# What Do Mutual Fund Managers' Private Portfolios Tell Us About Their Skills?

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**Abstract**

I collect a registry-based dataset on the personal portfolios of Swedish mutual fund managers. The managers who invest (a lot of) personal money in their own funds generate positive abnormal returns. Some managers are betting on their best ideas by investing personal money in individual securities that are simultaneously held by their funds. The majority do not invest in their funds nor in their funds' constituents, and hold more cash and more passive funds in their personal portfolios. Overall, the results suggest that fund managers are highly certain about their ability—or more often lack thereof—and invest their personal wealth accordingly.

JEL: G00, G11, G23, J44

Keywords: Mutual fund performance, Fund manager skill, Fund manager ownership

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# 1 Introduction

Despite competition from index funds and ETFs, actively managed mutual funds still accommodate an enormous amount of capital with assets under management (AUM) of more than $40 trillion dollar worldwide (Investment Company Fact Book 2017). However, the vast majority of studies on the performance of active mutual funds conclude that, after costs, the average mutual fund delivers no value to fund investors relative to a comparable passively managed fund (see, e.g. Fama and French, 2010). While the average investor is apparently not better off by investing in active funds, a subset of funds may add value and some investors may have superior information about the performance of these funds.[1] This paper studies the personal investment decisions of a special set of investors that is more than anybody destined to possess superior information: the funds' managers. What information do fund managers possess and how do they think about the products they are managing?[2]

To answer these questions, I construct a unique data set containing detailed personal, non-public (i.e. private) wealth data of 361 Swedish mutual fund managers from 1999 to 2007. I start from Morningstar data on the universe of mutual funds sold in Sweden—a country with a highly developed mutual fund industry—and then link the names and tenure of the individuals managing funds to tax records.

I first focus on the fund performance of the managers who invest personal money into the very same funds they professionally manage, that is the managers who have "skin in the game." In contrast to the vast amount of capital allocated to mutual funds by regular investors, more than 60% of the managers do not invest their own money in their own funds. The funds at which managers do commit their own personal money subsequently outperform relative to the funds with no managerial commitment. Controlling for wealth differences, a one million Swedish Krona ($\approx$ $150,000) increase in the amount managers invest in their own funds is associated with a four percentage points larger future annual fund alpha and a 0.5 larger information (appraisal) ratio, both estimated relative to the benchmarks stated in

[1] Fama and French (2010) find no evidence that the average manager beats her benchmark after costs, but do find evidence of inferior and superior performance in the extreme tails. Kosowski et al. (2006) find that a subset of managers have stock-picking ability, whereas Kacperczyk, Van Nieuwerburgh, and Veldkamp (2014) provide evidence of time-varying fund manager skill. Other studies that point to superior ability of a set of managers include Pástor and Stambaugh (2002), Kacperczyk, Sialm, and Zheng (2005), Kacperczyk, Sialm, and Zheng (2008), Baker et al. (2010), and Kempf, Spalt, and Manconi (2017).

[2] This revealed preference approach is similar in spirit to the approaches by Berk and van Binsbergen (2016) and Barber, Huang, and Odean (2016) who use regular fund investors' capital allocation decisions to back out investors' preferences. Koijen (2014) estimates a structural model and finds that a fund's alpha reflects not only managerial ability but also managers' risk preferences and incentives.

the fund's prospectus.[3] While a four percent increase in alpha is a large effect, a one million SEK increase corresponds to two standard deviations, and is thus also a significant increase for the median manager. The positive relationship between personal investments and fund performance is driven by the managers who invest a lot in their own funds. These managers manage around 11% of the funds in the sample and on average invest one million SEK in their funds, which accounts for 40% of their total personal stock and fund investments. Their funds outperform their benchmarks by a 2.1 percentage points alpha after costs. Much of the variation of fund performance to personal investments is driven by cross-sectional differences across funds, but even for a given fund years of larger managerial commitment are associated with a better performance in the subsequent year.

The positive relationship between personal investments and fund performance immediately suggests that the managers who invest in their own funds have superior information about their funds' future performance and thus—since they are the ones managing the funds—superior information about their own ability to generate abnormal returns with their funds (henceforth "ability"). In other words, the managers who invest in their own funds appear to be highly certain about their superior ability, or are at least rightfully confident, which stands in constrast to the overconfidence that has been documented for firm CEOs (see, e.g. Malmendier and Tate, 2005).[4] On the other hand, the worse performance of the managers who do not invest in their own funds suggests that the majority of managers rightfully lack confidence in the products they are managing.

Furthermore, in contrast to how regular fund investors dynamically allocate capital to funds (Chevalier and Ellison, 1997; Sirri and Tufano, 1998), I find no evidence that managers systematically update the investments they make in their own funds following years of good or bad past performance.[5] In contrast, the amount invested appears to be rather persistent with an autocorrelation coefficient of 0.67. Persistent investments are consistent with the notion that managers are highly certain about their ability, or lack thereof, and do not need to update their beliefs from past returns like regular fund investors (Berk and Green, 2004).

Consistent with this interpretation, managers are not forced to invest in their own funds but appear to do so voluntarily: over the sample period, the regulator(s) indicated no re-

[3] All Swedish Krona (SEK) amounts in this paper are expressed in 2005 SEK. The exchange rate between the U.S. dollar and the Swedish krona was 1 to 6.71 at the beginning of 2005.

[4] Bai et al. (2017) show that variation in fund managers' birth months is associated with variation in fund performance and link it to managerial confidence.

