MSCI Value | -9.75E-05 | 0.9620*** | -0.1700*** | 0.2897*** | -0.0765*** | 0.958 |
| MSCI Growth | 0.0009 | 1.0244*** | -0.2066*** | -0.2707*** | 0.0330** | 0.941 |
| MSCI Small cap[15] | 0.0003 | 1.0225*** | 0.7422*** | 0.1930*** | 0.0089 | 0.971 |
| MSCI Momentum | 0.0012 | 1.0572*** | -0.1655*** | 0.0133 | 0.2901*** | 0.880 |
| MSCI Minimum volatility | 0.0016** | 0.7563*** | -0.2103*** | 0.1819*** | 0.0243* | 0.894 |
| MSCI Quality | 0.0028*** | 0.8961*** | -0.2576*** | -0.1573*** | 0.0106 | 0.931 |
| MSCI high dividend yield | 0.0018* | 0.7952*** | -0.2749*** | 0.4088*** | -0.0501** | 0.846 |
| MSCI Value weighted | 0.0007* | 0.9872*** | -0.1498*** | 0.2752*** | -0.1120*** | 0.980 |
| MSCI Size tilt | 0.0007* | 0.9957*** | -0.0741*** | 0.1578*** | -0.0649*** | 0.980 |

Table IX: *** *Significant at the 1% level, ** significant at the 5% level, * significant at the 10% level*

The MSCI Small cap shows pleasant results. Figure 2 illustrates that the contribution of the size effect is 2.85% per year, against a total average return of 8.64%. This is extremely high compared to the size contribution to the other indexes. The fact that the average monthly size premium is 0.32% for the Small cap sample compared to 0.15% for the entire sample period is one of the reasons for this high contribution. Of course the high coefficient for the size premium also contributes to these findings.

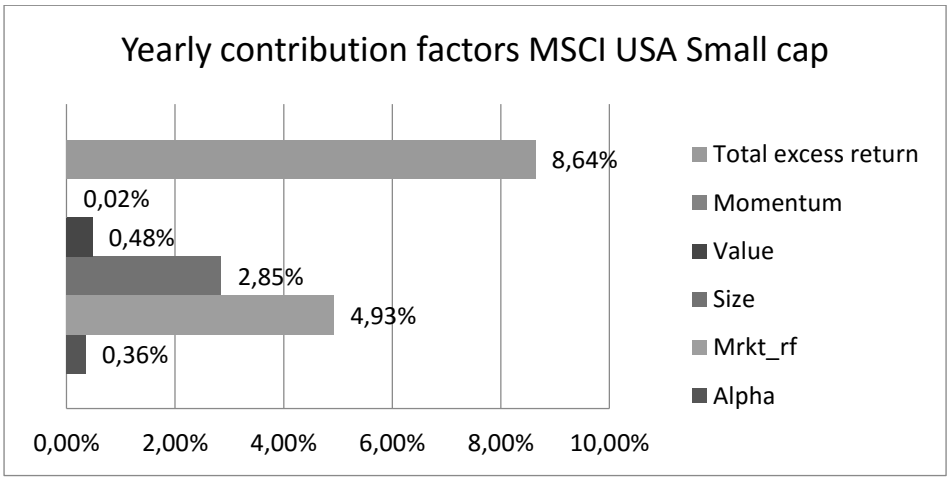


*Figure 2: Contribution MSCI USA Small cap*

[15] The regression analysis for the MSCI Small cap has another sample period.

Five of the factor indexes demonstrate a significant alpha at the 10% level. The alpha could indicate that the stock returns are explained by exposure towards other factors. The MSCI Quality shows the biggest alpha. An alpha of 0.0028 corresponds with an average yearly contribution of 3.41%[16]. This is not surprisingly because the Quality index does not attempt to capture one of the factors included in the model and is probably explained by different factors.

This part will compare the results of the world and the USA and mention interesting findings. The MSCI World Size tilt succeeds in finding positive exposure towards the size premium even with investing in large- and midcap stocks. The MSCI USA Size tilt did not manage to deliver positive exposure. An explanation could be that the world region on average exists of smaller firms. The results for both the MSCI High Dividend yield indexes suggest high exposure towards the value effect. These matching results show that stocks with high dividend in general also have high book-to-market ratios.

Some contrary results were also found. In contrast to the MSCI World Momentum the alpha is positive for the USA. This could imply that alpha (alternative factors) has a negative contribution for the world and a positive contribution for the USA. Although the total excess return of the momentum index for the USA (10.93%) is higher than for the world (8.52%), the contribution of the momentum effect for the USA (1.79%) is lower than the contribution for the world region (3.49%). A greater contribution of the market and alpha for the USA explain this. Figure 1 and 2 display the difference in contribution per factor for the MSCI Momentum index.

