OULUN YLIOPISTO
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STYLE ANALYSIS AND PERFORMANCE EVALUATION OF FINNISH EQUITY MUTUAL FUNDS

Master`s thesis

Finance

May 2014

UNIVERSITY OF OULU
Oulu Business School

ABSTRACT OF THE MASTER'S THESIS

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Title			
Style analysis and performance evaluation of Finnish equity mutual funds			
Subject	Type of the degree	Time of publication	Number of pages
Finance	Master	May 2014	70

Abstract

This study aims to analyze the style and performance of actively managed Finnish equity mutual funds by applying returns-based style analysis of Sharpe (1988, 1992) as the main methodology.

The main results support the findings of previous empirical studies, showing that the performance of actively managed equity mutual funds relative to passive market indices does not statistically differ from zero. Previous findings regarding the high correlation of mutual fund returns with standard asset classes and importance of asset allocation decisions are also strongly supported. The results of the study suggest that the styles obtained from returns-based style analysis are well in line with the stated investment objectives for most of the Finnish equity mutual funds, and that style analysis can effectively reveal additional information to support fund selection- and performance evaluation processes.

However, the results indicate that investment styles of many Finnish equity mutual funds do not significantly differ from a broad market index. The finding appears to be strong especially for the group of largest funds, whose returns a single broad market index is able to explain with an average of over 95%. Thus, the results of the study indicate that returns-based style analysis based on more specific style indices seems to generally provide the greatest relative benefit in the case of smaller funds that seem to have a higher likelihood to apply active management and investment styles not completely captured by a broad market index. The study also documents differences in the consistency of investment styles between different funds during the evaluation period 2004-2013 by applying style analysis with rolling estimation windows.

Main limitations of the study include the relatively small sample size and the general fact that the results obtained from style analysis and performance evaluation are very sensitive to the selection of benchmarks and the chosen sample period.

Keywords
Active and passive portfolio management, benchmarking, asset allocation

Additional information

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1 INTRODUCTION

The number and the overall variety of mutual funds have increased rapidly over the last few decades. In general, a clear growth in demand for all types of professional investment management has been observed, despite the controversy whether active fund management can truly deliver additional value over passive strategies. The majority of empirical studies suggest that after taking all costs into account, actively managed mutual funds with higher trading activity deliver lower returns than passively managed funds, and that practically all of the variation and persistence in mutual fund returns can be explained by exposures to common market factors and various investment styles. Previous studies also suggest that asset allocation decisions can be qualified as the main determinant of portfolio return and its variation, which is another key finding that has questioned the role of active stock picking- and market timing strategies of mutual funds. All these findings largely explain the increasing demand for low-cost index- and exchange-traded funds.(See e.g. Carhart 1997, Fama &French 2010, Petajisto 2013)

The popularity of mutual funds and other professionally managed portfolio products started to increase heavily during the 1980s and 1990s. In Finland, the amount invested in mutual funds increased from a total of 0.1 billion to 75.1 billion from 1992 till the end of year 2013 (Investment research Finland 2013). The high amount of different types of mutual funds makes it very challenging for an individual investor to collect all information regarding the strategies and fundamentals of investment funds these days. At the same time, it would be essential for investors to at least have a possibility to efficiently get detailed and reliable information in order to make successful investment decisions and to construct an optimal portfolio consisting of multiple funds and other investments. (See e.g. ter Horst, Nijman & de Roon 2004)

Humans generally have a strong tendency to classify and group similar objects into categories based on common characteristics in order to ease decision making and also make things more comparable. This can also be noticed clearly in financial markets, where investors group individual securities into broad asset classes, and asset class categories such as growth stocks and small-cap stocks as a part of the overall asset allocation- and investment process. These broad asset class categories can also be

referred to as styles, and making investment decisions based on these categories as style investing.(See e.g. Sharpe 1992, Barberis &Shleifer 2003)

In the concept of managed investment portfolios or funds, Sharpe (1992) defines style as the core investment philosophy of a portfolio manager, that first shapes guiding principles by which the manager builds a portfolio, and finally determines the risk/return-profile of the portfolio. A traditional approach to determine such investment style is to perform a step-by-step fundamental analysis of the securities held by a particular fund. A typical limitation for holdings-based approach is, however, that the analysis itself can take a notable amount of time and the overall availability of comprehensive information on portfolio composition can be limited especially for longer time periods. (Sharpe 1992)

To overcome these challenges, returns-based style analysis of Sharpe (1988, 1992) has become an important tool for the evaluation of different types of investment funds and their managers over the years. Together with more traditional fundamental analysis techniques it has greatly enhanced the processes of asset allocation and fund selection. The basic idea of style analysis is to compare time series of historical fund returns with those of a set of passive style indices, such as value-, growth- or small-cap indices by applying a constrained asset class factor-model. The resulting coefficients obtained from the analysis can be used to identify the investment style of a fund manager, for which previous literature has documented many beneficial applications especially for the purpose of improved performance evaluation. Returns-based style analysis can be considered as an external approach, as it is not subject to internal information of a fund. (Sharpe 1992, ter Horst et al. 2004)

Following these essential findings of empirical studies, the purpose of this thesis is to estimate and analyze the style and performance of Finnish equity mutual funds by applying returns-based style analysis as the main methodology. The obtained style exposures are applied to form subjective style-benchmarks for the purpose of style-adjusted performance evaluation of mutual funds, and the results are also compared to those obtained from some other widely applied performance evaluation methods. The main research question and goal of this thesis is to test and discuss the performance and information content of these methodologies by using data consisting of actively

managed Finnish equity mutual funds, and at the same time examine whether the funds have been able to provide additional value through active management.

The remaining component of this thesis is structured as follows: Chapter 2 introduces the general theoretical background for active and passive portfolio management, along with presentation of main empirical findings of previous studies primarily concerning equity mutual funds. Chapter 3 is dedicated for the review of theoretical background for portfolio performance evaluation. The chapter will introduce and discuss some of the most vital concepts and methods related to performance measurement, main focus being on traditional risk-adjusted measures of mutual fund performance, factor models, and related empirical findings. Chapter 4 provides theoretical background for style analysis along with presentation and discussion on its different applications and limitations. Chapter 5 is dedicated for the empirical analysis of Finnish equity mutual funds, starting with the presentation of the research data and main empirical methodology along with descriptive statistics of the data, following the presentation and discussion of the results obtained from the empirical analysis. Finally, section 6 will summarize the conclusions and main findings obtained from the study.

2 ACTIVE AND PASSIVE PORTFOLIO MANAGEMENT

The purpose of this chapter is to present and discuss the main theoretical background and empirical findings related to portfolio management and mutual fund performance. The chapter will also provide the main motivation for this study. Many of the discussed themes and concepts are closely linked to performance evaluation of mutual funds, and some of them will be discussed in more detail from a slightly different perspective in Chapter 3.

2.1 Background and review of previous empirical findings

Past decades have witnessed an increasing demand for professional fund management. The mutual funds registered in Finland received a total of 4.7 billion euros in new investments during year 2013, out of which 2.8 billion was invested in equity funds. Moreover, the positive market development during the year increased the total capital of Finnish mutual funds by 4.1 billion euros, out of which 80% was due to development of capital invested in equity mutual funds. (Investment research Finland 2014)

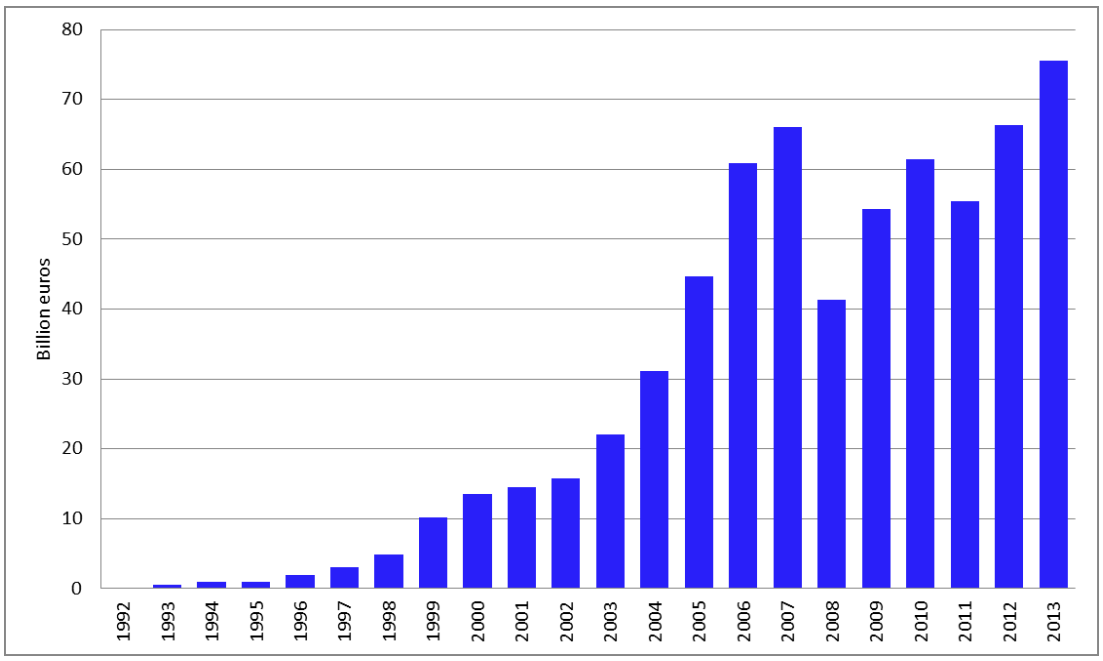

Figure 1. Development of total capital invested in Finnish mutual funds. (Investment research Finland 2013)

Figure 1 shows the development of total capital invested in Finnish mutual funds from year 1992 to 2013. By the end of year 2013 the total capital invested in Finnish mutual funds reached its all-time high of 71.5 billion euros. Out of Finnish equity mutual funds, the funds investing in Finland yielded the highest average annual return of 28.2% in 2013 (Investment research Finland 2014). According to French (2008) a clear trend of investors reallocating money from direct equity holdings into mutual funds can also be observed.

A good way to start discussing portfolio management and performance evaluation is by drawing a distinction between active- and passive management. Passively managed funds knowingly strive to replicate the performance of a particular market index or benchmark as closely as possible, with lowest possible costs. Actively managed funds, on the other hand, target to generate excess returns relative to a particular benchmark by applying different types of active market timing- and security selection strategies. Security selection and market timing ability are at the same time probably two of the most extensively studied and essential characteristics of actively managed investment portfolios. Timing ability can be defined as an ability to take advantage of the future movements of common market factors by strategically under- or overweighting an individual asset class. Alternatively expressed, if a manager has timing ability, he may actively change the allocation among different asset classes based on his market forecast in order to generate profit. The goal of active security on the other hand, is to select winning stocks or other securities within an asset class, by applying security-specific information in decision making. (See e.g. Sharpe 1991, Aragon &Ferson 2007:112-114)

In order to define the terms of active- and passive management, Sharpe (1992) breaks portfolio management into two main parts: style and selection. A passive portfolio manager provides only an investment style for an investor, whereas an active manager provides security selection in addition to investment style. Style can be seen as proportion of return that can be explained by changes in the market, while selection, or alternatively skill, is the proportion of return that is unique to the manager. Style is also closely related to the general concept of investment policy, which can be defined as the long-term asset allocation plan outlining the essential risk-return characteristics of a fund (See e.g. Brinson et al. 1986). However, it is good to notice that the

segregation between active- and passive funds may not always be completely clear, as the securities of some passive funds may represent just a certain portion of the whole market, style or a sector. Some of the passively managed funds may also charge investors relatively high fees, which can bring their total costs surprisingly close to those of their actively managed counterparts, albeit this is not often the case. (See e.g. Sharpe 1991)

A distinctive feature of all mutual funds is that they charge a varying number of fees from the investor, out of which the most common and notable one is usually the management fee. Other possible fees charged by mutual funds include different types of load-, redemption- and performance fees. It is also noteworthy to mention that the trading costs of a fund represent a cost from investor perspective, as they will reduce the final return obtained by investors. Even small differences in the overall expense ratios can significantly affect the final performance especially over a multiyear period. As already mentioned, the fees charged by actively managed funds are almost invariably higher than those of passively managed funds.(Aragon &Ferson 2007:108-110) Cremers, Ferreira, Matos and Starks (2011) find mutual funds to increase their active behavior and decrease their fees under the growing competitive pressure coming from passive index funds, which they conclude to be a positive phenomenon improving the overall efficiency of mutual fund industry.

Grinold and Kahn (1995: 481) list three essential questions of active portfolio management, which have also received most attention in empirical studies on the performance of actively managed investment portfolios:

- Can active managers on average beat benchmarks?
- Are the best managers truly skilled?
- Is there persistence in the performance?

Majority of previous studies suggest that only a small proportion of mutual funds are able to cover the extra costs and generate excess returns by applying active management strategies. Fama and French (2010) investigate the performance of a sample consisting of 3156 mutual funds between 1984 and 2006. The results of the

study suggest that only a negligible proportion of mutual funds are able to cover the extra costs of active management through abnormal performance. The study concludes that fund returns can be attributed almost entirely to market return, and that the average gross return of mutual funds is close to the market return, but eventually the extra costs of actively managed funds make the fund returns significantly lower as compared to the market return. Carhart (1997) proposes similar results finding no evidence for permanent skill among mutual fund managers. French (2008) concludes that as measured by performance, there generally exist no justifications for the various fees and expenses that actively managed mutual funds charge from investors.

Gruber (1996) and Malkiel (2005) propose similar findings as majority of empirical studies, concluding that actively managed funds on average provide lower returns compared to passive market indices (See also Elton, Gruber and Blake 1995). Moreover, Malkiel (2005) argues that investors should choose low-cost index funds instead of actively managed funds. Ferri and Benke (2013) propose a similar suggestion for investors, finding an all-index fund strategy to outperform portfolios consisting of actively managed funds. Ferri and Benke also find that the probability of an all-index fund portfolio beating actively managed portfolio further increases as the investment horizon gets longer, and as the number of individual funds included in the final portfolio increases. Sharpe (1991) argues that if classification between active and passive funds is done properly, the returns of actively managed funds should be equal with those of passively managed funds, and after costs the returns of actively managed funds should be less than those of passively managed funds. Malkiel (2005) states that in most cases the only result obtained from active security selection is an increase in transaction costs along with weaker performance.

There are also studies that have found some supporting evidence for the benefits of active management in mutual funds. Cremers and Petajisto (2009) find that funds whose portfolio compositions sufficiently deviate from those of passive benchmarks, seem to be able to cover the additional fees by applying active management strategies. Kacperzyk, Sialm and Zheng (2005) find that funds concentrating on few industries have better performance on average. Cochrane (1999) argues however, that in most cases the possible excess returns generated by some individual funds can be explained by the application of straightforward strategies based on investment styles, rather than

by absolute skill in fund management. Style investing will be discussed in more detail later during this chapter. It is good to perceive that even if there would be some individual funds that would be able to systemically deliver positive abnormal returns, it can be a very difficult task for investors to separate good funds from bad funds. Jenkinson, Howard and Martinez (2013) find that funds recommended by investment consultants underperform the average annual fund returns by 1.1 percent when they analyze a broad sample of investment consultants` recommendations over the period from 1999 to 2011.

2.2 Asset allocation and portfolio performance

One of the most vital steps of the overall investment process is to decide the proportions that each major asset class have in the final portfolio. This part of the investment process is generally referred to as asset allocation, which is also closely tied to the question of active- and passive management introduced in the previous section. A traditional way to define an asset class is to consider the essential risk-return characteristics that a particular group of securities have in common. These similarities make the returns of each individual security to behave similarly in the market with other securities inside an asset class. Equities, bonds and money market instruments are generally defined as the three major asset classes. There are also a number of more specific asset class categories or styles inside these broad asset classes, which are usually classified based on core characteristics behind observed asset pricing anomalies and mechanical strategies described later in this chapter. Different alternative investments such as hedge funds, commodities and real estate investments can also be seen as a supplement to these traditional asset classes, broadening the available asset allocation and diversification possibilities. Classification of different asset classes and asset class categories also serves as a basis for a number of performance evaluation methods such as different asset-class factor models and style analysis. (See e.g. Sharpe 1992, Greer 1997)

Several previous studies indicate that asset allocation covers a major part of the return variability when analyzing the returns of investment portfolios. A study by Brinson, Singer and Beebower (1991) uses historical investment data of large U.S. corporate pension plans to study the overall impact of different investment decisions and fund

policy to the formation of total return and its variability. They conclude that over 90% of investment portfolios` return variation can be explained by allocation to the main asset classes, making it clearly the main determinant of portfolio return variation.