[5] Ferreira et al. (2012) document a convex-flow performance relationship for Swedish mutual funds. The convex-flow performance relationship documented in the literature has been challenged by Spiegel and Zhang (2013).

quirement or recommendation for fund managers to invest in their own funds.[6] It may be that individual corporate policies require managers to invest in their own funds and/or managers with superior ability may match with employers where such requirements are common. I document significant differences in the amounts managers invest in their funds across fund families (firms) but even *within* a fund family there exists variation of personal investments to fund performance.[7] Systematic differences across fund families in Sweden have been highlighted in Ibert et al. (2018) who infer managerial compensation contracts from realized managerial income and find that the fund family accounts for much of the cross-sectional variation in managerial compensation.[8] Berk, van Binsbergen, and Liu (2017) suggest that the fund family, not necessarily the fund manager, has superior information about a manager's ability and rewards the best ones with larger funds to manage. In contrast, the fact that my results hold up within a fund family suggests it is the manager who has superior information because it rules out the fund family as the sole determinant of the observed cross-sectional dispersion in the amount managers invest in their funds.

In contrast to the managers who directly invest in their own funds, some managers decide not to earn their entire fund's return on their personal capital by investing in their funds but to buy individual components of their funds in their personal accounts (overlapping holdings) (Bodnaruk and Simonov, 2015). I find no evidence that managers who buy overlapping holdings perform better with their *funds* providing a potential reason why these managers do not invest their personal money in their funds in the first place. Next, I confirm that by buying overlapping holdings, managers are indeed—as one would expect—betting on their "best ideas" (Cohen, Polk, and Silli, 2010). Specifically, I find that managers tilt their funds towards securities that are also held in their personal accounts. Managers earn economically large returns with their best ideas but some of the statistical tests lack power. There is no evidence for cross-sectional differences in the ability to attract fund flows that could help explain why some managers decide to directly invest in their funds while others instead only

[6]European mutual funds, including the vast majority of Swedish funds, are commonly regulated under the UCITS directives. As of the introduction of UCITS V in June 2016, remuneration structures need to include rules on variable and fixed compensation, including a requirement that at least 50% of variable remuneration be in the form of units of the fund.

[7]Other characteristics that are significantly correlated with the amount invested besides the fund family a managers works for are gender (females invest less), cash holdings (see below), the number of funds a manager manages, and the investment category of the fund.

[8]Ma, Tang, and Gómez (2016) study the qualitative features of U.S. fund managers' compensation contracts, whereas Ben Naim and Sokolinski (2017) study the quantitative features of fund managers' compensation contracts in Israel. Theoretically, Cuoco and Kaniel (2011) study the equilibrium price effects of different managerial compensation contracts.

buy small parts of their funds.[9] I conjecture that managers do not tilt their fund portfolios more towards their best ideas because of tracking error constraints (career concerns) or regulatory diversification constraints. It is not clear what other mechanisms could explain why some managers invest in overlapping holdings and others invest in their funds. Ultimately, a manager's ability derives from having superior information about individual securities. The results on overlapping holdings are thus consistent with manager's being highly certain about the information they possess and investing their personal wealth accordingly. In the case of overlapping holdings, managers rightfully do not invest in their funds but only cherry pick the small subset of best ideas.

Next, I further investigate cross-sectional differences in the composition of managers' personal portfolios. Portfolio choice models with information acquisition usually collapse to the traditional diversified mean-variance solution in case an agent has not acquired any information (see, e.g., Van Nieuwerburgh and Veldkamp, 2010). In case a manager does not invest in her own fund nor in overlapping holdings, she presumably has not acquired any information, and is thus expected to hold a diversified portfolio. One of the risks she may have to diversify is her labor income risk, which is correlated with fund performance. Indeed, the managers who do not invest in their own funds hold more cash in their personal accounts and ultimately cash hedges income risks. If the managers who do not invest in their own funds do invest in the stock market, they hold more passive funds, that is they seek more zero-alpha assets—assets that are by definition unable to outperform.

The paper contributes to several strings of literature. The positive relationship between managers' personal investments and fund performance has been reported in Khorana, Servaes, and Wedge (2007) and Evans (2008).[10] In contemporaneous work, Gupta and Sachdeva (2017) document that inside investments predict future performance for hedge funds and relate it to capacity constraints. In their model, managers internalize that investing personal wealth in the fund earns the fund's abnormal return but pushes the fund further to its

[9] Although the personal wealth data is not accessible for the general public, investing in one's own fund may privately signal commitment to a subset of investors (e.g. large institutional investors).

[10] In the U.S., the SEC as of 2005 requires managers to report whether the dollar ownership in their own funds falls in one of the following ranges: \$0, \$1 - \$10,000, \$10,001 - \$50,000, \$50,001 - \$100,000, \$100,001 - \$500,000, \$500,001 - \$1,000,000, or above \$1,000,000. The positive relationship between fund ownership and performance has been picked up by the popular press, and a recent WSJ article recommends investors to pick managers who "eat their own cooking." (https://www.wsj.com/articles/find-mutual-fund-managers-who-eat-their-own-cooking-1433518014). Chen, Goldstein, and Jiang (2008) and Cremers and Petajisto (2009) analyze the investments of mutual fund directors. Robinson and Sensoy (2013) study the relationship of performance and ownership for a sample of private equity funds but find no evidence that lower ownership is associated with lower net-of-fee performance.

capacity constraint lowering the abnormal returns for all investors. Inside investments for mutual funds are, contrary to inside investments for hedge funds, trivial in relation to fund size, making it unlikely that mutual fund managers face a similar trade off.

Contrary to the aforementioned studies the personal wealth data that I observe is, first, not publicly available, and second I do not only observe managers' investment in their own funds but their entire wealth allocation. The latter allows me to finely differentiate between managers investing in their own funds and managers investing solely in their high conviction ideas. I contribute relative to the aforementioned studies by documenting cross-sectional differences in how active mutual fund managers invest in their personal accounts that are remarkably consistent with fund managers being highly certain about the quality of the products they are managing and the information they possess about individual securities. This interpretation in conjunction with the combined evidence is novel and stands in contrast to the common assumption in the theoretical literature. For instance, in Berk and Green (2004) investors and managers have symmetric information and are both uncertain about a manager's ability (although symmetric information is not necessary for their main results). Although the paper focuses on the cross-section, the time-series evidence on variation of fund performance to managers' personal investments for a given fund and on variation of managers' personal investments over time are also new.