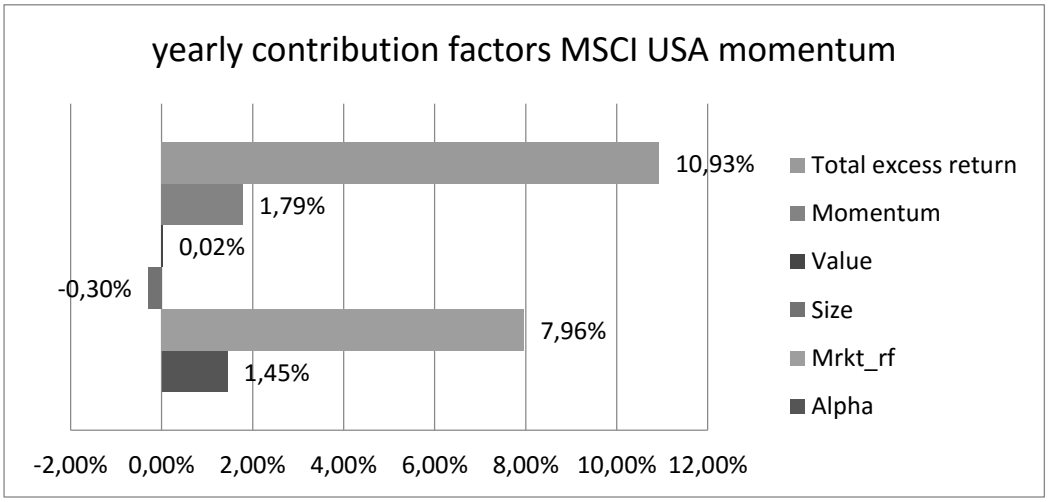


*Figure 3: Contribution MSCI USA Momentum*

[16] (1.0028)^12-1 ≈ 3.41%

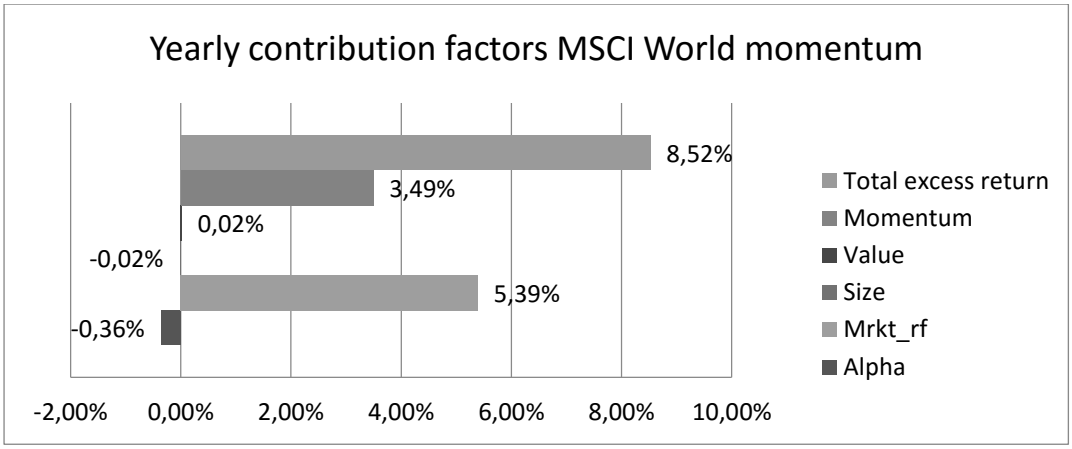


Figure 4: Contribution MSCI World Momentum

In short, many indexes experience unintended factor exposure. Only the results of the Small cap and the Momentum indexes indicate that practically all the exposure, apart from the market exposure, went to the target factor. Furthermore, it can be concluded that most of the indexes show matching results for both regions. The MSCI Value and the MSCI Value weighted practically do not differ. The MSCI Size tilt manages to receive positive exposure towards the size premium for the world region and does not for the USA region. Still the magnitude of the exposure and size premium is small and has no substantial influence that leads to outperformance of the parent index.

### *6.4. Responsible for outperformance*

#### *6.4.1. World*

The indexes that showed statistical outperformance (at least the 10% level) are analysed in more depth in this section. Table X displays how the outperformance is divided over the three factors and alpha. The small cap and the momentum owe their outperformance mainly to their target factor. In particular the momentum index. 3.11% of the total 3.30% is due to exposure towards the momentum factor. The other indexes do not aim to capture one individual factor, but surely receive active return through exposure either one of the factors. Minimum volatility experiences more than 2% from the value and momentum effect combined. After accounting for negative loadings to other factors, this brings the total outperformance to 1.17%. A big part of the MSCI High dividend yield index performance is also explained by the value effect. The active return of the MSCI Quality index is not due to one of the factors of the three-factor model. The big significant alpha indicates that alternative factors (not in the model) may drive the outperformance. From the results it can also be concluded that the MSCI High dividend yield is more exposed to the value effect than the MSCI Value index itself. This is odd because the main focus of the MSCI High dividend yield index is not to capture the full value effect. The explanation may be that firms that pay high and consistent dividends in general have a high book-to-market ratio, while the MSCI Value index fails to capture it fully because it weighs stocks based on multiple valuation ratios (other than book-to-market).

| **World** | Alpha (%) | Size (%) | Value (%) | Momentum (%) | Total outperformance (%) |
|---|---|---|---|---|---|
| MSCI Small cap | 2.05 | 2.15 | 0.70 | -0.35 | 4.55 |
| MSCI Momentum | -0.22 | 0.01 | 0.00 | 3.51 | 3.30 |
| MSCI Quality | 3.11 | -0.03 | -0.54 | 0.75 | 3.30 |
| MSCI Minimum volatility | -1.05 | 0.00 | 1.10 | 1.13 | 1.17 |
| MSCI High dividend yield | 0.70 | -0.01 | 1.44 | -0.01 | 2.12 |

Table X: The percentages are calculated by multiplying the coefficients with the appropriate average factor premiums found on the website of Kenneth French. The total outperformance may differ from previous presented outperformance due to annualizing and rounding differences.