Later studies show similar or even more significant results for the role of asset allocation to the contribution of investment return. Ibbotson and Kaplan (2000) find that asset allocation explains 90% of the return variation of a sample of balanced mutual- and pension funds. Blake, Lehmann and Timmermann (1999) conclude strategic asset allocation to be the main determinant of pension fund portfolio return variation. Ang, Goetzmann and Schaefer (2009) evaluate the role of active management in the performance of Norwegian Government Pension Fund. Ang et al. find that active management has a relatively small, yet a notable role to the contribution of the overall return of the fund. The authors also find that the significance of active management strategies to the contribution of total return may also vary from period to period. However, the authors conclude that only 1% of the total variance of the fund can be accounted for active management activities, and that exposures to systematic factors explain roughly 70% of the returns coming from active strategies. Based on these results it is reasonable to suggest that both institutional and retail investors should pay extra focus to the long-term asset allocation as a part of the overall investment process. According to Sharpe (1992) the role of asset allocation can be even greater if the overall portfolio consists of multiple funds.

Relatively strict regulation and stated objectives of equity mutual funds generally make asset allocation possibilities of mutual funds clearly more limited as compared to some other investment vehicles such as hedge funds. Fung and Hsieh (1997) argue that high correlation of mutual fund returns with standard asset classes demonstrates the fact that investment styles of most mutual funds are various buy-and-hold strategies based on allocation across asset classes. Fung and Hsieh also suggest that the performance of mutual funds is for most part location-driven, meaning that the market where the mutual funds primarily invest is generally the main determinant of mutual fund returns. Together with the highly important role of asset allocation in general, these are the two main findings that form a foundation for returns-based style analysis of mutual funds, and also the main motivation and reasoning for this thesis.

2.3 Efficient market hypothesis and traditional views

Performance evaluation literature concerning mutual funds has for a long time been very closely related to the vital question of market efficiency as originally presented by Fama (1970). Based on efficient market hypothesis (EMH) markets are informationally efficient, and therefore it should not be possible to generate excess returns based on historical price data as security prices should reflect all publicly available information. This naturally raises a big question considering the role of active portfolio management, as the hypothesis leads to a conclusion that if markets are well and truly efficient, it should not be possible to consistently beat simple market indices on a risk-adjusted basis. Most of the traditional- and also later studies on mutual fund performance indeed support the efficient market hypothesis, finding no evidence for abnormal performance of mutual funds relative to simple market indices. (See Cochrane 1999) Malkiel (2005) argues that even in the case that the markets wouldn`t be completely efficient, passive index investing will on average provide better results as compared to active management strategies.

However, studies testing the efficient market hypothesis have documented common patterns in average returns that cannot be completely explained by systematic market exposure. Banz (1981) finds evidence for the existence of size effect is stock returns, showing that small firms have delivered higher average risk-adjusted returns compared to large firms. The size factor has later been documented in several studies such as Fama and French (1993). Value is another widely studied asset pricing anomaly, as previous literature shows evidence for better performance of value stocks with high book-to-market ratio compared to growth stocks with lower book-to-market ratio. (See e.g. Fama &French 1993, 2010) However, there are also studies that find some contradictory evidence for value premium such as Lakonishok, Schleifer and Vishny (1992). Lakonishok et al. conclude that the average value fund provides a return that is 1% lower than that of S&P500 index, which is surprisingly a similar finding as proposed by studies on average mutual fund performance discussed previously.

A more recent study by Fama and French (2012) supports the results of earlier studies by finding global evidence for the existence common patterns in average returns, namely value premium and momentum. The findings of the study also suggest that the

magnitude of both anomalies decreases as the firm size gets larger. All the observed anomalies discussed so far provide a theoretical basis for some the most common and widely applied mutual fund performance evaluation methods discussed in the next chapter of this thesis.

2.4 Style investing and modern empirical research

Modern empirical studies have strongly shaped the way how market efficiency is tested and understood nowadays. More recent studies have realized the impact of potential real-world frictions to efficient market hypothesis, such as influence of information-, agency- and transaction costs. The discovery and application of multiple risk factors has also questioned the efficiency of market portfolio from a new perspective. New evidence suggests that there may be some fund managers that perform better than others, but finding the ones that are able to provide superior performance consistently is a question that still remains open in many ways. (See e.g. Cochrane 1999, Ang 2009) A key finding of modern empirical studies concerning equity mutual funds is that common stock return factors and investment expenses practically explain all of the observed persistence in mutual fund returns rather than skilled fund managers. The general predictability and a certain degree of persistence in asset returns is also a central and connective finding of modern empirical studies.(See e.g. Carhart 1997, Cochrane 1999, 2011) However, Carhart (1997) finds the persistence in the underperformance of the worst-performing mutual funds to be the only finding that is not explained by the common factors and expenses.

It is a common practice that investment styles are used as a basis for classification and marketing of mutual funds. The categorization of different asset classes and investment styles plays an important role also in bigger institutions such as pension plans, as main asset allocation decisions are based on identified asset classes and styles. Instead of focusing on selection of individual securities, style investing relies on the assumption supported empirical studies discussed so far, that there may be some particular broad asset class styles that can provide superior returns. Altogether, a general reason for the development of new investment styles is the discovery of abnormal performance in some asset class category, such as in the case of value stocks or small-cap stocks. Financial innovation can also create new investment styles by providing various new

investment products with different characteristics to the market. The popularity of individual investment styles may also fluctuate from year to another and also from market to market as a particular investment style may not continuously provide abnormal returns in all regions. (See e.g. Barberis &Shleifer 2003, Aragon &Ferson 2007:92-93)

Recent studies also find evidence for the existence mutual funds that endorse themselves as actively managed funds, although in reality the funds would for large part just mimic passive market indices. Cremers and Petajisto (2009) and Petajisto (2013) find that such funds, to which they refer to as "closet indexers", have a weaker change to beat the market. These studies argue that as of 2009 almost up to third of the total capital invested in mutual funds focusing on the U.S market was held by funds that fulfill the definition of closet indexing. According to Chan, Chen and Lakonishok (2002) most funds utilize investment styles that do not significantly deviate from a broad passive market benchmark. Chan et al. further argue that in cases when a fund manager actively takes divergent positions relative to the benchmark, there seems to be a tendency to weight growth stocks and securities with good past performance.

A management strategy that intentionally follows the benchmark fairly closely can be a tempting choice from perspective of a fund manager, as such strategy may safeguard that the fund will not underperform the benchmark too heavily. At the same time, closet indexing poses a real problem from investor perspective, as the index-mimicking returns of actively managed funds generally come with clearly higher costs as compared passive index funds effectively providing the equivalent returns. (See e.g. Cremers and Petajisto 2009) According to Cremers et al. (2011) the high degree of closet indexing in a particular country can for most part be explained by the low amount of competitive pressure coming from passive investment products.

3 MUTUAL FUND PERFORMANCE EVALUATION

The modern empirical findings discussed in the previous chapter have strongly shaped the way how the performance of investment portfolios managers is evaluated these days, and also provide the basis for the structure and content of this chapter. The purpose of this chapter is to provide a brief review of some of the most common mutual fund performance evaluation methods, along with the main findings and implications that support the object of this study.

3.1 Benchmarking

Portfolio performance evaluation is a very timely issue. Recent years have witnessed a broad development of new performance measures as well as a continuously growing amount of new empirical evidence on the subject. This goes well in hand with the fact that the demand for professionally managed investment portfolios has been growing at the same time. One main reason for the extent of the development is that cost of research has strongly declined as financial databases have continuously become more available to academic researchers and the investing public. Meanwhile, the computing tools required for the research have also developed and become more cost-effective. It is generally accepted that performance evaluation is not only useful and important for the owners of funds, as the portfolio managers also apply different performance evaluation tools to monitor and develop the overall investment process. (See e.g. Aragon & Ferson 2007:86-87)

A typical approach in portfolio performance evaluation is to compare the performance of a fund manager against a broad manager-specific benchmark, such as S&P 500 for a fund investing primarily in large-cap U.S companies. A core intuition of benchmarking is that it would be practically impossible to make any accurate and comparable conclusions of investment performance without relating the realized returns against some appropriate baseline. As different benchmarks will generally give notably different results concerning how the fund has performed, the selection of a benchmark is a vital step in the overall performance evaluation process. (See e.g. Sharpe 1992, Aragon &Ferson 2007:89-93)

According to Aragon and Ferson (2007:89-93) a proper benchmark portfolio should have equivalent return-relevant characteristics as the managed portfolio, excluding the reflection of the manager`s investment ability. They define this type of portfolio as an "Otherwise equivalent benchmark portfolio", which they also state to be an essential concept affecting the comprehension of many portfolio performance measures. More precisely, Aragon and Ferson emphasize the inextricable link between empirical asset pricing models and most portfolio performance measures, as they state that some sort of asset pricing model is needed in order to operationalize the concept of benchmarking and to be able to value different portfolio aspects and their outcomes.

Aragon and Ferson (2007:89-93) take Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965) as an example. CAPM states that allocation between market portfolio and risk-free asset define investor portfolios, and that proportions of these two components depends on the risk aversion of an investor. In the context of CAPM, the otherwise equivalent benchmark portfolio should simply have the same beta coefficient as the fund under evaluation, and therefore have an equivalent exposure to the market portfolio. The widely used Jensen`s alpha measure is based on this logic: a positive alpha implies that the manager has been able to beat the benchmark. Most of the empirical asset pricing models following the CAPM, such as the Arbitrage Pricing model (APT) of Ross (1976), apply exposures to several risk factors for the same process. In the context factor models, the set of factor exposures of the benchmark should be equal with those of the portfolio to be evaluated. APT and its extensions will be discussed more precisely later during this chapter.

In modern performance evaluation literature manager`s investment style is often assumed to define the otherwise equivalent benchmark portfolio, and style exposures are interpreted as risk factors. Thus, the style of the benchmark portfolio should be equal with that of the portfolio under evaluation (See e.g. Sharpe 1992, Aragon &Ferson 2007:92). Sharpe (1992) lists important features of a proper benchmark for performance evaluation. First, the benchmark portfolio should represent the manager`s investment strategy and style as closely as possible, and therefore should not be easily beaten. Second, it is important and desirable that the chosen benchmark would be cost-efficient and investable, meaning that the benchmark can be replicated using passive investment products. Properly defined performance measurement also provides the

basis for the argument that passively managed funds must on average outperform actively managed funds (Sharpe 1991).

In the context of performance evaluation, it is also very important to acknowledge the previously mentioned variety of investment expenses charged by mutual funds, as sometimes a manager may be able to beat the benchmark before these costs, yet after the costs the returns of a fund may be lower than those of its benchmark. In the case when a fund manager is able to beat the otherwise equivalent benchmark portfolio on an after costs basis, it can be stated that the fund is able to truly add value for an investor. On the other hand, if the fund manager is able to beat the benchmark only on a before-costs basis, the manager can be said to have investment ability. (Aragon &Ferson 2007:108-110)

3.2 Overview of classical performance measures

3.2.1 Sharpe ratio

Sharpe ratio (Sharpe 1966) is probably the most well-known and widely applied risk-adjusted performance measure of excess return. The following equation gives the Sharpe ratio for portfolio p:

$$SR_p = \frac{r_p - r_f}{\sigma_p} \tag{1}$$

where r_p denotes the return of a portfolio, r_f is the risk-free asset or cash, and σ_p is the standard deviation of the portfolio. The higher the Sharpe ratio of a fund, the better the performance of the fund has been on a risk-adjusted basis. Sharpe ratio can be seen as more reasonable performance measure compared to most of the simple return figures, since it also takes into account the nature of investments in terms of risk that have been made to attain the return. (See also Aragon &Ferson 2007:94-95)

Another risk-adjusted performance measure similar with Sharpe ratio is the Treynor ratio (Treynor 1965). The essential difference between these two ratios is that Treynor ratio applies systematic risk denoted by β as the denominator:

$$TR_p = \frac{r_p - r_f}{\beta} \tag{2}$$

The interpretation of the ratio is similar with the Sharpe ratio, higher ratio indicating better performance. A general limitation for both of these measures is that they do not accurately quantify the potential value and sources of the value generated by active portfolio management, and therefore the main purpose of use for these ratios is generally the ranking and comparison of mutual funds or other investments. (See e.g. Aragon &Ferson 2007:94-96)

3.2.2 Tracking error and Information ratio

An important aspect to consider in fund selection is that how much the fund returns deviate from those of its passive benchmark index. A common measure for such deviation is tracking error, which is simply defined as the standard deviation of the portfolio excess returns over a benchmark:

$$TrackingError_p = std(R_p - R_B) \tag{3}$$

where R_p is the return of portfolio p and R_B is the benchmark return. Tracking error measures the active risk of an investment portfolio. In the case of passive index funds it is desirable that the tracking error would be as close to zero as possible, meaning that the tracker of the fund has managed to successfully replicate the target index. In the case of actively managed funds on the other hand, a very small tracking error may indicate that the fund is basically just following a passive index and collecting higher fees as proposed by Cremers and Petajisto (2009).

A widely used and intuitive measure of active management is the Information ratio, which is closely related to the concept of tracking error. Information ratio of a portfolio can be expressed as:

$$InformationRatio_p = \frac{mean(R_p - R_B)}{std(R_p - R_B)} \tag{4}$$

where the mean excess return $mean(R_p - R_B)$, or alternatively expressed the residual return of a fund, is divided by the tracking error of a fund and its benchmark, which can be referred to as residual risk (Goodwin 1998). Intuitively information ratio can be interpreted as the degree to which a fund has beaten its benchmark to the consistency with which the fund has been able to beat the benchmark. It is an advantageous measure to compare the performance of different portfolio managers within the same market. Information ratio of a fund can also be expressed on the basis of the t-statistic of average abnormal return α:

$$IR \approx \frac{t_{\alpha i}}{\sqrt{T}} \tag{5}$$

where t-statistic is denoted as alpha divided by its standard error as shown in equation (7), and T is the number of years used for the estimation of excess return. The reliability of the estimation increases as the number of observation years increases. (Goodwin 1998) In order to improve the interpretation and comparability of information ratios between different portfolios, Grinold and Kahn (1995: 114) present a typical distribution of before-fee information ratios of mutual funds as shown in Table 1.

Table 1. Ranking based interpretation of Information Ratios (Grinold & Kahn 1995: 114).

Percentile	Information Ratio
90	1.0
75	0.5
50	0.0
25	-0.5
10	-1.0

Table 1 indicates that the information ratios are generally assumed to be distributed symmetrically around zero, which is consistent with the previously mentioned fundamental assumption that on average active management should represent a zero-sum game (Sharpe 1991). Information ratio can either be interpreted as an ex post information ratio or as an ex-ante information ratio, the former representing a measure of achievement and the latter a measure of opportunity or future expectation. (Grinold &Kahn 1995: 112-114)

3.2.3 Jensen`s alpha and CAPM

As already discussed, the main goal of active management is to generate excess return relative to a chosen benchmark. A widely used classical performance measure to quantify the abnormal return is investment alpha, that was originally advocated by Jensen (1968) based on the properties of the Capital Asset Pricing Model (CAPM). CAPM applies a single market risk factor to explain the returns of an asset. Alpha can be defined as the portion fund return, that the exposure to the systematic market factor cannot explain. Jensen (1968) examines the performance equity mutual funds by applying a regression:

$$R_{it} = \alpha_i + \beta_i Rm_t + (1-\beta_i)Rf_t + \varepsilon_{it} \quad (6)$$

where R_{it} is the asset or mutual fund return at time t, Rm_t denotes the market return, and Rf_t is the return of a risk-free asset. β_i coefficient denotes the proportions of risky- and risk-free assets, while the constant term α_i can be interpreted as the proportion of return that these two components cannot explain. When considering style/selection-framework, [$\beta_i Rm_t + (1-\beta_i)Rf$] can be viewed as the proportion of style while the residual returns [$\alpha_i + \varepsilon_i$] denote the potential selection return or skill of a manager. An essential assumption of CAPM is that expected alpha should equal zero, meaning that on long-run the average expected return should equal the expected return of the market. Alternatively expressed, CAPM assumes that higher average returns can only be achieved by increasing the exposure to the market as measured by the beta coefficient. However, there seems to be funds that follow rather mechanical

styles and are able to earn abnormal returns that cannot be explained by the CAPM without gaps. (See e.g. Fama &French 1993, Cochrane 1999)

Separating skilled investment managers from unskilled managers can be seen a main goal of portfolio performance evaluation. The t-statistic of alpha can be used to test the statistical significance of the measure, and therefore answer whether the performance of a portfolio manager has been a result of skill or luck. (See e.g. Fama and French 2010) Alpha t-statistic can be computed by dividing alpha by its standard error:

$$t_{\alpha i} = \frac{\alpha_i}{SE(\alpha_i)} \tag{7}$$

As mentioned earlier, most empirical studies such as Fama and French (2010) suggest that only a small number of mutual funds can be perceived to have enough skill to cover costs and therefore generate persistent excess returns as measured by investment alpha and its statistical significance.

