

# Performance-driven risk taking in Finnish equity mutual funds

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Iivo Paukkeri  
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## PERFORMANCE-DRIVEN RISK TAKING IN FINNISH EQUITY MUTUAL FUNDS

### PURPOSE OF THE STUDY

The purpose of this study is to assess whether mutual funds' risk taking is driven by past performance. Emerging from the risk taking incentives caused by the asymmetric relationship between fund's return and new flows of capital into the fund, this risk taking behavior reveals information on possible agency problems between investors and fund managers. Two different measures of risk, excess volatility over benchmark and tracking error, are employed to identify the different ways the manager can tilt the risk level of the fund. The study also distinguishes between the varying incentives between bull and bear years, thus providing more information on the behavior of mutual fund managers.

By employing several fund-specific characteristics, such as mutual fund size and age, this thesis studies the ways in which these characteristics affect performance-driven risk taking. Additionally, differences in behavior between funds managed by banks and non-banks are examined, as these can partially be seen as two different markets in Finland.

### DATA

The data set of the study consists of all actively managed Finnish equity mutual funds between 2002 and 2009. The data cover also discontinued funds, thus mainly avoiding the problem of survivorship bias. The data are in daily frequency and hold additional information on several fund-specific characteristics. Furthermore, data on several benchmark indices for different equity markets are used.

### RESULTS

Mutual funds' risk taking is positively related to their prior performance in bull years. This effect is not tied to calendar years. In bear years, no relationship between performance and subsequent risk taking is found. Several fund-specific characteristics affect the way the behavior appears among mutual funds. Using different measures of risk uncovers different ways of risk taking.

### KEYWORDS

Agency conflict, mutual fund tournament, risk taking, managerial incentives, fund flows

Aalto-yliopiston Kauppakorkeakoulu  
Rahoituksen pro gradu-tutkielma  
Iivo Paukkeri

Tiivistelmä  
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## MENESTYKSEN VAIKUTUS SUOMALAISTEN OSAKERAHASTOJEN RISKINOTTOON

### TUTKIMUKSEN TAVOITE

Tutkimuksen tavoite on selvittää, ohjaako aiempi menestys suomalaisten osakerahastojen riskinottoa. Tutkimalla aiemman menestyksen ja uusien rahavirtojen epäsymmetrisestä suhteesta syntyvien kannustimien aiheuttamaa riskinottoa, saadaan lisätietoa mahdollisesta osakerahastojen ja rahastosijoittajien välisestä agentti-ongelmasta. Tutkimuksessa käytetään kahta eri riskimittaria, tuottojen keskihajontaa ja tracking error – lukua, analysoimaan erilaisia tapoja, joilla osakerahastojen riskiä voidaan muuttaa. Lisäksi osakerahastojen kannustimien vaihtelevuuden huomioiminen nousevien ja laskevien osakemarkkinoiden välillä paljastaa lisätietoa rahastonhoitajien käyttäytymisestä.

Sisällyttämällä rahastokohtaisia ominaisuuksia mukaan analyysiin, voidaan näiden ominaisuuksien vaikutusta rahastojen menestyksen ohjaamaan riskinottoon tutkia. Lisäksi pankkien ja itsenäisten rahastoyhtiöiden välisiä käyttäytymiseroja tutkitaan, sillä nämä voidaan nähdä Suomessa osittain kahtena eri markkinana.

### AINEISTO

Tutkimuksen aineisto kattaa kaikki suomalaiset aktiivisesti hoidetut osakerahastot vuosina 2002–2009. Aineisto sisältää myös toimintansa lopettaneet rahastot, välttämättä näin pääasiallisesti ns. henkinjäämisharhan. Aineisto on päivätasoista ja sisältää lisäksi tietoa useista rahastokohtaisista ominaisuuksista. Lisäksi käytetään tietoa markkina-aluekohtaisten osakeindeksien päivätuotoista.

### TULOKSET

Osakerahastojen riskinotto on positiivisesti yhteydessä niiden aiempaan menestykseen, kun osakekurssit ovat nousussa. Tämä efekti ei ole sidottu kalenterivuosiin. Osakekurssien ollessa laskussa vastaavaa yhteyttä ei ole. Useat rahastokohtaiset muuttujat sekä käytetyt riskimittarit vaikuttavat efektin ilmenemiseen.

### AVAINSANOJA

Agentti-ongelma, rahasto-turnaus, riskinotto, kannustimet, rahastovirrat

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# 1 Introduction

## *1.1 Motivation of the study*

Mutual funds offer investors an easy and convenient way to outsource the management of their assets to professionally run portfolios. In addition to professional asset management, the benefits offered to the mutual fund investors are generally known to include means to better asset diversification with lower marginal costs. The globally increasing popularity of mutual funds can also be seen in Finland<sup>1</sup>. Here, the importance of the mutual fund industry in managing the assets of both retail and institutional investors has increased significantly. As the importance of the mutual fund industry has increased globally, it has also gained attention in academic studies.

One branch of academic studies on mutual funds focuses on the potential principal-agent – problems between mutual fund investors and mutual funds. As investors assign the management of their assets, e.g. pension savings, to the hands of a mutual fund manager, they should most certainly be interested in the motives of the manager, especially if they differ from the motives of the investors. As an example of the traditional principal agency –problem, a mutual fund manager (agent) with differing interests to those of the investor (principal) could deviate her behavior from what would be most beneficial to the principal.

As a possible embodiment of the principal-agent problem, several academic papers study if mutual fund managers change their funds' risk taking in response to their relative performance. This behavior would stem from two reasons. First, mutual fund managers' compensation is most often tied to a certain percentage of the assets under management. This gives the fund manager an incentive to maximize both the investment returns of the fund, i.e. the internal growth, but also the flows of new capital into the fund, i.e. the external growth. The second reason is that mutual fund investors are found to chase returns by investing into funds with better relative performance record.

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<sup>1</sup> See Figure 2 on page 36 for illustration on growth of the Finnish mutual fund market

The return chasing behavior of mutual fund investors has been documented e.g. by Sirri and Tufano (1998) and in Finland by Torkkeli (2002). However, this flow-performance relationship is not linear. Mutual funds with the best recent performance receive high new inflows, but the poorly performing funds do not encounter similarly high outflows. The asymmetric relationship between performance and fund flows creates a similar relationship between performance and fund manager's compensation. Sirri and Tufano (1998) point out that this compensation structure is similar to a call option, creating fund managers an incentive to increase the risk of the fund's portfolio.

The empirical evidence on the effect of past performance to the subsequent risk taking is somewhat mixed. In the early phase of academic studies on the subject, Brown, Harlow and Starks (1996) show that mutual funds with poor mid-year performance tend to increase the volatility of total fund returns in the latter part of the year to a greater extent than the funds with good mid-year performance. A similar finding in the Finnish markets is made by Koivulintu (2002) in his Master's Thesis.

The findings of Brown et al. (1996) are argued to be fragile by later studies, e.g. Busse (2001) and Goriaev, Nijman and Werker (2005), who use more precise methods. They find no relationship between interim performance and subsequent change in risk taking. At the same time, some academic studies have found perfectly opposite results, in which funds with better than average interim return increase their risk taking more than poor performers (e.g. Chevalier and Ellison 1997 and Ammann and Verhofen 2007). Furthermore, the failure of some earlier studies in documenting the relationship between performance and risk taking could result from inability to distinguish between different, contradictory incentives faced by mutual fund managers under different market conditions. This kind of argument is made by Kempf, Ruenzi and Thiele (2009). They show that interim losers tend to increase risk more relative to interim winners in bull markets when the compensational incentives dominate. On the other hand, Kempf et al. (ibid.) find that interim losers tend to increase risk less relative to interim winners in bear markets, when the employment incentives dominate. The dominance of the portfolio managers' employment incentives in bear markets is due to higher probability of losing their job should they



face catastrophic performance. Without distinguishing between bear and bull markets, Kempf et al. (ibid.) find no evidence on tournament behavior.

To make the discussion more interesting, in another recent study, Chen and Pennacchi (2009) argue that it is the tracking error, i.e. deviation from the benchmark index, that should be measured when analyzing tournament behavior. This argument is based on a theoretical model they introduce. In their empirical tests, Chen and Pennacchi (ibid.) find evidence that underperforming fund managers increase the tracking error of their funds, but not the standard deviation, i.e. volatility, of the total fund returns.

With mixed evidence on performance-driven risk taking, further studies are more than needed. Better understanding of the incentives driving mutual fund managers' behavior is important to both mutual fund investors and fund companies as these incentives can potentially lead to adverse managerial behavior.

## ***1.2 Objective of the study***

The objective of this thesis is to study if mutual fund managers change their behavior towards risk taking as a result of mid-year performance. This is done by studying both the changes in volatility of total fund returns and the tracking error proposed by Chen and Pennacchi (2009). To take into consideration the varying strength of compensational and employment incentives, introduced by Kempf et al. (2009), this thesis analyzes the performance-driven risk taking by accounting for bear and bull markets. Finally, the effects of several fund specific characteristics are examined. These include mutual fund's size, age and the length of portfolio manager's tenure in a given fund. Additionally, differences in behavior between funds managed by banks and non-banks are examined, as in the light of earlier studies these can partially be seen as two different markets in Finland.

This thesis contributes to previous academic studies in several ways. First, it re-evaluates the previous findings on tournament behavior in the Finnish mutual fund markets. As the size and thus the available sample of the Finnish equity mutual funds have greatly increased in the 21<sup>st</sup> century, re-evaluation of the previous evidence is justified. Second, this thesis employs another risk measure, the tracking error (as in Chen and Pennacchi 2009), to measure the risk taking of

the fund managers. These measures of risk sheds light into understanding the different ways a mutual manager may tilt the risk level of the portfolio. Most importantly, this thesis also takes into account the effect of time-varying managerial incentives in bull and bear markets, hence deepening our understanding of the incentives driving managerial behavior. The sample period, with turbulent financial markets, is an optimal time period to test the effects of these arguably contradictory incentives.

On the more practical side, this thesis contributes to the understanding of mutual fund behavior and possible discrepancies between the motives of the investors and fund managers. By understanding how mutual fund managers tend to behave as a response to prior performance and how relative strength of conflicting incentives as well as different fund characteristics affect this tendency, the investors can better evaluate the risk profiles of their mutual fund portfolios and hopefully avoid the potentially adverse effects of managerial behavior.

### ***1.3 Main Findings***

Mutual funds' risk taking is found to be positively related to prior performance in bull years. After above average performance in the first half of the year, mutual funds are indicated to have a tendency to increase both their volatility in excess of the benchmark and their tracking error. A contrary tendency is indicated after poor performance. In bear years, when different incentives are argued to dominate, no relationship between performance and risk taking is found. The positive performance-risk taking relationship of the bull markets is not bound to calendar years. When risk changes are studied between latter half of given year and the first half of the following year, similar positive relationship is documented with excess volatility as a measure of risk. However, no relationship between past performance and change in tracking error is indicated in this alternative setting. The positive bull year relationship between performance and risk taking is concluded to result from compensational incentives caused by the asymmetric flow-performance relationship as well as from managerial overconfidence. In bear years, the incentives of fund managers are concluded not to differ in relation to prior performance.

In addition, certain fund specific characteristics are indicated to affect the behavior of mutual funds. Fund size is found to affect the way in which risk is altered. Both large and small funds have the same tendency to increase risk measured by tracking error after good performance in

bull years. At the same time, only the large funds increase their excess volatility as a result of good bull year performance. With more limited options available in fine-tuning their portfolio compared to small funds, large funds are concluded to be unable to alter their tracking error without affecting their excess volatility. Fund age and portfolio manager's tenure are found to cause no difference in behavior, whereas the change of portfolio manager gives inconclusive results. Finally, bank managed funds are indicated to behave differently than non-bank managed funds. Both are found to have the tendency to increase tracking error after good performance in bull years, but only non-bank funds increase excess volatility at the same time. This difference in behavior is concluded to result most likely from the more aggressive behavior of non-bank funds due to stronger incentives from the flow-performance relationship.

#### ***1.4 Limitations of the study***

Limitations of the study are mainly limitations of the available data. First, the way the tracking error is calculated could in theory cause problems. This is because the tracking error as a measure of risk is affected by the cash position of the fund. If good performance brings new flows of money into the fund, then this fund's cash position is likely to be higher for some time before all new capital can be invested. This would cause the fund to deviate more from the benchmark portfolio and would thus increase its tracking error. This effect, if existing, could potentially explain the positive relationship between good performance and subsequent increase in tracking error. However, as this effect mainly coincides with increased volatility, which should be lower with higher cash position, this theoretical limitation does not sound credible and is deemed to cause no severe problems in drawing the conclusions. Furthermore, many mutual funds use derivatives, such as index futures, to balance their market exposure at times of high fund flows. Lastly, the question of liquidity affecting the performance-driven change in mutual funds' risk levels has been studied by Koski and Pontiff (1999), who find little support for it.

Second, portfolio manager's tenure, as defined in the data, does not describe how long experience the manager has in mutual fund industry and therefore does not describe the incentives associated with manager tenure (e.g. job stability). Instead, this measure only describes how long the manager has managed the fund in question. Therefore, the fact that manager's tenure was found to have no effect could be merely due to wrong explanatory variable.

### ***1.5 Structure of the study***

The study is structured as follows: Chapter 2 discusses the relevant academic literature on mutual funds covering both theories and relevant empirical evidence. Based on this theoretical background, Chapter 3 presents the hypotheses to be examined. After the hypothesis, Chapter 4 offers a brief introduction to development of the Finnish mutual fund industry and presents and describes the data sample used. Chapter 5 goes through the methodologies to be used in the analysis. In Chapter 6, the empirical findings are presented and discussed. Finally, Chapter 7 concludes.

## **2 Theoretical background**

Mutual funds have been a subject of intensive studying for decades and a large variety of aspects in mutual fund industry have been covered in several academic papers. This chapter goes through the most relevant academic discussion on mutual funds considering the performance-driven risk taking. This chapter is organized as follows: Part 1 focuses on performance – flow relationship in the mutual fund industry as a result of the investor behavior. Part 2 concentrates on the theories and prior empirical evidence describing mutual funds’ performance-driven risk taking. Part 3 focuses on mutual fund specific characteristics and how they have been documented to affect fund behavior. Finally, Part 4 offers a summary and conclusions of the theories and earlier empirical findings.

### ***2.1 Flow-performance relationship in the mutual fund industry***

One of the most studied aspects of mutual fund industry is the determinants of new money flows into mutual funds. By explaining the decision making criteria of mutual fund investors, these studies shed light into the incentives of mutual fund managers attempting to attract those flows. This chapter discusses the relevant academic research on the perceived relationship between mutual funds’ past performance and flows of new money in and out of the funds.

Sirri and Tufano (1998) study the mutual fund flows of US equity mutual funds over the period of 1971-1990. They report that investors of equity mutual funds channel money into high performing funds, but at the same time do not flee from the poor performing funds at the same rate. Especially the funds that are in the top quintile in performance rankings realize very strong flow-performance relationship. At the same time in the bottom quintile, there is virtually no relationship between prior performance and fund flows. These results are robust with different measures of performance as well as with different measurement periods of performance. From the documented flow-performance relationship and the normal compensation structure of the mutual fund industry in which management fee is a function of fund size, Sirri and Tufano (ibid.) conclude that mutual fund managers are given a payout that resembles a call option. If mutual

fund managers are awarded on good performance with high inflows and thus increasing management fees but are not penalized in similar manner for poor performance and lower management fees due to fund outflows, it might be reasonable for them to take higher risks and hope for extraordinary returns.

A similar finding on the flow-performance relationship is made by Chevalier and Ellison (1997). They study mutual funds' incentives by analyzing the relationship between past performance and new investments into funds and then analyze how mutual fund portfolios are in fact altered towards the end of a calendar year. Their analysis on the flow-performance relationship finds evidence of a highly convex relationship, which gives option-like incentives to mutual fund managers. Hence, in both upper and lower ends of the performance scale, the effect on fund flows of past performance increases faster than near the middle of the scale. Chevalier and Ellison then argue that in addition to the intuitive "losers gamble – winners index" argument, the flow-performance relationship will cause these incentives to reverse in extreme positions. Funds that are far behind the index may want to reduce their risk, while funds that are well ahead of the market may have a strong incentive to gamble.

An alternative explanation for the convex performance – flow relationship is proposed by Lynch and Musto (2003), who argue that the convexity follows directly from the strategic environment of the mutual fund industry. They propose a model, in which some money managers' strategies are better than others, and the returns generated by these strategies provide information about their quality. In their model, money managers change those strategies that underperform, so that future performance and new money inflows are relatively insensitive to past performance below some threshold. This is consistent with Chevalier and Ellison (1999), who argue that poor performers that change their portfolio managers suffer from less money outflows than those poor performers that do not replace their management. By studying daily returns of US equity mutual funds between 1985 and 1995, Lynch and Musto (ibid.) find significantly greater probability of both manager changes and investment strategy changes among bad performers than on good performers. Similarly, they find that the sensitivity of money flows in relation to performance for poor performers is lower for those bad performers who change strategy. From these findings,

Lynch and Musto (ibid.) conclude that the convex relationship between flows and past performance is natural as long as investors view investment strategy persistence very likely after good performance and very unlikely after poor performance.

The determinants of mutual fund flows and the impact of past performance have also been documented in the Finnish mutual fund market with somewhat mixed results. Torkkeli (2002) reports in her Master's Thesis that Finnish investors tend to invest in funds that have performed well in the past. She finds positive correlation between last 12 months' Jensen alpha and fund flows. In the end, she concludes that funds in the highest quintile performance class receive more net capital flows than funds with poorer prior performance. Her findings were similar for bank and non-bank managed funds, resulting in a conclusion that the retail-bank status has no effect on the flow-performance relationship. Särkijärvi (2008), in his Master's Thesis, finds indications of the same pattern, although his findings are somewhat mixed depending on the methods used. Knuutila (2005) reports significant difference in the flow-performance relationship between mutual funds managed by banks and non-banks by studying the effect of Morningstar ratings, a risk and fee adjusted performance measure, on mutual fund flows. Non-bank managed funds are reported to experience positive flow-performance relationship, but the same relationship is not found on bank managed funds. Similar findings are made by Kasanen, Lipponen and Puttonen (2001). They conclude that investors of mutual funds managed by banks seem to be ignorant of prior performance while investors of mutual funds managed by non-banks put emphasis on relative short term performance. By studying the relationship between prior performance ranking and fund flows for mutual funds managed by non-banks, Kasanen, Lipponen and Puttonen (ibid.) conclude the relationship to be asymmetric in a manner similar to e.g. Sirri and Tufano (1998).

## ***2.2 Performance-driven risk taking in mutual funds***

As in all industries operating in open markets, also the mutual fund industry is a subject to heavy competition. It is therefore intuitive to assume that this competition affects the behavior of the funds in the industry. The effect of the competition on mutual fund behavior is a well studied but inconclusive field of academic research. This part discusses the relevant research finding on the performance-driven risk taking in mutual funds.