### *6.4.2 USA*

The same analysis is performed on the indexes for the USA that showed outperformance. It emerges that the MSCI Small cap realizes the outperformance mainly because of the factor loading regarding the size effect. According to table XI the 4.40% total outperformance consist of 3.44% size effect. The remaining active return is explained by the value effect (0.48%) and possibly by some unknown factors (0.47%). For the MSCI USA Momentum the contribution of the momentum factor (1.78%) is less dominant than for the MSCI World momentum (3.51%). About half can be assigned to the momentum effect. The other half is due to alternative factors. For the MSCI USA Quality index practically the same results are found as for the MSCI World Quality index. Most of the outperformance comes from factors that are not included in the three-factor model. The findings for the minimum volatility and high dividend yield are less distinct. This is not surprisingly because they do not favor tilt towards one of the employed factors. The significant value contribution is probably due to the focus on consistent and mature firms. Also for the USA can be concluded that the MSCI High Dividend index has higher performance due to value factor exposure then the MSCI Value index.

| **USA** | Alpha (%) | Size (%) | Value (%) | Momentum (%) | Total outperformance (%) |
|---|---|---|---|---|---|
| MSCI Small cap | 0.47 | 3.44 | 0.48 | 0.01 | 4.40 |
| MSCI Momentum | 1.55 | 0.06 | -0.04 | 1.78 | 3.36 |
| MSCI Quality | 1.99 | -0.17 | -0.26 | 0.34 | 1.89 |
| MSCI Minimum volatility | -0.67 | -0.15 | 0.45 | 0.66 | 0.29 |
| MSCI High dividend yield | -0.07 | -0.25 | 0.85 | 0.14 | 0.67 |

Table XI: The percentages are calculated by multiplying the coefficients with the appropriate average factor premiums found on the website of Kenneth French. The total outperformance may differ from previous presented outperformance due to annualizing and rounding differences.

## 7. Conclusion

This paper assesses the performance of the MSCI factor indexes in the developed world and the USA relative to their market-weighted benchmark. Furthermore, the exposure of the factor indexes towards the factors is examined by conducting regression analysis. The research question is:

"Do the MSCI World and MSCI USA factor indexes show outperformance (active return and/or risk-adjusted returns) towards their market weighted benchmarks?"

The paper finds that the following factor indexes statistically outperform their benchmark for both regions when focused on active returns and risk-adjusted returns: MSCI Small cap, MSCI Momentum, MSCI Minimum volatility, and MSCI Quality. Investing in the appropriate MSCI factor index, during the period 1994-2016, would have resulted into outperformance of the market-weighted standard benchmark. However, outperformance is not found for the following factor indexes: MSCI Value, MSCI Value Weighted and MSCI Size tilt.

Because outperformance alone does not indicate where the additional returns come from, a regression analysis is conducted. In Section 3 two statements were presented. The first hypothesis stated that the results found for both regions do not show substantial differences. The results for the developed world slightly dominate those of the USA. Therefore, the hypothesis is not completely true. The most notable differences are found for the Quality indexes and the Momentum indexes. For the Quality indexes, the MSCI World Quality shows substantial higher active return the MSCI USA Quality. For the Momentum indexes the deviation is found in the amount of outperformance that is due to exposure towards the momentum factor. The premium from the target factor is substantially higher for the developed world (3.51%) than for the USA (1.78%), while the total outperformance is almost the same (respectively 3.30% and 3.36%).

The other hypothesis stated that in case an MSCI factor index outperforms the standard market cap weighted benchmark, the outperformance is mainly due to exposure towards the intended factor. The research shows that in many cases this is not correct. Only the Momentum and Small cap indexes show outperformance that is mainly through exposure towards the target factor. Therefore, the hypothesis is not true. The reason that many factor indexes experience exposure towards unintended factors is probably due to strong relationships between stock characteristics and the inability to use short positions to eliminate unwanted factor exposures.

That factor indexes can capture some active alpha will have a significant impact on the investment world. Investing in alternatively weighted factor indexes through ETF's and index funds will probably gain in popularity, and investors may seek to find new weighting strategies resulting in even

higher alphas. For traditional active fund managers that do not capture alpha on a consistent basis these findings could mean bad news.

This paper determines the performances looking at average return and risk-adjusted return. Therefore, it is not possible to discover temporary underperformance (or outperformance). When further research succeeds in modeling these cycles together with the relationship between the factors this could result in even better indexes. This way a multi-factor index can be constructed. For example, Asness (1997) finds a negative relationship between momentum and value across stocks. Strategies combining these two factors could potentially result in better-diversified factor portfolios.

Another way to extend the research is by including additional factor premiums for the regression analysis. Factors premiums for profitability and low volatility (risk) could provide additional information about which factors are responsible for the outperformance (or underperformance).