3.3 Arbitrage pricing theory

Two main approaches generally considered in the performance evaluation of mutual funds. A traditional approach is to adjust the mutual fund returns only to the market portfolio as in equation (6). An alternative approach is to apply a multi-factor framework for the analysis, originally introduced by Ross (1976) as Arbitrage Pricing Theory (APT). Multifactor models use zero-cost portfolios that capture empirically observed patterns such as size, value and momentum described in the previous chapter. Multi-factor models target to control the effects of these potential mechanical strategies, which are also strategies that fund managers have been discovered to apply in portfolio management (See e.g. Sharpe 1992, Fama &French 2012).The core intuition behind both the CAPM and APT is that risk factors strongly influence the determination of expected asset returns. A general APT factor model can be expressed as:

$$R_{it} = \alpha_i + \sum_{j=1}^{k} b_{ij} F_{jt} + \varepsilon_{it} \quad (8)$$

where R_{it} is the return of a security and b_{ij} denotes the weights for each k factors F_{jt} . The intercept α_i is interpreted similarly as in the single-factor model shown in equation (6). Multifactor models commonly have an essential role in modern studies on mutual fund performance (See e.g. Carhart 1997, Fama &French 1993, 2010). As a result of the empirical studies some generalized extensions of APT have been introduced over the years, which will be introduced in the next section.

3.4 Generalized extensions of APT

3.4.1 Fama-French 3-factor model

In order to improve the capability to capture potential patterns in average returns, Fama and French (1993) present a three-factor model for asset returns:

$$R_{it} - R_{ft} = \alpha_i + \beta_i \left[Rm_t - Rf_t \right] + s_i SMB_t + h_i HML_t + \varepsilon_{it} \quad (9)$$

where R_{it} denotes the month t return of an asset or fund i, R_{ft} represents the risk-free return, Rm_t is the return of the market, SMB_t is the return of a portfolio formed by subtracting the returns of large stocks from small stocks, and HML_t denotes the return of a portfolio formed by subtracting the returns of growth stocks from value stocks. Fama and French (1993) find that a model considering additional risk factors provides a significantly greater explanatory power as compared traditional CAPM when examining variation of security returns.

3.4.2 Carhart 4-factor model

Carhart (1997) extends the three-factor model of Fama and French (1993) with a momentum factor:

$$R_{it} - R_{ft} = \alpha_i + \beta_i \left[Rm_t - Rf_t \right] + s_i SMB_t + h_i HML_t + m_i MOM_t + \varepsilon_{it} \qquad (10)$$

where the additional factor MOM_t denotes the momentum factor indicating the difference in returns of a portfolio consisting of stocks with high past performance and a portfolio of stocks with low past performance. Carhart finds that a portfolio that is composed of mutual funds with high past performance outperforms portfolio consisting of funds with low performance with a monthly average of 1%, showing evidence for persistence in fund performance and supporting the findings of Jegadeesh and Titman (1993). However, Carhart suggest that the abnormal performance is rather a result of momentum in individual securities held by a fund, than a result explained by the existence of actual "momentum funds".

In the context of mutual fund performance evaluation the size-, value-, and momentum factors can be interpreted as the returns of diversified passive benchmarks that are applied to capture the return variation and factor exposures of funds (See e.g. Fama &French 2010). The intercepts of both models can be used to examine the influence of active management similarly as in the case of CAPM and the traditional Jensen`s alpha, and the statistical significance of the intercepts as shown in equation (7) can be used to draw a conclusion whether the abnormal performance has been due to luck or skill. Cochrane (1999) concludes that presumably the most important thing for mutual fund investors is to acknowledge the existence of funds following different styles in addition to the role of broad market index. This essential finding provides a natural transition to the next chapter of this thesis, which will present the theoretical background for returns-based style analysis of investment portfolios.

4 RETURNS-BASED STYLE ANALYSIS

This chapter will present and discuss the theoretical background for returns-based style analysis and its applications along with supporting findings of previous empirical studies.

4.1 Determination of investment style

The rapid growth of mutual fund industry has increased overall variety of funds with different styles that are available to investors. According to Chan et al. (2002) investors have also become more aware about the features of investment styles and asset allocation possibilities across funds utilizing different styles. Chan et al. further argue that the overall importance and focus on investment style has increased as a result of this development and due to the increasing amount of empirical evidence on the subject. The relationship between mutual fund performance and investment style has gained a lot of attention in previous literature, such as Fama and French (1998) and Chan and Lakonishok (2004). Sharpe (1992) shows that the performance of U.S. mutual funds can be replicated by using a small amount of different asset classes to explain the return variation. Sharpe uses the term “tracks in the sand” to describe the portfolio manager`s return pattern, and to illustrate the core intuition of style analysis. In returns-based style analysis, the “tracks” of a manager are compared to those of a chosen set of passive benchmark indices.

Multi-factor models reviewed in Chapter 2 are commonly used to characterize the relation of investment portfolios and a set of factors, such as economic- and industry factors. Studies such as Fama and French (1993) and Chan, Karceski and Lakonishok (1998) find that factors based on size and book-to-market valuation efficiently explain variation in stock returns. The purpose of these models is to try to replicate the evaluated investment portfolio, and attain information about the essential characteristics of an investment. Sharpe (1992) proposes a generic factor model in a form:

$$R_i = \left[w_{i1}F_1 + w_{i2}F_2 + \ldots + w_{in}F_n\right] - \varepsilon_i \tag{11}$$

where R_i represents the returns of asset i, F_1 through F_n present the values of factors, w_{i1} through w_{in} present the sensitivities, or weights of R_i to these factors, and ε_i is the residual component of return. Two essential differences of style analysis compared to a generic factor model are that style analysis uses a set of particular passive style indices as explaining factors, and the weights of the chosen factors are generally imposed to be positive and sum up to one in order to constitute a positively weighted portfolio. In the case of equity mutual funds, a non-negativity constraint is also generally applied to better adjust for the actual investment strategies and regulation. The amount of applied factors in style analysis is case-specific. The standard Sharpe (1992) style analysis model is generally represented by presenting equation (11) in a form:

$$\varepsilon_i = R_i - \left[w_{i1}F_1 + w_{i2}F_2 + ... + w_{in}F_n\right] \tag{12}$$

where the sum $\left[w_{i1}F_1 + w_{i2}F_2 + ... + w_{in}F_n\right]$ represents the investment style of a fund manager. The residual component ε_i can be interpreted as the difference between the returns of a fund and that of a passive style portfolio shown in the square brackets, and it reflects the selection of a manager depart from the passive style portfolio. Style analysis aims to find a set of factor exposures that minimizes the residual component of the model, which can also be referred to as the tracking variance of a fund. Due to the general constraints applied in the model, the process requires the use of quadratic programming. Style analysis can alternatively be defined as the process for finding style weights that result the best fitting style-benchmark for explaining the variation of fund returns. The resulting style weights obtained from style analysis are sometimes also referred to as exposures, sensitivities, coefficients, or return drivers of a fund.(Sharpe 1992, Mason et al. 2012) Becker (2003:450-453) summarizes the main mathematical difference between returns-based style analysis and classical multivariate regression analysis by stating that returns-based style analysis targets to minimize the variance of the excess return by applying quadratic optimization, whereas general regression analysis aims to minimize the sum of the squares of the difference between the fund returns and those of a linear combination of asset classes.

The generally applied portfolio- and short-sales constraint for equation (12) can be expressed as:

$$\sum_{i=1}^{K} w_i = 1 \tag{13}$$

$$w_i \geq 0, i = 1..., K \tag{14}$$

Based on these general constraints used in returns-based style analysis, Horst et al. (2004) define three forms of style analysis subject to the applied constraints. They refer to *weak style analysis* when no constraints are applied. In the case of *semi-strong style analysis*, only the portfolio constraint is applied in the analysis, while in *strong style analysis* both portfolio- and short-sale constraints are required. According to Horst et al. the decision between these three forms depends on the characteristics of the analyzed data and the overall objective of the analysis.

The evaluation of the results obtained from style analysis is based on the model`s ability to explain the variance of returns, which can be measured by examining the coefficient of determination defined as:

$$R^2 = 1 - \frac{Var(\varepsilon_i)}{Var(R_{i)}} \tag{15}$$

The resulting R^2-values of style regression can be interpreted as effect of fund style to the realized return, and the remaining 1-R^2 as the proportion of active selection (Sharpe 1992).

The results obtained from style analysis can be used to evaluate the performance of individual fund managers and to decide whether the manager has been able to add value through active management. Style analysis also provides tools to examine the consistency of investment style over time and to analyze whether the portfolio manager has been working within the limits of fund`s investment objectives. All this information can be very valuable for individual investors` fund selection and asset

allocation processes. Identification of investment style may also be seen as a tool for controlling the overall risk of a portfolio including multiple funds, as it may be the case that the overall portfolio is unintentionally undiversified if the individual funds included in the portfolio have similar styles. In addition to individual investors and portfolio managers, investment research firms also exploit style analysis results for different purposes, such as classification of equity funds and for ratings. The growing emphasis on investment style has also increased the need for tools that can be used to perform style analysis, which has made several firms develop software packages to the market. (Sharpe 1992, Chan et al. 2002, Horst et al. 2004)

Horst et al. (2004) emphasize the fact that the estimated style weights obtained from style analysis may differ from the actual holdings of a fund. Horst et al. argue that this can be mainly explained by the fact that there can be cross exposures between asset classes, and that individual securities held by a fund may possibly not have a beta exposure relative to one with the asset class they belong to. They further state that the estimated factor exposures will most of the time perform better if the object is to predict future returns, whereas actual portfolio holdings most probably provide better results if the target is to predict the actual portfolio composition.

According to Lucas and Riepe (1996:8) the three main advantages of returns-based style analysis over holdings-based analysis can be summarized as:

- Better data availability
- Return data is generally more timely, impartial and identical as compared to holdings data
- Cost-efficiency and feasibility of returns-based approach

Lucas and Riepe further state that one possible way to confirm the reliability of results obtained from returns-based style analysis is to compare them with the actual holdings of a fund. They emphasize that one should always take into account that returns-based style analysis only provides an estimate of the actual holdings of a fund and that much of the reliability of the results depends on the applied benchmarks.

4.2 Proper selection of benchmarks

Style analysis assumes that the set of indices used for the analysis is exclusive and covers the market. An ideal condition would be that no stock would be included in more than one index, but this may occasionally lead to some compromises in practice. (See e.g. Sharpe 1992, Mason et al. 2012) As discussed earlier, several studies such as Fama and French (2012) find global evidence for the existence common patterns in average returns, namely value, size and momentum. These asset class categories are also commonly applied as the main style dimensions in the returns-based style analysis of mutual funds. Studies such as Brown and Goetzmann (1997), Carhart (1997), and Chan et al. (2002) show that market capitalization and value-growth orientation efficiently explain mutual fund performance, and that they can be utilized to explain mutual fund styles and make comparison between different funds.

Just as in the case of general factor models, the results obtained from style analysis are very sensitive to the selection of benchmarks that are used for the analysis. In some cases the obtained results may change substantially even if an individual style index is replaced by another index. Sharpe (1992) applies a total of twelve asset classes, mainly consisting of equity indices representing different capitalizations and markets, and indices representing bonds with different maturities. The reasoning behind the selection of benchmarks should be based on the observed strategies and core objectives stated in the fund prospectus, as the foregoing may substantially differ between equity funds, balanced funds, hedge funds and other possibilities. (See e.g Fung and Hsieh 1997)

Lobosco and DiBartolomeo (1997) study the use of approximated confidence intervals in order to improve the usefulness and interpretation of style analysis results, and therefore consider the statistical significance of individual style coefficients along with the goodness of fit of the overall analysis. They find an inverse relationship between the length of the applied return period and the confidence interval for an individual style index, and also show that an increase in the standard error of the style regression results an increase in the confidence interval. They also find that the confidence interval of an individual index decreases with the relative independence of an index among the chosen set of indices.

4.3 Misclassification of mutual funds

In general, the names of mutual funds describe their investment style quite adequately, but previous literature suggests that the stated objectives or styles of mutual funds do not always perfectly match up with the funds` actual styles. This phenomenon is generally referred to as mutual fund misclassification, and the possibility for the existence of misclassification should be taken into account when evaluating mutual funds and making allocation decisions (See e.g. diBartolomeo &Witkowski 1997). The general implication and an example of potential misclassification is that some funds may classify themselves as value funds, although the realized returns of the funds may more closely resemble growth funds, and should therefore be treated as growth portion of the overall asset allocation. Studies of Brown and Goetzmann (1997) and DiBartolomeo and Witkowski (1997) indicate that up to 40% of mutual funds more or less fulfill the definition of misclassification. Saez and Izquierdo (2000) however find the styles obtained from returns-based style analysis to be consistent with the stated investment objectives. DiBartolomeo and Witkowski (1997) emphasize the fact that most of the funds have a similar return objective in a form of targeted real- or absolute return, but there can be significant differences in the strategies that the funds apply to reach these pre-specified targets. The authors argue that such differences in the applied strategies can significantly affect to the overall risk/return-profile of funds, and at the same time increase the variety of possible risk and return drivers between different funds.

One proposed explanation for misleading fund names and vague investment objectives is that some funds may try to give investors false information about the true riskiness of their investment policy, as additional risk taking generally result in higher expected returns. Sirri and Tufano (1998) show that investors are more willing to invest in mutual funds that have a high rank on the performance charts. DiBartolomeo and Witkowski (1997:34) illustrate this phenomenon in an apposite phrase: “Easiest way to win a contest for the largest tomato is to paint a cantaloupe red and hope the judges do not notice”. In the context of mutual funds investors can be seen as judges for such contest, and that the lesson behind the phrase should be interpreted such that investors should aim to identify the exposures to relevant risk factors.

4.4 Performance evaluation conditional on investment style

As discussed earlier, the chosen benchmark portfolio should represent the investment strategy of a portfolio manager as closely as possible, and at the same time be cost-efficient and investable. All these requirements can be easily achieved through style analysis by forming a mix of asset classes or style indices, a style-benchmark, based on the resulting coefficients of style analysis as shown in equation (12). Grinold and Kahn (1995: 477) argue that returns-based analysis is the simplest and most reliable method for finding managers that have true skill.

Although it is nowadays a widely accepted principle that portfolio managers should be evaluated against a passive benchmark that has the same style as the managed fund, this is not always the case in reality. Sharpe (1992) suggests that a benchmark that is formed based on results of properly performed style analysis provides a more appropriate baseline for the performance evaluation of most mutual funds. According to Chan et al. (2002) the recognition of investment style improves the identification of potential security selection skill of a manager. They further argue that evaluating the performance a fund against a style-specific benchmark may lead a whole another conclusion as compared to the situation when the performance is evaluated against a single broad market index. Sometimes it may be the case that a fund has been able to beat its style-specific benchmark and at the same time underperform relative to a broader benchmark over the evaluation period or vice versa. Aragon and Ferson (2007:165) document mutual funds to have a better relative performance against a style-based benchmark as compared to broad market benchmark, which they explain by the potential underperformance of some individual styles relative to a broad market index during the evaluation period from 1973 to 2000.

Fama and French (2012) argue that the fact that some mutual funds may have extreme tilts towards certain asset class categories such as value or growth, should be considered when evaluating the performance of such funds. Alternatively expressed, they state that the empirical asset pricing models should somehow adjust for such extremes in order to work properly. Studies such as Sharpe (1992) and ted Horst et al. (2004) show that style analysis can be considered as a valuable tool for identifying such extremes in mutual fund styles. Ahmed and Nanda (2005) document benefits of

returns-based style analysis also for the purpose of determining a proper benchmark category, namely categories of large-cap growth, large-cap value, small-cap growth and small-cap value.

4.5 Limitations and additional challenges

4.5.1 Style drift

Although most funds report clear objectives and styles that serve as a basis for classifying funds into different categories, there is still usually a certain amount of freedom in the decision making of fund management, which may affect the style and performance of individual funds over time (Chan et al. 2002). The potential drift in the style of a fund over time generally increases the divergence of fund returns as compared to those of its benchmark. The most common way to consider these possible changes in style exposures over time is to perform returns-based style analysis over rolling periods, by applying estimation windows with length of anywhere from 24 to 60 months (See e.g. Sharpe 1992, Lucas &Riepe 1996, Annaert &Van Campenhout 2007). The advantage of a longer estimation window is that the results will have less noise, while a shorter window will more likely and accurately reflect active bets done by a manager. However, the selection of an appropriate window length can be challenging and also sometimes make the results unreliable (Swinkels &Van 2006).