There are few papers that theoretically study the portfolio choice problem of fund managers who can invest both personally and professionally. A notable exception are Kaniel, Tompaidis, and Zhou (2017) who present a model in which fund managers have the ability to generate abnormal returns and study the impact of managerial commitment on fund risk taking. They find that a manager with higher ability does not necessarily achieve higher expected returns but lower idiosyncratic volatility, thus larger Sharpe ratios, which is consistent with my baseline results that scale a fund's alpha by idiosyncratic volatility.

Bodnaruk and Simonov (2015) study a similar data set of personal wealth data for 84 Swedish fund managers from 2001 to 2007. They find no evidence that managers outperform in their personal portfolios relative to a group of peer investors, but consistent with my results find that managers perform better in their best ideas. While they focus on evaluating the performance of the average manager in her personal portfolio, the focus of this paper is on the performance of fund managers in their funds and cross-sectional differences in their personal portfolios.

Berk and Green (2004) and Berk and van Binsbergen (2015) propose the dollar value added as a measure of managerial skill and find that the average manager is skilled. Hav-

ing defined a manager's ability as her ability to generate abnormal returns with her fund, in the framework of Berk and Green (2004) my results imply that managers have private information about their funds' equilibrium size. The managers who are certain that their funds run below their equilibrium size invest in their funds and are able to capture a positive alpha. On the other hand, the managers who do not invest in their own funds are certain that their funds run at or above their equilibrium size and, thus, do not commit personal money to their funds. The fact that alphas are predictable by personal investments implies that investors' learning about managerial ability from past returns is incomplete and could be amplified if the Swedish policy maker required managers to publicly disclose the personal investments in their own funds. Incomplete learning mirrors the conclusion of Choi, Kahraman, and Mukherjee (2016) who examine investors' capital allocations to managers with multiple funds and find that investors' learning from past returns only is incomplete. The exact policy implications, however, require an equilibrium model as Berk and van Binsbergen (2017) highlight.

The rest of this paper is organized as follows. Section 2 describes the data and Section 3 provides descriptive statistics of how fund managers invest their private wealth. Section 4 shows that managers who invest in their own funds subsequently outperform with their funds. Section 5 shows that managers who invest in overlapping holdings bet on their best ideas and subsequently do not outperform with their funds. Section 6 investigates cross-sectional differences in fund managers' personal portfolios and finds that managers who neither invest in their funds nor in overlapping holdings hold more cash and more passive products in their personal portfolios. Section 7 shows that the main results are robust. Section 8 concludes.

# 2 Data and Methodology

## 2.1 Fund data

From Morningstar Direct, I retrieve a survivorship bias-free dataset of open-ended mutual funds for sale in Sweden or the Nordic region for the period 1990 to 2015. The sample is then restricted to funds that were present at some point during 1999–2007 due to the availability of manager wealth data. The data are on the share class level and include AUM and return series, annual total expense ratio (TER) series, an investment category indicator, and the name of the prospectus benchmark index. The AUM and TER time series from Morningstar Direct are complemented by two additional sources, Bloomberg and some hand-collected data from AMF Fonder. Missing AUM and TER values for a given fund are imputed using

the algorithms described in Appendix A.1. Several funds have multiple share classes. The different share classes of a fund are aggregated into a single fund observation by summing up AUM across share classes and taking AUM-weighted averages for all other variables. The raw data include 1,103 funds belonging to 91 fund companies (identified by Morningstar's "BrandingName" variable). From this sample, I eliminate money market mutual funds, index funds (identified by Morningstar as such or by the word "index" in their name), and the four government pension funds that invest public pension money. These funds are fundamentally different from an ordinary actively managed mutual fund. The funds' remaining investment categories are: Equity, Allocation, Alternative, Fixed Income, and a Rest category in which commodity funds, miscellaneous funds, and funds where the category variable is missing are grouped. The Alternative category contains some hedge funds, which in Sweden are allowed to market themselves directly to the general public. The funds in the sample invest their assets in various international markets, but by far the two most common investment areas are "Sweden" and "Global."

For the funds domiciled in Sweden, I obtain holdings data from the Swedish Financial Supervisory Authority (Finansinspektionen) and hand-match these to the funds in Morningstar based on ISINs. Finansinspektionen requires the funds domiciled in Sweden to file quarterly holdings and makes the data publicly available. Unfortunately, not all funds for sale in Sweden or the Nordic region are domiciled in Sweden, which leads to a loss of around 180 funds when working with fund holdings data (henceforth "restricted sample").[11]

## 2.2 Manager data

Morningstar also provides a manager history for each fund. The history contains the first and last name of each manager with a start and end date. Using publicly available sources, the manager names are hand-matched to social security numbers, which are then matched with tax records from Statistics Sweden, the government's statistical agency. Appendix A.2 details the matching procedure. The data from Statistics Sweden include demographic information such as age, gender, and education as well as income variables such as labor and capital income. The data set is similar to the one used in Ibert et al. (2018). Unique

[11]The most common domiciles besides Sweden are Luxembourg and Finland. In general, the holdings data is quarterly, but there are gaps: The data starts in 09/2000, has a one-year gap between 12/2000 and 12/2001, a half-year gap between 06/2002 and 12/2002, a half-year gap between 12/2003 and 06/2004, and finally a one-year gap between 06/2004 and 09/2005. When working on the monthly frequency, I fill in the holdings for each fund forward from the last quarterly observation, except for the first nine months in 2000, for which I fill in backwards.

to this paper is the use of highly disaggregated wealth information available from 1999 until 2007 when Sweden levied a wealth tax. On December 31 of each year, the data show a snapshot of the portfolio holdings at the individual security level (identified by an ISIN) as well as cash in bank accounts, real estate ownership, and outstanding debt. In particular, the data show how much a fund manager personally invests in the very same fund that she manages. Returns and prices for non–mutual fund Nordic personal holdings up to 2009 are retrieved from the FINBAS database. For securities not covered by FINBAS, I use data from Datastream and Morningstar.