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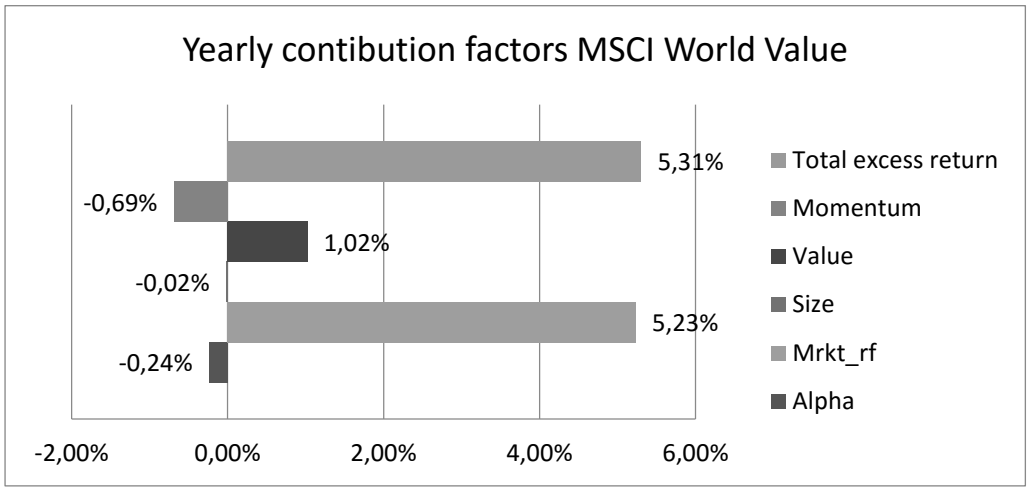
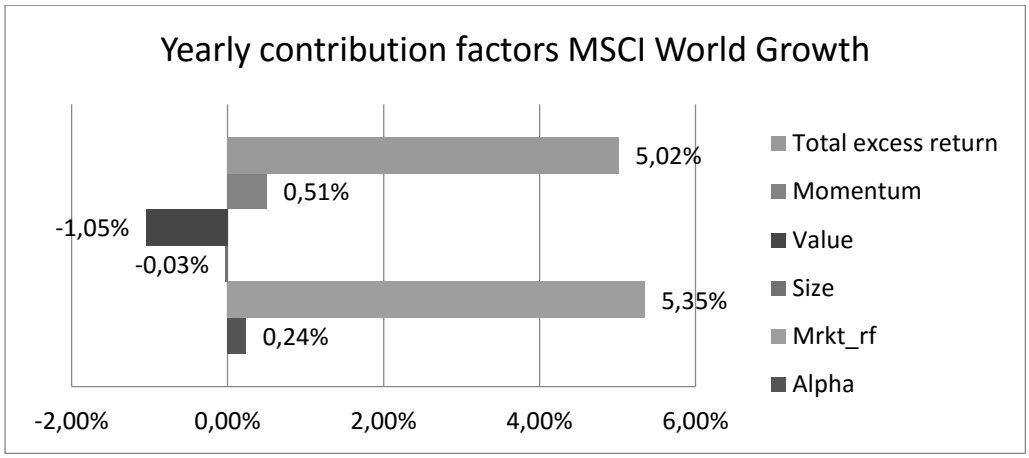
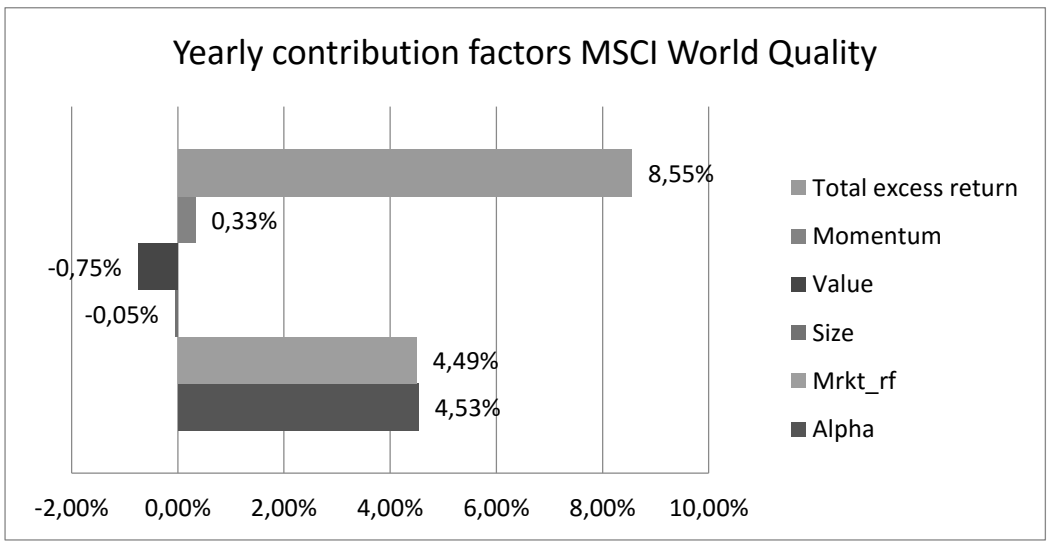
## 9. Appendix