These changes in the exposures of a fund, which are generally referred to as style drift, may be caused by intentional decisions of a fund manager to deviate from a benchmark, or by other reasons such as a change in the fund`s management. It is also possible that some of the companies included in the holdings of a fund will grow or otherwise change, which may lead to a change in capitalization- or style categories of these companies.(See e.g. Sharpe 1992, Gallo &Lockwood 1999) According to Chan et al. (2002) potential explanations for style drift include manager`s effort to time different styles, utilize styles with good past performance, recover past losses, and potential herd behavior among investors and fund managers. Sharpe (1992) argues that the potential changes in the style of a fund can mainly be explained by active security selection and rotation among different asset classes, and suggests that one may simply apply term selection when referring to such changes in the style of a fund. Sharpe

further states that sometimes also potential changes in the fund size may at least partly explain the style drift, as in the case of substantial growth of a fund it may start to become more and more difficult for the fund to invest large amounts in small- and micro-cap stocks.

Chan et al. (2002) examine domestic U.S mutual funds and find consistency in mutual fund styles over time. They also find that the largest style drifts occur for funds with weak past performance, and that the finding seems to hold especially for value funds with weak past performance. Gallo and Lockwood (1999) evaluate the effect of fund management changes to style, performance and risk among equity mutual funds. They find that all these characteristics may significantly change following a shift in the fund management. More precisely, they find that the change in the management improved the performance and decreased the amount of total risk on average, and that for 65.2% of the funds the style classification changed following a management change.

Idzorek and Bertsch (2004) propose a quantitative measure for the extent of style drift over a specific estimation period:

$$SDS = \sqrt{\sum_{k=1}^{K} \sigma_k^2} \tag{16}$$

where SDS is the style drift score of a fund, and σ_k^2 denotes the variance of each individual style factor weight obtained from repeatedly performed style analyses over rolling estimation periods. Idzorek and Bertsch show that style drift score has many beneficial applications for the purpose of monitoring and comparison between funds, as it easily enables to detect the potential drift of investment style with a single score even for a large number of funds. The authors show that the monitoring can easily be performed by placing limits within which the style drift score should remain.

4.5.2 Style analysis of hedge funds

Studies subsequent to Sharpe (1992) have tested the performance of returns-based style analysis also for hedge funds and some other investment vehicles. According to

Fung and Hsieh (1997) the trading strategies of hedge funds are more dynamic as compared to mutual funds, and thus their performance is not as efficiently explained by allocation between standard asset classes. More precisely, the fact that hedge funds have possibility to apply a wide range of derivatives and significant amounts of leverage as compared to equity mutual funds, accounts for a large part of these differences. However, Fung and Hsieh along with Brown and Goetzmann (2001) find evidence for the existence of distinct investment styles also among hedge funds, and emphasize the important role of style analysis also for hedge fund investors.

The results of Agarwal and Naik (2000) find that the explanatory power of returns-based style analysis performed to hedge funds is lower as compared to style analysis of mutual funds, even when the portfolio- and short-sales constraints are relaxed to better match up the differences in regulation and strategies of these two investment vehicles. Altogether the question of market neutrality in the case of hedge funds, meaning that the general markets exposures of hedge funds may be significantly lower as compared to highly regulated mutual funds due to application of more complex trading strategies, is arguably the main reason why factor models based on general asset classes may not as effectively explain hedge fund style and performance. This also emphasizes the previously stated importance of case-specific benchmarks for returns-based style analysis. (See e.g. Fung and Hsieh 1997)

Liang and McIntosh (1998) apply returns-based style analysis for the evaluation of different types of real estate invest trusts (REIT). Liang and McIntosh find that a set of basic asset classes similar to that of Sharpe (1992) can be used to evaluate the style and performance of the trusts. These findings indicate that returns-based style analysis has many potential applications in addition to mutual fund style- and performance analysis, yet the empirical evidence for the applications still remains fairly limited and do not directly serve the aim of this thesis.

4.6 A brief summary of investment style and style analysis

On the basis of previous literature and empirical findings discussed so far, the main justifications for the proper selection of performance evaluation benchmarks and the importance of acknowledging potential investment styles could be listed as:

- The analysis of investment style can be helpful when evaluating the essential risk/return-profiles of equity mutual funds
- Performance evaluation and management fees are generally more or less based on chosen benchmarks, and proper identification of investment style can substantially improve the validity of the process in some cases
- Identified style serves as a benchmark for finding possible changes in style through time
- Style analysis may effectively provide additional information for institutional- and retail investors to support the fund selection- and asset allocation processes

Taking all these findings and advantages into consideration, style analysis could be summarized as a highly beneficial tool to efficiently improve the understanding of the big picture as a part the overall asset allocation- and investment process. As already discussed, the analysis of investment style will not necessarily and accurately yield the actual holdings of a fund, but that takes nothing away from all of its widely documented benefits.

5 EMPIRICAL ANALYSIS OF FINNISH EQUITY MUTUAL FUNDS

The purpose of this chapter is to present and discuss the main findings obtained from style analysis and performance evaluation of actively managed Finnish equity mutual funds whose object is to invest in the Finnish stock market. The chapter starts with an introduction of the data and main empirical methods used for the analysis.

5.1 Data and methodology

The research data consists of monthly returns of actively managed Finnish mutual funds from January 2004 to December 2013, or in the case of some of the funds in the sample, from the month that the fund has been active. The minimum return history for a fund to be included in the sample is chosen to be at least three years. The original sample included two funds that had missing observations in the database before year 2006 (SEB Finland small-cap and SEB Finland B), and for those funds the returns are calculated starting from January 2006. The fact that there may be differences in the lengths of the return histories between different funds should be taken into account and may be considered as a limitation, but it is not considered as a serious problem as the main purpose of the study is to evaluate the style and performance of individual funds against style-specific benchmarks. However, for 20 out 31 funds the data covers the entire 10-year evaluation period and for most funds the analysis period is at least 7 or 8 years.

Returns used for the analysis are continuously compounded returns calculated from monthly mutual fund price data obtained from Bloomberg database. The returns are obtained as:

$$R_{it} = \ln \frac{P_{it} + D_{it}}{P_{it-1}} \tag{17}$$

where R_{it} denotes the continuously compounded return for month t, P_{it} and D_{it} are the price and the paid dividend at month t respectively, and P_{it-1} denotes the fund price at the previous month. The set of benchmarks used for the style analysis of Finnish

equity mutual funds consist of six MSCI Finland gross size/style-indices and a cash-equivalent return calculated using 1-month EURIBOR rate. The applied indices take dividends into account so that they are invested back into the index, similarly as the equity mutual funds included in the sample. These indices fulfill the requirements of a proper a set of style analysis benchmarks proposed by Sharpe (1992), as all of the chosen indices represent investable passive alternatives and are non-overlapping, mutually exclusive with each other. The selection of the set benchmarks in question can also be justified based on the fact that they can be assumed to represent practically the entire universe of different asset class categories available for Finnish equity mutual funds due to similarities in stated fund objectives, strategies and regulation.

The first applied models are single-factor model shown in equation (6) following the three-factor model represented in equation (9). The main contribution of the study is to examine styles of mutual funds, so the additional models are mainly applied to support and for the purpose of comparison with the results obtained from style analysis, and therefore the four-factor model is not applied also to control the scope of the study. For style analysis of the sample of Finnish equity mutual funds, the main contribution is to explain the fund returns using dimensions of market capitalization (size) and price-to-book valuation (value/growth) as the main explaining variables, along with the return of a cash-equivalent estimated using 1-month EURIBOR rate. The style exposures for each fund are obtained by following equation (12), and more precisely the style-adjusted performance is evaluated by following:

$$R_{it} = \alpha_i + \beta_1 R_t^{(LC\_Growth)} + \beta_2 R_t^{(MC\_Growth)} + \beta_3 R_t^{(SC\_Growth)} + \beta_4 R_t^{(LC\_Value)} + \beta_5 R_t^{(MC\_Value)} + \beta_6 R_t^{(SC\_Value)} + \beta_7 R_t^{(Cash)} + \varepsilon_{it}$$

where R_{it} is the mutual fund return at month t, α_i and ε_{it} form the residual return component of the model, and the set of factors represent the returns of six MSCI size/style-indices and the return of the cash-equivalent with weights denoted by β, together forming the positively weighted mimicking style portfolio obtained from returns-based style analysis. More precisely:

$R_t^{(LC\_Growth)}$ is the return of MSCI Finland Large-cap growth index at time t

$R_t^{(MC\_Growth)}$ is the return of MSCI Finland Mid-cap growth index at time t

$R_t^{(SC\_Growth)}$ is the return of MSCI Finland Small-cap growth index at time t

$R_t^{(LC\_Value)}$ is the return of MSCI Finland Large-cap value index at time t

$R_t^{(MC\_Value)}$ is the return of MSCI Finland Mid-cap value index at time t

$R_t^{(SC\_Value)}$ is the return of MSCI Finland Small-cap value index at time t

$R_t^{(Cash)}$ is the cash-equivalent return based on 1-month EURIBOR rate

Both, positivity- and portfolio constraints (13) and (14) are applied for the analysis in order to adjust for the actual strategies of mutual funds and to serve the purpose of finding an investable mimicking passive portfolio. For the analysis of the potentially changing style of mutual funds over the evaluation period, style analyses are performed over rolling periods for each fund using 24- and 36-month rolling estimation windows. The minimum return history for the analysis of the evolution of investment style is restricted to be ten years in order to get useful and comparable results. As discussed in the literature review, one potential limitation for performing style analyses over rolling periods is the requirement for a relatively long and continuous datasets. Finally, the performance of mutual funds with at least 10-years of return history is also experimentally evaluated against a 12-month rolling style-benchmark, which is composed for each month based on the estimated style of prior 12 months.

5.2 Descriptive statistics

Table 2 presents some key summary statistics of the sample of Finnish equity mutual funds used for the analysis. Table shows the beginning month of the return period for each fund, which is also the beginning of the period used for the style- and performance analysis. For 20 out of a total of 31 funds in the sample the start of the sample is

January 2004, which makes the total length of the analysis period for these funds as 10 years, being also comparable with many of the previous studies on style analysis of mutual funds discussed in the literature review. The minimum analysis period for funds to be included in the sample was restricted to three years, as shorter return histories may have provided more or less unreliable results.

Table 2 reports the average monthly return and standard deviation from January 2004 to December 2013 for funds with a minimum of 10-year return history. The average monthly return of these funds during the period was 0.75%, which makes the average annual return of the 10-year sample period to be 9%. The corresponding return of OMXH Cap Gross index for the same period was 0.79% (9.48% annually). The results show that during the 10-year sample period only 4 out of 20 funds were able to deliver returns greater than the passive market index. The highest individual average monthly returns of 0.94% (11.28% annually) and 0.91% (10.92% annually) can be observed for Fondita Equity Spice and Evli Finland Small-cap funds, both of which concentrate on small-cap securities. These were also the only two funds that were able to beat the passive Seligson & Co OMX Helsinki 25 ETF in 10-year return (Investment research Finland 2013). However, the lowest average return of 0.51% (6.12% annually) can be found for OP Finland small-cap fund, which suggests that there can be rather significant differences in the performance of different funds even if they would have pretty much the same stated objectives and style. The standard deviations of monthly returns range from 4.48% of Seligson and Co Phoebus to 6.49% of FIM Fenno, the average of the sample being 5.75%.

Table 2 also reports the annual management fees of the mutual funds that the funds charge investors for a position in the fund based on year 2013. The lowest fees of 0.63% and 0.75% can be found for Fourton Fokus Finland and Seligson and Co Phoebus respectively, while the highest fees of 2.50% and 2.10% can be found for SEB Finland small-cap and Alfred Berg small-cap respectively. The average management fee across the whole sample of funds is 1.55%, which is similar with the findings of earlier studies on equity mutual funds. As a comparison, the passive Seligson & Co OMX Helsinki 25 ETF has a management fee of 0.17% (Investment research Finland 2013).

Table 2. Summary statistics of the sample of actively managed Finnish mutual funds.

Fund	Sample start	Average return 2004-2013 (%)	Std.dev. (%)	AUM (million €)	Fee (%)	Owners
Aktia Capital	01/2004	0.82	5.58	286.3	1.83	21117
Alfred Berg Finland	01/2004	0.68	5.67	136.9	1.80	1408
Alfred Berg Small Cap	01/2004	0.68	6.00	26.6	2.10	733
Arvo Finland Value	12/2005	-	-	31.2	1.20	1798
Danske Invest Small Cap	01/2004	0.72	6.12	73.1	1.30	1609
Danske Invest Equity	01/2004	0.75	5.76	232.1	1.90	9668
Danske Invest Dividend	01/2004	0.76	5.74	43.5	1.52	1578
Danske Invest Inst. Eq	01/2004	0.84	5.79	211.3	0.95	765
Evli Small Cap	01/2004	0.91	5.72	105.9	1.60	937
Evli Finland Select B	01/2004	0.70	5.56	100.4	2.08	694
FIM Fenno	01/2004	0.70	6.49	77.3	1.60	2290
Fondita Equity Spice	01/2004	0.94	6.47	82.5	2.00	291
Fourton Fokus Finland	10/2009	-	-	10.5	0.63	97
Handelsbanken Finland	01/2004	0.79	5.87	58.0	1.85	6942
LähiTapiola Finland	10/2006	-	-	82.2	1.50	2945
Nordea Pro Finland	01/2004	0.79	5.80	305.2	0.50	538
Nordea Finland	01/2004	0.67	5.89	611.1	1.60	24252
Nordea Finland 130/30	05/2008	-	-	20.1	1.50	2919
Nordea Suomi Small Cap	12/2010	-	-	51.7	1.60	2615
OP-Delta	01/2004	0.69	5.67	408.5	2.00	31650
OP-Focus	01/2004	0.76	5.63	398.5	1.80	14487
OP-Finland Value	01/2004	0.68	5.54	212.1	1.60	8449
OP-Finland Small Cap	01/2004	0.51	6.01	115.9	2.00	10466
POP Finland	06/2005	-	-	41.4	1.80	9172
SEB Finland Small Cap	02/2006	-	-	45.3	2.50	775
SEB Finlandia B	02/2006	-	-	132.4	1.30	1470
Seligson & Co Phoebus	01/2004	0.75	4.48	31.6	0.75	3166
Säästöpankki Finland	01/2004	0.76	5.16	189.9	1.84	30139
Taaleritehdas Value	06/2010	-	-	100.9	1.20	168
UB HR Finland K	05/2004	-	-	2.4	0.78	59
Ålandsbanken Finland Value	05/2007	-	-	10.5	1.50	1070
Average		0.75	5.75	136.62	1.55	6267
OMXH Cap GI		0.79	5.59			

The table reports the beginning month of returns for each mutual fund included in the sample and the average percentage monthly return and standard deviation between period 2004-2013 using monthly log returns. The original price data is obtained from Bloomberg. The column 'AUM' reports the size of the fund as measured at the end of year 2013 in million euros, while the column 'Fee' reports the annual management fee that the fund charges for a position in the fund. The last column "Owners" reports the number of fund share owners by the end of 2013. The information regarding the assets under management, fees and number of fund share owners are obtained from Investment research Finland mutual fund report (2013).

In addition to annual management fees, most funds in the sample also charge load- and redemption fees which are typically around 1%. Table 2 also reports the size (AUM) and number of share owners for each fund as measured by the end of 2013. The table indicates that the variation is rather large among the group of funds, the average value of net assets being 136.62 million euros and the average fund size as measured by the number of fund share owners is 6267.

Figure 2 shows the annual returns of different equity styles along with the annual returns of OMXH Cap Gross index from 2004 to 2013. The figure indicates clear variation between the annual returns of different equity styles for most of the years, which is an essential finding consistent with Sharpe (1992), providing a key basis for returns-based style analysis. Sharpe (1992) states that if one would form the same set of style dimensions randomly rather than by first considering similarities in the key characteristics of individual assets, most probably there wouldn`t be as much variation between the returns of different groups of assets. The figure also clearly shows that 2008 and 2011 were difficult years for equities down the line due to globally affecting financial crises, and that during the 10-year period small-cap equities yielded the highest single annual return of nearly 70% in 2009.