In their 1996 study, Brown et al. argue that mutual fund's portfolio decisions are affected by the natural competitive nature of the industry. The rationale behind this argument is easy to understand. The reward of mutual fund managers is typically determined as a percentage of the assets under management, thus giving the fund managers an incentive to try to maximize the size of the mutual fund under their management. Mutual funds earning the highest returns in a given assessment period receive the highest flows of new investments into their fund, as shown by Sirri and Tufano (1998). Sirri and Tufano (ibid.) also find that this relationship between past performance and fund flows is asymmetric, as funds that performed poorly did not experience significant outflows of capital. Brown et al. (1996) argue that this asymmetric relationship gives the mutual fund managers an option-like compensation arrangement, similar in spirit to those discussed by e.g. Grinblatt and Titman (1989) in relation to formal performance based fee contracts of portfolio managers, and should thus give mutual fund managers an incentive to alter the riskiness of their portfolios.

These arguments lead Brown et al. (1996) to a hypothesis that mutual fund managers who find themselves positioned at an interim assessment period as losers (i.e. performed worse than the average manager), will manipulate their fund's riskiness differently than those managers who perform better than average in the interim assessment. In their argument, both interim winners and losers can either increase or decrease the riskiness of their portfolio. It is the "risk adjustment ratio", volatility in the latter period divided by the volatility in the earlier period that is likely to be larger for interim losers than for interim winners.

By studying monthly returns of 334 growth-oriented mutual funds over the period of 1980-1991, Brown et al. (1996) argue that, at the margin, losers (winners) shift their investments to increase risk by a greater (lesser) degree. They choose funds with growth classifications because they are argued to be the most widely followed and often ranked class of publicly traded funds. Furthermore, they argue that it is also the fund class that is likely to have a high a priori tendency towards taking risky positions.



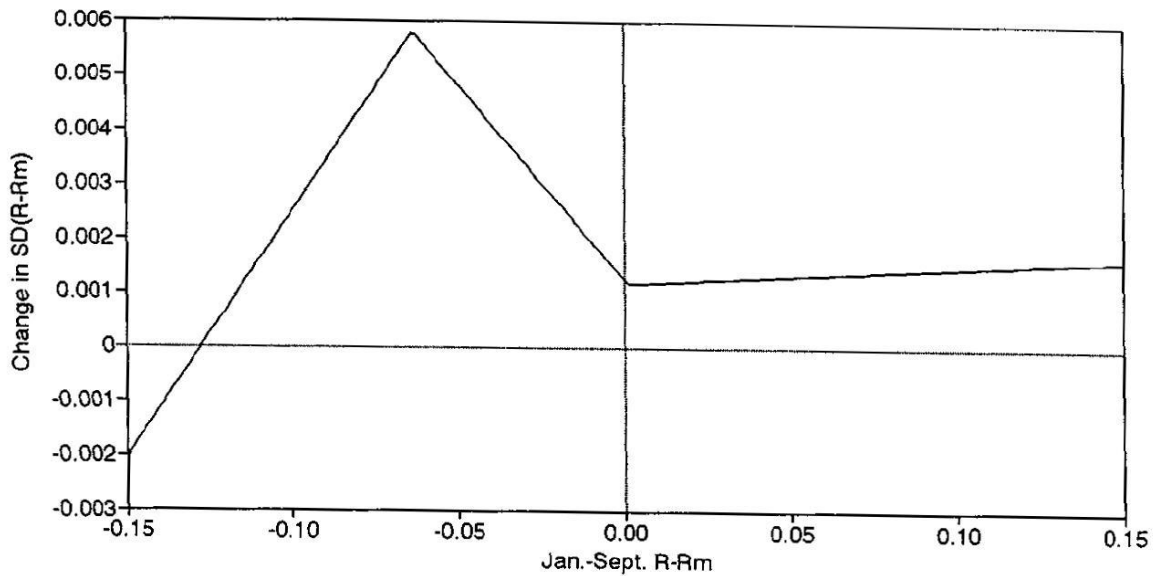
Brown et al. (1996) find that the effect of risk manipulation is more pronounced during the last six years of their study period. This, they argue, is due to increased investor awareness of relative performance and increased pace of new funds entering the market. By analyzing a simulated set of unmanaged stock portfolios, Brown et al. (ibid.) argue that their analysis suggests these risk changes to be due to explicit managerial actions and not generated entirely at the asset level. In the asset level risk increase, the worse performing assets are argued to become riskier and thus no active decision from fund manager to increase in portfolio risk is needed for the effect to occur.

Brown et al. (ibid.) also study the effect of two mutual fund characteristics, age and size, on the risk alteration. They hypothesize that younger and smaller funds have more incentives to alter their risk. This hypothesis is based on the assumptions that smaller funds are less constrained to alter the riskiness of their portfolios, smaller and newer funds have more incentives to pursue riskier investments to survive and finally, investors are more likely to be influenced by bad short-term performance of a fund with short track record than of one with extensive history. To study these aspects, they divide their sample by both size of assets under management and by the age of the fund and study the risk changing effect for these sub-groups. Their results indicate that it is indeed the newer funds that provide more of the separation between the portfolio risk adjustments between interim winners and losers. Additionally, their results support the notion that it is the smaller funds that tend to alter portfolio risk by the largest amount, although the statistical significance of the latter finding was relatively weaker.

To widen the scope of their study further, Brown et al. (1996) release themselves from the tournament assumption tied to a calendar year. As Sirri and Tufano (1998) found, it is also the past years' performance that explained mutual fund flows. Thus Brown et al. (ibid.) predict that the more consistently the manager has been a loser (winner) in the past, the more (less) likely he or she is to alter the volatility of the portfolio. They study the effects of two- and four-year cumulative performance, in addition to the interim performance, to their "risk adjustment ratio" with a logistic regression and find evidence that both cumulative and current year performance significantly influences the probability of a fund to increase its volatility ratio subsequent to the

mid-year performance assessment. The effect of cumulative performance seems to have almost as large an impact than do the interim, i.e. beginning of the calendar year, performance.

The findings of Brown et al. (1996) are put under further testing by Chevalier and Ellison (1997). They study both mutual funds' incentives by analyzing the relationship between past performance and new investment flows into funds and then analyze how mutual fund portfolios are in fact altered towards the end of the calendar year. Their analysis on the flow-performance relationship finds evidence on a highly convex relationship, which causes option-like incentives to mutual fund managers. With a data set of 3163 fund-years between 1983 and 1993, consisting of detailed portfolios held by mutual funds, Chevalier and Ellison (1997) study whether empirical evidence on mutual fund behavior support the idea that mutual funds alter their portfolios due to these incentives. By studying changes in total portfolio riskiness, as measured by tracking error, they find that higher excess return in the first period (Jan-Sept.) clearly correlated with larger risk increases, thus implying a higher tendency to gambling behavior for interim winners, a result contrary to Brown et al. (1996). They model this relationship of actual mutual fund behavior based on their analysis of flow-performance relationship, which is presented in Figure 1. Their results further indicate this positive correlation between interim excess return and risk increases to be higher for older fund than for the younger funds in their sample. In their study, they are able to graph the flow-performance relationship in a rather detailed level, revealing a more complex setting than the one assumed e.g. by Brown et al. (1996). Therefore, the flow-performance relationship, and hence the incentives for mutual fund managers, are not simply twofold but require a more detailed understanding of the competitive situation of a fund.



b

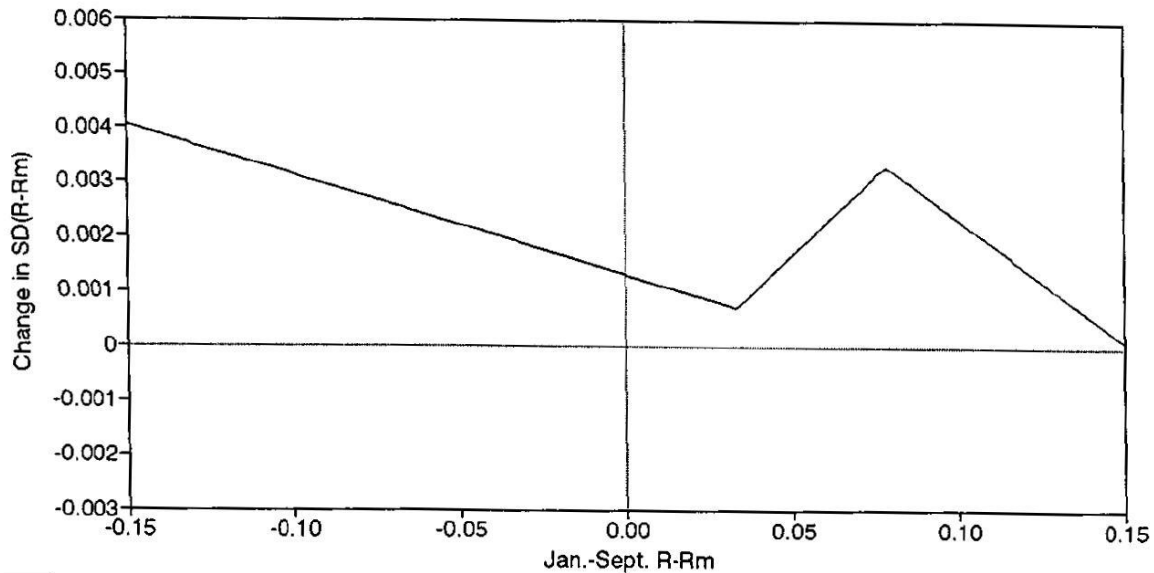


Figure 1: Actual performance-driven risk change pattern modeled by Chevalier and Ellison (1997) with fitted values from piecewise linear model. a, Young funds' equity portfolios. b, Old funds' equity portfolios. The horizontal axis presents the fund's excess return over benchmark in January-September period while the vertical axis presents the change in tracking error between January-September and October-December.

Busse (2001), studies further the hypothesis that fund managers actively alter the riskiness of their portfolio in response to past performance. The difference of his empirical study to Brown et al. (1996) is that he uses daily returns of mutual funds. With more observations than monthly data

used by Brown et al. (1996), more precise estimates of volatility can be calculated. The difference arises from biases in the monthly standard deviation estimates, resulting from autocorrelation patterns in daily returns. Autocorrelation patterns arise, as Busse (2001) argues, from different exposures to small capitalization stocks. To tackle this problem, he calculates volatilities for the fund returns in two ways, first by assuming the daily returns are independent and second by modeling the returns as a first order moving average process. The first method equals the one used by Brown et al. (1996), except using daily returns instead of monthly ones.

Busse's findings are interesting, since the tendency of poor performing funds to increase risk more relative to well performing fund disappears completely when calculated from the daily returns. However, when he compounds his daily returns into monthly returns and performs the same analysis, he finds same risk taking pattern documented by Brown et al. (1996). His results with daily returns actually implicate a contrary effect than predicted by tournament hypothesis, in that mid-year winners increase end of the year risk more than losers. However, these results are statistically significant in only two of the five cut-off periods in his sample. Thus, the results remain non-conclusive and Busse (2001) is not able to reject the null-hypothesis of no tournament effect with either the assumption of independent returns or by modeling the return series as a moving average process. In addition, his further analyses with sub-groups based on fund style as well as sub-periods fail to reject the null hypothesis of no tournament behavior.

Instead of focusing only on total variance, Busse (*ibid.*) argues that fund managers should have higher control over beta and residual risk, since the total variance is affected by the aggregate behavior of all market participants. To test the implications of this argument, he repeats the tournament analysis with beta and residual risk. By using both single (excess return on S&P500-index) and four-factor (adding size, value and momentum effects) models, the conclusions remain. He finds no evidence of a relationship between performance and any of the coefficients or residual risk for either one- or four-factor models. As his daily risk estimates are much more precise than the monthly estimates used e.g. by Brown et al. (1996), he concludes that a failure to reject the null-hypothesis casts doubt on the hypothesis that fund managers alter the riskiness of their portfolio in response to interim performance.

Findings of Busse (2001) are further studied and confirmed by Goriaev, Nijman and Werker (2005) with methodologies adopted from Busse (ibid.). They study US equity mutual funds between 1976 and 2001 and conclude that there is little evidence on tournament behavior of mutual fund managers. Besides confirming the findings of Busse (ibid.), Goriaev et al. (ibid.) study the reasons for the difference in empirical results of the tournament tests based on daily and monthly returns. They argue that the evidence found in previous studies is due to neglected cross-correlation between idiosyncratic fund returns. Finally, Goriaev et al. (ibid.) conclude that the methodological problems presented in their study, as well as in Busse (2001), do not invalidate the empirical evidence concerning the tournament hypothesis based on studies on actual portfolio holdings of the mutual funds, as in Chevalier and Ellison (1997).

In their 1999 paper, Koski and Pontief analyze the use of derivatives by equity mutual funds by comparing the return characteristics of funds that use derivatives to funds that do not. As the ability to trade derivatives is likely to affect the mutual fund managers trading in other securities, they study the returns of total portfolios, instead of focusing solely on trading in derivatives. Koski and Pontief (1999) study three ways in which the use of derivatives could affect mutual fund returns. They study both the total riskiness and performance of funds that use derivatives versus funds that do not. The third aspect of their study, how the use of derivatives affects the intertemporal relationship between fund performance and risk, is highly interesting considering this thesis. Contrary to the hypothesis of gambling in tournaments presented in the previous studies, they form an alternative hypothesis, in which fund's risk level changes in response to cash flows in and out of the fund. This alternative hypothesis is based on the findings that cash flows are related to fund performance; i.e. money flows into funds that perform well (Sirri and Tufano, 1998). This could result in fund managers being reluctant to invest immediately in response to these cash flows if their timing does not correspond to the managers' information about optimal timing. As shown by Edelen (1995), mutual fund trades that are related to cash flows are less profitable than trades not influenced by cash flows. Therefore, lower risk after good performance could be related to higher cash positions as cash inflows cannot be invested immediately due to non-optimal timing. Similarly higher risk after poor performance could be caused by decreased cash position (or borrowing) as a result of investors redeeming their shares.

As the two alternative hypotheses predict the same effect between performance and risk, Koski and Pontief (1999) use derivative to distinguish between them, since, as they argue, derivatives are a low cost way to achieve a desired risk exposure without affecting fund's cash position.

In short, if managers who use derivatives are able to accentuate changes in risk relative to managers who do not use derivatives, one would expect the relation between prior performance and change in risk to be stronger for funds that use derivatives. Conversely, if change in fund risk relative to prior performance arises as a result of variations in cash flows, managers who use derivatives would be better able to dampen the impact of performance on risk relative to those who do not use derivatives. In this alternative, one would expect the relation between prior performance and change in risk to be weaker for funds using derivatives.

Koski and Pontief (ibid.) find evidence that change in risk is in general significantly related to prior performance. By studying monthly returns of 679 equity mutual funds between 1992 and 1994, Koski and Pontief find similar results to the findings of Brown et al. (1996). Their results support both hypothesis, the incentive gaming conjecture and the cash flow management conjecture. Furthermore, these effects are consistently less severe for funds using derivatives, implicating that past performance has relatively weaker impact on risk for funds using derivatives.

Koski and Pontief also perform a further analysis to distinguish between the two conjectures presented above by differentiating the time periods in the analysis. Under the tournament hypothesis, funds are evaluated on their performance in a given calendar year. In this case, also the risk manipulation due to economic incentives should be concentrated within calendar years. On the other hand, if fund risk changes due to cash investments and redemptions, as the second hypothesis goes, then the changes in risk may span the calendar year. By repeating their analysis with varying time periods, in addition to calendar years, Koski and Pontief find similar results as before for change in risks related to prior performance, and the relation is weaker for funds that use derivatives. On the other hand, they also find evidence that the change in risk is, at least partially, tied to calendar years, as the calendar year end affects the relationship between fund

risk and prior performance, thus supporting the tournament hypothesis. This leads them to conclude that their results are more consistent with managerial gambling than the cash flow explanation. Furthermore, Koski and Pontief document a significantly positive relationship between change in risk in the first sub-period of a year and performance in the last sub-period of prior year, a result not supported by any of their hypotheses.

In a more recent paper, Ammann and Verhofen (2007) analyze the behavior of mutual funds with a special focus on the effects of past performance. In addition to different measures of volatility, they also consider other measures such as beta, tracking error and style measures in a similar manner to Busse (2001). They build their analyses using a Bayesian network, a graphical model for representing conditional dependencies between a set of random variables. This methodology is, as they acclaim, able to capture also non-linear effects since it does not impose any distributional assumptions. Furthermore, with their methodology Ammann and Verhofen are able to assign exact probabilities on the adjustment of behavior.

With a data set including monthly returns of all U.S. open-end equity mutual funds between December 1984 and December 2003, they find that prior performance has a positive impact on the choice of subsequent risk taking. This contrasts with the tournament theory, as successful managers take more risk in the following calendar year. More precisely, they increase volatility, beta and tracking error and assign more weight on value stocks, small firms and momentum stocks. On the other hand, fund managers with poor prior performance turn into more passive strategies. In interpreting their findings, Ammann and Verhofen (*ibid.*) point out the differences between the setting of their study compared to the previous studies. First of all, they use larger sample of funds during a longer time period, instead of e.g. a subset of funds as Brown et al. (1996). Furthermore, they do not concentrate on mid-year changes in behavior, which is typical for tournament hypothesis. Therefore, also their reasoning behind the findings differs somewhat from the earlier studies. Their explanation on the findings is two-sided. First, managers with poor prior performance follow more passive strategies to minimize their further risks, since it is the relative, not absolute performance that is relevant. Second, managers with good prior performance tend to take more risk due to increased confidence in their own abilities. This effect

is in nature similar to a more general effect of managerial overconfidence documented in other fields on academic research (for more information about overconfidence see e.g. Malmendier and Tate 2005 or Grinblatt and Keloharju 2009). Finally, Ammann and Verhofen conclude that the behavior of mutual fund managers is much more complex than assumed by theoretical models, as they usually capture only one aspect of the actual behavior.

In one of the most recent papers on this issue, Chen and Pennacchi (2009) bring new theoretical and empirical insight into mutual funds' risk taking. They model the optimal intertemporal portfolio strategy for a mutual fund manager facing a competitive tournament environment, as assumed earlier by several studies. In the model, fund managers' compensation can be concave, linear or convex function of the fund's relative calendar year performance, which leads to a simple and intuitive closed-form solution for a fund manager's optimal portfolio choice. In their model, Chen and Pennacchi (ibid.) show that the deviation of the fund manager's optimal portfolio from the benchmark is a function of the fund's prior performance. With limited penalty from poor performance, i.e. total compensation cannot fall to zero, fund manager chooses to deviate more from the benchmark as her fund's relative performance declines. This deviation from the benchmark is seen as increased tracking error. Chen and Pennacchi (ibid.) emphasize that it is not necessarily true that poor performance would lead fund managers to increase the standard deviation of total returns (i.e. volatility), beta or residual risk.

This brings new insight into the discussion, since majority of previous papers concentrate on these other measures of risk taking behavior. The model of Chen and Pennacchi (ibid.) does not necessarily imply the same "risk adjustment ratio" as Brown et al. (1996), and hence previous empirical evidence against this equation (Busse 2001 and Gorjaev et al. 2005) cannot rule out tournament behavior. From their model, Chen and Pennacchi (ibid.) conclude that worsening performance can cause mutual funds to deviate more from the benchmark portfolio, but this could also move the portfolio closer to one minimizing the standard deviation. Therefore, it is the standard deviation of fund's portfolio return relative to the benchmark portfolio return, i.e. tracking error that is the correct empirical indicator of risk shifting.