The raw data include 832 managers, but the final sample contains only 361 managers. Many of the manager names are Finnish, Danish, or Norwegian and likely stem from the inclusion of Nordic cross-borders funds. The final sample contains 556 funds.[12] Table A1 shows in detail how I arrive at the final sample.

## 2.3 Definitions

A fund's monthly gross return is its monthly net return plus the annual TER divided by 12. Alphas and returns are net of costs unless otherwise indicated. A manager's personal risky financial wealth (risky portfolio) is the sum of non–money market fund and direct stock investments. Cash is the sum of money market funds and bank account holdings. Financial wealth is the sum of risky financial wealth, cash, bonds, capital insurance, structured products, derivatives, and other financial wealth. The risky share is risky financial wealth over the sum of cash and risky financial wealth. (Net) Wealth is the sum of financial wealth, commercial, and noncommercial real estate net of debt. These definitions closely follow Betermier, Calvet, and Sodini (2017).

## 2.4 Aggregation and performance measurement

The data consist of a panel of fund-month observations for high frequency fund level variables such as returns and fund size and a panel of manager-year observations for the personal wealth data. The distinction between a manager and a fund arises because a manager can manage multiple funds, a fund can have multiple managers at the same time, and a fund can turn over its managers over time. Because of such cases, managers as well as funds can appear multiple times in the combined panel. The combined panel is aggregated to

[12] A fund is included in the sample if data on at least one of the managers managing it is available, but in cases of team management not all managers are required to be identified.

the fund level (indexed by $i$) by taking equal-weighted averages of manager ($m$) level variables whenever the dependent variable in a regression varies on the fund level. Specifically, in cases of team management the amount the $N_{i,t}$ managers of a given fund $i$ in a given year $t$ commit to their fund and the fund's wealth are defined as follows:[13]

$$Amount\ in\ MF_{i,t} = 1/N_{i,t} \sum_{m=1}^{N_{i,t}} Amount\ in\ MF_{m,i,t} \tag{1}$$

$$Wealth_{i,t} = 1/N_{i,t} \sum_{m=1}^{N_{i,t}} Wealth_{m,t} \tag{2}$$

Similarly, if the dependent variable in a regression varies on the manager level the combined panel is aggregated to the manager level. The manager level counterparts of fund level variables are defined by taking AUM-weighted averages of fund level variables (following Berk, van Binsbergen, and Liu, 2017). For instance a manager's AUM and TER in a given year $t$ are:

$$AUM_{m,t} = \sum_{i=1}^{N_{m,t}} AUM_{i,t}/N_{i,t} \tag{3}$$

$$TER_{m,t} = 1/AUM_{m,t} \sum_{i=1}^{N_{m,t}} \frac{AUM_{i,t}}{N_{i,t}} TER_{i,t} \tag{4}$$

where all variables are measured at year's end and $N_{m,t}$ is the number of funds a manager manages in a given year. In case a manager manages multiple funds, the amount she invests in her own funds is simply the sum across funds, $Amount\ in\ MF_{m,t} = \sum_{i=1}^{N_{m,t}} Amount\ in\ MF_{m,i,t}$. To assess yearly fund performance, I estimate a standard factor regression year-by-year:[14]

$$R_{i,s} - R_{f,s} = \alpha_i^{BM} + \beta_i^{BM}(R_{i,s}^{BM} - R_{f,s}) + \epsilon_{i,s}^{BM} \tag{5}$$

where $s$ indicates a month, $R_{i,s}$ is the net fund return, $R_{f,s}$ is the risk-free rate as approximated by the one-month STIBOR rate, and $R_{i,s}^{BM}$ is the fund's benchmark return as stated in the fund's prospectus. The prospectus benchmark is of particular relevance since an active

[13] Following the procedures in Appendix A.2, 36 managers of team managed funds remain unidentified. For the aggregation to the fund level, their amount invested and other non-calculable manager variables are imputed using the mean of other fund managers at the same fund.

[14] To estimate the coefficients, a full set of 12 monthly observations is required. This approach is slightly different from the one used in Ibert et al. (2018) to keep the regressions entirely predictive. They estimate betas over the whole sample and then compute abnormal returns within a year.

fund manager promises to deliver an alpha relative to the prospectus benchmark, which is the ultimate reason why investors pay a fee to the manager. Appendix A.3 provides details about the prospectus benchmarks and describes alternative benchmark/factor models.

Following Kosowski et al. (2006) and Fama and French (2010) the main measure of fund performance this paper uses is a fund's information ratio (IR), which scales a fund's alpha in a given year ($\alpha_{i,t}$) by its residual volatility ($\sigma_{\epsilon,i,t}$). The results are robust using plain alphas. The information ratios in this paper are equivalent to the t-statistic of alpha up to a scaling constant since they are estimated year by year.

Berk and van Binsbergen (2015) point out that the net alpha in Equation (5) is the relevant measure of managerial ability for fund investors. The managers who invest in their own funds are fund investors, but they are not regular fund investors. It is unclear whether managers face the same costs as regular fund investors when investing in their own funds. First, a manager may not pay the same price for the fund, and second, investing in her own fund directly (and potentially indirectly) increases fund size, which increases her salary. Therefore, it is unclear whether a sufficient condition for a manager investing in her own fund is a positive net or a positive gross alpha. I present results with net alphas and net information ratios but emphasize that net returns may understate a manager's return on the personal capital invested in her fund.

## 2.5 Fund size and fund performance

Panel A of Table 1 shows summary statistics for the 2,416 fund-years, corresponding to 556 funds and 9 years, that enter the final sample. The median fund-year is managed by exactly one manager, has 658 million SEK in AUM, and a yearly TER of 1.4%. Panel B of Table 1 shows that even before costs, the median fund has trouble beating its benchmark. The prospectus benchmark annualized gross alpha has a median of zero and a mean of 25 basis points. The performance measures net of costs in Panel C of Table 1 are disheartening for Swedish fund investors. The mean prospectus benchmark alpha after costs is minus one percentage point, the median being the same.[15] These results are similar when alternative benchmarks are used to assess fund performance (unreported).