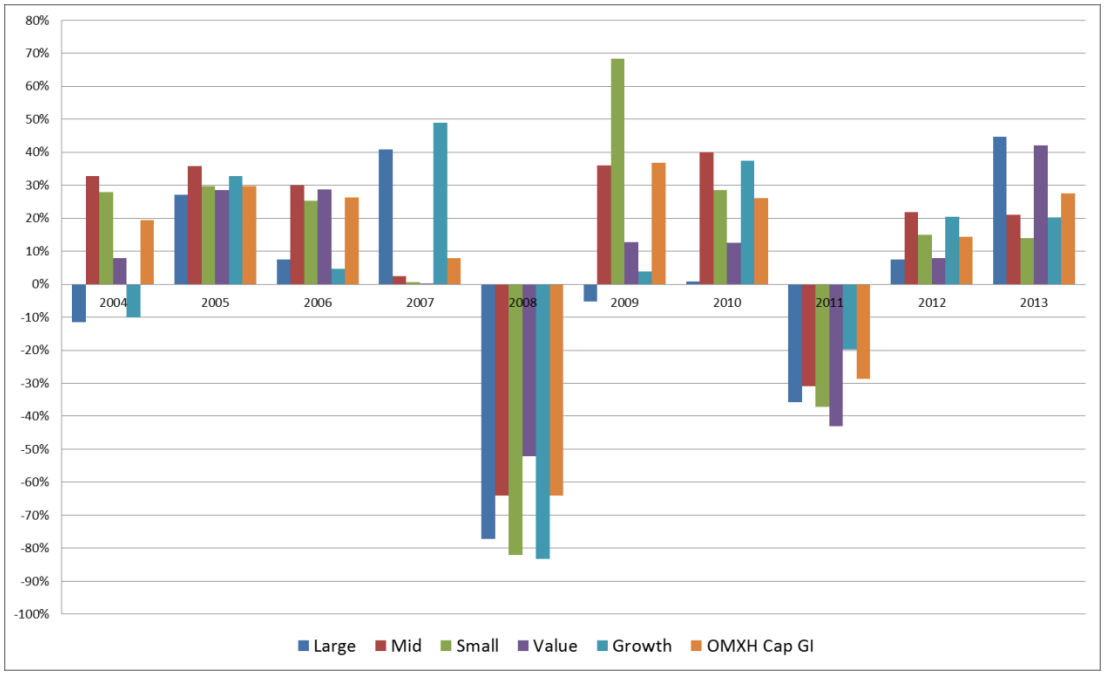

Figure 2. Annual returns of Finnish equities 2004-2013.

Figure 3 shows the cumulative returns of the different equity styles and OMX Helsinki Cap Gross index from January 2004 to December 2013. As one would expect, the performance of OMX Helsinki Cap GI settles roughly in the middle of the individual style indices being a broad market index of Finnish equities. Figure also indicates that the performance of large-cap equities has been relatively weak compared to mid-caps and small-caps during the sample period, the mid-cap index having the highest cumulative return from 2004 to 2013 out of the six equity indices. However, it is good to perceive that the results based on cumulative returns are very sensitive to the chosen analysis period in general, and do not always clearly indicate the performance of individual years as shown in figure 2.

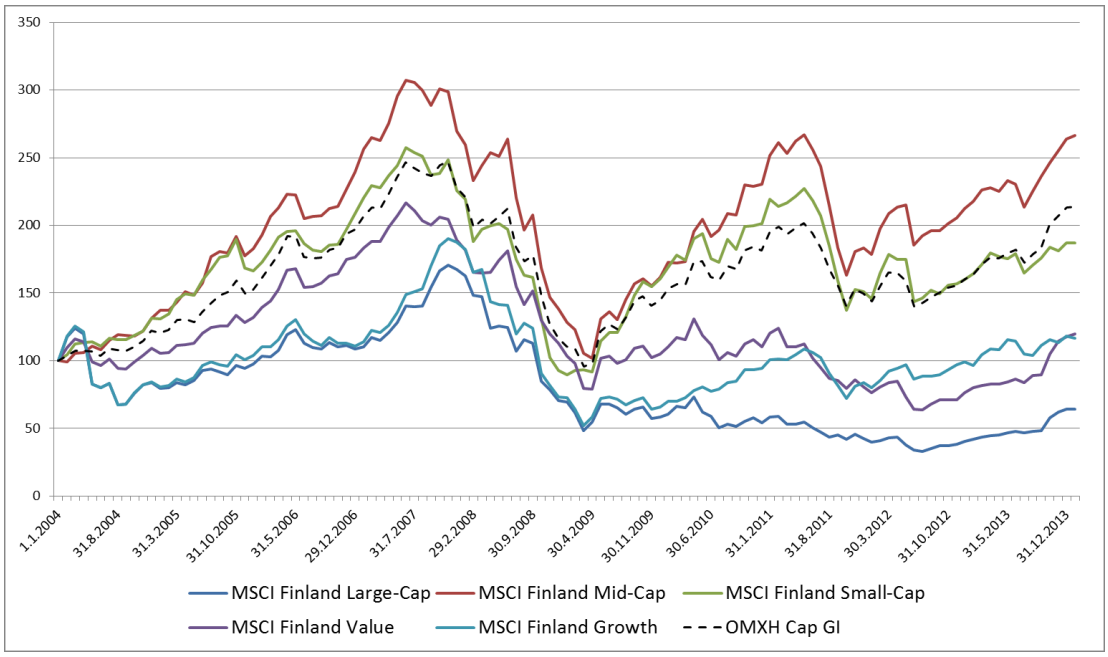

Figure 3. Cumulative returns of Finnish equities 2004-2013.

Table 3 reports the bivariate correlation coefficients between the six MSCI size-valuation benchmark indices and cash-equivalent return used for the style analysis of actively managed Finnish equity mutual funds. Although some of the correlations are relatively high, especially the correlation of 85% between the two small-cap indices, there does not appear to be perfect linearity between any two of the variables. As mentioned in the theoretical literature review, this is an essential characteristic that the set of benchmarks used for style analysis should fulfill, as otherwise it wouldn`t be possible to capture the individual explanatory effects of each asset class. Table 3 also

indicates that the only negative correlations can be observed between the cash-equivalent return and different equity styles, and that the lowest positive correlations of 31.1% and 32.4% can be observed between the large-cap growth-index with the indices of mid- and small-cap value stocks.

Table 3. Bivariate correlations between the benchmark indices for style analysis. Time period 01/2004 - 12/2013.

	Large-Cap Growth	Mid-Cap Growth	Small-Cap Growth	Large-Cap Value	Mid-Cap Value	Small-Cap Value	Cash
Large-Cap Growth	1.000						
Mid-Cap Growth	0.331	1.000					
Small-Cap Growth	0.343	0.790	1.000				
Large-Cap Value	0.380	0.429	0.444	1.000			
Mid-Cap Value	0.311	0.717	0.714	0.584	1.000		
Small-Cap Value	0.324	0.844	0.850	0.565	0.818	1.000	
Cash	-0.164	-0.291	-0.202	-0.125	-0.195	-0.289	1.000

5.3 Performance of Finnish equity mutual funds

Table 4 presents the summary statistics for the applied explanatory returns of three-factor model for January 2004 through December 2013. The size factor SMB clearly has the highest average monthly return of 0.76% (t=1.09), that is also clearly higher than the corresponding 0.03% of Fama and French (2010) studying the returns of US equities from 1984 to 2006. The average monthly market excess return of the period is 0.64% (t=1.24), which is interestingly exactly the same result as obtained by Fama and French (2010), resulting an average annual market excess return of 7.68%. Interestingly, it seems that the hypothesis of abnormal performance of value stocks over growth stocks has not held true in Finland over the 10-year analysis period based on the negative value -0.36% of the HML factor. Table 4 also reports the standard deviations and t-statistics for each factor.

Table 4. Summary statistics of monthly explanatory returns for the three-factor model. Period 2004-2013.

Period	Average return (%)			Standard deviation (%)			t-statistic		
	R_m-R_f	SMB	HML	R_m-R_f	SMB	HML	R_m-R_f	SMB	HML
04-13	0.64	0.76	-0.20	5.62	7.63	6.01	1.24	1.09	-0.36

In the table R_m stands for the return on OMXH Cap GI index, and R_f is the risk-free rate based on 1-month EURIBOR rate. SMB and HML factors are constructed by subtracting the returns of small-cap and large-cap MCSI indices of Finnish equitis (SMB), and returns of MSCI value- and growth indices of Finnish equities (HML). The table reports the average monthly return, standard deviation t-statistics for the average returns.

Table 5 shows the results obtained from single-factor and Fama-French three-factor model regressions, along with tracking error and information ratio for each fund relative to OMXH Cap GI index. First notable results seen from table 5 are the remarkably high R^2-values throughout the sample of Finnish mutual funds. The average R^2-values of the single-factor and three-factor model are 90% and 92% respectively. In the case of OP-Delta and OP-Focus funds the single-factor model explains a significant 98% and 97% of the fund returns respectively, and the result may be seen as potential sign to question the presence of true active management in some mutual funds as proposed by Petajisto (2013). The tracking errors of these two funds are also very low 3% and 3,5% respectively, the average of the sample being 6,2%. Surprisingly, the differences between the explanatory power of CAPM and three-factor model are relatively small for most of the funds yet naturally a slight increase can be observed in the R^2-values as the number of explaining factors increase. The biggest improvements in the explanatory power can be observed for funds whose return variation the single-factor model was able to explain relatively weakly with R^2-values below 90%.

Another central finding indicated by table 5 is that for each of the funds a decrease in the alpha-values can be observed when moving from single factor model to a three-factor model. The results of the table show that the average monthly abnormal return based on single-factor model was -0.063%, while the average alpha based on three-factor model was -0.107%, resulting average annual abnormal returns of -0.76% and -1.28% respectively. The results confirm the finding already shown by table 2 that most Finnish equity mutual funds underperformed the market index during the evaluation period, although none of the observed differences shown in table 5 are statistically significant. When analyzing the factor exposures, the largest exposures for the SMB factor can clearly be observed for small-cap funds as expected. The average beta value

of 0.981 supports the general hypothesis that the beta values of most equity mutual funds do not practically differ from zero. The smallest individual beta estimate of around 0.70 can be found for Seligson & Co Phoebus fund. The fund also had the smallest, yet still significant explanatory powers of 77% and 81% as obtained by single- and three-factor model respectively. Finally, the average information ratio of the sample is -0.157, which is clearly negative but still close to the hypothesis that information ratios of actively managed funds should settle around zero. Altogether, it seems that a clear majority of the sample underperformed the market index in spite of the relatively small deviations from composition of market index as indicated by the results.

Table 5. Intercepts and slope coefficients of the single-factor and Fama-French 3-Factor model regressions for actively managed Finnish mutual funds.

Fund	α (%)	β	s	h	R^2	Track.Err	Inf.Ratio
Aktia Capital	0.064	0.956			0.92	0.057	0.082
	(0.41)	(36.09)					
	-0.031	0.957	0.107	-0.072	0.94		
	(-0.24)	(41.92)	(6.25)	(-3.34)			
Alfred Berg Finland	-0.008	0.985			0.94	0.047	-0.059
	(-0.06)	(44.72)					
	-0.017	0.984	0.015	0.008	0.94		
	(-0.13)	(44.39)	(0.92)	(0.41)			
Alfred Berg Small-cap	-0.087	0.960			0.80	0.093	-0.190
	(-0.34)	(21.89)					
	-0.214	0.959	0.145	-0.086	0.83		
	(-0.94)	(28.88)	(4.84)	(-2.29)			
Arvo Finland value	0.086	0.920			0.87	0.077	0.102
	(0.38)	(24.72)					
	0.082	0.900	0.113	0.133	0.90		
	(0.43)	(28.11)	(4.28)	(4.33)			
Danske Invest Finland Dividend	-0.022	0.992			0.93	0.051	-0.091
	(-0.16)	(41.12)					
	-0.089	0.992	0.076	-0.046	0.94		
	(-0.71)	(44.46)	(4.55)	(-2.21)			
Danske Invest Finland Equity	-0.048	1.006			0.95	0.043	-0.160
	(-0.41)	(49.92)					
	-0.077	1.006	0.037	-0.011	0.96		
	(-0.69)	(50.63)	(2.48)	(-0.58)			
Danske Invest Institutional equity	0.037	1.011			0.95	0.043	0.100
	(0.31)	(49.88)					
	0.004	1.010	0.041	-0.011	0.96		
	(0.04)	(50.89)	(2.78)	(-0.58)			
Danske Invest Finnish Small-cap	-0.056	0.978			0.80	0.096	-0.137
	(-0.22)	(21.62)					
	-0.179	0.974	0.153	-0.048	0.83		
	(-0.76)	(23.41)	(4.90)	(-1.23)			
Evli Finland Select B	-0.071	0.965			0.94	0.047	-0.251
	(-0.58)	(44.20)					
	-0.114	0.965	0.049	-0.033	0.95		
	(-0.96)	(45.71)	(3.11)	(-1.64)			
Evli Finland Small-cap B	0.125	0.983			0.92	0.055	0.250
	(0.84)	(37.63)					
	0.042	0.985	0.089	-0.077	0.94		
	(0.32)	(42.16)	(5.07)	(-3.51)			

FIM Fenno	-0.148	1.095			0.89	0.077	-0.239
	(-0.72)	(31.03)					
	-0.227	1.093	0.096	-0.038	0.90		
	(-1.20)	(32.52)	(3.81)	(-1.193)			
Fondita Equity Spice	0.099	1.078			0.87	0.083	0.147
	(0.44)	(27.85)					
	-0.046	1.082	0.149	-0.151	0.91		
	(-0.25)	(33.30)	(6.12)	(-4.95)			
Fourton Fokus Finland	-0.403	1.037			0.81	0.085	-0.610
	(1.14)	(14.57)					
	-0.306	0.995	0.127	0.158	0.83		
	(0.88)	(13.50)	(1.61)	(1.85)			
Handelsbanken Finland	-0.026	1.036			0.97	0.034	-0.074
	(-0.29)	(64.85)					
	-0.074	1.036	0.053	-0.040	0.98		
	(-0.90)	(71.45)	(4.85)	(-2.96)			
LähiTapiola Finland	0.028	0.885			0.93	0.059	0.059
	(0.15)	(32.64)					
	-0.062	0.879	0.113	0.035	0.95		
	(0.45)	(38.89)	(6.18)	(1.62)			
Nordea Pro Finland	-0.017	1.022			0.97	0.035	-0.053
	(-0.18)	(62.09)					
	-0.051	1.022	0.037	-0.032	0.97		
	(-0.57)	(64.56)	(3.09)	(-2.15)			
Nordea Finland	-0.138	1.035			0.96	0.040	-0.434
	(-1.28)	(55.95)					
	-0.183	1.035	0.047	-0.040	0.97		
	(-1.84)	(59.10)	(3.60)	(-2.44)			
Nordea Finland 130/30	-0.160	1.142			0.91	0.090	-0.308
	(0.54)	(0.54)					
	-0.308	1.141	0.138	-0.061	0.93		
	(1.18)	(28.84)	(4.15)	(1.57)			
Nordea Finland Small-cap	-0.283	1.160			0.85	0.090	-0.378
	(0.68)	(13.91)					
	-0.025	1.092	0.379	0.083	0.95		
	(0.10)	(20.68)	(6.03)	(1.32)			
OP-Delta	-0.107	1.003			0.98	0.030	-0.471
	(-1.32)	(71.13)					
	-0.130	1.003	0.024	-0.018	0.98		
	(-1.65)	(72.30)	(2.35)	(-1.42)			
OP-Focus	-0.022	0.990			0.97	0.035	-0.107
	(-0.22)	(59.36)					
	-0.034	0.992	0.006	-0.030	0.97		
	(-0.36)	(59.80)	(0.47)	(-1.96)			
OP Finland value	-0.080	0.949			0.91	0.057	-0.242
	(-0.51)	(35.71)					
	-0.095	0.938	0.058	0.112	0.94		
	(-0.75)	(41.60)	(3.47)	(5.31)			
OP Finland Small-cap	-0.260	0.970			0.81	0.090	-0.434
	(-1.02)	(22.73)					
	-0.391	0.972	0.141	-0.114	0.85		
	(-1.79)	(25.20)	(4.90)	(-3.16)			
POP Finland	0.111	0.923			0.86	0.077	0.124
	(0.51)	(25.18)					
	0.046	0.922	0.091	-0.062	0.88		
	(0.22)	(26.35)	(3.19)	(1.82)			
SEB Finland Small-cap	-0.205	0.950			0.80	0.099	-0.299
	(0.70)	(19.44)					
	-0.338	0.937	0.257	-0.018	0.89		
	(1.51)	(25.21)	(8.44)	(0.50)			
SEB Finlandia B	-0.026	1.004			0.95	0.047	-0.096
	(0.19)	(43.26)					
	-0.051	1.006	0.027	0.027	0.95		
	(0.37)	(43.43)	(1.44)	(1.22)			
Säästöpankki Finland	0.040	0.895			0.94	0.049	-0.010
	(0.33)	(42.85)					

	0.019	0.889	0.047	0.056	0.95		
	(0.18)	(46.43)	(3.28)	(3.120)			
Seligson & Co	0.148	0.706			0.77	0.094	0.023
Phoebus	(0.71)	(19.92)					
	0.042	0.704	0.127	-0.052	0.81		
	(0.23)	(21.92)	(5.29)	(-1.73)			
Taaleritehdas	-0.410	1.062			0.92	0.054	-0.914
value	(1.71)	(22.00)					
	-0.294	1.016	0.173	0.112	0.94		
	(1.31)	(21.18)	(3.03)	(1.90)			
UB HR Finland	0.102	0.979			0.96	0.040	0.290
	(0.94)	(51.76)					
	0.094	0.977	0.022	0.011	0.96		
	(0.87)	(51.49)	(1.43)	(0.61)			
Ålandsbanken	-0.224	0.973			0.94	0.055	-0.479
Finland value	(1.26)	(34.59)					
	-0.291	0.969	0.089	-0.032	0.95		
	(1.81)	(38.02)	(4.27)	(1.33)			
Avg.(CAPM)	-0.063	0.981			0.90	0.062	-0.157
Avg.(3-Factor)	-0.107	0.980	0.075	-0.036	0.92		

The table reports the intercepts, regression slopes and R^2-values of CAPM and Fama-French 3-Factor Model (β, s and h for R_m-R_f, SMB and HML, respectively). T-statistics (in absolute values) are reported in parentheses. Table also reports tracking error (Track.Err) and information ratio (Inf.Ratio) of each fund compared to OMXH Cap GI market index.