In their empirical analysis, Chen and Pennacchi (*ibid.*) study monthly returns of more than 6000 mutual funds over the period 1962-2006 by using two different methods. First, they modify the standard deviation –ratio test performed by Brown et al. (1996) by using standard deviation of tracking errors instead of standard deviations of total returns. Secondly, they employ a new time-series estimation method that permits the mutual fund’s risk to respond to calendar-year performance at each of the monthly observation date, not only once during the year. This method is argued to be more logical, as their model predicts that an optimizing manager would adjust the fund’s risk continuously as its relative performance changes.

In their standard deviation ratio –test, in which standard deviations of tracking errors are used, Chen and Pennacchi (*ibid.*) report statistically significant evidence that underperforming funds increase the standard deviations of their tracking errors. This behavior is present during the whole study period. From this first analysis, Chen and Pennacchi conclude that measuring risk appropriately as tracking error makes a big difference in testing tournament behavior. In their further tests with sub-samples similar to Brown et al. (1996), i.e. small vs. big funds and young vs. old funds, Chen and Pennacchi report that all of these groups showed a tendency to increase the standard deviation of their tracking error as a response to low relative performance. This evidence was strongest for larger and older funds.

In their second method, Chen and Pennacchi (*ibid.*) document that relatively more funds significantly raise tracking error due to poor performance. However, this finding is not widespread in their whole sample, as majority of funds did not alter their tracking error significantly. However, the tournament behavior, and its effects could be sizeable to many funds and Chen and Pennacchi (*ibid.*) concluded that underperformance can lead to economically significant rises or falls in tracking error, depending on the fund. To study the issue further, Chen and Pennacchi investigated whether funds that significantly raised tracking error due to underperformance differ from funds that significantly lowered tracking error due to underperformance, by comparing characteristics of these two groups of funds. By analyzing the funds that significantly changed their tracking error as a result of prior performance, Chen and Pennacchi document that only the fund manager’s tenure is a statistically significant determinant

of fund's tendency to increase the volatility of its tracking error after underperformance. This finding is in line with the predictions of their theoretical model, as tenured fund managers are more likely to have accumulated personal wealth and have more secure jobs, which both increase the possibility that the managers' total wealth remains positive even after poor performance in the current calendar year. In the earlier papers, this better job stability of portfolio managers with long tenure at their funds has been documented by Chevalier and Ellison (1999). In a similar manner, a manager with shorter tenure is likely to have accumulated less personal wealth and be more likely to suffer termination due to poor performance. The empirical results of Chen and Pennacchi (*ibid.*) confirm the prediction of their theoretical model that longer tenured managers tend to increase tracking error more as performance declines.

Another recent and interesting study on mutual funds' tournament behavior is by Kempf, Ruenzi and Thiele (2009). They study managerial risk taking in the tournament setting taking into account both employment and compensation incentives and their relative importance in affecting risk taking behavior in different market conditions. The employment incentives brought into discussion by Kempf et al. (*ibid.*) bring new insights into tournament behavior. They argue that employment incentives contradict the compensation incentives caused by convex relationship between performance and fund flows. If mid-year losers follow more risky strategies in the second half of the year, they also increase the probability of achieving a performance so poor that they would end up losing their jobs. This inverse relationship between performance and probability of fund manager replacement has been documented e.g. by Khorana (1996). Therefore, it is the compensation incentives that would lead managers with poor interim performance to increase risk relative to interim winners. At the same time, the employment incentives would lead the interim losers to decrease the risk relative to interim winners to avoid "catastrophic" poor performance and potential loss of job, loss of reputation and even loss of future job opportunities. Kempf et al. (*ibid.*) further argue that the relative strength of these incentives depends on the expected cost of job loss and expected increase in compensation, which is proxied in their study simply by market returns. The reasoning behind using this proxy is intuitive. In bear markets, inflows of new money into mutual funds is generally low and therefore the potential for gaining new inflows due to relatively good, or less bad, performance is low. This

makes the compensation incentive weak in bear markets. As argued by Karceski (2002), fund managers do not care much about outperforming other fund managers during bear markets. Similarly, Chevalier and Ellison (1999) find that potential of losing job is more likely after bear markets than after bull markets. Hence, employment incentives should dominate in bear markets. Similarly, the opposite reasoning goes for strong compensation incentive and weak employment incentive in the bull markets. This leads Kempf et al. (ibid.) to their main hypothesis that in bull markets managers with poor interim performance increase risk relative to interim winners and inversely in bear markets interim losers increase risk less than interim winners.

Kempf et al. (2009) test these hypotheses by studying the behavior of U.S equity mutual funds between 1980 and 2003. They use data including quarterly or semiannual portfolio holdings of mutual funds to investigate the risk taking of fund managers. To analyze the intentional change in risk taking, they compute an intended portfolio risk for the second half of the year based on the portfolio holdings in the second part of the year and the expected volatility of those stocks in the second part of the year. The stock volatility in the first half of the year (H1) is used as an estimator for expected stock volatility in second half of the year (H2). From this estimate, they calculate a risk adjustment ratio similar to Brown et al. (1996), defined as intended risk in H2 divided by realized risk in H1. By using both contingency table approach and regression approach, they find strong support for their hypotheses. Their findings indicate that mid-year losers increase risk more than mid-year winners in bull markets, i.e. when compensation incentives are argued to dominate employment incentives. In the bear markets, the opposite finding is made. As the employment incentives dominate, interim losers are found to increase risk less than interim winners. As an additional finding, Kempf et al. (ibid.) document a significantly negative relationship between risk level in the first half of the year and subsequent change in risk. This confirms the mean reversion of fund risk levels documented by e.g. Koski and Pontiff (1999).

These empirical findings of Kempf et al. (ibid.) are reported to be stable over time and also hold after controlling for fund and market segment characteristics. What is interesting in relation to findings of earlier studies reporting no tournament behavior (e.g. Busse 2001), is that when

Kempf et al. (2009) estimate the tournament behavior without distinguishing between periods of bull and bear markets, the influence of past performance on risk taking is reported to be virtually zero. This finding gives strong justification for distinguishing between these two market conditions and thus dominant incentives when studying mutual funds' risk taking behavior.

Finally, Kempf et al. (ibid.) also discuss and analyze the impact of portfolio manager's tenure on risk taking behavior. They argue that sensitivity to employment and compensation incentives would vary during the fund manager's life-cycle. In their reasoning, fund managers with long tenure would be less concerned about losing their jobs than managers with short tenures because they have built a reputation and are closer to retirement. Similar findings have been documented earlier by Chevalier and Ellison (1999). Furthermore, managers with longer tenures would be less concerned about compensation as their personal wealth is probably already higher. When studying this hypothesis, Kempf et al. (ibid.) find, in line with their theoretical reasoning that managers with longer tenures respond less to compensation incentives in bull markets when the compensation incentives dominate. Therefore, managers with longer tenures change the risk level less as a result of past performance. On the other hand, they find no evidence on difference between long and short tenured managers in bear years when the employment incentives dominate. From this they conclude that older managers still care about keeping their jobs, although they are less influenced by the compensation incentives.

### ***2.3 Mutual fund specific characteristics in explaining mutual fund behavior***

The earlier part of this chapter has already presented discussion on two incentives potentially driving mutual fund risk taking; economic compensation and portfolio managers' employment concerns in the sense of job stability. This sub-chapter presents academic literature and empirical evidence on a more clearly visible driver of mutual fund behavior, i.e. fund specific characteristics. These characteristics, such as size and age, are easily visible to all investors with very low information cost. While the main focus is on the effects on risk taking behavior, some other effects are also covered in this chapter since many of them affect the behavior of mutual funds in a broader sense. This sub-chapter widens the theoretical foundations for the subsequent analyses on effects of fund specific characteristics.

### ***2.3.1 Mutual fund size***

The size has been documented to affect the behavior and performance of mutual funds. For example, Yan (2008) documents significantly negative relationship between mutual fund's performance and its size, measured as Total Net Assets (TNA). Yan concludes that the main source of this negative relationship is constrained liquidity. The negative relationship is more pronounced for mutual funds with less liquid portfolios and for mutual funds with high turnover and growth strategies, being therefore more dependent on liquidity.

Pollet and Wilson (2008) study how mutual fund size affects the behavior of the funds. They document effects in which mutual funds respond to growth in their total size by increasing their ownership shares in the existing equity possessions instead of increasing the number of investments in their portfolio. Pollet and Wilson (ibid.) also show that the number of stock increases only slowly as a response to fund flows. Pollet and Wilson (ibid.) conclude that mutual fund managers diversify as a result of fund growth only when they are prevented to increase their share in existing holdings due to significant ownership costs. Hence, size sets constraints on the behavior and thus also risk taking of the mutual funds as they grow. Another finding on size effect is made by Beckers and Vaughan (2001). They study the size effect by simulating constructed small and large portfolios with real market data and analyzing their behavior. They conclude that size sets constraints to active management of the funds by restricting the opportunities to fine-tune the large funds in a similar way to the smaller funds.

Brown et al. (1996) hypostasize that smaller funds would be more inclined to show tournament behavior, as they are less constrained to do so. Based on their empirical analyses they conclude this to be true, although the statistical significance of this finding is relatively weak. On the other hand, Kempf et al. (2009) find no statistically significant effect of mutual fund size on its performance-driven risk taking. To make the situation more ambiguous, Chen and Pennacchi (2009) document that both large and small funds showed a tendency to increase their tracking errors as a response to low relative performance, but this effect was stronger for the larger funds.

In the Finnish equity mutual funds, the effect of mutual fund size has been studied by Tapio (2002) in her Master's Thesis. She studies how mutual fund's size affects the tracking error of the fund. With her sample of Finnish equity mutual funds between 1997 and 2001, she finds no relationship between the size and the tracking error. However, as the average size of Finnish equity mutual funds has grown significantly since 2001 (see e.g. table 1 on page 41), validity of these results today is somewhat ambiguous.

### ***2.3.2 Mutual fund age***

The effect of mutual fund age to fund behavior is a less investigated area in the academic research. Brown, Goetzmann and Park (2001) study career concerns of hedge funds managers and commodity trading advisors. From their analyses, Brown et al. (ibid.) conclude that fund termination is a function of performance relative to high water mark thresholds as well as to industry benchmarks. What is interesting in the sense of this study is the finding by Brown et al. (ibid.) that older funds are less sensitive to performance. Although these results are not from funds perfectly comparable to this study, they suggest that the older funds could in fact have fewer incentives to alter their risk due to prior performance.

Mutual fund age has also been used as a variable in abovementioned studies on mutual fund tournament. Brown et al. (1996) use mutual fund age to explain behavioral differences between funds. They hypothesize that newer funds have more incentives to pursue riskier investments to survive. Second, they argue that investors are more likely to be influenced by bad short-term performance of a fund with short track record than of one with extensive history. In their analyses, Brown et al. (ibid.) conclude that it is indeed the newer funds that provide more of the separation between the portfolio risk adjustments between interim winners and losers. However, similarly compared to their analysis on mutual fund size, Kempf et al. (2009) are not able to find any kind of difference in performance-driven risk behavior between young and old funds. Finally, Chen and Pennacchi (2009) find that both young and old mutual funds tend to increase the tracking error as a response to low relative performance, but the evidence is stronger for older funds. Similar findings are made by Chevalier and Ellison (1997), although they find the positive

relationship between performance and risk taking to be stronger for older funds. Hence, also the effect of fund age on risk behavior remains ambiguous in the light of earlier studies.

### ***2.3.3 Portfolio manager's tenure***

Similar argumentation can be found in academic studies concerning effects of portfolio manager's tenure. Career concerns of mutual fund portfolio managers have been studied by Chevalier and Ellison (1999). They find that young managers are punished for large deviations from the average beta or unsystematic risk level in their peer group. They also find that younger managers take less unsystematic risk compared to older managers. Similarly, younger managers are less likely to deviate from the herd, i.e. industry peer group, than older managers.

In the earlier studies on mutual fund tournaments, Chen and Pennacchi (2009) find that portfolio manager's tenure is a statistically significant determinant of fund's tendency to increase the volatility of its tracking error after underperformance. As a result, Chen and Pennacchi (ibid.) conclude that long tenured managers tend to increase the tracking error more as performance declines. Conflicting findings are made by Kempf et al. (2009). They document that managers with short tenures are more likely to increase risk after poor performance when compensational incentives dominate, i.e. in bull markets. In bear markets, when employment incentives are hypothesized to dominate, they find no difference between the behavior of short and long tenured managers.

### ***2.3.4 Retail bank status***

Retail bank status as a driver for mutual fund behavior is especially a feature of the Finnish mutual fund industry and is a subject to several domestic studies, although some international studies also exist (see e.g. Frye 2001). Kasanen, Lipponen and Puttonen (2001) study what determines mutual fund growth in the Finnish mutual fund industry. They document a clear distinction between the flow determinants of fund managed by independent management companies (non-banks hereinafter) and banks. Investors of mutual funds managed by non-banks allocate capital to funds based on prior performance, whereas investors of bank managed mutual

funds are documented to be relatively ignorant of prior performance. Kasanen et al. (ibid.) also document that the average investment in funds managed by banks is significantly smaller than the average investment into funds managed by non-banks. They offer an intuitive explanation for the investor ignorance of prior performance relating to bank managed funds. If investors of bank managed funds invest on average smaller amounts, they might also be less willing to use resources in allocating their assets between mutual funds. Hence, they would rather invest into mutual funds managed by the bank in which they are already customers, than enter into costly search of alternative funds.

Mutual fund expenses and the effects of distribution channels in the Finnish mutual fund industry are examined by Korpela and Puttonen (2005). They study the determinants of mutual fund expenses and especially aim to search for a reason for higher average management fees of bank managed mutual funds. Korpela and Puttonen (2005) conclude that existing customer relationship, bank's cross-selling and simply convenience contribute to the fund selection of mutual fund investors of bank managed funds. Hence, these investors put less emphasis on expense levels of the funds they invest into. Finally, in a similar manner to abovementioned papers, Knuutila (2005) reports significant difference in the flow-performance relationship between mutual funds managed by banks and non-banks. He studies the effect of Morningstar ratings, a risk and fee adjusted performance measure, on the mutual fund flows. Non-bank managed funds are reported to experience positive rating-flow relationship, but the same relationship is not found for bank managed funds.

An opposite finding is presented by Torkkeli (2002) in her Master's thesis. Studying the effects of distribution channels on the flow-performance relationship between bank and non-bank managed funds she is not able to make a distinction between these sub-groups. However, the findings of all other studies presented above cast a strong doubt on her findings.



## ***2.4 Summary and discussion on the theoretical background***

As can be seen in the three earlier sub-chapters, the theoretical background for studying the effects of prior performance on mutual fund risk taking is somewhat ambiguous. There exists a relatively clear consensus about the way in which investors channel new capital into mutual funds. As documented by several writers, investors mainly chase returns by investing into funds with relatively high past performance but the contrary effect is not visible for poor performing funds. However, the way in which this effect has been introduced into previous studies on performance-driven risk taking varies considerably. Some studies, e.g. Brown et al. (1996) take this relationship to be simply twofold in their empirical analysis, while Chevalier and Ellison (1997) dive much deeper into this flow-performance analysis in testing for managerial incentives it causes. To make this aspect more interesting in relation to this thesis, the return chasing behavior has been documented in Finland to cover mainly investors of mutual funds managed by non-banks. At the same time, investors of bank managed funds are found to be relatively ignorant of past performance.

The way in which investors channel their assets into funds causes incentives to mutual funds and gives reason to hypothesize that mutual fund risk taking is at least partially a function of relative past performance. However, the specific way in which this affects the behavior of mutual funds is unclear. In the literature on mutual fund tournaments, some authors have found evidence on negative relationship between prior performance and subsequent change in risk taking (Brown et al. 1996). At the same time, several authors have not been able to document same results (Busse (2001) and Goriaev et al. (2005) or have found an opposite, positive relationship (Chevalier and Ellison 1997 and Ammann and Verhofen 2007). Partially the academic discussion between these authors has considered methodological questions, such as frequency of the data used. On the other hand, there have been different views on how the mutual funds are supposed to change their behavior, i.e. which measure of risk should be used to test these effects. While the traditional volatility of total returns has been the most common, also tracking error, beta or different residual measures of risk have been used.

To make the issue more interesting, there is no reason to assume the risk taking behavior to be constant over all mutual funds or to hold similarly over time. As documented by several authors, there are other drivers or limitations that affect the way in which mutual funds alter their risk. These include employment concerns of portfolio managers and fund specific characteristics potentially limiting the options of the fund. The relative strength of these incentives can be intuitively understood to vary from time to time and between funds.

Therefore, the earlier academic discussion is concluded as follows. There are reasonable evidence and theory to suggest that mutual funds do alter their risk due to prior relative performance. To which direction this effect goes, which type of risk taking it is (i.e. which measure of risk can detect it), how it varies over time or how several fund specific characteristics affect it remains unclear. With mere intuition it is therefore easy to agree with the conclusion of Ammann and Verhofen (2007): “Mutual fund manager behavior is more complex than assumed by theoretical models, which usually capture only one aspect of the actual behavior”. To understand how mutual funds behave, interaction of all abovementioned aspects should be allowed as extensively as possible. With this in mind, we now turn into the empirical part of this thesis.

### 3 Hypotheses

This chapter presents the hypotheses of the study. The general objective of this thesis is to study if mutual fund managers change their behavior towards risk taking as a result of mid-year performance and whether this behavior has a time varying nature driven by the general market conditions. Furthermore, the effect of several fund specific characteristics, such as size and age, on the tendency to change risk is examined. Finally, this thesis will examine if the potential alteration of risk as a result of past performance is only bound to a mutual fund tournament of a calendar year or does a more general, continuous effect exist. As the previous academic evidence on performance-driven risk taking is somewhat ambiguous, the hypotheses are presented on a rather general level. Therefore, based on earlier academic discussion and documented findings, the hypotheses to be tested in the empirical part of this thesis are:

*H1: Mutual funds alter their risk taking as a result of interim performance*

This hypothesis stems from the earlier findings on flow-performance relationship documented e.g. by Sirri and Tufano (1998). As the performance affects the flows in and out of the mutual funds, this introduces mutual funds with incentives to alter their behavior to attract new flows of capital. However, the direction of this phenomenon will depend on the exact shape of the flow-performance relationship as well as on the weight of this compensational incentive relative to other incentives. Hence, we come to hypothesis number two:

*H2: The relationship between prior performance and subsequent change in risk will differ between bull and bear years*

This second hypothesis follows straight from the discussion on incentives of mutual fund managers presented by Kempf et al. (2009). In bull years, new money flows into mutual funds and good returns are generated making it possible to achieve higher compensation and at the same time, the risk of losing job is lower than in bear markets. The opposite goes in bear markets, as less money flows in funds, high compensations are less likely to be received with poor returns on portfolios and the risk for losing the job is higher. Hence the risk taking behavior is expected to differ based on these market conditions.

*H3 The relationship between prior performance and subsequent change in risk is not completely tied to calendar years*

As discussed in the literature review, the relationship between prior performance and subsequent change in risk taking has been documented to exist also between calendar years (see. e.g. Brown et al. 1996). To some extent, studying the effects inside a calendar year makes sense, as it is a natural cycle of time on which to assess performance and several sources list historical performance for calendar years (e.g. Morningstar). Similarly, annual performance figures can often be seen in the mutual fund advertisements. At the same time, there is no reason to believe this effect to be completely tied to calendar years. Especially in Finland, where information on relative performance of mutual funds is continuously offered by an independent sources (see monthly Mutual Fund Reports of Finnish Association of Mutual Funds) comparisons between mutual funds can take place on a continuous basis.