[15] See Dahlquist, Engström, and Söderlind (2000) and Flam and Vestman (2014) for earlier studies of fund performance in Sweden.

# 3 How Fund Managers Invest Their Personal Wealth

## 3.1 Descriptive statistics

Part I of Table 2 shows summary statistics for the 1,380 manager-years, corresponding to 361 managers and 9 years, in the final sample. The median manager manages two funds that belong to the same investment category. Panel B shows that average income is 1.5 million SEK. Average net wealth is 4.3 million SEK, but the distribution has positive skewness. Panel C of Table 2 shows that the majority of managers do not invest in their own funds. Even in cases of investment the absolute investment remains modest: at the 90th percentile, the investment is only 319,000 SEK ($\approx$ 50,000 USD). Part II of Table 2 shows summary statistics for selected variables for the restricted sample.

## 3.2 Portfolio compositions

Panel (a) of Figure 1 visualizes the average portfolio composition of fund managers over time. The vast majority of financial wealth is invested either in cash, funds, or directly in stocks.[16] Panel (b) contrasts this with the evolution of the average portfolio composition for the whole Swedish population. Two facts stick out. First, fund managers invest a larger fraction of their financial wealth in risky assets than the average Swede which is consistent with Calvet, Campbell, and Sodini (2007) who find that financially sophisticated investors invest more aggressively. Second, whereas the average Swede's risky portfolio consists mainly of mutual funds, fund managers invest a sizable part of their financial wealth directly in the stock market. The three most commonly held securities in the portfolios of fund managers are Ericsson (ISIN SE0000108656), Telia (ISIN SE0000667925), and H&M (ISIN SE0000106270). Panel (b) decomposes managers' risky assets further into professionally managed funds by the very same manager, funds from the same fund family,[17] unrelated funds,[18] overlapping stocks, and finally unrelated stocks. The average manager invests slightly less than 15% of her risky portfolio in her own funds.

[16] The exact composition of capital insurance accounts (Kapitalförsäkringar) is not observed. These may also contain stock and fund investments. However, as Panel (a) of Figure 1 depicts, capital insurance accounts as a proportion of the risky portfolio are small on average.

[17] Managers can work for multiple families. In such cases all funds from these families are included.

[18] A very small fraction, not shown in the figure, of managers privately invest in funds that are not from the same family, and they invest in the very same funds via their own professionally managed mutual fund(s). These are overlapping fund holdings and, thus, not strictly unrelated.

## 3.3 Investment restrictions

Mutual fund managers face trading restrictions in their personal accounts either by law or by corporate policies from the fund families that employ them. Not surprisingly, insider trading is prohibited by Swedish law. Moreover, the Swedish Securities Dealers Association, an association representing the common interest of banks and investment services firms active on the securities market, regularly publishes guidelines on employee trading.[19] Most, if not all, Swedish fund companies are in turn members of the Swedish Mutual Fund Association, and the Swedish Mutual Fund Association references the Dealers Association's guidelines. For the sample period, the guidelines are summarized as follows: (i) All employees shall notify their employer of their own holdings, and those of closely related persons, of financial instruments and changes in such holdings; (ii) closing a position with a profit until 30 days have passed from when the position was initiated is prohibited (closing with a loss is allowed). There was no legislation or official recommendation requiring a fund manager to be invested in her own fund. Although the econometrician can observe managers' personal investments in their own funds ex post, contrary to the U.S. there exists no requirement for Swedish fund managers to file their investments publicly, which means these investments are likely not observable to the regular investor.

Individual corporate policies may deviate from these guidelines. Almost all managers participate in the stock market and, as shown above, sometimes do so with individual positions that overlap with the holdings of the professionally managed mutual fund. Thus, the restrictions outlined above and potential nonobservable firm-specific restrictions do not restrain managers from making such investments. All in all, it seems like fund managers are in control of their own wealth and the investments they make are voluntary. I further investigate the role of the fund family within the next section.

[19] The historical documents (in English) can be found here: http://www.fondhandlarna.se/regler-mm/anstalldas-vardepappers-och-valutaaffarer/historik. Kaniel, Tompaidis, and Zhou (2017) discuss in detail the regulations that apply to U.S. fund managers who trade in their personal accounts.

# 4 Predicting Fund Performance

## 4.1 Cross-sectional differences in fund performance

I postulate the following (main) specification to show that funds with larger managerial commitment subsequently outperform relative to funds with less managerial commitment:

$$\widehat{IR}_{i,t}^{BM} = \gamma_i + \gamma_t + \gamma_c + \delta Amount\ in\ MF_{i,t-1} + \theta Wealth_{i,t-1} + \zeta' X_{i,t-1} + \eta_{i,t} \tag{6}$$

where $\gamma_t$ is a year fixed effect, $\gamma_i$ a fund fixed effect, and $\gamma_c$ are investment category fixed effects. $\widehat{IR}_{i,t}^{BM}$ is the fund's information ratio, $\alpha/\sigma_\epsilon$, in a given year. $Wealth_{i,t}$ is net wealth (net worth), the most comprehensive measure of wealth. The controls $X_{i,t}$ include age ($Age$), experience (in years) as a fund manager ($Exper$), labor income ($Income$), gender ($Female$), AUM, TER, the number of categories a manager manages ($NumCategories$), the number of funds a manager manages ($NumFunds$), and the number of managers on a fund ($NumManagers$). The regressions also control for a fund's risky share $RiskyShare_{i,t}$ to account for cross-sectional differences in managerial risk-aversion (in addition to risk-adjusting the dependent variable).[20] If the funds with larger personal investments in fact realize larger information ratios subsequently, I expect a positive coefficient estimate $\widehat{\delta}$. Standard errors are clustered by funds.