5.4 Style exposures and style-adjusted performance of Finnish equity mutual funds

Table 6 presents the main results obtained from the returns-based style analysis of Finnish equity mutual funds. The table shows the style exposures for each fund along with the corresponding coefficient of determination R^2, which can be interpreted as the proportion of style to the contribution of total return of the fund. The average R^2-value of the sample is 92.4%, which is well in line with previous studies and confirms the hypothesis of the importance of passive investment style to the contribution of return. The highest R^2-value of 95.8% can be found for Ålandsbanken Finland Value fund, which indicates that the set of passive style indices can explain almost up to 96% of the fund`s return variation. The R^2-value is below 90% only for 5 funds in the whole sample. Results also indicate that for most of the funds the obtained exposures are well in line with the stated objectives of the fund. This can be seen especially from the style exposures of funds whose core objective is to invest in small cap- or value companies, as a major proportion of the style exposures of these funds are clearly divided among small capitalization- and value indices respectively. Figures 8 and 9 illustrate this finding by showing the style exposures and the proportion of style and selection to the total contribution of return for OP-Finland value fund and SEB Finland Small Cap B fund. Bar chart in Figure 8 shows that the style exposures of OP-Finland value fund

are almost solely divided among three value indices with different capitalization (a total of 86.1%) and the cash equivalent benchmark (13.9%), together explaining almost up to 94% of the variation in fund returns. In figure 9 the style exposures of SEB Finland small cap fund are clearly divided between the small capitalization growth- and value indices (74.8%), along with exposures of about 12.5% for mid-growth index and the risk-free cash equivalent benchmark, explaining a bit more than 93% of the variation in the fund returns. The results show that style analysis can be highly beneficial for an investor who for example would like to find out whether a small-cap fund is concentrating on value- or growth stocks.

Although the R^2 is clearly above 90% for most of the funds, there were still five funds for which the value was below 90%, 80.8% of Fourton Fokus Finland and 81.6% of Seligson & Co Phoebus being the smallest individual estimates. There may be several different reasons behind the results. As discussed earlier, the coefficient of determination of style analysis can be interpreted as the proportion of style to the contribution of total return, while the remaining 1-R^2 can be interpreted as the proportion of active selection of a manager. Based on this hypothesis the funds with relatively low R^2-values can be considered as making more active bets and therefore deviating more from passive market indices. However, the results are well in line with Sharpe (1992) and later studies showing that mutual fund returns can effectively be replicated with a small set of passive indices. Comparing the results obtained from style analysis to those obtained from analysis based on single-factor and three-factor models, it seems that accounting for investment style via returns-based style analysis does not necessarily result worse relative performance. This may be explained by the fact that some investment styles may not have worked as expected over the entire evaluation period. In Finland this can be interpreted to be the case at least for value funds based on the negative HML factor over the period 2004-2013 as shown in table 4. However, the results suggests that all funds who describe themselves as value funds except Arvo Finland Value also underperformed the style-adjusted benchmark, yet the differences were still not statistically significant. The very high R^2-values and very small tracking errors of some funds relative to broad market index shown in table 5 also indicate that some funds seem to not even apply any particular styles or active strategies that would not be explained and captured by the single broad market index.

Table 6. Average estimated styles and style-adjusted performance of Finnish equity mutual funds.

Fund	Large Growth	Medium Growth	Small Growth	Large Value	Medium Value	Small Value	Cash	R^2	α (%)	IR
Aktia Capital	0.049	0.105	0.168	0.093	0.116	0.341	0.128	0.937	0.161 (1.24)	0.392
Alfred Berg Finland	0.053	0.029	0.131	0.168	0.256	0.265	0.097	0.935	0.114 (0.86)	0.271
Alfred Berg Small-cap	0.035	0.000	0.264	0.023	0.153	0.395	0.130	0.860	0.016 (0.08)	0.025
Arvo Finland Value	0.000	0.000	0.000	0.110	0.322	0.411	0.157	0.913	0.146 (0.81)	0.285
Danske Invest Small-cap	0.021	0.000	0.229	0.153	0.084	0.521	0.111	0.874	0.042 (0.21)	0.066
Danske Invest Finnish Equity	0.060	0.088	0.155	0.151	0.258	0.241	0.082	0.935	0.051 (0.38)	0.120
Danske Invest Dividend	0.050	0.083	0.155	0.113	0.237	0.264	0.099	0.927	0.069 (0.48)	0.152
Danske Invest Institutional Equity	0.059	0.099	0.113	0.153	0.246	0.253	0.077	0.938	0.132 (0.99)	0.313
Evli Finland Small-cap B	0.068	0.066	0.172	0.088	0.179	0.325	0.102	0.928	0.216 (1.52)	0.481
Evli Finland Select B	0.061	0.042	0.165	0.109	0.217	0.290	0.115	0.949	0.028 (0.24)	0.076
FIM Fenno	0.053	0.073	0.174	0.106	0.162	0.431	0.001	0.906	-0.046 (0.25)	-0.079
Fondita Equity Spice	0.074	0.075	0.215	0.034	0.081	0.515	0.006	0.938	0.172 (1.16)	0.367
Fourton Fokus Finland	0.007	0.126	0.042	0.175	0.345	0.200	0.106	0.808	-0.228 (0.64)	-0.310
Handelsbanken Finland	0.059	0.110	0.144	0.151	0.245	0.233	0.057	0.955	0.083 (0.73)	0.231
LähiTapiola Finland	0.023	0.081	0.142	0.073	0.206	0.277	0.198	0.950	0.126 (0.92)	0.342
Nordea Pro Finland	0.072	0.062	0.108	0.148	0.254	0.295	0.062	0.958	0.072 (0.65)	0.206
Nordea Finland	0.064	0.112	0.133	0.158	0.220	0.262	0.051	0.956	-0.031 (0.27)	-0.085
Nordea Finland 130/30	0.033	0.020	0.258	0.086	0.288	0.314	0.000	0.939	0.006 (0.03)	0.013
Nordea Finland Small-cap	0.000	0.038	0.082	0.000	0.105	0.739	0.035	0.949	0.103 (0.44)	0.251
OP-Delta	0.063	0.078	0.119	0.163	0.263	0.231	0.084	0.957	-0.001 (0.01)	-0.003
OP-Fokus	0.073	0.077	0.121	0.171	0.264	0.198	0.095	0.942	0.094 (0.75)	0.237
OP-Finland Value	0.000	0.000	0.000	0.147	0.341	0.374	0.139	0.936	-0.053 (0.41)	-0.130
OP-Finland Small-cap	0.037	0.113	0.254	0.042	0.024	0.409	0.121	0.885	-0.143 (0.76)	-0.240

POP Finland	0.064	0.035	0.168	0.081	0.105	0.396	0.151	0.883	0.250 (1.25)	0.427
SEB Finland Small-cap B	0.000	0.000	0.213	0.000	0.126	0.535	0.125	0.933	-0.059 (0.35)	-0.124
SEB Finlandia B	0.056	0.062	0.104	0.161	0.290	0.248	0.079	0.941	0.094 (0.61)	0.217
Seligson & Co Phoebus	0.011	0.076	0.094	0.028	0.098	0.332	0.361	0.816	0.170 (0.95)	0.300
Säästöpankki Finland	0.015	0.000	0.055	0.144	0.288	0.311	0.187	0.941	0.106 (0.92)	0.291
Taaleritehdas Value	0.070	0.000	0.029	0.113	0.391	0.324	0.074	0.943	-0.187 (0.93)	-0.491
UB HR Finland	0.055	0.082	0.029	0.151	0.313	0.266	0.104	0.946	0.159 (1.28)	0.412
Ålandsbanken Finland Value	0.045	0.007	0.167	0.079	0.313	0.281	0.108	0.958	-0.057 (0.39)	-0.151
Average								0.925	0.052	0.125

The table reports the style exposures and R^2-values obtained from returns-based style analysis of Finnish equity mutual funds using six MSCI size/valuation-indices and a cash equivalent return index based on 1-month EURIBOR-rate. The sample period starts from January 2004 or later, depending on the fund, and ends in December of 2013. Table also reports the intercept (α) from the style-adjusted performance evaluation in percentages, that can be interpreted as the average monthly abnormal return of a fund compared to a style-adjusted benchmark portfolio. Annualized alpha can be calculated as 12 * α. Alpha t-statistics (in absolute values) are reported in parentheses. Column "IR" reports the Information ratio of a fund compared to its style-adjusted benchmark portfolio.

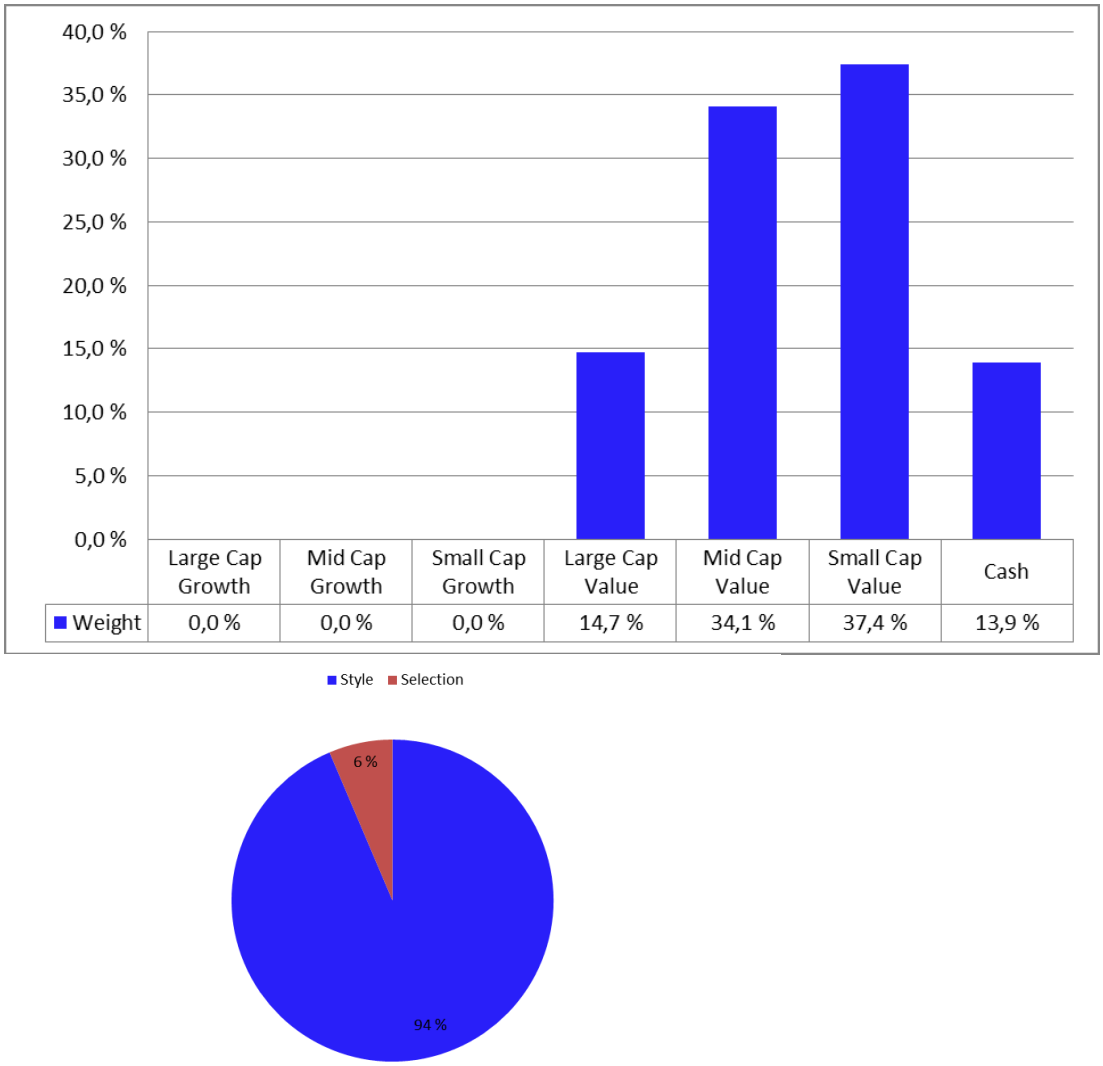

Figure 4. Average estimated style and proportion of Style vs Selection: OP-Finland Value Fund.

More precisely, results of table 6 indicate that for most of the funds the alphas relative to benchmarks formed based on long-term average estimated styles are slightly positive, yet not statistically significant. The results show that 9 funds out of the total of 31 funds have small negative alphas while the remaining 22 funds have small positive alphas compared to a style-specific benchmark. The finding is similar with Aragon and Ferson (2007:165), who find the style-adjusted alphas to be larger than traditional Jensen alphas for growth-, sector-, small-cap and timers-mutual fund groups, when they analyze mutual fund performance between 1973 and 2000. They state that the finding can be explained by the relatively weak performance of some particular styles during particular time periods, which can make the style-adjusted

indices underperform the market index, and therefore potentially make the style-adjusted results look better from the perspective of mutual funds.

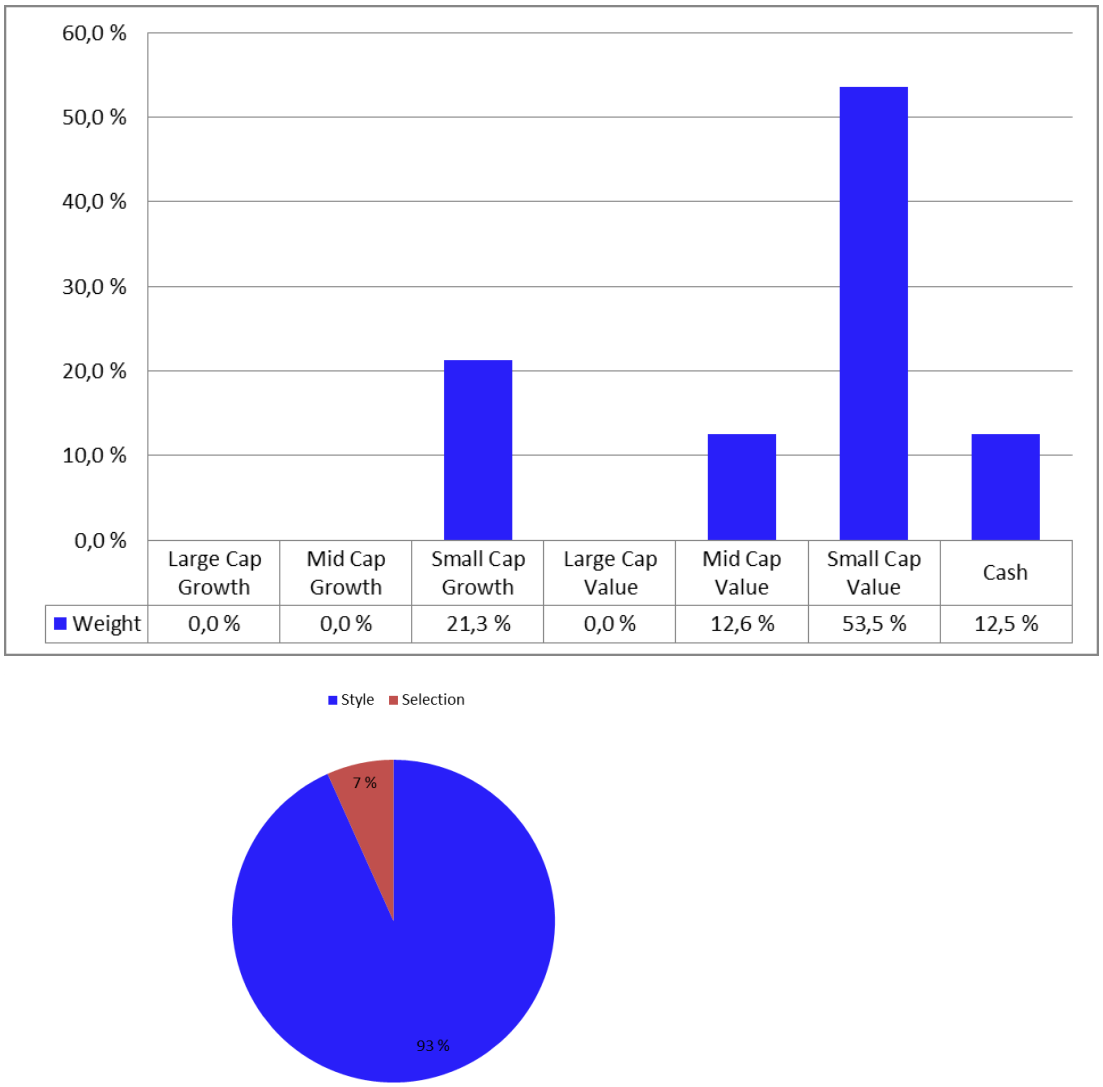

Figure 5. Average estimated style and proportion of Style vs Selection: SEB Finland Small Cap B.