*H4: Different fund specific characteristics affect mutual funds' behavior in relation to performance-driven risk taking*

Fund specific characteristics have been documented to affect the behavior of mutual funds by causing differences in their ability to operate (e.g. liquidity constraints of large funds), differences in the set of incentives they face (e.g. bank managed vs. non-bank managed funds) or differences in the relative weight of the incentives they face (e.g. manager tenure). How these characteristics should affect the performance-driven risk taking is unclear, since the earlier academic studies have found mostly conflicting results. Therefore, more detailed hypothesis will not be provided.

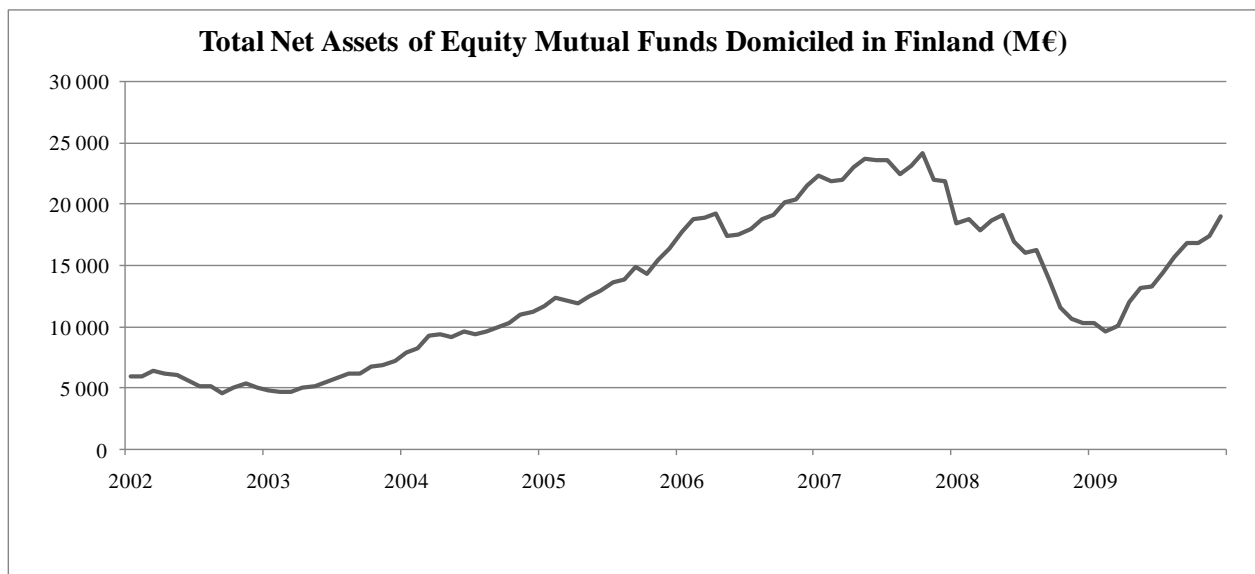
*H5: Different measures of risk imply different relationships between interim performance and risk taking*

Mutual funds are able to alter their portfolio risk by several ways, two of which are studied in this thesis. Relating to the previous hypothesis, different kinds of funds face different constraints and incentives. Therefore, different measures of risk should be able to capture different changes in managerial behavior.

## 4 Data

### 4.1 Short description of the Finnish mutual fund industry

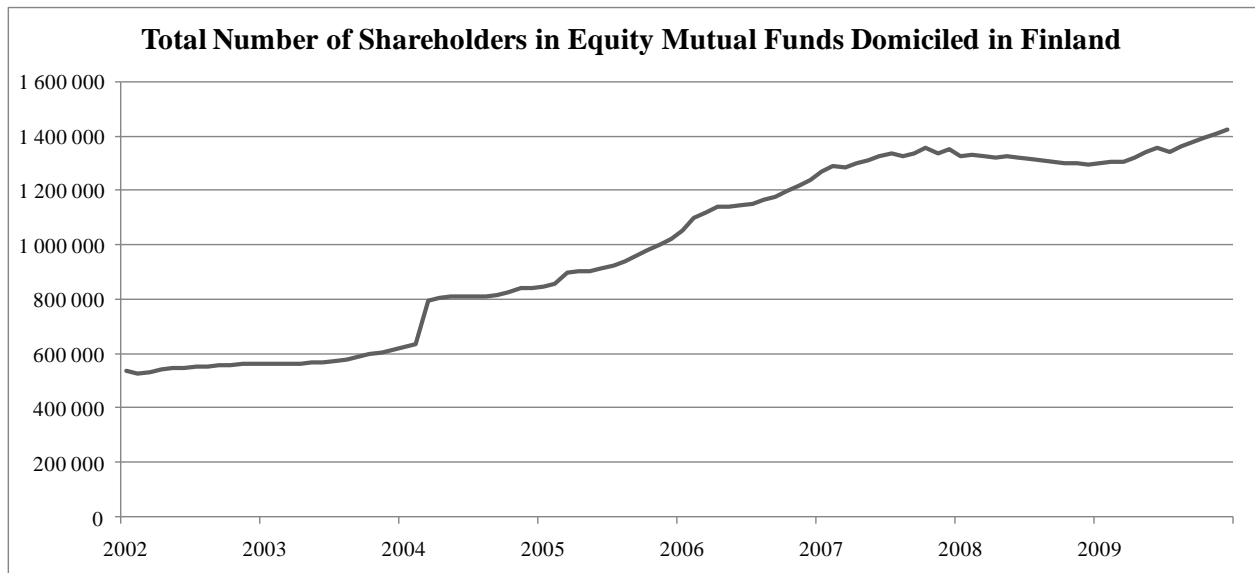
The early phases of the Finnish mutual fund industry are documented e.g. by Kasanen, Lipponen and Puttonen (2001) and are presented here as a brief introduction into the data used in this thesis. The law for mutual funds was passed in Finland on September 1987 and the first mutual fund was introduced in October, same year. This event coincided with the more general deregulation process of the Finnish financial markets in 1980's. The birth of Finnish mutual fund industry took place rather late relative to many other countries (e.g. US 1924, Germany 1949 and Sweden 1970). The first mutual funds were introduced by the retail banks, which had a dense network of offices to market this new investment vehicle.



**Figure 2: Total Net Assets of Equity Mutual Funds Domiciled in Finland between 2002 and 2009 in million of euros. Source: Calculations by the author, data gathered from monthly mutual fund reports of Finnish Association of Mutual Funds**

Since these early days, the Finnish mutual fund industry has grown drastically. For example in 1992, total net assets of mutual funds domiciled in Finland were around 100 million euros. In 2007, just before the global financial crisis, these total net assets had grown to around 66 billion euros, hence growing over 600-fold in 15 years (Source: Monthly Mutual Fund Reports). The

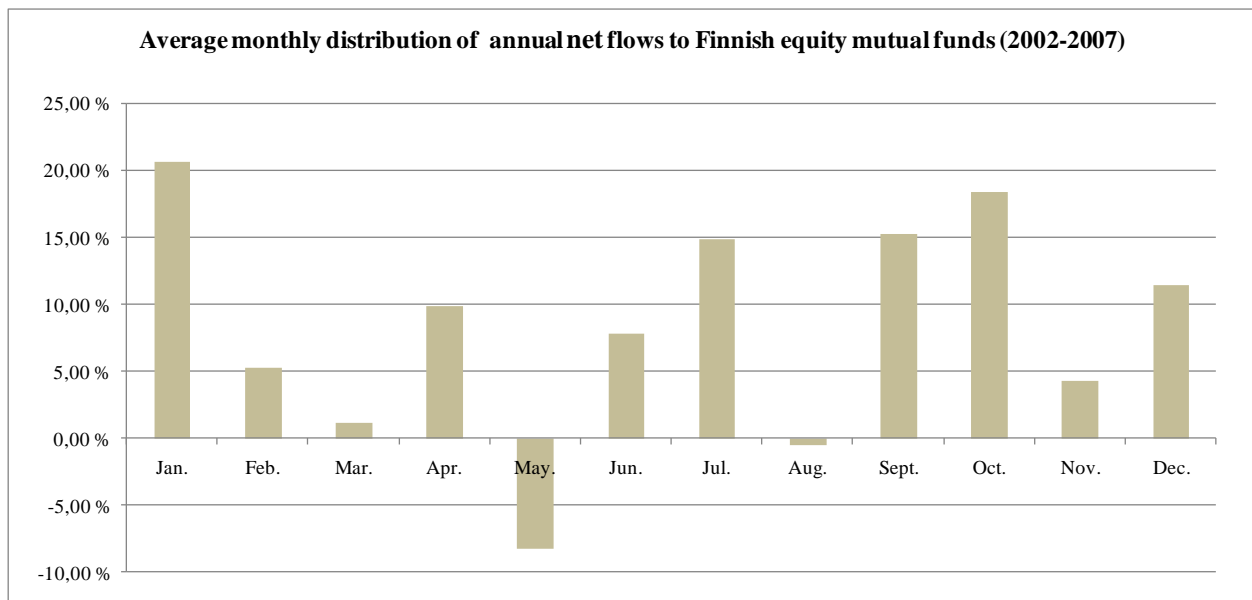
growth of assets managed in mutual funds has been similarly fast with equity mutual funds, a subject of this thesis. This growth in total assets under management for the study period of 2002-2009 is presented in Figure 2. This figure shows both the fast growth in assets under management until late 2007, as well as the subsequent crash due to global financial crisis. At the same time, the number of investors holding shares in Finnish domiciled equity mutual funds has grown steadily despite of the problems in financial markets. This growth pattern is presented in Figure 3. Both of these patterns show that equity mutual funds have become more and more important as vehicles of asset management for Finnish investors.



**Figure 3: Total Number of Shareholders in Equity Mutual Funds Domiciled in Finland between 2002 and 2009.**  
**Source: Calculations of the author, data gathered from monthly mutual fund reports of Finnish Association of Mutual Funds**

As discussed in the literature review, majority of the studies on mutual funds' performance-driven risk taking study these effects inside calendar years. This is based on the assumption that mutual funds are often ranked and observed based on their calendar year performance. Therefore it is interesting to ask, whether the flows of new capital into the funds has some sort of non-even distribution during the calendar year.

Information on monthly net flows of capital in and out of the mutual funds is provided in the monthly Mutual Fund Reports by the Finnish Association of Mutual Funds. This information shows that between 2002 and 2007, January was on average the month receiving most net flows into the funds studied in this thesis. The monthly distribution of net flows for the period of 2002 and 2007 is presented in Figure 4. In 2008 and 2009, the monthly distribution of the net flows was severely affected by the global financial crisis. Therefore, if these two years are included in the analysis on the monthly distribution of fund flows, the leading position of January disappears. However, as January seems to have the strongest net flows of capital during the first six years of the study, it is reasonable to assume that this would increase the importance of mutual funds' calendar year performance. At the same time, as can be seen in the Figure 4, the weight of January in the monthly distribution of fund flows is not dominant. The flows in July, September and October are also relatively strong. In sum, the monthly distribution of fund flows gives some support for studying the performance-driven risk taking within calendar years. At the same time, there is no reason to exclude other time periods from the analyses, as there clearly are strong net flows in other months as well.



**Figure 4: Average monthly distribution of annual net flows to Finnish equity mutual funds between 2002 and 2009. Source: Calculations of the author, data gathered from monthly mutual fund reports of Finnish Association of Mutual Funds**

## ***4.2 The aggregate data set***

The two data sets used in this study are from Investment Research Finland. The first set contains the daily Net Asset Values (NAV's) of euro-denominated equity mutual funds in the Finnish mutual fund industry between 2002 and 2009. The net asset value is calculated by dividing the total net assets of a fund with the number of fund shares outstanding, thus giving a price per share of the mutual fund. The total net assets of a mutual fund is calculated as the market value of fund's total assets minus total liabilities. Using daily data, instead of e.g. weekly or monthly, give considerably more detailed information on the behavior of the mutual funds as it includes considerably more observations per year.

The NAV-data are merged with the data from monthly Mutual Fund Reports of the Finnish Association of Mutual Funds, also provided by Investment Research Finland. This merging of the data is done by using a combination of individual ISIN-codes of the mutual funds, as well as individual fund identifiers used by Investment Research Finland. The two data sets are merged by linking the ISIN-codes of the NAV-data with fund identifiers of the monthly Mutual Fund Reports. The combination of ISIN-codes and fund identifiers is provided by Investment Research Finland.

The mutual funds in the data set invest into equity markets in Finland, Nordic countries, Europe, North America, Japan, Asia, emerging markets or globally. This information is available in the data set. Based on this information, funds are divided into peer groups that invest into same geographical market area. To focus solely on the effects in Finnish equity mutual funds, a fund is included into the sample only if the company managing the fund is a member of Federation of Finnish Financial Services. Also this information is provided by the Investment Research Finland. As the focus of the study is on changes in mutual fund's risk behavior as a result of prior performance, only actively managed mutual funds are included. Mutual funds with passive strategies, i.e. index or enhanced index funds, should follow their passive strategy regardless of the past performance. Hence, both their risk and return should follow closely those of the benchmark index. As the funds with passive strategies should not, by definition, change their behavior as a result of prior performance, they are excluded from the sample.



The second data set from monthly Mutual Fund Reports also includes information on several mutual fund specific characteristics. The size of a mutual fund is defined as total net assets (TNA), calculated as the market value of total assets minus total liabilities of the mutual fund. The data set also includes the date in which the fund began its operations. From this information, the age of the fund at a beginning of each year is calculated. Furthermore, the data set offers information on the portfolio managers, including the date in which the manager has started as a portfolio manager of a certain fund. From this information, portfolio manager's tenure in a given fund, as well as change of portfolio managers can be tracked. Finally, the separation between bank managed funds and non-bank managed funds is made based on the mutual fund company managing the fund. This information is also included in the data set. A mutual fund is included in the bank sub-group if the mutual fund company has retail banking operations in Finland. Otherwise, the fund is a non-bank managed. Unfortunately the data on fund characteristics are not totally comprehensive. The proportion of observations, i.e. fund-years, with these characteristics available varies between 90% and 100% of total observations.

The data set is mainly free of survivorship bias, as it includes all mutual funds that existed during the period, i.e. also the funds that ended their operations. Due to the requirements of the research question, only funds existing in a given year from January to December are included in the analyses. This restriction could potentially cause some survivorship bias, as funds that existed less than a full calendar year are excluded. However, this effect is marginal at best. Finally, 8 outlier observations were excluded from the sample. As a result, the total sample size is 1893 observations.

Table 1 gives an overview of the development of Finnish mutual fund industry throughout the sample period. The number of mutual funds more than doubled from the 123 funds in 2002, to 311 funds in 2008. At the same time, the average size of the mutual funds, defined as total net assets, increased significantly. As a result of both trends, the amount of assets managed through these mutual funds multiplied several fold. Both the number of mutual funds and the average size of funds decreased considerably in 2008 as a result of the global economic downturn. This is seen in the figures from the beginning of 2009. The average age of funds has mainly grown through

the sample period similarly to the average tenure of the portfolio managers. The proportion of bank managed funds in the sample has increased especially in the later years. As shown by the number of observations representing bull and bear years, in six out of the eight years all observations represent the same market conditions. In two years, both bull and bear years are represented due to differing benchmark returns of the peer groups.

**Table 1: Annual Characteristics of the Aggregate sample (2002-2009)**

Table 1 presents a summary of the aggregate sample on annual basis. The table presents the number of observations, i.e. funds that existed in a given year from January to December. In addition, number of observations representing bull and bear years is presented. N (Bull) is the number of observations with positive benchmark index return in the first half of a given year. N (Bear) is the number of observations with negative benchmark index return in the first half of a given year. The mean TNA is the mean total net assets of the funds in the beginning of the year, presented in millions of euros. Total net assets is calculated as a market value of the total assets minus total liabilities. Average Age of the Funds presents the mean age of the funds in years in the beginning of each year. Similarly, Average Tenure of Portfolio manager presents the mean tenure of portfolio managers in the beginning of each year. Finally, proportion of Bank Managed Funds gives the annual proportion of funds managed by a company with retail bank operations. This statistic is calculated from the total number of funds in a given year.

Year	N (Total)	N (Bull)	N (Bear)	Mean TNA (M€)	Mean Age of Funds (Years)	Mean Tenure of Portfolio Mgr (Years)	Proportion of Bank- managed mutual funds
2002	123	0	123	59.7	4.78	2.42	44.6 %
2003	183	138	45	41.0	5.72	2.63	47.5 %
2004	200	200	0	62.1	6.42	2.99	43.9 %
2005	225	225	0	76.4	6.58	2.84	43.8 %
2006	268	104	164	115.3	6.34	2.79	48.1 %
2007	306	306	0	124.9	6.63	2.91	46.4 %
2008	311	0	311	101.2	7.29	4.40	52.4 %
2009	277	277	0	52.5	7.54	3.20	51.6 %
<b>Total Period</b>	<b>1893</b>	<b>1250</b>	<b>643</b>	<b>84.3</b>	<b>6.59</b>	<b>3.15</b>	<b>47.8 %</b>

Table 2 describes the return and risk statistics for the aggregate sample between 2002 and 2009. As shown by the mean raw returns, the market conditions have varied drastically during the period. Especially the effects of the global financial crisis and the subsequent recovery between 2007 and 2009 are clearly visible in all statistics. As was described before, the sample used in this thesis represents both bull and bear markets, thus being optimal for studying the differences in performance-driven risk taking in different market conditions. Finally, as can be seen in the

risk measures, total return volatilities and tracking errors have evolved differently over time. This gives further justification to examine both effects in relation to the performance-driven risk taking.

**Table 2: Annual Return and Risk Statistics of the Aggregate Sample (2002-2009)**

Table 2 presents a summary of the return and risk characteristics of the aggregate sample. Mean raw return H1 gives the mean logarithmic raw return of all funds in the sample in the first half of a given year. Similarly, Mean raw return H2 gives the mean logarithmic raw return of all funds in the sample in the second half of a given year. Mean annualized volatilities for H1 and H2 show the mean standard deviations of total logarithmic returns of all funds included in the sample for the first and the second half of a given year, respectively. Finally, mean annualized tracking error for H1 and H2 show the mean tracking error of all funds included in the sample for the first and the second half of a given year, respectively. The bottom row shows the same characteristics for the total period.

<b>Year</b>	<b>Mean raw return H1 (%)</b>	<b>Mean raw return H2 (%)</b>	<b>Mean Annualized Volatility, H1 (%)</b>	<b>Mean Annualized Volatility, H2 (%)</b>	<b>Mean Annualized Tracking Error, H1 (%)</b>	<b>Mean Annualized Tracking Error, H2 (%)</b>
2002	-19.17 %	-16.96 %	22.97 %	29.69 %	22.21 %	26.64 %
2003	3.64 %	15.18 %	22.90 %	16.96 %	23.84 %	17.07 %
2004	6.01 %	3.02 %	15.49 %	12.75 %	15.94 %	12.11 %
2005	11.78 %	14.48 %	11.60 %	12.56 %	11.56 %	12.12 %
2006	1.34 %	13.61 %	17.55 %	12.25 %	20.51 %	15.01 %
2007	9.37 %	-6.59 %	15.11 %	19.45 %	12.36 %	16.35 %
2008	-19.19 %	-48.46 %	23.01 %	42.42 %	19.54 %	36.63 %
2009	15.38 %	21.55 %	30.28 %	18.76 %	26.92 %	15.29 %
<b>Total period</b>	<b>1.94 %</b>	<b>-1.54 %</b>	<b>19.86 %</b>	<b>21.00 %</b>	<b>18.86 %</b>	<b>19.13 %</b>

Table 3 describes the characteristics between bank and non-bank managed mutual fund observations. This statistics is presented since the division of mutual funds into these two sub-groups is based on characteristics of the managing company, not the individual funds. Therefore, it is reasonable to analyze if these two sub-groups differ in some aspects. This is essential later in analyzing the behavioral differences between the two sub-groups.