Column (1) of Table 3 shows the main specification without controls. A one million SEK increase in the amount a manager invests in her fund in a given year is associated with a 0.882 larger information ratio in the following year. Put differently, a one million SEK increase, which is a large increase for the average manager (roughly two standard deviations), is associated with a t-statistic of alpha that is $\sqrt{12} \times 0.8882 \approx 3$ units larger.[21] Column (2) of Table 3 shows that the positive relationship between personal investments and fund performance is robust to the inclusion of the control variables, although the coefficient estimate on the amount invested drops slightly to 0.528.

Khorana, Servaes, and Wedge (2007) provide two interpretations for the positive relationship between managerial commitment and fund performance. Increased commitment may improve a manager's incentives to generate superior performance or fund managers may have

[20] 33 fund-year observations have a risky share that is undefined because the manager(s) at the fund neither own cash nor stocks or funds. These observations are, thus, excluded from the regression.

[21] The results are robust to winsorizing the amount invested and information ratios at the 1 and 99% levels. The results are also robust when standard errors are clustered by fund family and when investment area fixed effects are included. The number of observations varies across columns because singleton observations are not included in the fixed effects specifications.

superior information about their future fund performance or both. Put differently, either the coefficient estimate $\widehat{\delta}$ is causal or it is not. Without any exogenous variation, I do not attempt to establish causality. In stark contrast, my interpretation is that the coefficient estimate on the amount invested in one's own fund is *not* causal: the amount managers invest in their own funds merely reveals their unobserved ability.

Column (3) of Table 3 includes fund fixed effects to account for such cross-sectional differences in unobserved ability that are constant over time. The adjusted r-squared jumps from 13.4% to 31.8% suggesting that a chunk of the variation of personal investments to fund performance is indeed driven by cross-sectional differences in unobserved ability. Nevertheless, the point estimate on the amount invested remains similar in magnitude and significant, suggesting that a given manager performs better in years in which she is more committed to her own fund. This finding is consistent with both (i) managers exerting more effort when they are more committed (causal interpretation), and (ii) with managers increasing the exposure to their own funds when market conditions for outperformance are more favorable (non-causal interpretation).

To highlight these endogeneity concerns, suppose the amount invested was exogenous and the coefficient estimate in Equation (6), thus, had a causal interpretation. If the cross-sectional dispersion in personal investments was not driven by self-selection according to ability, there would remain few players that could induce such cross-sectional dispersion. More specifically, some fund families may require managers to invest in their own funds. For instance, the requirement to invest personal wealth is a common feature of hedge fund firms or private equity firms.[22] Column (4) of Table 3 shows that the results are not driven by such fund family fixed effects. Even within a fund family there exists variation of personal investments to fund performance, which supports the notion that managers self-select in investing in their funds according to their ability.

The distribution of the amounts managers invest in their own funds is positively skewed. The majority of managers invest nothing, lots of managers invest small amounts, and some managers invest a million dollars. Column (5) of Table 3 shows that the managers who invest large amounts in their funds drive the results. Column (5) runs a piecewise constant regression and bins the amount managers invest in their own funds in four equally spaced quartiles conditionally on a positive investment (the coefficient on the funds with no personal investments is omitted). The funds in the largest quartile earn a 1.1 larger information ratio

[22]However, even if some fund families require their managers to invest, that requirement is likely not exogenous because the matching of fund families to managers is not exogenous.

relative to the funds with no personal investments. The funds in the largest quartile amount to 11% of the total sample of funds and their managers on average invest one million SEK in their funds, which accounts for 40% of their risky financial wealth. Managers with large investments driving the results does not change the interpretation from "managers who invest in their funds outperform" to "managers who invest a lot in their funds outperform" since the latter are a subset of the former. Instead, the non-linear results in Column (5) merely reflect a low r-squared—a common feature when predicting (fund) returns.[23]

Throughout Table 3, three other variables are significant predictors of future fund performance. Fund size negatively affects fund performance which mirrors the results in the decreasing returns to scale literature (see e.g. Pástor, Stambaugh, and Taylor, 2015).[24] Funds that have larger expense ratios and funds at which managers manage multiple investment categories have lower information ratios. The latter result is consistent with the idea that investment ability is highly specialized and not ubiquitously applicable across different investment categories (Agarwal, Ma, and Mullally, 2016; Evans, Gil-Bazo, and Lipson, 2017). While the total capital allocated to a fund by regular investors deteriorates fund performance, the total amount *all* fund managers in the sample allocate to a particular fund, excluding the manager(s) who manage the fund, positively predicts fund performance (unreported). Thus, there is some evidence that fund managers as a group are able to identify an outperforming fund even when the fund is not their own. The relevant coefficient estimate in a specification similar to Column (2) of Table 3 is 0.15 with a t-statistic of 2.09.

## 4.2 Persistence and performance relative to benchmark

Panel (a) of Figure 2 plots annual net alphas over time time for a no investment group and four quartiles based on the amount a manager initially invests in a particular fund, that is at the end of the first year when she starts to appear in the data.[25] Alphas for the top

[23] An alternative way to document the positive correlation between the amount invested and fund performance is to consider the top performers relative to the bottom performers and compute the amount invested at both types of funds. I sort the 2,416 fund-year observations into four quartiles based on their information ratios. The worst performing funds (quartile 1) feature average investments of 34,000 SEK while the best performing funds (quartile 4) feature average investments of 141,000 SEK; the relationship is monotonically increasing.

[24] Specifically, my specification with fund fixed effects is similar to Equation (2) in Pástor, Stambaugh, and Taylor (2015). They note, however, that the fixed effects estimator can be biased in small samples.

[25] For the majority of managers, the year they first appear in the data is the year when they start managing a fund. However, some managers manage funds already before 1999. The initial sorting is based on manager-fund combinations, that is the combined panel is not aggregated to the fund level because funds turn over their managers over time and become or stop being team managed over time. The top quartile contains 47 managers managing 44 funds. In contrast to the baseline analysis, the figure also uses fund return data post

quartile persist up to three years. Traditional studies of persistence in fund returns find little evidence for persistence in returns for top performers, see e.g. Grinblatt and Titman (1992), Carhart (1997). Traditional persistence tests rank funds based on short-term past performance which may result in little evidence of persistence because the ranking is largely based on noise. In contrast, the allocation a manager makes to her own fund is precisely measured.