An interesting finding is that for the five most successful funds over the 10-year period a clear majority of the style exposures are divided between small-cap growth and small-cap value indices, along with varying exposures towards mid-cap value index. These five best performing funds based on realized returns as already shown in table 2 were Fondita equity spice, Evli small-cap, Danske Invest institutional equity, Aktia Capital along with Nordea Pro Finland and Handelsbanken Finland sharing the fifth place with equal average monthly returns. Fondita equity spice and Evli small-cap

were also among the top style-adjusted performers out of funds with full 10-year return history, yet neither of the positive alpha estimates were statistically significant similarly as in the case of single-factor- and three-factor models.

Figure 6 illustrates the relative performance of a fund against the average estimated style by showing the cumulative returns of FIM Fenno fund and its style-specific benchmark portfolio from January 2004 till the end of 2013. Figure indicates that the mimicking style portfolio on average outperformed the fund throughout the evaluation period with an annual average of 0.55%. Style portfolio also seems to have slightly outperformed the OMXH Cap Gross index up until the last two quarters of year 2013. Figure 7 shows a similar graph for OP-Delta fund. The figure indicates that the spread between the fund and both benchmarks has been relatively small, indicating that the returns of all three portfolios have moved quite close to each other during the evaluation period. The observed return patterns illustrate the previously stated finding that styles of some mutual funds seem to be very close to passive market index, and such funds seem to not follow any particular style also based on the rather evenly distributed exposures obtained from style analysis.

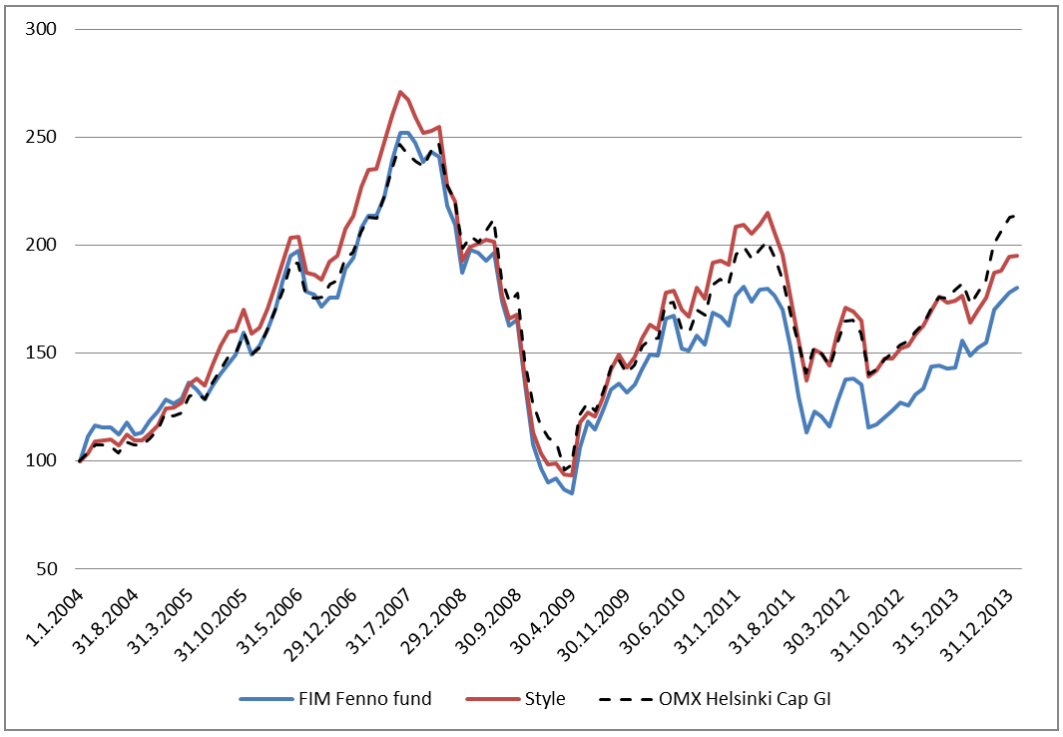

Figure 6. Fund vs. average estimated style: FIM Fenno

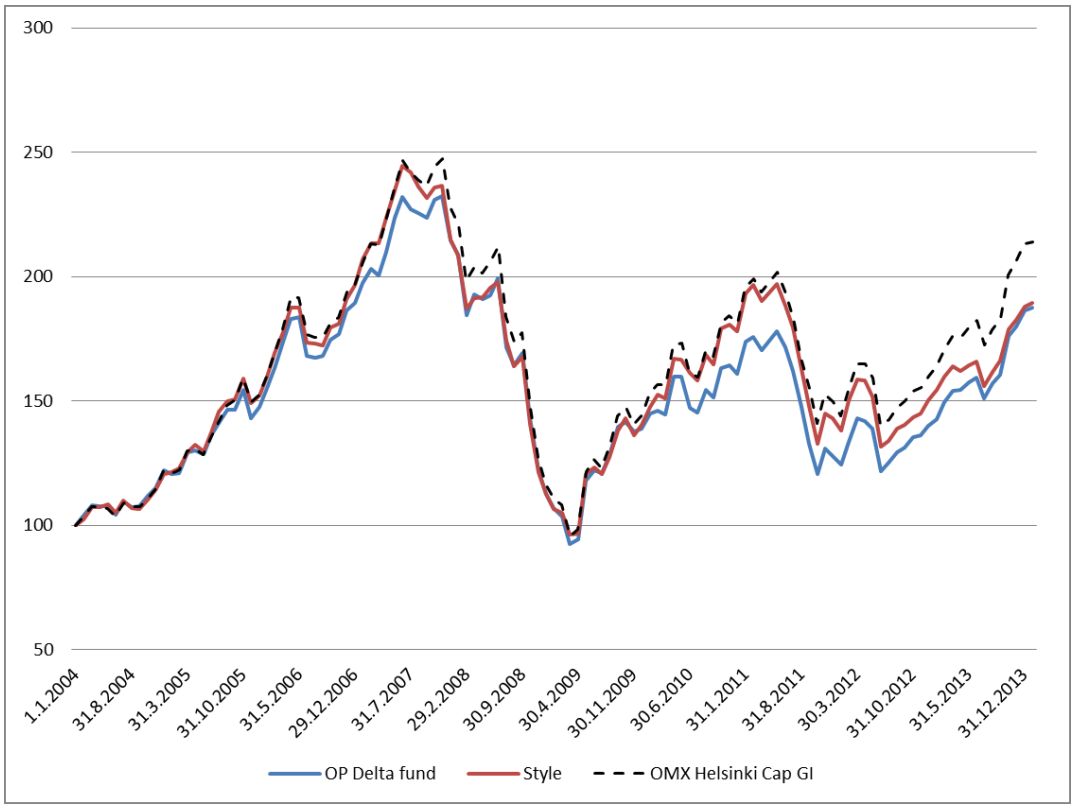

Figure 7. Fund vs. average estimated style: OP-Delta

Table 7 summarizes the explanatory powers of the applied models by sorting the results on the basis of mutual fund size as measured by assets under management (AUM). The results of table indicate that the average explanatory powers of single-factor model, three-factor model and style analysis are highest for the group of biggest Finnish equity mutual funds, and start to decrease gradually as the fund size gets smaller, the group of smallest funds having the lowest average explanatory powers for all three models. The results indicate that the bigger the mutual fund, the more likely will the fund return-behavior resemble that of an individual broad market index, which is a finding similar with Cremers and Petäjistö (2009) and Petäjistö (2013), although achieved by a different method and by using a clearly smaller sample size. The result can be interpreted so that the biggest Finnish mutual funds do not practically apply, or do not have as good opportunities apply investment styles and active bets that would make the fund returns deviate from passive market indices. Thus, the findings suggest that more advanced models applying several factors seem to provide the greatest relative benefit for the evaluation of smaller Finnish mutual funds, as smaller funds seem to have higher likelihood of applying investment styles that are not as effectively captured by a single broad market index as in the case of bigger funds.

Table 7. Explanatory powers of single-factor model, three-factor model and returns-based style analysis for different fund size groups.

		R^2			Average R^2-values of fund size group		
Mutual fund	AUM	1-factor	3-factor	Style analysis	1-factor	3-factor	Style analysis
Nordea Finland	611.1	0.96	0.97	0.96			
OP-Delta	408.5	0.98	0.98	0.96			
OP-Focus	398.5	0.97	0.97	0.94			
Nordea Pro Finland	305.2	0.97	0.97	0.96			
Aktia Capital	286.6	0.92	0.94	0.94			
Danske Invest Equity	232.1	0.95	0.96	0.94			
OP Finland Value	212.1	0.91	0.94	0.94			
Danske Invest Inst. Equity	211.3	0.95	0.96	0.94	**0.951**	**0.961**	**0.948**
Säästöpankki Finland	189.9	0.94	0.95	0.94			
Alfred Berg Finland	136.9	0.94	0.94	0.94			
SEB Finlandia	132.4	0.95	0.95	0.94			
OP Finland Small-cap	115.9	0.81	0.85	0.89			
Evli Small-cap	105.9	0.92	0.94	0.93			
Taaleritehdas Value	100.9	0.92	0.94	0.94			
Evli Finland Select B	100.4	0.94	0.95	0.95			
Fondita Equity Spice	82.5	0.87	0.91	0.94	**0.911**	**0.929**	**0.934**
LähiTapiola Finland	82.2	0.93	0.95	0.95			
FIM Fenno	77.3	0.89	0.9	0.91			
Danske Inv Small-cap	73.1	0.8	0.83	0.87			
Handelsbanken Finland	58	0.97	0.98	0.96			
Nordea Fin Small-cap	51.7	0.85	0.95	0.95			
SEB Small-cap	45.3	0.8	0.89	0.93			
Danske Invest Dividend	43.5	0.93	0.94	0.93			
POP Finland	41.4	0.86	0.88	0.88	**0.879**	**0.915**	**0.923**
Seligson & Co Phoebus	31.6	0.77	0.81	0.82			
Arvo Finland Value	31.2	0.87	0.9	0.91			
Alfred Berg Small-cap	26.6	0.8	0.83	0.86			
Nordea Finland 130/30	20.1	0.91	0.93	0.94			
Fourton Fokus	10.5	0.81	0.83	0.81			
Ålandsbanken Finland Value	10.5	0.94	0.95	0.96			
UB HR Finland	2.4	0.96	0.96	0.95	**0.866**	**0.887**	**0.893**

The table summarizes the explanatory powers of single-factor (6), three-factor model (9) and returns based style analysis (12) for the sample of Finnish equity mutual funds along with averages for different size groups as measured by assets under management (AUM) by the end of 2013.

A similar conclusion can be made by examining the tracking errors relative to market index reported in table 5, which indicate that the average tracking error of the group of eight largest funds is 4.3% while the corresponding value for the group of smallest funds is 7.3%. However, the results do not indicate a similar connection between the fund size and performance based on alphas or information ratios. It is also good to perceive that according to the results there may be some exceptions like UB HR Finland fund with the smallest reported assets under management of 2.4 million, whose returns the single-factor model was able to explain by 96%. Overall, the small sample size should also be taken into account in the interpretation of the results and it also seems to be case that most of the largest Finnish equity mutual funds are funds that describe themselves as active funds investing widely in Finnish securities, whereas majority of the smaller funds are value- and small-cap funds with more specific styles. However, it seems that a substantial proportion of the total assets invested in Finnish equity mutual funds are invested in funds that have a very low 3-4% tracking error and a negative information ratio relative to a broad passive market index.

Interestingly, yet not surprisingly, there seems to be no eminent difference between the charged fees of arguably more active funds and funds providing practically index-like returns as measured by the tracking error and explanation power of the single-factor model. Especially for three of the largest funds the result is quite convincing, as the average explanatory power of single-factor model for Nordea Finland, OP-Delta and OP-Focus is 97%, and the average management fee of these funds is 1.8%, which is slightly above the average 1.55% of the whole sample. Overall, the results support the findings of Chan et al. (2002), suggesting that investment styles of most mutual funds are very close to the passive market index, and that application of multifactor models in the case of such funds may not always provide a lot of additional benefit for the purpose of performance evaluation.

As discussed in the literature review, the growing amount of assets under management can make it harder and harder for funds to deviate from benchmark returns, which will naturally also limit the possibilities of delivering superior returns relative to the benchmark especially on an after-fee basis. One may also argue that larger funds don`t even bother to try to deviate too heavily from benchmark and take any unnecessary risks of losing customers, as the collected management fees can arguably present a

substantial portion of total income for such funds. This can be seen as a justifiable decision from the perspective of mutual fund managers and investment companies, but definitely as a questionable and essential issue from investors` point of view, as the same returns could practically be obtained using passive investment products with significantly lower expenses.

5.5 Style drift of Finnish equity mutual funds

Table 8 reports the style drift scores (SDS) for Finnish equity mutual funds based on evaluation period from January 2004 to December 2013. The table reports the style drift scores based on repetitively performed style analyses with 24- and 36-month rolling windows for 20 mutual funds that had net asset value over the entire 10-year analysis period. The average of the 36-month moving window style drift scores is 20.61, that is very close to the result of Idzorek et al (2004), who find the average of style drift score of 812 mutual fund managers to be 18.54 by using the same 36-month window length and a 10-year evaluation period between 1993 and 2003.

Figures 8 and 9 illustrate the evolution of investment style and results of table 8 by showing results of repeatedly performed style analyses using 24-month and 36-month estimation windows for two funds. Figure 8 indicates that the style of Danske Invest Finnish Small-cap fund has clearly drifted towards small-capitalization value companies during the estimation period based on the applied style indices. The fund also had the highest style drift scores of 33.60 and 30.42 based on 24-month- and 36-month rolling window estimations respectively as shown in table 8. Figure 9 shows similar graphs for Evli Finland Select B fund, which had the lowest style drift scores out of the sample of 20 actively managed Finnish mutual funds with a minimum of 10-year return history. As the figure clearly indicates, the style of the fund seems to have remained much more constant over the estimation period as compared to fund shown in figure 8. Both figures 8 and 9 also illustrate the fact that as the length of the estimation window is increased from 24 months to 36 months, the overall noise in the obtained results slightly decreases as discussed in the literature review. This can also be seen from the results of table 8, and particularly based on the higher average style drift score of 25.22 in the case of 24-month rolling window style analysis as compared to the average score of 20.61 for the 36-month rolling window analysis.