The first notion from the table is that the sample is divided rather evenly between the two sub-groups. There are 893 bank managed fund observations and 995 non-bank managed fund observations. Bank managed funds are slightly larger than non-bank funds, but at the same time they are also younger. The average tenure of the portfolio manager is longer in non-bank fund observations. Considering the risk and return statistics, non-bank funds have somewhat higher

average raw return in the first half of the years. The average raw returns in the second half of the years are rather similar. Finally, bank managed funds have on average higher levels of risk, measured both with total return volatility and tracking error. This holds for both first and second period's average risk levels.

**Table 3: Descriptive Statistics between Bank and Non-bank managed Mutual Funds**

Table 3 presents descriptive statistics between bank and non-bank managed mutual fund observations. The table presents the total number of observations for both sub-groups. The average TNA is the mean total net assets of the fund observations in the beginning of the year, presented in millions of euros. Average Age of the Funds presents the mean age of the fund observations. Similarly, Average Tenure of Portfolio manager presents the mean tenure of portfolio manager of the fund observations. Mean raw return H1 gives the mean first half-year logarithmic raw return. Similarly, Mean raw return H2 gives the mean second-half logarithmic raw return. Mean annualized volatilities for H1 and H2 show the mean standard deviation of total logarithmic returns of the observations for first and second half of a given year, respectively. Finally, mean annualized tracking error for H1 and H2 show the mean tracking error of the observations for first and second half of a given year, respectively.

Descriptive Variable	Bank Managed Mutual Funds	Non-bank Managed Mutual Funds
No. of Observations	893	995
Mean TNA (M€)	81.38	78.14
Mean Age of Funds (Years)	5.99	7.14
Mean Tenure of Portfolio Manager (Years)	2.72	3.57
Mean raw return H1 (%)	1.59 %	2.29 %
Mean raw return H2 (%)	-1.50 %	-1.55 %
Mean Annualized Volatility, H1 (%)	20.09 %	19.67 %
Mean Annualized Volatility, H2 (%)	21.29 %	20.73 %
Mean Annualized Tracking Error, H1 (%)	19.30 %	18.48 %
Mean Annualized Tracking Error, H2 (%)	19.79 %	18.55 %

### 4.3 Market Benchmark Indices

The different characteristics of the regional equity markets affect the performance and risk levels of the mutual funds and therefore all performance and risk measures are calculated in comparison to a market benchmark index. The data on benchmark index returns, as well as the euro-dollar exchange rates are from Bloomberg Professional. The data contain daily US-dollar denominated values of the MSCI-indices. The daily values of the OMX Helsinki Cap Gi –index are originally euro-denominated. By using the euro-dollar exchange rates, the MSCI benchmark indices are

converted to euro-denominated values. From these euro-nominated values, daily logarithmic returns are calculated for each index. This daily benchmark return data are further used in the empirical part to isolate the changes in performance and risk levels resulting from managerial actions.

**Table 4: Market Benchmark Indices**

Table 4 presents the market benchmark indices used for each peer groups divided by geographical market area of investments. The definitions for peer groups and the market areas are based on the classifications in the monthly Mutual Fund Reports by the Association of Finnish Mutual Funds. Similarly, the benchmark indices used are the same indices that are used in the report.

<b>Geographical Market Area of the Peer Group</b>	<b>Market Benchmark Index</b>
Finland	OMX Helsinki Cap Gi
Nordic Counties	MSCI Nordic TR
Europe	MSCI Europe TR
Asia excluding Japan and Emerging Markets	MSCI Far East TR
Japan	MSCI Japan TR
North America	MSCI North America TR
Emerging Markets	MSCI Emerging Markets TR
Global	MSCI World TR

The benchmark indices for different peer-groups are presented in Table 4. The classification follows the market area in which the mutual fund invests and is derived from the classification in the monthly Mutual Fund Reports. The benchmark indices are the same than the ones used in the monthly Mutual Fund Reports.

## 5 Description of the methodology

This chapter presents the methodology of the analyses performed in this thesis.

From the NAV-data, daily logarithmic returns for each fund are calculated. The logarithmic return for a given mutual fund in day  $t$  is defined as the natural logarithm of fund's NAV on day  $t$  minus natural logarithm of fund's NAV on day  $t-1$ .

As described in the literature review, majority of the earlier studies on the performance-driven risk taking make no distinction between bull and bear years. To see how the performance-driven risk taking would be indicated by the empirical analyses without this distinction, the following simplified regression equation is first tested:

$$\text{Risk}_{py2} - \text{Risk}_{py1} = \alpha + \gamma_1 * \text{Perf}_{py1} + \gamma_2 * \text{Risk}_{py1} + \varepsilon_{py} \quad (1)$$

$\text{Risk}_{py1}$  ( $\text{Risk}_{py2}$ ) is the annualized risk of fund  $p$  from January to June (July to December) in year  $y$ ,  $\text{Perf}_{py1}$  is fund  $p$ 's January-June logarithmic return on year  $y$  in excess of the logarithmic return of the benchmark index during the same period.  $\varepsilon_{py}$  is the error term of the regression analysis.

In the primary regression equation used in this study the distinction between the effects of bull and bear years are added to the analysis. To do this, a cross-sectional regression model modified from Busse (2001) and Kempf et al. (2009) is applied. The regression equation in general form is:

$$\text{Risk}_{py2} - \text{Risk}_{py1} = \alpha + \gamma_1 * \text{Perf}_{py1} * D_1 + \gamma_2 * \text{Perf}_{py1} * D_2 + \gamma_3 * \text{Risk}_{py1} + \varepsilon_{py} \quad (2)$$

Once again,  $\text{Risk}_{py1}$  ( $\text{Risk}_{py2}$ ) is the annualized risk for fund  $p$  from January to June (July to December) in year  $y$ ,  $\text{Perf}_{py1}$  is fund  $p$ 's January-June logarithmic return on year  $y$  in excess of the logarithmic return of the benchmark index at the same period.  $\varepsilon_{py}$  is the error term of the regression analysis.  $D_1$  and  $D_2$  are dummy variables defines so that  $D_1$  gets the value 1 in bull markets and value 0 in bear markets. Contrary,  $D_2$  gets the value 0 in bull markets and value 1 in

bear markets. With these dummy variables, different coefficients for past performance in bull and bear markets can be captured, thus enabling the analyses of the differences in managerial behavior. A single observation is defined to represent a bull market if the logarithmic return of the peer group's benchmark index is positive between January and June and bear if the January-June logarithmic return of the peer group's benchmark index is negative.

As described in the introduction, two different measures of risk are used. First one is the volatility of the total fund return in excess of benchmark volatility. The volatility of total mutual fund returns is the standard deviation of the total returns and is calculated from daily logarithmic returns as:

$$\text{Volatility} = \sigma_p = \sqrt{\frac{\sum_{i=1}^n (r_i - \bar{r})^2}{(n-1)}} \quad (3)$$

where  $r_i$  is fund  $p$ 's logarithmic return on day  $i$ ,  $\bar{r}$  is the average daily logarithmic return of the fund during the period and  $n$  is the number of days in the period. The volatility of total returns is the most often used measure of portfolio risk and equals the measure used e.g. in Brown et al. (1996) and Koivulintu (2002). To be able to take into account the varying volatilities of different equity markets and concentrate on the risk changes caused by managerial decisions, excess volatility of total returns is used, defined as:

$$\text{Excess Volatility} = e\sigma_p = \sigma_p - \sigma_{bm} \quad (4)$$

in which  $\sigma_p$  is fund  $p$ 's volatility in a given period and  $\sigma_{bm}$  is the volatility of the fund's benchmark index during the same period. This definition of the excess volatility removes the effect of time-varying volatilities in different equity markets. As a result, only the part of volatility change that results from the portfolio managers' decisions is left to be analyzed.

Another risk measure to be employed is the tracking error calculated as the standard deviation of fund's daily returns in excess of the returns of the benchmark index. The tracking error is also calculated from daily logarithmic returns and is defined as:

$$\text{Tracking Error} = \text{TE} = \sqrt{\frac{\sum_{i=1}^n (er_i - \overline{er})^2}{(n-1)}} \quad (5)$$

where  $er_i$  is the logarithmic return of a given fund on day  $i$  in excess of the logarithmic return of the benchmark index on day  $i$ ,  $\overline{er}$  is the mean of  $er_i$  in the calculation period and  $n$  is the number of days in the period. It is also worth mentioning that several definitions of the tracking error exist. This definition equals the one used by Chen and Pennacchi (2009) and is sometimes also referred to as the standard deviation of tracking errors.

Both risk measures presented above are annualized by multiplying the calculated risk measures by the square root of 252, the average number of trading days in a year. These annualized risk measures are then used in the empirical analyzes.

To further analyze the competitive dynamics of the Finnish mutual fund industry, the relationship between changes in risk taking and past performance is studied between several sub-groups.

### **Mutual fund size**

For each peer group, each year, mutual funds are defined as large, if the size (TNA) of the mutual fund is above the median size mutual funds in the same peer group and same year. Otherwise the mutual fund is defined as small. Defining this variable annually and relative to the peer group ensures that funds are not allocated to the sub-groups based on either the year of observation in question or on certain peer group specific reasons. As the average size of the funds varies over time and between the peer groups, this is essential. Observations lacking the information on mutual fund size are excluded from this sub-group analysis.



### **Mutual fund age**

For each peer group, each year, mutual funds are defined as old, if the age of the mutual fund, calculated from the starting date of operations is above the median age of mutual funds in the same peer group and same year. Otherwise the mutual fund is defined as young. Defining this variable annually and relative to the peer group ensures that funds are not allocated to the sub-groups based on either the year of observation in question or on certain peer group specific reasons. As the average age of the funds varies over time and between peer groups, this is essential. Observations lacking the information on mutual fund's starting date are excluded from this sub-group analysis.

### **Portfolio manager's tenure**

For each peer group, each year, portfolio manager's tenure is defined as long, if the tenure, calculated from the starting date of the portfolio manager in a fund, is above the median of portfolio managers' tenures in the same peer group same year. Otherwise the portfolio manager's tenure is defined as short. Defining this variable annually and relative to the peer group ensures that funds are not allocated to the sub-groups based on either the year of observation in question or on certain peer group specific reasons. As the average tenure of portfolio managers varies over time and between peer groups, this is essential. Observations lacking the information on portfolio manager's tenure are excluded from this sub-group analysis.

### **Retail bank status**

A mutual fund is defines as a bank managed, if the corresponding mutual fund company has retail bank operations in Finland. Otherwise the mutual fund is defined as a non-bank managed.

By using a Chow-test, the statistical significance of the difference between these sub-groups is estimated (Chow 1960). If the Chow test-statistics indicates that the two sub-groups differ from each other in a statistically significant way (i.e. the Chow-test probability value is less than 0.1), then separate linear regressions are run for both sub-groups. After that, results of these regressions can be compared to draw conclusions on the effect the fund specific characteristics on its behavior.

## 6 Analyses and results

In this chapter, the empirical analyses and results are presented and discussed. The first part of the chapter presents the analyses and results from the aggregate sample. The second chapter presents the analyses and results from the sub-group analyses. Part three will present further analysis after the assumption on the calendar year effects is loosened. In this part, the effect of performance in the second half of a given year on changes in mutual funds' risk taking in the first half of the following year is studied. Finally, in part four, all results are analyzed and reflected to the theory and findings of the earlier academic studies.

### *6.1 Analyses of tournament behavior with the aggregate sample*

To begin with, the performance-driven risk taking is studied by using the aggregate sample and the regression equations 1 and 2 presented in Chapter 5. As described earlier, two different measures of risk taking are used; excess volatility and tracking error. Similarly with Koivulintu (2002), strong heteroscedasticity exists in the analysis when a simple OLS-regression is employed. This problem is evident for both excess volatility and tracking error as risk measures. With the heteroscedasticity, the variances of the error terms of the regressions are not constant throughout the observations, thus breaking the homoscedasticity assumption of the OLS regression. Residual plots from the OLS-regressions with error terms presented can be found in Appendix I. The appendix presents the residual plots from regressions with the regression equation 2.

The heteroscedasticity will cause the t-values, and thus the statistical significance of the results to be exaggerated and the results to be inefficient, although still unbiased. This problem is tackled by using a robust regression method, which uses heteroscedasticity-consistent standard errors and therefore provides the t-values of the regression coefficients more accurately. Therefore, the implications of these robust results are more reliable (Long and Ervin 2000).

As described in the literature review, majority of the earlier studies on the tournament behavior make no distinction between bull and bear years. This is also the case in Koivulintu (2002), which is the only other study focusing on the same effects in Finland. To mitigate the earlier

studies, the regression is first run without the distinction between bull and bear years. This regression equation 1 is in nature similar to the one used by Koivulintu (2002) and Busse (2001). The results of this simplified regression with the aggregate data are presented in Table 5.

**Table 5: Robust regression results from the aggregate sample with no separation between bull and bear years**

Table 5 presents the regression results from robust linear regressions using the simplified regression equation 1 on the aggregate sample. Results from the regression with the change in excess volatility as a dependent variable are presented on the left, while the results from the regressions with the change in tracking error as a dependent variable are presented on the right. Estimates and standard errors are the corresponding values indicated by the regression analyses for a given explanatory variable. p-Value indicates the significance level of the estimate. Number of observations used and the total explanatory power of the regression equation as R-squared for both regressions are presented in the lower part of the table.

Independent variable	Excess Volatility as a measure of Risk			Tracking Error as a measure of Risk		
	Estimate	Standard Error	p-Value	Estimate	Standard Error	p-Value
Intercept	-0.00171	0.00108	0.1128	0.075643	0.00539	<0.0001
Perf	0.028612	0.0204	0.1601	-0.002	0.0335	0.9524
Risk <sub>py1</sub>	-0.35302	0.0467	<0.0001	-0.38688	0.0328	<0.0001
Number of Observations	1893			1893		
R-squared	0.2098			0.1134		

As shown in Table 5, the results of the simplified regression imply no relationship between performance in the first half of the year and subsequent change in risk taking in the latter part of the year. This finding is similar for both measures of risk.

Next, the regression equation 2 is run on the aggregate sample. This equation includes the distinction between bull and bear years. This way, the hypothesized differences in managerial incentives and thus behavior can be extracted between the two market conditions. The results of the regression equation 2 from the aggregate sample are presented in Table 6.

**Table 6: Robust regression results for the aggregate sample**

Table 6 presents the regression results from robust linear regressions run using regression equation 2 on the aggregate sample. Results from the regression with the change in excess volatility as a dependent variable are presented on the left side, while results from the regression with the change in tracking error as a dependent variable are presented on the right. Estimates and standard errors are the corresponding values indicated by the analysis for a given explanatory variable. p-Value indicates the significance level of the estimate. Number of observations used and the total explanatory power of the regression equation as R-squared for both regressions are presented in the lower part of the table.

Independent variable	Excess Volatility as a measure of Risk			Tracking Error as a measure of Risk		
	Estimate	Standard Error	p-Value	Estimate	Standard Error	p-Value
Intercept	-0.00172	0.00108	0.1113	0.076714	0.00546	<0.0001
Perf*D(bull)	0.0680	0.0271	0.0122	0.068366	0.0272	0.0122
Perf*D(bear)	-0.01051	0.0313	0.7371	-0.06575	0.0563	0.2428
Risk <sub>py1</sub>	-0.36419	0.0481	<0.0001	-0.3933	0.0333	<0.0001
Number of Observations	1893			1893		
R-squared	0.2133			0.1162		

As shown in Table 6, for both measures of risk, the coefficients of bull year performance are positive with 98% confidence level and almost identical in value (0.068 and 0.068366 for excess volatility and tracking error respectively). Similarly, the standard errors of the coefficients are almost equal. These results indicate that good performance in the first half of the year is positively related to increases in the risk in the latter part of the year in bull markets. In addition, the relationship is almost identical for both excess volatility and tracking error as measures of risk.

At the same time for both measures of risk, the coefficients for bear market performance are not statistically significantly different from zero. These results indicate no relationship between performance in the first half of the year and subsequent change in the risk in the latter half of the year in bear markets. The lagging risk variable of the regression equation receives a highly significant and in both cases negative coefficients and thus captures the mean reversion pattern of mutual fund risk. This indicates that with both excess volatility and tracking error, risk taking in the first period is negatively related to the increase in risk taking in the second period. This

reversal effect is the part of the change in risk that is explained solely by the risk level in the first period, irrespective of the relative performance. The negative relationship between the prior risk level and the subsequent change in risk is similar to the findings of Koski and Pontiff (1999) and Kempf et al. (2009).

Finally, the total explanatory power of the regression model, given by R-squared, is relatively low. This indicates that only a part of the risk changing behavior is explained by prior performance or prior level of risk. The low explanatory power of the model is well expected, as the model only analyses the effects of performance and prior level of risk. The model does not try to provide a comprehensive explanation for the changes in mutual fund risk taking. Therefore, despite of the low total explanatory power, the coefficients received to the explanatory variables are nonetheless interesting and useful.

These results clearly indicate that the behavior of mutual funds varies over time and that one driver for this behavior is the current market conditions. Thus, the testing of these behavioral changes must be made with the distinction between bear and bull years.

These results are the perfect opposite of those expected based on the tournament hypothesis. Instead of a negative relationship in bull years, as was documented by Kempf et al. (2009), these analyses give positive ones. During bear years, a positive relationship is expected in the light of the tournament hypothesis, but here no relationship is found. In short, these results cast a heavy doubt on the tournament behavior of the Finnish equity mutual funds. A further discussion of the results is presented in the last part of this chapter.

## ***6.2 Analyses of fund characteristics in explaining mutual fund behavior***

To dive deeper into understanding the behavior of mutual funds in relation to performance-driven risk taking, we now turn into analyzing several mutual fund specific characteristics. The variables used in this analysis are size as total net assets of the mutual fund (TNA), age as years since the beginning of operations, portfolio manager's tenure as years since started managing the mutual fund and finally the retail-bank status of the company managing the mutual fund.

From the mutual fund specific characteristics used, size and retail-bank status are clearly indicated to affect the mutual behavior. The effect of portfolio manager's change is somewhat ambiguous, while the portfolio manager's tenure and age of the fund shows indicate no difference. Each sub-group analysis is presented next.

### ***6.2.1 Mutual fund size***

Mutual funds above and below or at the median size of their peer groups in a given year are indicated to behave differently in relation to the performance-driven risk taking when excess volatility is used as a measure of risk. This is clearly indicated by the probability value of the Chow-test, which is below 0.0001. At the same time, a difference is not found when using tracking error as a risk measure, i.e. the Chow-test probability value with tracking error is 0.4136. Hence, the performance-driven risk taking behavior between large and small funds differs only in relation to changes in the excess volatility.