Panel (b) of Figure 2 bins managers not based on the amount, but the fraction of their financial wealth they invest in their funds. The results are similar compared to Panel (a). Subsection 7.1 discusses in detail the relationship between the amount invested and the share of wealth it accounts for.

Figure 2 also illustrates that the managers who invest (a lot) in their own funds not only outperform relative to the managers who do not invest in their own funds, but also relative to their benchmarks after subtracting the fund's operating costs and management expenses.

## 4.3 Managerial learning

How are the managers who invest in their own funds able to predict their fund's future outperformance? The regressions in subsection 4.1 control for experience and age, but omit measures of past performance.[26] One natural conjecture is that managers have learned about their own ability from past performance. Managerial learning would imply that managers increase (decrease) the amounts they invest in their own funds following good (bad) past performance—just like regular investors allocate capital to funds (Chevalier and Ellison, 1997; Sirri and Tufano, 1998; Ferreira et al., 2012). Appendix B investigates manager flow-performance regressions and finds no evidence that managers systematically update the investments in their own funds following past performance. This is consistent with the idea that managers, in contrast to fund investors, are highly certain about their ability and do not need to update their beliefs from past returns.

Arguably, however, at some point over their career, maybe even before becoming a fund manager, the managers who invest a lot in their own funds must have accumulated the wealth that they now invest in their own funds. Presumably, the accumulation of wealth is related to the development of strategies which these managers now employ to outperform with their funds. Investigating cross-sectional differences in career paths before becoming a

2008.

[26] In unreported results, I have also controlled for a specialized finance education and military assessment scores, both without any change in results.

fund manager represents an interesting area for future research but is outside of the scope of this paper.

### 4.4 The role of the fund family

Subsection 4.1 shows that the positive relationship between personal investments and fund performance holds up within a firm. Nevertheless, there are significant differences in the amounts managers invest in their own funds and fund performance across fund families. The Swedish fund market is dominated by four large commercial banks (Big 4) that own the majority of assets under management and funds.[27] Funds of the Big 4 account for 1,368 of the 2,416 observations in the baseline regression. They earn an average annual net alpha of -1.5 percentage points, which is significantly different from the net alpha of non-big 4 funds, which is zero. The predominant role and underperformance of asset management divisions of commercial banks is not a fact unique to Sweden; Ferreira, Matos, and Pires (2017) provide international evidence. The Swedish regulator has even publicly called out the asset management divisions of large commercial banks for being closet indexers.[28] Strikingly, managers at the Big 4 on average commit 12,000 SEK to their funds, whereas their counterparts at other families on average commit 140,000 SEK.

Overall, these results are potentially consistent with a segmented labor market and models of ability in short supply where managers with superior ability match with particular types of fund families and commit personal money to their own funds.[29]

## 5 Overlapping Holdings

### 5.1 Fund performance of managers who invest in overlapping holdings

So far the paper has focused on the personal wealth a manager invests in her own fund. The fact that managers are legally allowed to buy overlapping holdings theoretically allows

[27] These are Handelsbanken, SEB, Swedbank, and Nordea.

[28] Source: https://www.ft.com/content/101bde26-d2a1-11e6-b06b-680c49b4b4c0

[29] The results, however, do not imply that large commercial banks behave irrationally by employing managers who apparently lack ability. In fact, Kostovetsky and Manconi (2016) argue that firms realize their ability, or lack thereof, to generate abnormal returns. Perhaps managers at the large commercial banks have other skills than generating alpha that justify their pay. These skills could be soft skills, such as catering to existing clients and attracting new clients (Del Guercio and Reuter, 2014; Gennaioli et al., 2015).

managers to entirely replicate their funds in their personal accounts. Directly investing in one's own fund and *entirely* replicating one's own fund in one's personal account are equivalent in terms of the return on the invested capital. Replicating in one's own account may even avoid paying the fund's management fee. On the other hand, an advantage of investing in one's own fund may be to (privately or publicly) signal commitment to fund investors to attract fund flows. Appendix C investigates such cross-sectional heterogeneity in the ability to attract flows but, in short, finds no evidence that managers who directly commit money to their own funds attract more inflows.

Empirically, investing in one's own fund directly and replicating it in one's personal account capture two different aspects. First, unsurprisingly managers never entirely replicate their funds in their personal accounts. The average fund has around 100 holdings, of which only a handful, if any, are held in a manager's personal account. Second, in contrast to managers who invest in their own funds, managers who invest in overlapping holdings do not outperform with their funds. Table 4 re-estimates Columns (1)–(4) of Table 3 but adds the amount managers invest in overlapping holdings as an independent variable. The point estimates on the amount invested in overlapping holdings are consistently positive, but economically tiny and statistically insignificant. For instance, in Column (2) of Table 4 a one million SEK increase in the amount invested in overlapping holdings is associated with a 0.03 larger information ratio. In comparison, the same increase in the amount directly invested in the fund is associated with a 0.46 larger information ratio.

I hypothesize that not investing in one's own fund but instead in overlapping holdings is an endogenous response of fund managers who (think that they) possess superior information about a subset of securities but, for whatever reason, do not want to or are not able to trade on that information with their funds. These managers realize that their funds are not able to outperform, thus they do not invest in their funds.