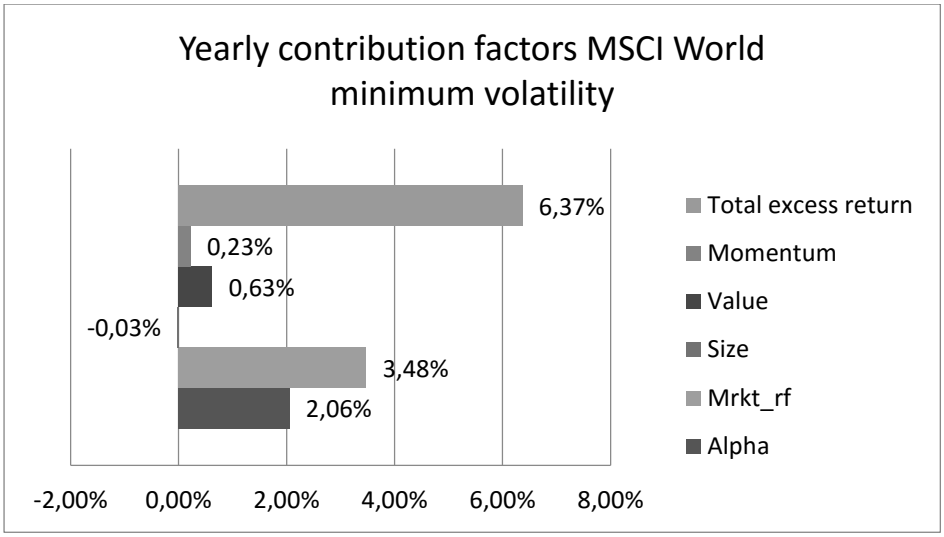
### *Graphs world*

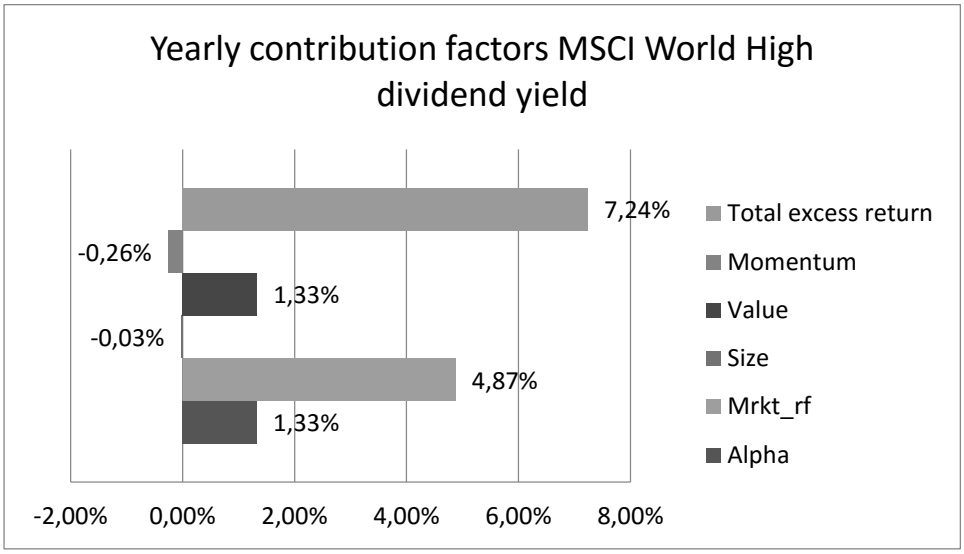
Figure 5-11

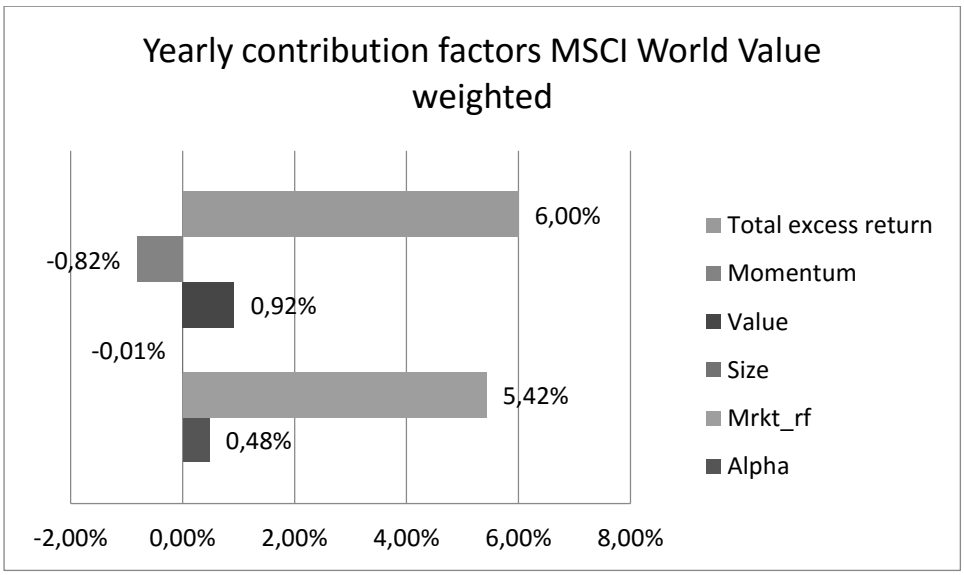


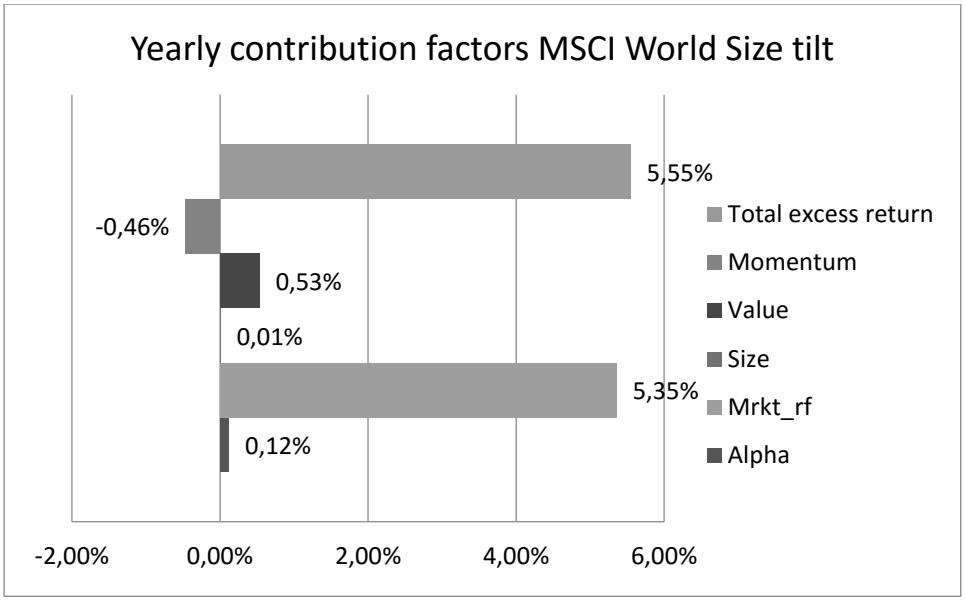




Yearly contribution factors MSCI World minimum volatility
6,37%
0,23%
0,63%
-0,03%
3,48%
2,06%
Total excess return
Momentum
Value
Size
Mrkt_rf
Alpha
-2,00%
0,00%
2,00%
4,00%
6,00%
8,00%

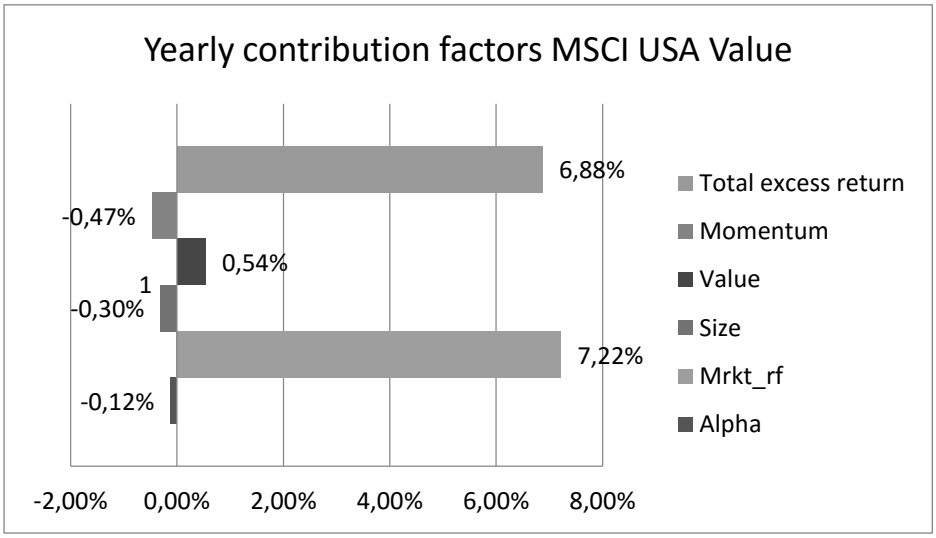