Results from employing the regression equation 2 separately for small and large funds, with the excess volatility as a measure of risk, are presented in Table 7. The table shows all coefficient values separately for both sub-groups. As shown by the high p-values in the small funds, neither bull nor bear year performance have statistically significant relationship to changes in risk taking measured as excess volatility. Only the lagging risk variable from the first half of the year is negatively related to changes in risk taking. Similarly, the explanatory power of the regression for small funds, shown by R-squared, is considerably lower than for the aggregate sample (0.093 versus 0.2098).

**Table 7: Robust regression results for small and large funds, excess volatility as a measure of risk**

Table 7 presents the regression results from robust linear regressions run using the regression equation 2 on sub-samples divided by fund size (TNA). The dependent variable is the change in excess volatility. Results from the regression for funds below or equal to the median size in their peer group in a given year are given on the left, while the results for funds above median size in their peer group in a given year are presented on the right. Estimates and standard errors are the corresponding values indicated by the analysis for a given explanatory variable. p-Value indicates the significance level of the estimate. Number of observations used and the total explanatory power of the regression equation as R-squared for both regressions are presented in the lower part of the table.

Independent variable	Small Funds			Large Funds		
	Estimate	Standard Error	p-Value	Estimate	Standard Error	p-Value
Intercept	-0.00128	0.00164	0.4357	-0.00184	0.00147	0.2128
Perf*D(bull)	-0.01952	0.0335	0.5604	0.172967	0.0357	<0.0001
Perf*D(bear)	-0.02715	0.039	0.4868	0.013947	0.0483	0.7728
Risky <sub>py1</sub>	-0.27823	0.0425	<0.0001	-0.38937	0.0674	<0.0001
Number of Observations	900			957		
R-squared	0.093			0.3233		

On the other hand, results from the regression on large funds are more interesting. For large funds, the positive relationship between the performance and the change in risk taking in bull years is stronger compared to the aggregate sample. This is indicated by the considerably higher statistical significance of the bull year performance and also the coefficient (0.173 vs. 0.068 with the aggregate sample). The two other explanatory variables behave similarly compared to the aggregate sample. Bear year performance has no statistically significant relationship and the lagging risk variable receives a strong negative coefficient. Finally, the explanatory power of the model, R-squared, is considerably higher for the large funds than for the aggregate sample (0.3233 vs. 0.02098).

In sum, the size of the fund seems to have an effect on its performance-driven risk behavior. Both small and large funds indicate a positive relationship between the bull year performance in first half of the year and the change in tracking error in the latter half of the year. However, the large funds are suggested to have a strong positive relationship in bull years when excess volatility is used as a risk measure. At the same time, the small funds indicate no relationship at all. In short,

smaller funds seem to be able to deviate from market portfolio without changing their total return volatility in respect to the benchmark volatility. Similar deviation from the market portfolio by the large funds results also in an increase in excess volatility.

### ***6.2.2 Mutual fund age***

As described above, age of the mutual fund is not indicated to have any effect on the performance-driven risk behavior. The Chow-test p-values for the difference between the sub-samples are 0.5212 and 0.9694 for excess volatility and tracking error as risk measures, respectively. These sub-groups therefore are indicated to behave similarly compared to the aggregate sample.

### ***6.2.3 Portfolio manager's tenure and change***

The effect of portfolio manager's tenure on the performance-driven risk taking is first analyzed by testing for the difference in behavior between portfolio managers above and below (or at) median tenure. However, this distinction does not indicate statistically significant difference between the sub-groups. The Chow-test p-values for both excess volatility and tracking error are statistically insignificant; 0.3341 and 0.2578 respectively. Thus, no separate analysis can be performed based on this distinction.

To test a more aggravate effect of portfolio manager's tenure on the performance-driven risk taking, the effect of a recent change in portfolio manager is tested. By identifying those mutual funds, in which the portfolio manager has changed less than 6 months before the beginning of each year, funds are separated into two sub-groups; manager changed and manager not changed. This new distinction clearly indicates differences between the two sub-groups. The Chow-test p-values for the difference between the two groups are less than 0.0001 and 0.022 for excess volatility and tracking error respectively. As their behavior is different at such a high confidence levels, the regression equation 2 is employed for both sub-groups. Both excess volatility and tracking error are used as risk measures. The regression results are presented in Table 8.



**Table 8: Robust regression results of mutual funds with portfolio manager changed vs. not changed**

Table 8 presents the regression results from robust linear regressions run using the regression equation 2 on the sub-samples divided based on the change in portfolio manager. In Panel A, the dependent variable is the change in excess volatility, while in Panel B, the dependent variable is the change in tracking error. Results from the regression for funds with no change in portfolio manager within six months before the beginning of each year are given on the left, while the results for funds with a change in portfolio manager within six months before the beginning of each year are given on the right. Estimates and standard errors are the corresponding values indicated by the analysis for a given explanatory variable. p-Value indicates the significance level of the estimate. Number of observations used and total explanatory power of the regression equation as R-squared for both regressions are presented in the lower parts of both panels.

<b>PANEL A</b>						
<b>Excess volatility as a risk measure</b>						
<b>Independent variable</b>	<b>Portfolio manager not changed</b>			<b>Portfolio manager changed</b>		
	<b>Estimate</b>	<b>Standard Error</b>	<b>p-Value</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>p-Value</b>
Intercept	0.000144	0.00123	0.9073	-0.00248	0.00345	0.4736
Perf*D <sub>(bull)</sub>	0.048309	0.0297	0.1043	-0.05108	0.0624	0.4142
Perf*D <sub>(bear)</sub>	0.027692	0.0364	0.4472	0.031511	0.1144	0.7833
Risk <sub>py1</sub>	-0.29544	0.0597	<0.0001	-0.50539	0.234	0.0319
Number of Observations	1468			228		
R-squared	0.1554			0.3086		

<b>PANEL B</b>						
<b>Tracking error as a risk measure</b>						
<b>Independent variable</b>	<b>Portfolio manager not changed</b>			<b>Portfolio manager changed</b>		
	<b>Estimate</b>	<b>Standard Error</b>	<b>p-Value</b>	<b>Estimate</b>	<b>Standard Error</b>	<b>p-Value</b>
Intercept	0.07334	0.0065	<0.0001	0.11248	0.0162	<0.0001
Perf*D <sub>(bull)</sub>	0.052355	0.0327	0.1097	0.063174	0.055	0.2518
Perf*D <sub>(bear)</sub>	-0.09687	0.0702	0.1677	0.079662	0.2908	0.7844
Risk <sub>py1</sub>	-0.36843	0.0399	<0.0001	-0.58292	0.0892	<0.0001
Number of Observations	1468			228		
R-squared	0.0927			0.2266		

Panel A on Table 8 presents the regression results with excess volatility as a risk measure, while Panel B presents similar results using tracking error as a risk measure. In Panel A, the bull year performance coefficients are of opposite sign for the two sub-groups. However, neither is statistically significantly different from zero, although the positive coefficient for funds with no

change in portfolio manager is close to the 90% confidence level. For both sub-groups the bear year performance coefficients are also insignificantly different from zero. Dividing the sample with such an aggressive way leaves the two sub-samples to vary drastically in size. The total number of observations in the sub-group in with change in portfolio manager is only 228, which is likely to cause the probability levels of the analysis to be relatively low.

For Panel B, in which the results from the regression with tracking error as a risk measure are presented, the story is rather similar. None of the performance variables receive a statistically significant value, although also here, the bull year performance variable for mutual funds with no change in portfolio manager is very close to the 90% confidence level. Similarly to Panel A, bear year performance variables are insignificantly different from zero.

Finally, for both sub-groups and both measures of risk, the lagging risk variables receive statistically significant negative values. Once again, this implicates that for both measures of risk and for both sub-groups, high risk in the first half of the year is negatively correlated to the change in risk in the latter half of the year, *ceteris paribus*. This value is in absolute terms much higher for mutual funds in which the portfolio manager has changes recently.

#### ***6.2.4 Retail bank status***

Analyzing the bank and non-bank managed funds separately implies differences in their performance-driven risk behavior. That bank and non-bank managed funds differ in their behavior was expected in the light of the earlier studies on Finnish mutual funds. In this study, the difference in behavior is clearly indicated by the Chow-test p-value of 0.0001 for the bank and non-bank managed funds, when excess volatility is used as a risk measure. However, similarly than with the fund size, tracking error as a risk measure suggests no clear difference between these two sub-groups as the Chow-test p-value is 0.1881. Results from running the regression equation 2 separately for the sub-groups, with excess volatility as a measure of risk, are presented in Table 9.

**Table 9: Robust regression results for bank and non-bank managed funds, excess volatility as a measure of risk**

Table 9 presents the regression results from robust linear regressions run using the regression equation 2 on the sub-samples divided by the retail bank status of the managing company. The dependent variable is the change in excess volatility. Results from the regression for bank managed funds are given on the left, while the results non-bank managed funds are presented on the right. Estimates and standard errors are the corresponding values indicated by the analysis for a given explanatory variable. p-Value indicates the significance level of the estimate. Number of observations used and the total explanatory power of the regression equation as R-squared for both regressions are presented in the lower part of the table.

Independent variable	Bank managed Funds			Non-bank managed Funds		
	Estimate	Standard Error	p-Value	Estimate	Standard Error	p-Value
Intercept	-0.00126	0.0016	0.4204	-0.00209	0.0016	0.1760
Perf*D(bull)	-0.01348	0.0406	0.7400	0.11017	0.0329	0.0008
Perf*D(bear)	0.05277	0.0422	0.2118	-0.05619	0.0453	0.2153
Risk <sub>py1</sub>	-0.28390	0.0410	<0.0001	-0.39576	0.0654	<0.0001
Number of Observations	893			995		
R-squared	0.1246			0.2806		

In the left side of Table 9, as shown by high p-values in the bank managed funds, neither bull nor bear year performance have a statistically significant relationship to the changes in risk taking measured as excess volatility. Only the lagging risk variable from the first half of the year is significantly and negatively related to the changes in risk. Similarly, the explanatory power of the regression, shown by R-squared, is considerably lower compared to the aggregate sample (0.1246 versus 0.2098).

On the right side of Table 9, the results from the regression for the non-bank managed funds are more interesting. The positive relationship between the performance and the change in risk taking in bull years is indicated to be somewhat stronger compared to the aggregate sample. The statistical significance of the bull year performance is also higher and the coefficient received a higher value (0.110 vs. 0.068). The two other explanatory variables behave similarly compared to the aggregate sample with the bear year performance having no statistically significant relationship and the lagging risk variable having a strong negative coefficient. In addition, the

explanatory power of the model, R-squared, is higher for the non-bank managed funds compared to the aggregate sample.

As expected based on the earlier studies, the retail-bank status of the managing company is clearly indicated to affect the behavior of the mutual funds. Both sub-groups are indicated to increase their tracking error as a result of good performance in bull year. However, for bank managed funds, no relationship between performance in the first half of the year and subsequent change in risk is indicated when the excess volatility is used as a measure of risk. These results are similar for bull and bear years. Non-bank managed funds on the other hand are indicated to have a positive relationship between performance and subsequent risk taking in bull years with the excess volatility as a measure of risk. Similarly to all earlier tests, no relationship between the performance in the first half of the year and subsequent change in risk in the latter half of the year is found in bear markets, neither with excess volatility nor tracking error.

### ***6.3 Mutual funds' performance-driven risk taking outside calendar year***

As indicated by the results of the two earlier parts of this chapter, the mutual funds' performance-driven risk taking does not resemble the kind of behavior expected under the tournament hypothesis. Instead, a totally opposite behavior is indicated. The results clearly indicate that better relative performance in the first half of the year is positively related to increase in the risk taking in the latter part of the year. These findings are inevitably pointing towards abandoning the tournament hypothesis within the Finnish equity mutual funds.

As a result of these findings, detaching from the original tournament hypothesis feels rather intuitive. This would induce one to relax parts of the tournament framework used also in the earlier part of the analysis. One interesting part of this framework is the assumption of calendar-year time frames. Based on the theoretical background and earlier empirical evidence on tournament behavior, this assumption was somewhat justified. However, especially as the results of the earlier analyses do not support the tournament behavior, relaxing the calendar-year time frame would provide a deeper understanding of the performance driven risk taking.

To be able to analyze the performance-driven risk taking outside calendar years, the sample is rearranged by changing the testing periods. In this new setting, the first period is the latter half of

year  $y$  and the second period is the first half of year  $y+1$ . By moving the setting forward by six months, it is possible to study whether the results found in the earlier analyses are tied inside a calendar year or if they appear in a continuous way.

Besides the rearranging the sample, this further analysis follows identically the process of the previous ones. Hence, the regression equation used in this part is in general form:

$$\text{Risk}_{p(y+1)1} - \text{Risk}_{py2} = \alpha + \gamma_1 * \text{Perf}_{py2} * D_1 + \gamma_2 * \text{Perf}_{py2} * D_2 + \phi \text{Risk}_{py2} + \varepsilon_{py} \quad (6)$$

in which  $\text{Risk}_{p(y+1)1}$  ( $\text{Risk}_{py2}$ ) is the annualized risk for fund  $p$  from January to June (July to December) in year  $y+1$  (in year  $y$ ),  $\text{Perf}_{py2}$  is fund  $p$ 's July to December logarithmic return on year  $y$  in excess of the logarithmic return of the benchmark index at the same period.  $\varepsilon_{py}$  is the error term from the regression analysis.  $D_1$  and  $D_2$  are dummy variables defines so that  $D_1$  gets a value 1 in bull markets and value 0 in bear markets based on the latter half of the year  $y$ . Contrary,  $D_2$  gets a value 0 in bull markets and value 1 in bear markets. A single observation is defined to represent a bull market if the return of the corresponding index is positive between July and December in year  $y$  and bear market if the corresponding return is negative during the same period. Once again, both excess volatility and tracking error are used as measures of risk.

In redefining the testing periods, the data on the first half of year 2002 as well as the last half of 2009 are lost. This naturally causes the new sample to contain fewer observations in total compared to the original aggregate sample. However, with 1555 observations remaining, this new adjusted sample should provide reliable results also in the statistical sense.

The results from employing the equation (6) on the redefined sample are presented in Table 10. To avoid the problems of inflated probability values due to heteroscedasticity, the regressions are run using the same robust methods as earlier.

**Table 10: Robust regression results from the adjusted sample with altered time setting**

Table 10 presents the regression results from robust linear regressions run using the regression equation 6 on the altered sample. Results from the regression with the change in excess volatility as a dependent variable are presented on the left, while the results from the regressions with tracking error as a dependent variable are presented on the right. Estimates and standard errors are the corresponding values indicated by the analysis for a given explanatory variable. p-Value indicates the significance level of the estimate. Number of observations used and the total explanatory power of the regression equation as R-squared for both regressions are presented in the lower part of the table.

Independent variable	Excess Volatility as a measure of Risk			Tracking Error as a measure of Risk		
	Estimate	Standard Error	p-Value	Estimate	Standard Error	p-Value
Intercept	0.001064	0.0008	0.1937	0.077284	0.0032	<0.0001
Perf*D(bull)	0.157262	0.0195	<0.0001	0.007948	0.0288	0.7828
Perf*D(bear)	0.005631	0.0132	0.6700	0.018043	0.0111	0.1053
Riskpy2	-0.29892	0.0229	<0.0001	-0.45357	0.0159	<0.0001
Number of Observations	1555			1555		
R-squared	0.2942			0.4825		

Table 10 presents the results for both measures of risk. In the left side of the table with excess volatility as a risk measure of risk, the bull year performance variable receives a much higher and statistically even more significant coefficient compared to the aggregate sample (see Table 6). This indicates stronger relationship between the prior performance and subsequent risk taking. This clearly indicates that performance-driven risk taking is not tied to a span of calendar years. At the same time, the bear year performance variable does not receive a statistically significant coefficient. This finding is similar to the original test with the aggregate sample. Once again, the lagging risk variable receives a strong negative and statistically very significant coefficient, indicating a strong reversal in risk taking between the test periods. The explanatory power of this model, given by R-squared, is somewhat stronger compared to the aggregate sample (0.2942 vs. 0.2133).

In the right side of the Table 10, with tracking error as a risk measure, the picture looks rather different. The bull year performance variable, which received a significant positive coefficient in the aggregate sample, does not statistically differ from zero. Hence, no relationship is indicated

between the bull year performance and subsequent change in tracking error. Similarly, the bear year performance variable received a coefficient which is not significantly different from zero, although being stronger than in the earlier analysis with the aggregate sample. Finally, the lagging risk variable receives once again a strong and significantly negative value, indicating a reversal in risk levels between the periods. This finding is identical to all previous analysis in all samples and sub-groups.

These findings from the adjusted sample with altered time setting reveal that the performance-driven risk taking is not tied to calendar years. These results clearly indicate this effect to be continuous in nature so that mutual funds alter their risk in an ongoing process with at least prior performance and prior level of risk as drivers. Similarly to the results of the sub-group analyses, the means in which the risk is altered seems to vary over time and between different funds. To pull all these findings together into concise conclusions, the next part of this chapter provides more thorough discussion on the results.

#### ***6.4 Discussion on the results***

This sub-chapter goes through the results of the empirical analyses presented above. The aim is to discuss these findings more thoroughly and to reflect the findings as well as potential explanations to earlier academic studies. This sub-chapter is divided in two parts. The first one discusses the findings from the regressions performed with the aggregate and adjusted samples. This refers to the tests presented in sub-chapters 6.1 and 6.3. The second part discusses the findings of the sub-sample analyses described in sub-chapter 6.2.

##### ***6.4.1 Findings from the aggregate sample***

As described in the chapters above, the performance-driven risk taking in the Finnish equity mutual funds is studied with several robust linear regressions. These tests take into account possible differences in the managerial behavior between bull and bear years, as well as different measures of risk. This is done to observe the managerial behavior in a more detailed level.

Furthermore, several fund specific characteristics are included in the analysis to shed light into the way they affect the behavior of the mutual funds.

The results of the empirical analysis do not support the traditional tournament hypothesis according to which mutual funds with poor relative mid-year performance would increase their risk relatively more in the latter part of the year than do funds with good relative mid-year performance. Instead, the results strongly suggest an opposite relationship. The results clearly indicate that good relative interim performance is associated with a subsequent increase in the risk level in bull markets, i.e. when the compensational incentives are argued to dominate the employment incentives. Similarly, the results indicate that poor interim performance in bull years is related to decrease in risk taking.

These findings of bull year behavior are almost identical with both excess volatility and tracking error as risk taking measures. Therefore at the aggregate level there seems to be no difference between these two measures of risk. The managerial decisions driven by interim performance affect both excess volatility and tracking error at the same direction and with approximately same proportion.

At the same time with positive bull year performance relationship, no statistically significant relationship between interim performance and subsequent change in risk is found in bear markets. This finding holds once again for both excess volatility and tracking error as measures of risk. However, this result does not mean that bear years would not affect mutual funds' risk taking, but merely indicates that the managerial decisions on mutual funds' risk levels are not driven by the relative interim performance in bear years. Naturally there can be other drivers behind those actions when market conditions are negative, but these drivers are not studied in this thesis.