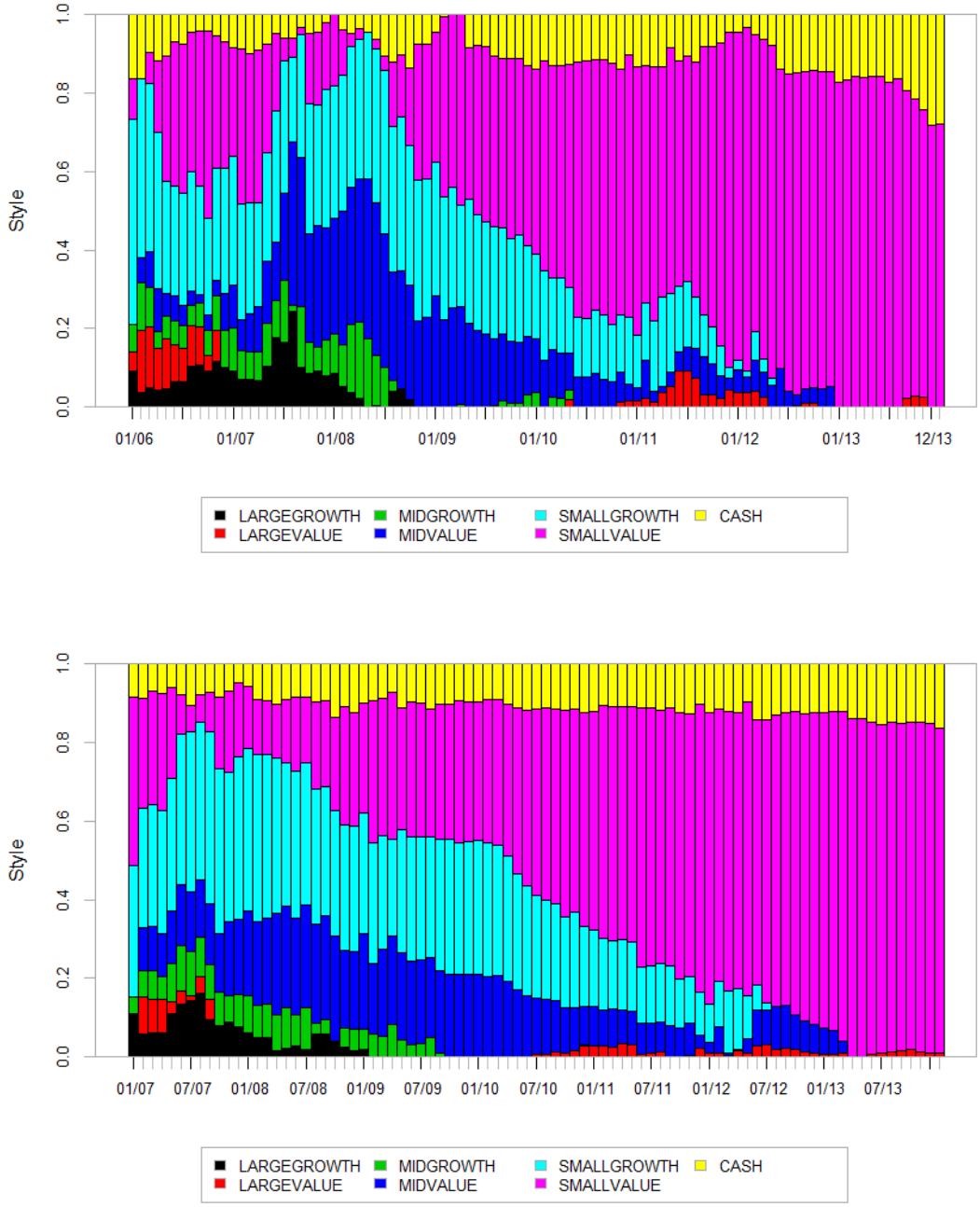

Figure 8. Style drift of Danske Invest Finnish Small-cap fund using 24-month- and 36-month rolling windows.

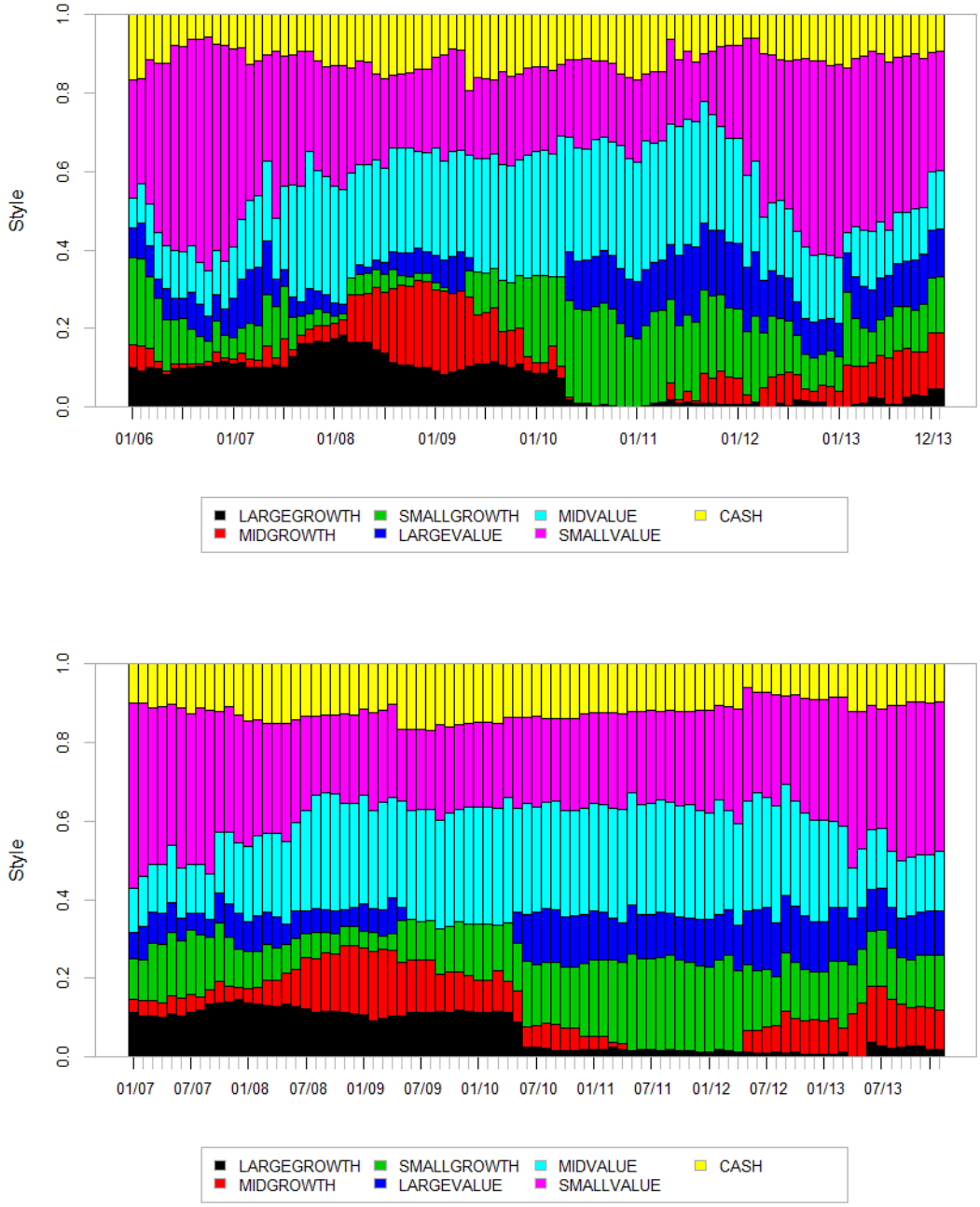

Figure 9. Style of Evli Finland Select B fund using 24-month- and 36-month rolling windows.

Table 8. Style drift scores of Finnish equity mutual funds based on 24- and 36-month rolling window style analyses over the period 2004-2013.

Mutual fund	SDS (24)	SDS (36)
Aktia Capital	26.26 (9)	18.60 (15)
Alfred Berg Finland	24.28 (14)	19.70 (11)
Alfred Berg Small-cap	30.23 (3)	26.01 (3)
Danske Invest Dividend K	26.12 (10)	20.84 (8)
Danske Invest Finland	26.90 (6)	21.72 (7)
Danske Invest Finland Instit.	27.09 (5)	21.86 (6)
Danske Invest Small-cap	33.60 (1)	30.42 (1)
Evli Finland Select B	19.05 (19)	13.86 (20)
Evli Finland Small-cap B	26.44 (8)	23.07 (4)
FIM Fenno	25.23 (12)	18.95 (14)
Fondita Equity Spice	24.54 (13)	19.16 (13)
Handelsbanken Finland	25.48 (11)	20.17 (10)
Nordea Pro Finland 1K	21.38 (16)	17.71 (17)
Nordea Finland	26.57 (7)	22.48 (5)
OP-Delta	19.45 (18)	16.06 (18)
OP-Focus	23.48 (15)	19.61 (12)
OP Finland Value	21.28 (17)	18.38 (16)
OP Finland Small-cap	31.63 (2)	28.89 (2)
Säästöpankki Finland	18.13 (20)	14.34 (19)
Seligson & Co Phoebus	27.27 (4)	20.42 (9)
Average	25.22	20.61

The table reports the Style drift scores for Finnish equity mutual funds over the period 2004-2013. The scores are based on the variance of style exposures as shown in equation (16), and the exposures are obtained from repeatedly performed returns-based style analyses with the same set of explanatory indices as in table 6. The relative position of each fund among the group of 20 funds based on the style drift score is reported in parentheses.

Table 9 reports the performance of actively managed Finnish mutual funds by applying a 12-month rolling style-adjusted benchmark, which is based on the estimated style of 12 months prior to the month under evaluation. More precisely, the benchmark is composed for each month based on estimated style of previous 12 months. The results of the table indicate that the average abnormal monthly performance is practically zero (0.006%). Interestingly, the results suggest that the average Sharpe ratio of mimicking style portfolios is slightly higher than that of mutual funds and the average information ratio is -0.037. The R^2-values are pretty much the same as the ones obtained from style analysis over a single estimation window as shown in table 6. However, due to the very small sample size and insignificant differences, the results cannot be generalized, but still present another potential application of returns-based style analysis.

Table 9. Performance analysis of Finnish equity mutual funds using rolling style-benchmark based on 12-month estimation windows. Period 2004-2013.

			Sharpe Ratio		
Mutual fund	α (%)	R^2	Fund	Mimicking style portfolio	Information Ratio
Aktia Capital	0.104 (0.57)	0.89	0.255	0.212	0.064
Alfred Berg Finland	-0.138 (0.72)	0.89	0.207	0.325	-0.353
Alfred Berg Small-cap	-0.335 (1.16)	0.77	0.123	0.399	-0.546
Danske Invest Div.	0.044 (0.24)	0.89	0.187	0.181	-0.008
Danske Invest Equity	0.117 (0.70)	0.91	0.199	0.143	0.165
Danske Invest Inst.	0.207 (1.21)	0.91	0.250	0.142	0.344
Danske Invest Small-cap	-0.063 (0.26)	0.84	0.152	0.245	-0.191
Evli Finland Select B	-0.033 (0.19)	0.91	0.184	0.226	-0.163
Evli Finland Small-cap	0.267 (1.55)	0.91	0.287	0.140	0.467
FIM Fenno	-0.290 (1.31)	0.89	0.089	0.277	-0.537
Fondita Equity Spice	0.266 (1.41)	0.92	0.250	0.121	0.448
Handelsbanken Finland	0.127 (0.80)	0.93	0.212	0.150	0.199
Nordea Pro Finland	0.121 (0.91)	0.95	0.202	0.138	0.254
Nordea Finland	-0.029 (0.20)	0.94	0.130	0.158	-0.131
OP-Delta	-0.014 (0.11)	0.95	0.151	0.170	-0.113
OP-Focus	0.117 (0.73)	0.92	0.199	0.141	0.182
OP Finland value	-0.160 (0.92)	0.91	0.139	0.260	-0.394
OP Finland Small-cap	-0.511 (1.94)	0.81	-0.013	0.343	-0.793
Säästöpankki Finland	0.127 (0.88)	0.91	0.233	0.165	0.172
Seligson & Co Phoebus	0.193 (0.91)	0.78	0.306	0.206	0.187
Average	0.006	0.89	0.187	0.207	-0.037

Figure 10 illustrates the results of table 9 by showing the performance of OP Finland Small-cap fund and style-adjusted benchmark portfolio formed each month based on style of previous 12 months. The figure indicates that the rolling style-benchmark outperformed the fund and the market index especially after year 2008 with a surprisingly large cumulative difference. Figure 11 shows a similar graph for Seligson & Co Phoebus fund. The figure indicates that the market index and estimated style of the fund move very close to each other and slightly above the fund up until the end of

year 2011. The figure suggests that the fund was able to beat the market index and the 12-month rolling style-benchmark over the last two years of the evaluation period. Overall, the results of table 9 also illustrate the fact that using a shorter evaluation window may slightly increase variation and the spread between the performance of the fund and benchmark, although the average R^2-values still remain very high.

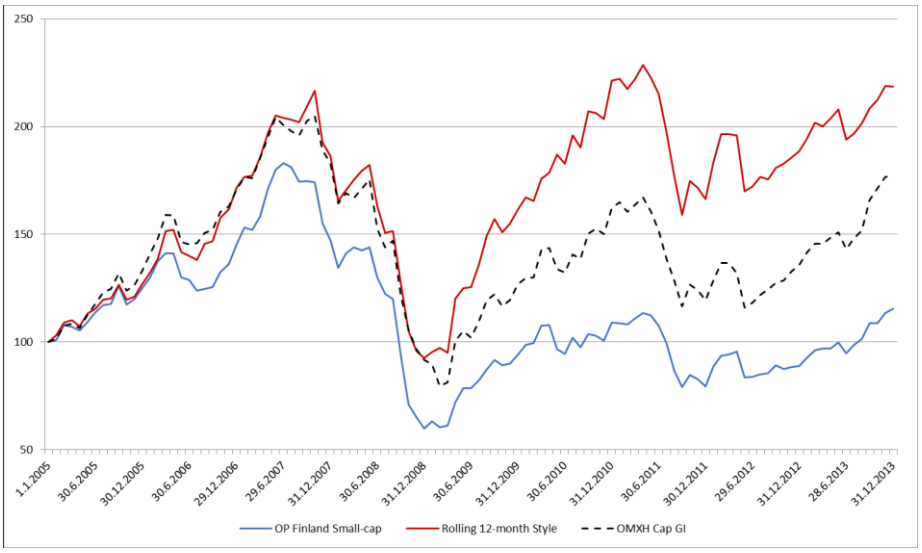

Figure 10. Fund vs. 12-month rolling style-benchmark: OP Finland Small-cap

Figure 11. Fund vs. 12-month rolling style-benchmark: Seligson & Co Phoebus

6 SUMMARY AND CONCLUSIONS

The purpose of this thesis was to analyze the style and performance of Finnish equity mutual funds by applying returns-based style analysis as the main methodology. The main results are in line with previous studies confirming the hypothesis of the importance of allocation decisions to the contribution of return, and that the performance of actively managed equity mutual funds relative to market does not seem to significantly differ from zero. More precisely, the results obtained from single-factor, three-factor and style-adjusted performance evaluation methods show that actively managed Finnish equity mutual funds do not seem to offer statistically significant value as compared to passive market indices or combinations of the former based on the analysis period 2004-2013. When considering the generally higher total expenses of actively managed funds as compared to passive investment products, it is justifiable to make a conclusion that investing in passively managed funds will on average yield a better result for an investor in the form of higher returns. At least investors should aim to find funds that truly target to beat the benchmark index, and therefore at least have a change to deliver superior returns.

Results of the study also confirm that returns-based style analysis can effectively reveal useful information and therefore support other performance evaluation- and asset allocation methods such as portfolio-based analysis. The average estimated styles obtained by way of style analysis seem to be well in line with the stated fund objectives in the case of most of the actively managed Finnish equity mutual funds. However, there seems to be funds whose returns are very effectively, or in some cases even better explained by a single broad market index than a weighted style-adjusted benchmark portfolio composed by several exclusive passive indices. There also seems to be some degree of dependence between the mutual fund size as measured by the assets under management and the explanatory powers of asset class factor models, especially in the case of the single-factor model applied for the sample of Finnish equity mutual funds. The results support the hypothesis that bigger funds seem to have higher likelihood to be closet indexers as proposed by Cremers and Petajisto (2009), and indicate that returns-based style analysis seems to provide the greatest relative improvement in the explanatory power as compared to simpler factor models when evaluating smaller equity mutual funds.

However, the results are not able to indicate a similar connection between the mutual fund size and performance, as none of the applied performance evaluation methods were able to indicate any statistically significant abnormal performance in Finnish equity mutual funds over the main evaluation period from 2004 to 2013. Overall, the differences in the performance evaluation results of the three models are relatively small, which may be partly explained by the fact the differences in the explanatory powers between the models were also relatively small, as the simplest single-factor model was able to explain over 90% of the returns for most funds. Further, the results also suggest that most funds had a slightly better relative performance against the estimated style-benchmark than a broad market benchmark over the evaluation period, which may be explained by the fact that the applied investment styles may not have performed as expected. The results of style analysis over rolling estimation windows indicate that there can be significant differences in the consistency of investment styles between different funds as measured by style drift scores, which may also affect the style-adjusted performance evaluation results over a long term.

As a conclusion, due to the relatively small sample size and limited scope of the study, the results of the thesis do not offer an unambiguous answer for the question which individual analysis method will provide the most consistent and reliable results in each individual case, but as previous studies have found, it seems that acknowledging the essential role of the broad market index and the main discovered investment styles will typically take far when analyzing equity mutual funds. Overall, the results highlight the general fact that the choice of the benchmark indices and evaluation period can have a major impact to the outcome of style- and performance analysis. Some interesting challenges and possibilities for further research include the question how to combine and make the most of the benefits of different returns- and holdings-based evaluation methods, and through that try to develop more efficient and case-specific, but at the same time consistent solutions for the performance evaluation of funds with different styles and characteristics. Also, the amount of research on style analysis over rolling estimation windows and possible applications of periodically re-adjusted style-benchmarks still remains fairly limited.

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