Yearly contribution factors MSCI World High dividend yield
7,24%
-0,26%
1,33%
-0,03%
4,87%
1,33%
Total excess return
Momentum
Value
Size
Mrkt_rf
Alpha
-2,00%
0,00%
2,00%
4,00%
6,00%
8,00%

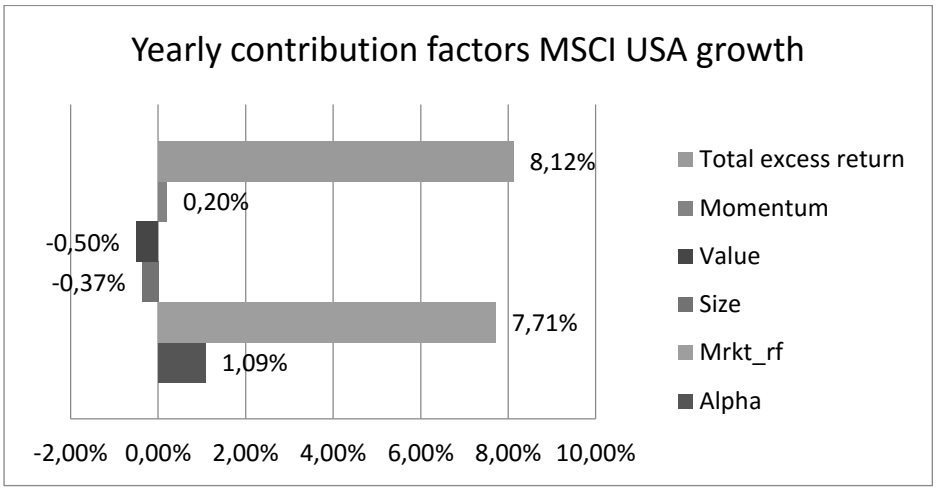

Yearly contribution factors MSCI World Value weighted
6,00%
-0,82%
0,92%
-0,01%
5,42%
0,48%
Total excess return
Momentum
Value
Size
Mrkt_rf
Alpha
-2,00%
0,00%
2,00%
4,00%
6,00%
8,00%