What is interesting to note, is that the variables used in the analysis explain a considerably larger part of the changes in the excess volatility than they do in the tracking error. From this finding, one could conclude that other drivers behind managerial risk taking are stronger for the changes in tracking error compared to the excess volatility. Therefore, this finding also indicates that these



two measures of risk have partially different drivers and therefore it is justified to use both of them in analyzing the behavior of mutual funds' risk taking.

The findings from the analyses of the aggregate sample are partially in line with the ideas presented by Kempf et al. (2009) in that mutual funds' incentives and thus their behavior are subject to change as the market conditions change. Some incentives are dominant or exist in bull markets while others take over in bear markets. Therefore, whenever the behavior of the mutual funds is studied, these prevailing market conditions must be taken into account. This conclusion can be further backed by the analysis performed without the distinction between bull and bear years, presented in Table 5. Here, no relationship is found between the interim performance and subsequent change in risk taking. With this simplified definition of the regression model, the conclusions would have been against any relationship between performance and subsequent risk taking. As there are considerable amount of both bull and bear year observations in the sample (1250 bull year observations vs. 643 bear year observations), the effect of bull year performance is non-existent when combined with the observations from the bear years.

What distinguishes these findings from those of e.g. Kempf et al. (2009) and Brown et al. (1996) is the positive relationship between prior performance and subsequent risk taking in bull years. This is a clear contradiction to the hypothesis of mutual fund tournaments. However, these findings are in line with those of other authors studying the performance-driven risk taking. The same positive relationship is documented by Chevalier and Ellison (1997) and Ammann and Verhofen (2007). In fact, also Busse (2001) finds this positive relationship in two out of five sub periods studied, although in the end he concluded that no relation existed. Although they all find positive relationships without distinguishing between the bull and bear years, this can be explained by the chosen time periods in their samples. These time periods, 1983-1993, 1984-2003 and 1985-1995 for Chevalier and Ellison (1997), Ammann and Verhofen (2007) and Busse (2001) respectively, are periods when the U.S. stock market was dominated by years of positive returns. Therefore, by merely choosing to study those particular periods, these authors were in effect dominantly studying the mutual fund behavior and incentives in bull markets. Therefore, the findings of this thesis are in line with these earlier academic studies.

The remaining question is what drives mutual funds into taking more risk after good performance in bull years? Two possible, potentially coexisting explanations are presented. The first explanation follows the ideas and findings presented by Chevalier and Ellison (1997). The performance-risk taking relationship, the root of the discussion on performance-driven risk taking, is most likely more complicated and nuanced than expected by the simple models. Chevalier and Ellison (*ibid.*) document the shape of this relationship to be all but linear (see Figure 1). The strength and direction of this relationship also varies as the relative performance changes. Therefore, both interim winners and interim losers can have an incentive to increase or decrease their risk levels, depending on their location in the performance-risk taking curve. Although documenting a positive relationship between actual performance and subsequent risk taking, Chevalier and Ellison (*ibid.*) nevertheless conclude this to be in line with the compensational incentives implicated by their modeled flow-performance relationships.

If the flow-performance relationship of the funds represented in this study are similar to those modeled by Chevalier and Ellison (*ibid.*), then the results of this thesis would illustrate behavior in line with the compensational incentives produced by this flow-performance relationship, similarly compared to Chevalier and Ellison (*ibid.*). This means, that the funds are distributed unevenly on the performance-risk taking curve. Interim winners are on average situated in the part of the performance-risk taking curve with stronger risk taking incentives, while interim losers are on average situated in the part of the curve with lower risk taking incentive. Thus, the stronger risk taking incentives of the winners dominate the sample. However, to be able to validate this conclusion, a highly detailed modeling of the flow-performance relationship of Finnish mutual funds would be needed.

In addition, the second potential explanation is the one presented by Ammann and Verhofen (2007) and is simply managerial overconfidence. As the managers reach higher than average performance and are able to beat their benchmark indices, their confidence in their own skills increases. This drives them both to deviate more from the market portfolio and also take riskier bets. The same pattern of behavior has been documented on managers in general (e.g.

Malmendier and Tate 2005) and is thus more general in nature. Both explanations presented are plausible within the framework of this study.

The explanation for the non-existent relationship between the performance and risk taking in bear years is much simpler. In short, the results indicate that the incentives and thus the behavior between well and poorly performing mutual funds do not differ when the market conditions are negative, i.e. in bear years. With similar incentives, similar behavior is to be expected. With the compensational incentives being arguably less important in bear years, understanding of the employment incentives would be essential to further analyze these results. In the international studies, an inverse relationship between the performance and the probability of fund manager replacement has been documented (e.g. by Khorana 1996). This has been hypothesized to affect the managerial incentives in bear years by causing poorly performing funds to decrease risk more than well performing funds. As no such studies, to the best knowledge of the author, exist on the Finnish equity mutual funds, further analysis on this finding is not possible. However, the results indicate that the employment incentives do not differ between well and poorly performing managers in bear years. This is most likely related to the job stability of the Finnish mutual fund managers.

As these findings cannot support the tournament hypothesis, it is reasonable to ask if the tournament framework is valid. One of the most interesting assumptions is the focus on the effects inside a calendar year. To study whether the performance-driven risk taking found in the earlier analyses exists also outside calendar years, the sample was rearranged to study this effect between the latter half of a certain year and the first half of the following year. The results are presented in Table 10 and are very illustrative. Indeed, these results indicate that the relationship between past performance and the subsequent change in risk taking in bull years exists also in this altered time frame, but only when it comes to the risk taking implied by excess volatility. With this measure of risk, the significance and the strength of the coefficient of bull year performance is considerably higher compared to the aggregate sample. On the contrary, the effect is non-existent with the tracking error as a measure of risk. Again, the relationship between performance and risk taking is non-existent in bear years.

In sum, when the bull year performance is analyzed with the adjusted sample, the strength of the relationship with changes in the excess volatility more than doubles while the relationship with changes in the tracking error completely disappears. Analyzing the reasons behind this difference would require data on detailed portfolio holdings of the mutual funds. Whatever the cause behind this behavior, these findings teach us two things. First, the performance-driven risk taking exists also between calendar years and thus should be analyzed in the future on a continuous basis. Second, this finding brings more support for the conclusion that mutual funds adjust the risk level of their portfolios in several ways which differ over time and between funds. More sophisticated measures of risk, e.g. ones derived from actual holdings of the mutual funds' portfolios, are needed to understand this behavior more thoroughly.

#### ***6.4.2 Findings from the sub-samples***

To analyze the effects of several mutual fund specific characteristics, the aggregate sample was divided into sub-samples based on these characteristics. The characteristics used were fund size measured as total net assets (TNA), fund age, portfolio manager's tenure as well as retail bank status of the company operating the fund. Especially the retail bank status is interesting due to previously found differences between the Finnish bank and non-bank managed equity mutual funds. With each of the four characteristics, the sub-samples were tested for the statistical difference using the Chow-test (Chow 1960). If the Chow-test indicated a statistically significant difference between them, separate regressions were employed for both groups.

Using size of the mutual fund as a determinant for the two sub-groups, a statistically significant difference between these groups was found from the regression with the excess volatility as a measure of risk. The probability value indicated by the Chow-test for the difference between these sub-samples was 0.0001. At the same time, the Chow-test p-value for the difference of the sub-samples in the regression with the tracking error as a measure of risk indicated no difference between the two. In this case, the Chow-test p-value was 0.4136 and the results of the original test with the aggregate sample are valid for both sub-groups considering tracking error as a measure of risk.

In the separate regressions for small and large funds with the excess volatility as a measure of risk, the earlier documented positive relationship between the bull year performance and the subsequent risk taking is visible only for large funds. This coefficient for bull year performance is considerably higher and more significant compared to the aggregate sample. For small funds, the same coefficient is slightly negative but does not reach statistical significance. Thus no relationship between the bull year performance and the risk taking in relation to excess volatility is found for the small funds. Similarly compared to the aggregate sample, the bear year performance remained insignificant while the lagging risk variable received a negative and significant value.

These findings indicate that both small and large funds have a statistically significant and positive relationship between prior performance and subsequent risk taking when the tracking error is used as a measure of risk. This means that both have the tendency to deviate more from the market portfolio as a result of good relative performance. However, for the small funds this same relationship of bull year performance is not visible with the excess volatility as it is for the large funds. Therefore, these results indicate that the large funds are not able, or for some reason do not want to change their behavior in a way that is only reflected on the tracking error. From these two possibilities, the first one is more convincing. As was discussed in the literature review, the size of the fund sets constraints on its behavior by limiting its room for manoeuvre (e.g. Pollet and Wilson 2008). Due to their smaller size and therefore presumably larger available set of options in adjusting their portfolio, the smaller funds are able to change the risk of their portfolio by seeking further away from the market portfolio while at the same time keeping their excess volatility constant. For larger funds, this is not possible. This is in line with the findings of Beckers and Vaughan (2001). Therefore, this explanation of the behavioral difference between large and small funds is in line with the earlier academic discussion considering the way in which fund's size affects its behavior. When it comes to the direction and magnitude of the relationship between the performance and the subsequent risk taking, this result conflicts with all previous findings and therefore no sensible comparison can be made.

As a summary, the analysis on the effects of size to mutual fund behavior concludes that both groups have the tendency to increase risk after relatively good performance. However, the size of the fund sets constraints on the means available to do this and hence the resulting effect on fund's risk is different for the small and large funds.

When analyzing the differences between sub-groups divided based on mutual funds' age, no statistically significant difference was found. The Chow-test for testing the difference between the sub-samples resulted in probability values of 0.5212 and 0.9694 for excess volatility and tracking error as risk measures respectively. Therefore, both young and old funds have the same tendency to increase their risk after good performance, both in the excess volatility and tracking error sense. Comparing these results to previous academic findings is troublesome. In spirit, these findings are similar to those by Kempf et al. (2009), who found no difference between old and young funds, although their original findings supported negative performance-risk taking relationship. No support is found for the findings of Brown et al. (2001), who documented that older funds are less sensitive to performance and would therefore have less incentives to alter their risk due to prior performance. Therefore, the explanation for this finding is simple; age does not affect the incentives and thus the behavior of mutual funds in relation to performance-driven risk taking.

Next we turn to the discussion on the results from testing the differences between sub-groups divided based on the portfolio manager's tenure. First, the sample was divided between funds with manager with above median tenure and funds with manager with below (or at) median tenure. Testing these sub-groups resulted in no statistical difference between the two. The Chow-test p-values for these tests were 0.3341 and 0.2578 for excess volatility and tracking error, respectively. Therefore, the behavior of these sub-groups is concluded to be identical compared to the aggregate sample; both groups have the tendency to increase both excess volatility and tracking error after good interim performance in bull years.

Another way to study the effect of portfolio manager's tenure is to look at the differences between funds in which the portfolio manager has changed recently. To do this, the sample was

rearranged to separate funds in which the portfolio manager had changed within six months from the beginning of each year. However, this distinction of the sub-groups caused the sizes of the groups to differ drastically. From the original observations holding information on portfolio manager's tenure, 228 observations had encountered a change in portfolio manager within six months. At the same time, the number of observations in the other sub-group, in which portfolio managers had remained for at least six months, was 1468.

With this new definition for sub-groups, statistically significant differences for both excess volatility and tracking error as measures of risk were found between them. The Chow-test p-values from the regressions with excess volatility and tracking error were less than 0.0001 and 0.022, respectively. In the separate regressions for the both sub-samples, rather interesting results were found; all performance variables in both regressions and for both sub-groups remained statistically insignificant. Furthermore, the probability estimates for these coefficients in the sub-group in which the portfolio manager had not changed were close to the 90% confidence level. Still, the only statistically valid conclusion is that no relationship between performance and risk taking is found for these sub-groups with neither of the risk measures.

The only explanation for this finding is the decrease in the sample size due to lack of information on portfolio manager's tenure for so many observations. In this test, the total number of observations for the larger group was 1468, which is more than 400 observations less compared to the aggregate sample. With total explanatory power of the models being relatively low, this unexpected fitting of the regression equation, and thus the insignificant performance coefficients received, can be understood. In short, dividing the aggregate sample with this distinction causes the sub-samples to be formed in a way that the regressions were unable to find in statistically significant fit for the regression equation in these samples and hence no significant results were found. Therefore, no conclusion on any difference in performance-driven risk taking between mutual funds based on portfolio manager's tenure or change of portfolio manager can be withdrawn. Taking into account the conflicting findings of the earlier academic studies (e.g. Chen and Pennacchi 2009 and Kempf et al. 2009), this conclusion brings no surprise.

The last fund specific characteristic studied was the retail bank status of the company operating the fund. The difference in behavior between these sub-groups was clearly indicated by the Chow-test p-value of 0.0001 when the excess volatility was used as a risk measure. However, the tracking error as a risk measure showed no clear difference between these two sub-groups as the Chow-test p-value was 0.1881. These results indicate that both bank and non-bank managed mutual funds share the tendency to increase their tracking error after good interim performance in bull years. No relationship between the performance and subsequent change in the tracking error exists in bear years. In addition, the tracking error has the same reversal nature for both sub-groups compared to the aggregate sample.

This difference in risk taking in relation to excess volatility was studied further by employing the regression separately for both sub-groups. The regressions clearly indicate that the non-bank funds exhibit the positive the bull year performance-risk taking relationship found in the aggregate sample. These results are slightly stronger and more significant compared to the aggregate sample. For the bank managed funds, no relationship between the bull year performance and subsequent change in excess volatility can be found. The coefficient for the bull year performance for bank managed funds is slightly negative, but not significantly different from zero. Once again, the bear year performance variables remain insignificant and the lagging risk variables receive similar negative coefficients as before.

Both bank and non-bank managed funds are indicated to change their behavior as a result of good interim performance when the compensational incentives are argued to dominate the employment incentives, i.e. in bull markets. However, the way in which this change is visible differs. For non-bank funds, both the excess volatility and tracking error have the tendency to increase after good performance. Therefore, they follow the same pattern seen in the aggregate sample. For bank managed funds, the effect is similar to that of the small mutual funds. Positive performance in bull years results in increase in the tracking error but not in the excess volatility.

One potential explanation for this difference in behavior could be the one used with the discussion on the effects of fund size. If non-bank managed mutual funds are not able to change



their tracking error without affecting the excess volatility, similar findings would be expected. This would require that bank and non-bank managed funds differ also in some other, yet unidentified way. One such difference could in theory be the size of the funds, in line with the earlier findings. If non-bank managed funds were on average larger than bank managed funds, then these findings could be just another embodiment of the fund size effect. This, however, is not the case. As shown in Table 3, the bank managed funds are on average larger compared to the non-bank funds. As a result, this first potential explanation of fund size affecting the performance-driven risk taking must be abandoned.

Another potential explanation might arise from the way the tracking error is calculated. As described in the introduction, this is one of the limitations of this thesis. Tracking error is here calculated from the portfolio returns as a standard deviation of the fund's daily returns in excess of the benchmark index. If funds with good prior performance receive larger inflows of new capital (as in Sirri and Tufano 1998), especially in bull markets, then these funds would have, at least temporarily, higher cash positions compared to the poorly performed funds. This would result from the fact that all new capital cannot be invested at once. Therefore, if the well performing funds receive higher cash flows and thus have higher cash positions, they would at the same time deviate more from the market portfolio and also their tracking error would increase temporarily. If the increase in tracking error after good performance in bull years reflects this liquidity effect, then the only valid measure of the changes in managerial behavior would be the excess volatility. This would result in the conclusion that the bank managed funds do not intentionally change their behavior as a result of good performance, whereas non-bank funds would take more risk measured as the excess volatility.

However, also this explanation has several shortcomings. First is the more general one presented already in the introduction discussing the limitations of this study. Mutual funds that face large inflows (or outflows) can balance their market exposure using derivatives (such as index futures) that do not affect their liquidity. Therefore the cash flows should not affect their tracking error significantly. The other shortcoming relates to the validity of this argument in relation to the bank managed funds. It has been well documented that investors of the bank managed funds in Finland

do not pay much attention to the funds' past performance when making investment decisions. Therefore, it is hard to assume that new performance-driven money-flows would affect the tracking error of well performing bank managed funds, since no (or at least not strong) flow-performance relationship should exist. Due to these shortcomings, also this potential explanation is abandoned.

Therefore, the only plausible explanation is that the bank managed funds alter their behavior more subtly than the non-bank funds. If the bank managed funds do not face a similar flow-performance relationship than non-bank funds, then they would also have fewer incentives to change their behavior due to past performance. The change in tracking error could be explained e.g. by the overconfidence theory already discussed, in which the manager puts modestly more weight on the already owned possessions of the fund. This would mean that the bank managed funds take more view in respect to markets after good bull year performance, but in a way in which the excess volatility is not affected. At the same time, the non-bank funds face the same strong flow-performance relationship that was documented e.g. by Chevalier and Ellison (1997). This would give them the incentive to alter their portfolio more aggressively by taking riskier bets, thus resulting also in an increase in the excess volatility. In short, this thesis concludes that that due to stronger flow-performance relationship, and hence compensational incentives, the non-bank funds react more strongly to past performance than do bank managed funds, which is seen as a difference in their performance-driven risk taking behavior in relation to changes in excess volatility.

Although the conclusion here is that the behavior between bank and non-bank funds differ due to different incentives caused by different flow-performance curves, another additional point is worth mentioning. As the distinction between these sub-groups is based on the company operating them, there could potentially be differences in the way in which these companies are organized and how they operate. This could lead to differences e.g. in the formal incentives given to portfolio managers. As an example, Elton, Gruber and Blake (2003) have documented that incentive fee systems increase the risk taking behavior of the mutual funds. One such incentive would be portfolio manager's ownership in the fund she is managing. Kumlin and Puttonen

(2009) document that in Finland funds with positive managerial ownership are more likely to be managed by non-banks. If managerial ownership, or some other performance based compensation structures, were more common in non-bank funds, then we would expect to see stronger performance-risk taking relationship in non-bank funds compared to bank managed funds.

Finally, a brief discussion on the economical significance of the findings is justified. The positive relationship between bull year performance and subsequent change in risk was found statistically significant for the aggregate sample and several sub-samples. The coefficients of this relationship varied between the tests performed. For the aggregate sample, the coefficients for bull year performance were ca. 0.068 for both measures of risk. These indicate that 1 percentage point of excess return over benchmark index during the first half of a given year would on average lead to an increase in both the excess volatility and tracking error of the fund by 0.068 percentage points. The economical significance of this risk taking on the aggregate level is therefore relatively small. The strongest effect was found for large funds, in which 1 percentage point of excess return over benchmark during the first half of a given year would on average lead to an increase in the excess volatility of the fund by 0.17 percentage points. Therefore, the magnitude of the effect varies clearly between fund groups and most likely between individual funds. Therefore, although these effects are not economically significant at the aggregate level, they could potentially reach economically harmful levels at the individual fund level.

As a summary of the earlier discussion, the empirical part of this thesis has found support for all the hypotheses presented in Chapter 3. To sum up all earlier discussion and the contribution of this thesis, we now turn to the last chapter presenting the conclusions.

## 7 Conclusions

This thesis has studied the behavior of mutual funds by analyzing their performance-driven risk taking. As discussed in the literature review, previous academic studies have documented a strong positive relationship between mutual funds' performance and the flows of new capital they face. This results from the return chasing behavior of mutual fund investors. However, the flow-performance relationship is not symmetrical. Well performing funds receive high inflows of capital but poorly performing funds do not face similar outflows. As an exception from this pattern, the Finnish investors of bank managed mutual funds are documented to be rather ignorant of the previous performance when allocating their capital into mutual funds.

This asymmetric flow-performance relationship is argued to impose mutual funds with incentives to alter their risk taking to attract higher inflows and thus receive more fees. This risk taking behavior was originally hypothesized and documented as mutual fund tournaments, in which poorly performing funds would increase their risk more after interim evaluation compared to well performing funds (Brown et al. 1996). However, the story has developed to a much more complex and contradictory one since then. While some academic studies have found no relationship between past performance and subsequent risk taking (e.g. Busse 2001), others have documented this relationship to be positive (e.g. Chevalier and Ellison 1997), contrary to the findings of Brown et al. (ibid.). At the same time, the discussion has evolved into a debate about appropriate risk measures as well as including other incentives into the analyses. As the performance-driven risk taking potentially causes severe principal-agent problems between investors and their money managers, it is studied further in this thesis with a focus on the Finnish equity mutual funds.

This thesis employs daily return data on all actively managed Finnish equity mutual funds between 2002 and 2009, as well as data on several fund specific characteristics. These mutual funds are divided into several peer groups based on the geographical market area in which they invest. Comparable benchmark indices for each peer group are appointed. In total, the aggregate sample includes 1893 observations. The number of observations in the sub-groups based on the fund specific characteristics is slightly lower due to incomplete fund characteristics data.

The analyses in the empirical part of this thesis were performed by employing robust linear regressions. The regression equations were modeled to explain the changes in mutual fund's risk taking between two periods, measured either as a change in excess volatility over benchmark or as a change in tracking error. The explanatory variables were bull and bear year performance as well as the risk level in the first period.

The results from the empirical analysis clearly indicate that mutual fund risk taking is driven by past performance. However, this effect is neither constant over time nor apparent in a same way for all mutual funds. With the aggregate sample, including all observations available, mutual funds were documented to have a tendency to increase their risk taking after good performance and decrease the risk taking after poor performance. However, this effect only appears in bull years. In bear years, no relationship between performance and risk taking was indicated. These findings are contrary to the hypothesis of mutual fund tournaments, and were implied by regressions with both excess volatility and tracking error as measures of risk. As was indicated by the further analysis, this positive relationship between performance and risk taking in bull years exists also outside calendar year setting. However, in this setting, the change in risk taking was shown in excess volatility but not in tracking error. Analyzing this difference further would require data on detailed portfolio holdings of the mutual funds.

Two potentially coexisting explanations are concluded to be behind this positive performance-risk taking relationship in bull years. The first one is the flow-performance relationship documented by Chevalier and Ellison (1997) in which the shape of the flow-performance relationship, and hence also the performance-risk taking relationship, are all but linear. Therefore, both interim winners and interim losers can have an incentive to increase or decrease their risk levels (see Figure 1). The stronger risk taking incentives of the interim winners are argued to dominate the sample over the risk taking incentives of the interim losers. The second potential explanation is overconfidence of the interim winners caused by the better than average performance. This conclusion is equal to the one proposed by Ammann and Verhofen (2007) and is in line with a more generally documented effect of managerial overconfidence (see e.g. Malmendhler and Tate 2005). Both explanations presented are plausible within the scope of this study.

For the bear year effect, the conclusion is much simpler. With no relationship between performance and risk taking in bear years, this study concludes that the incentives faced by interim winners and losers are similar in bear years, resulting in insignificant coefficients for bear year performance. With compensational incentives argued to be relatively less important in bear years, this conclusion would indicate that the employment incentives do not differ between mutual funds with better and poorer relative performance. To validate this, a more thorough analysis of career concerns of Finnish portfolio managers, including e.g. job stability, would be needed.

The analysis on the effect of fund specific characteristics showed that these characteristics indeed affect the behavior of mutual funds in relation to the performance-driven risk taking. While the behavior between old and young funds showed no difference, the size of the fund clearly indicated a difference in the risk taking behavior. Both small and large funds' risk taking is suggested to be driven by the past performance in bull years, but it is shown differently. Large funds alter both the excess volatility and tracking error after good performance in bull years. At the same time for the small funds only the tracking error changes. As a conclusion, smaller funds have presumably larger available set of options available in adjusting their portfolios and are therefore able to change the risk of their portfolio by moving further away from market portfolio while at the same time keeping their excess volatility constant. For larger funds, this is not possible. Hence the size partially defines the means in which the fund changes its behavior, in line with earlier academic findings (see e.g. Pollet and Wilson 2008).

Portfolio manager's tenure indicated no difference in behavior between above and below median tenured managers. Also the analysis on the effects of change in portfolio manager was inconclusive.

Finally, the effect of the retail bank status of the company operating the mutual fund was examined. As discussed in the earlier literature on the Finnish mutual funds, bank and non-bank managed funds have been documented to face different flow-performance curves. Both bank and non-bank managed funds were found to increase the tracking error after good performance in bull years. However, only the non-bank funds showed the same effect with excess volatility. This difference in increasing excess volatility in bull years cannot be addressed to result from

difference in fund sizes and also the potential explanation of fund liquidity affecting the tracking error is abandoned. Therefore, the only plausible explanation is that the bank managed funds alter their behavior more subtly than the non-bank funds. Non-bank managed funds are documented to face a stronger flow-performance curve and thus a stronger incentive to alter their risk compared to the bank managed funds. Therefore, the non-bank funds react more strongly to past performance than do bank managed funds, which is seen as a difference in their performance-driven risk taking regarding the changes in excess volatility. This conclusion is in line with the earlier studies on the difference between Finnish bank and non-bank managed funds.

This thesis has found considerable evidence on the behavior of mutual funds and performance-driven risk taking. Although the economical significance of the performance-driven risk taking is relatively weak on the aggregate level, the effect could reach economically significant and potentially harmful magnitudes on the individual fund level.

By analyzing different fund groups with different measures of risk and in different market conditions, the findings of this thesis contribute to understanding how mutual funds behave. However, the most important finding of the thesis is to show how complex the behavior of the mutual funds is. Again citing Ammann and Verhofen (2007), it is hard to develop theoretical models and empirical analyses to be able to fully analyze and describe these nuances in detail. Therefore, in addition to the findings already presented, a major contribution of this thesis is to show where the efforts of further academic studies should be aimed to better understand the behavior of mutual funds.

For further studies on performance driven risk taking, the research question should no longer be stated as “do mutual funds exhibit tournament behavior?”. Instead, a far deeper analysis is needed. The questions to be studied to further shed light into this issue would be to analyze the nature of the flow-performance relationships different funds in different market conditions encounter. Combined with other incentives they face (e.g. job stability) and more accurate measures of managerial behavior (e.g. fund’s portfolio turnover), the behavior of the mutual funds in relationship with the incentives imposed by the flow-performance relationship should be studied further.

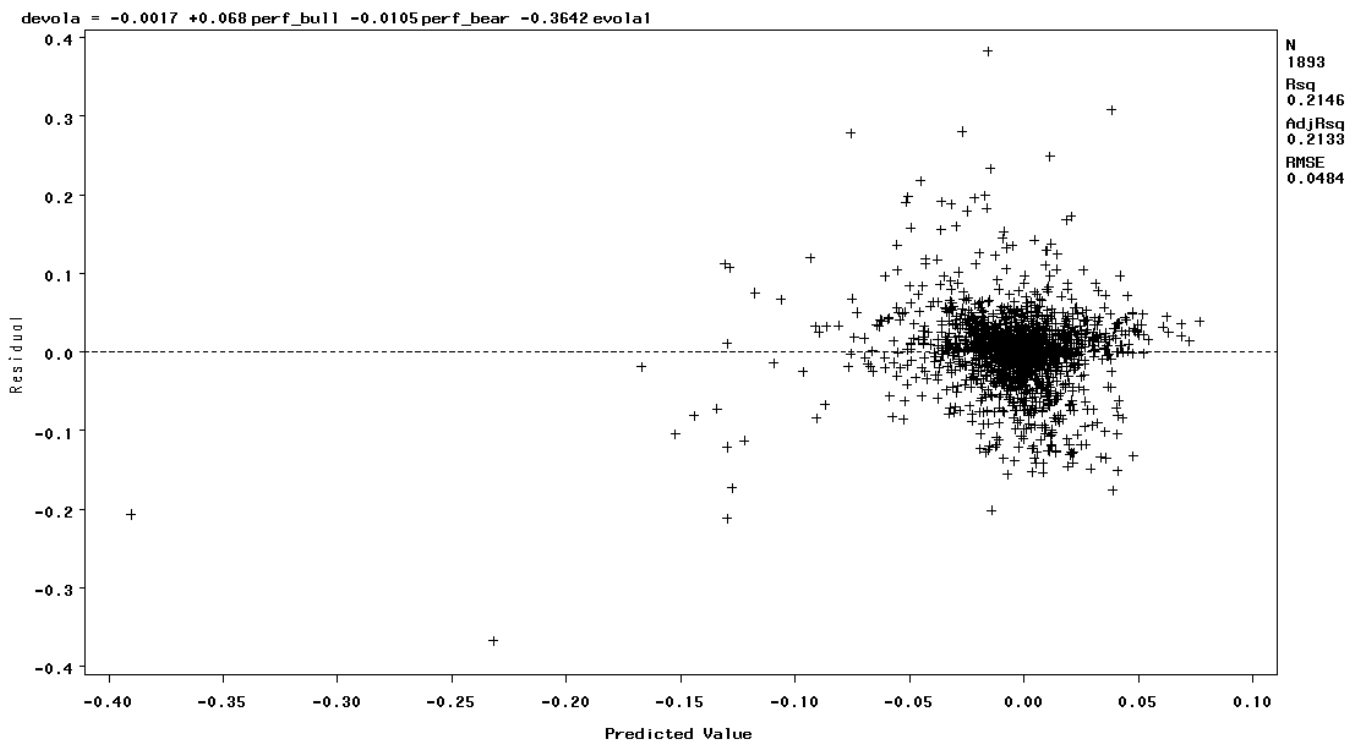
## Appendix I: Residual plots from the OLS regressions

Residual plots for the regression equation:

$$\text{Excess Volatility}_{py2} - \text{Excess Volatility}_{py1} = \alpha + \gamma_1 * \text{Performance in excess of benchmark}_{py1} * D_1 + \gamma_2 * \text{Performance in excess of benchmark}_{py1} * D_2 + \gamma_3 * \text{Excess Volatility}_{py1} + \varepsilon_{py}$$

$D_1$  is a dummy variable receiving value 1 when return of the benchmark of a given fund is positive in the first half of the observation year, 0 otherwise

$D_2$  is a dummy variable receiving value 1 when return of the benchmark of a given fund is negative in the first half of the observation year, 0 otherwise



Note: Predicted values are presented on the horizontal axis and residuals on the vertical axis

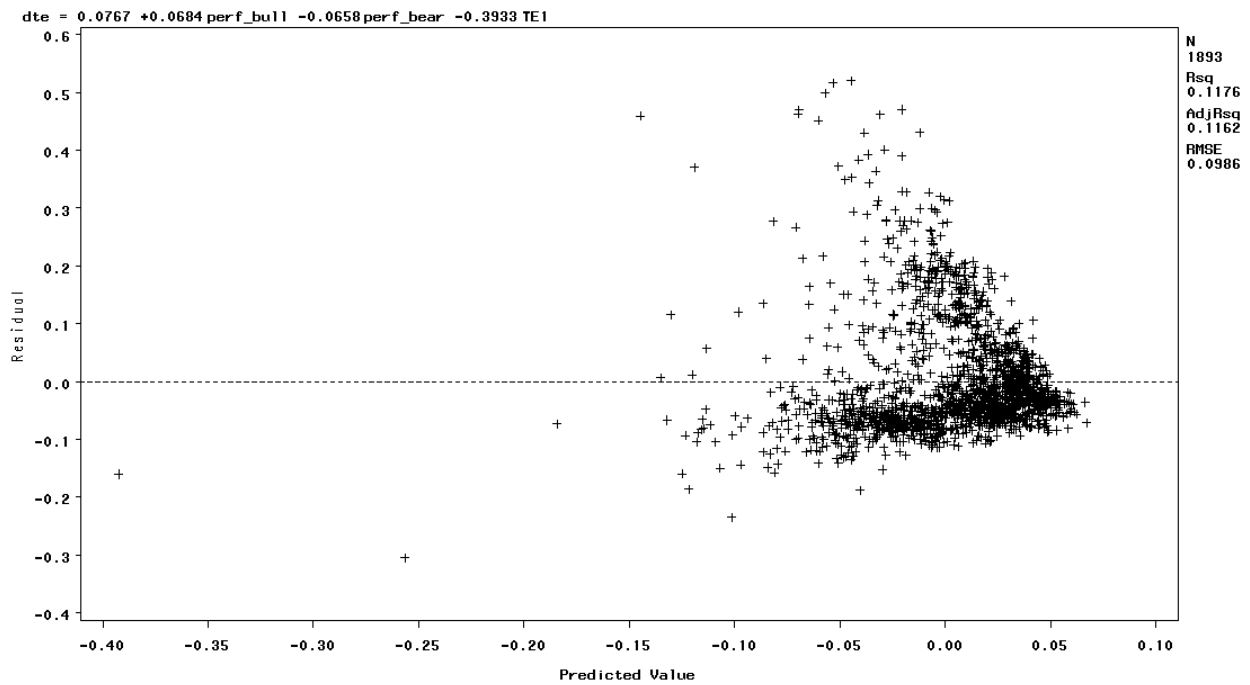


Residual plots for the regression equation:

$$\text{Tracking Error}_{py2} - \text{Tracking Error}_{py1} = \alpha + \gamma_1 * \text{Performance in excess of benchmark}_{py1} * D_1 + \gamma_2 * \text{Performance in excess of benchmark}_{py1} * D_2 + \gamma_3 * \text{Tracking Error}_{py1} + \varepsilon_{py}$$

$D_1$  is a dummy variable receiving value 1 when return of the benchmark of a given fund is positive in the first half of the observation year, 0 otherwise

$D_2$  is a dummy variable receiving value 1 when return of the benchmark of a given fund is negative in the first half of the observation year, 0 otherwise



Note: Predicted values are presented on the horizontal axis and residuals on the vertical axis

## References

Ammann, M., Verhofen, M. 2007. Prior Performance and Risk-Taking of Mutual Fund Managers: A Dynamic Bayesian Network Approach. *Journal of Behavioral Finance* 8, 20–34.

Beckers, S., Vaughan, G. 2001, Small is beautiful, *Journal of Portfolio management* 27, 9-17

Berk, J., Green, R. 2004. Mutual Fund Flows and Performance in Rational Markets. *Journal of Political Economy* 112, 1269–1295.

Brown, K., Harlow, W., Starks, L. 1996. Of Tournaments and Temptations: An Analysis of Managerial Incentives in the Mutual Fund Industry. *Journal of Finance* 51, 85–110.

Brown, S., Goetzmann, W., Park, J. 2001. Careers and survival: Competition and Risk in the Hedge Fund and CTA Industry. *Journal of Finance* 56, 1869–1886.

Busse, J. 2001. Another Look at Mutual Fund Tournaments. *Journal of Financial and Quantitative Analysis* 36, 53–73.

Chen, H., Pennacchi, G. 2009. Does Prior Performance Affect a Mutual Fund's Choice of Risk? Theory and Further Empirical Evidence. *Journal of Financial and Quantitative Analysis* 44, 745 - 775

Chevalier, J., Ellison, G. 1997. Risk Taking by Mutual Funds as a Response to Incentives. *Journal of Political Economy* 105, 1167–1200.

Chevalier, J., Ellison, G. 1999. Career Concerns of Mutual Fund Managers. *Quarterly Journal of Economics* 114, 389–432.

Chow, G. 1960. Tests of equality between sets of coefficients in two linear regressions. *Econometrica* 28, 591-605.

Edelen, R. 1995. The relation between mutual fund flow, trading activity and performance, Working paper, University of Pennsylvania

Elton, E., Gruber, M., Blake, C. 2003. Incentive Fees and Mutual Funds. *Journal of Finance* 58, 779–804.

Frye, M. 2001. The Performance of Bank Managed Mutual Funds. *Journal of Financial Research* 24, 419-442

Goriaev, A., Nijman, T., Werker, B. 2005. Yet another look at mutual fund tournaments. *Journal of Empirical Finance* 12, 127-137

Grinblatt, M., Keloharju, M. 2009. Sensation Seeking, Overconfidence, and Trading Activity. *Journal of Finance* 64, 549-578

Grinblatt, M., Titman, S. 1989. Adverse risk incentives and the design of performance-based contracts, *Management Science* 35, 807-822.

Karceski, J. 2002. Returns-chasing behavior, mutual funds, and Beta's death. *Journal of Financial and Quantitative Analysis* 37, 559–594.

Kasanen, E., Lipponen, V., Puttonen, V. 2001. What determines mutual fund growth: Evidence from Finland. *Finnish Journal of Business Economics* 2/2001, 227-259

Kempf, A., Ruenzi, S., Thiele, T. 2009. Employment risk, compensation incentives and managerial risk taking: Evidence from the mutual fund industry. *Journal of Financial Economics* 92, 92-108

Khorana, A. 1996. Top management turnover: an empirical investigation of mutual fund managers. *Journal of Financial Economics* 40, 403–427.

Knuutila, M. 2005. The effect of Morningstar ratings on Finnish mutual fund flows. Master's Thesis in Finance, Helsinki School of Economics

Koivulintu, J. 2002. Mutual fund risk-taking behavior: volatility changes as a function of past performance. Master's Thesis in Finance. Helsinki School of Economics.

Korpela, M., Puttonen, V. 2005. Mutual fund expenses: Evidence on the effect of distribution channels. *Journal of Financial Services Marketing* 11, 17-29

Koski Lynch, J., Pontiff, J. 1999. How Are Derivatives Used? Evidence from the Mutual Fund Industry. *Journal of Finance* 54, 791–816.

Kumlin, L., Puttonen, V. 2009. Does portfolio manager ownership affect fund performance? Finnish evidence. *The Finnish Journal of Business Economics* 2/2009, 95-111

Long, S., Ervin, L. 2000. Using heteroscedasticity consistent standard errors in the linear regression model. *The American Statistician* 54(3), 217-224

Lynch, A., Musto, D. 2003. How Investors Interpret Past Fund Returns. *The Journal of Finance* 58, 2033-2058

Malmendier, U., Tate, G. 2005. CEO overconfidence and Corporate Investment. *Journal of Finance* 60, 2661-2700

Pollet, J., Wilson, M. 2008. How Does Size Affect Mutual Fund Behavior? *Journal of Finance* 64, 2941-2969

Sirri, E., Tufano, P. 1998. Costly Search and Mutual Fund Flows. *Journal of Finance* 53, 1589–1622.

Särkijärvi, J. 2008. Determinants of fund flows of Finnish mutual funds: a comparison between retail and institutional funds. Master's Thesis in Finance, Helsinki School of Economics

Tapio, E. 2002. The size effect on mutual fund tracking error. Master's Thesis in Finance. Helsinki School of Economics.

Torkkeli, A. 2002. What affects external fund growth of Finnish equity funds? Master's Thesis in Finance, Helsinki School of Economics

Yan, X. 2008. Liquidity, Investment Style, and the Relation between Fund Size and Fund Performance. *Journal of Financial and Quantitative Analysis* 43, 741–768.