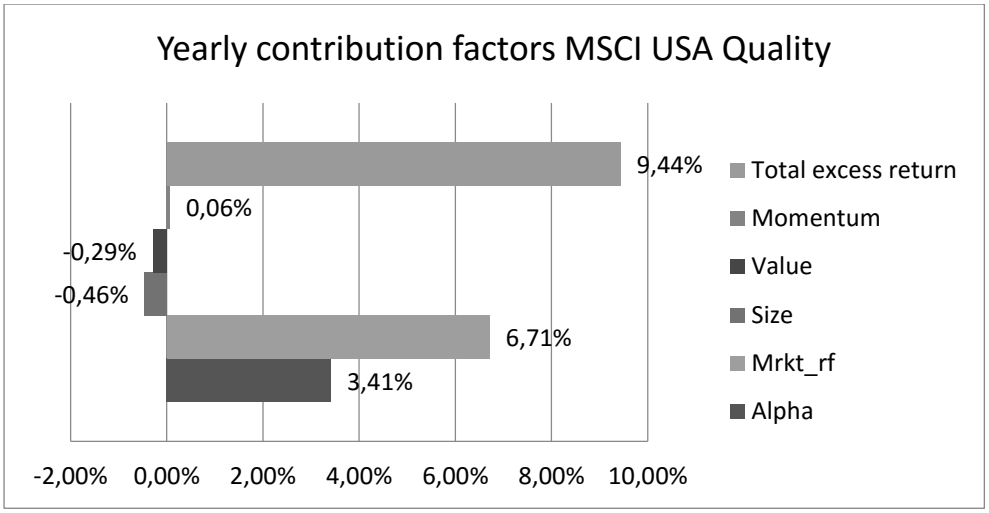


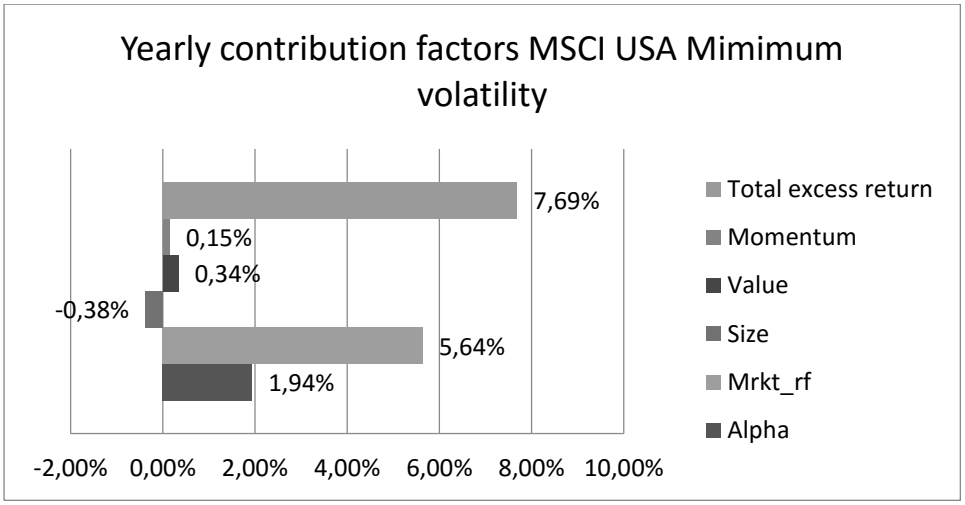

***Graphs USA***

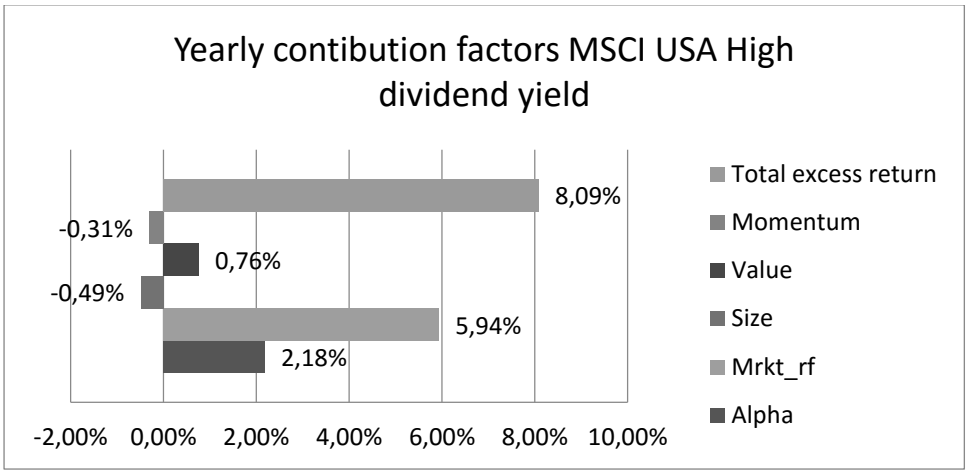
Figure 12-18

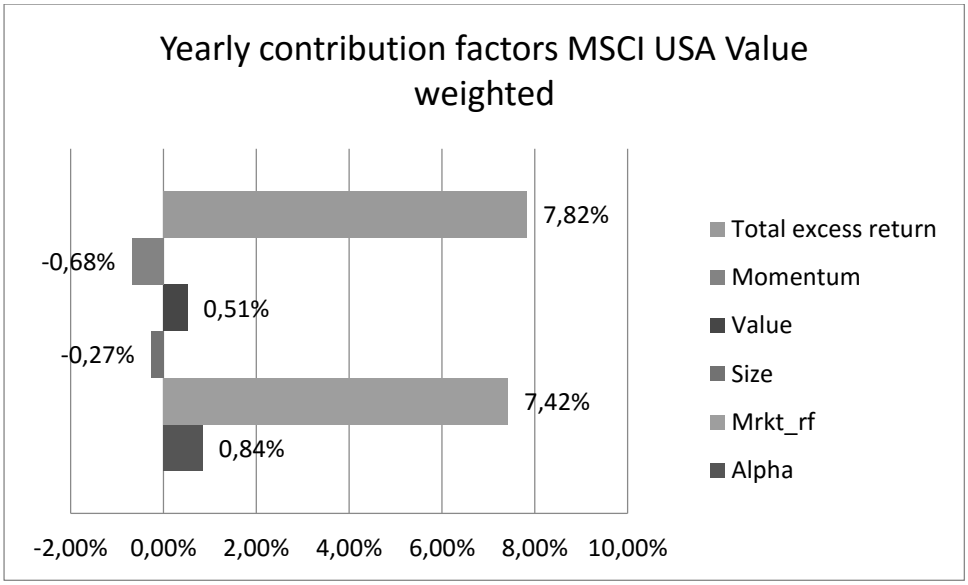


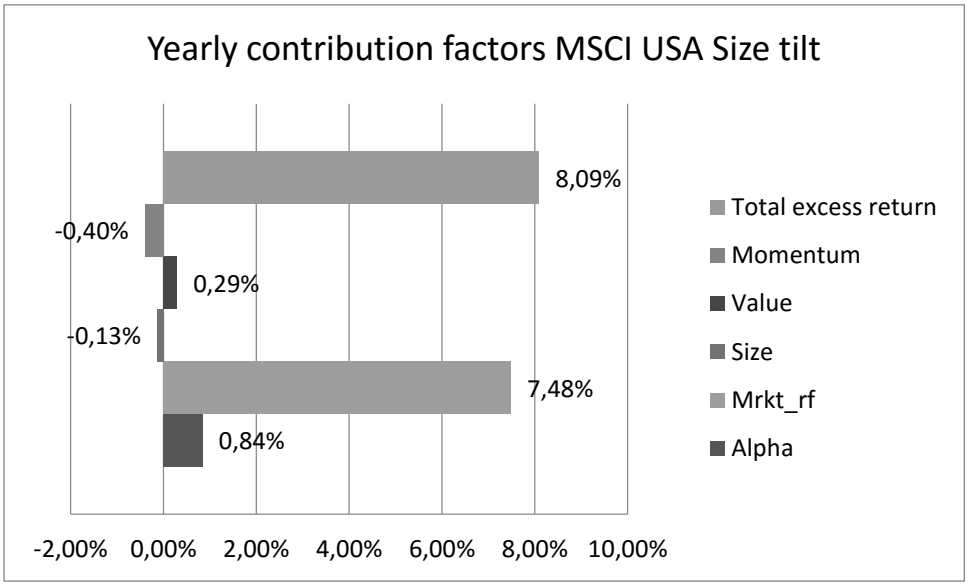




Yearly contribution factors MSCI USA Quality
9,44%
0,06%
-0,29%
-0,46%
6,71%
3,41%
Total excess return
Momentum
Value
Size
Mrkt_rf
Alpha
-2,00% 0,00% 2,00% 4,00% 6,00% 8,00% 10,00%


Yearly contribution factors MSCI USA Mimimum volatility
7,69%
0,15%
0,34%
-0,38%
5,64%
1,94%
Total excess return
Momentum
Value
Size
Mrkt_rf
Alpha
-2,00% 0,00% 2,00% 4,00% 6,00% 8,00% 10,00%


Yearly contibution factors MSCI USA High dividend yield
8,09%
-0,31%
0,76%
-0,49%
5,94%
2,18%
Total excess return
Momentum
Value
Size
Mrkt_rf
Alpha
-2,00% 0,00% 2,00% 4,00% 6,00% 8,00% 10,00%


Yearly contribution factors MSCI USA Value weighted
7,82%
-0,68%
0,51%
-0,27%
7,42%
0,84%
-2,00% 0,00% 2,00% 4,00% 6,00% 8,00% 10,00%
Total excess return
Momentum
Value
Size
Mrkt_rf
Alpha


Yearly contribution factors MSCI USA Size tilt
8,09%
-0,40%
0,29%
-0,13%
7,48%
0,84%
-2,00% 0,00% 2,00% 4,00% 6,00% 8,00% 10,00%
Total excess return
Momentum
Value
Size
Mrkt_rf
Alpha