## 5.2 Best ideas

To further investigate this hypothesis, I first provide evidence that managers indeed use their personal money to bet on securities that they think are particularly promising. Although the vast majority of securities in fund managers' personal portfolios are domiciled in Sweden and many funds (31%) have Sweden as their main investment area, overlapping holdings are not just a mechanical result of managers investing in their home country and managing funds that invest in securities in the same country. Figure 3 plots the weights of individual positions in funds conditional on whether the manager personally holds the

position in her personal account or not. Overlapping holdings do appear to be "best ideas" (Cohen, Polk, and Silli, 2010)—their average portfolio weight in a mutual fund is 1.5 percentage points larger relative to positions that do not overlap. Put differently, managers tilt their funds towards those securities that are also held in their personal accounts. Columns (1)—(3) of Table 5 provide the corresponding regression analysis. In Column (2), a one million SEK increase in the amount personally invested in a particular security is associated with a 0.36 percentage points larger weight in the fund.[30]

Second, to confirm that managers actually have superior information about a subset of stocks I investigate the performance in overlapping holdings. Unfortunately, the personal wealth data is only observed once per year and the true return managers earn in their personal portfolios is thus unobserved. Appendix D.1 investigates personal performance of fund managers in overlapping holdings assuming a buy and hold strategy throughout the year as in Bodnaruk and Simonov (2015). Appendix D.2 examines whether managers front run their funds and the associated performance.[31] Both appendices support the notion that managers indeed have superior information about their best ideas by showing that returns earned from overlapping holdings are economically large both on the portfolio and on the individual security level. However, statistical tests on the portfolio level lack power. Although managers tilt their funds towards their best ideas and perform better with their best ideas, as shown above there appears to be enough room for the outperformance in best ideas to not be reflected in the fund's return.

Despite making significant progress on the existence and nature of best ideas, an open question is why some managers do not replace their funds' investments with their best ideas only (and then invest directly in their funds). Consistent with a large literature on career concerns (see, e.g., Chevalier and Ellison, 1999), I conjecture that a manager having superior information about a small subset of securities may be unwilling to further tilt her fund towards these stocks because of tracking error constraints. Alternatively, regulatory diversification constraints may prevent managers from further tilting their funds towards

[30] Investments in overlapping holdings can be substantial. The maximum amount invested in overlapping holdings is 60 million SEK, accounting for 97% of that particular manager's risky financial wealth. In general, investments in overlapping holdings strongly crowd out investments in own funds (unreported).

[31] Appendix D.3 examines the performance of managers in their entire risky portfolios, which is the focus of Bodnaruk and Simonov (2015).

their best ideas, although such constraints affect all funds equally.[32][33] In unreported results, I find some evidence that managers managing highly diversified funds (measured by the number of position the fund holds) also hold a larger number of overlapping holdings in their personal accounts, presumably because the aforementioned constraints are more binding for such funds. However, ultimately the conjecture, which has important policy implications as it implies that fund investors could be better off if funds held less concentrated portfolios, is left open for prove or disprove by future research.

# 6 Cross-sectional Differences in Personal Portfolios

The positive relationship between personal investments and fund performance indicates that the managers who invest in their own funds are highly certain about their funds' superior future performance. One may argue that the managers who do not invest in their own funds do so not because they think they lack ability, but because their labor income is correlated with fund performance and they use their personal portfolios to hedge income risks.[34] First, Ibert et al. (2018) show that a manager's labor income is actually less correlated with fund performance than one may presume. Second, I *expect* a manager to hold a hedge portfolio precisely when she does not have superior information (either about her entire fund's performance or the performance of a subset of stocks).

In accordance with this prediction, Columns (1)–(3) of Table 6 show that a manager's risky share is an increasing function of the amount she invests in her own fund(s). That is, managers who do not invest in their own funds hold more cash, which ultimately hedges income risks. In contrast, managers in the top quartile of investments in their own funds invest almost 80% of their financial wealth in the stock market.[35]

[32]Swedish funds regulated according to UCITS face the so-called 5/10/40 rule. A maximum of 10 percent of a fund's net assets may be invested in securities from a single issuer, and investments of more than 5 percent with a single issuer may not make up more than 40 per cent of the whole portfolio. The corresponding U.S. threshold for investments in securities from a single issuer is 5% for diversified funds under the Investment Company Act.

[33]Alternatively, one could hypothesize that an alpha opportunity exists if an individual security is traded with a small amount of personal money but once the fund increases its weight in the security, the opportunity erodes because the opportunity is not scalable. Decreasing returns to scale alone, however, cannot explain the phenomenon of overlapping holdings since a manager could always relocate personal money invested in an overlapping holding to the fund such that the scaling constraint binds at the fund level.

[34]Betermier et al. (2012) document hedging behavior for Swedish households that switch jobs. Massa and Simonov (2006) find that—consistent with the results for my sample of fund managers—Swedish investors invest in stocks closely related to their nonfinancial income because of a preference for familiar stocks due to heterogeneous information.

[35]However, using the buy and hold assumption, I find no evidence that managers who do not invest in

Next, I investigate whether and how the managers who do not invest in their own funds delegate their personal money to other fund managers, or whether they avoid mutual funds altogether. The theoretical predictions for whether managers who lack ability to generate abnormal returns should hold more funds or more individual securities in their risky portfolios are less clear. On the one hand, a manager may want to save on the management fees of active mutual funds and, therefore, only invest in individual securities. On the other hand, investing in funds may lead to a well diversified portfolio relative to investing in individual securities. I find evidence consistent with the former prediction.

Column (4) of Table 6 shows that managers who do not invest in their own funds hold more of their risky financial wealth in passive funds, that is index funds and ETFs, relative to the managers who invest in their own funds in case they do invest in the stock market. Mechanically, a manager who invests in her own (active) fund already commits a part of her wealth to a non-passive fund. Column (5) of Table 6 removes the investments managers make in their own funds from the denominator of the dependent variable and the result holds up. While the results in Columns (4) and (5) are statistically significant, they are economically small which likely is a result of the limited availability of index funds and ETFs over the sample period in Sweden. In Column (4), a one million SEK increase in the amount invested in own funds is associated with a 0.602 percentage points lower fraction of risky financial wealth invested in passive products.

Naturally, the managers who invest in their own funds invest a larger fraction of their risky financial wealth in mutual funds relative to the managers who do not invest in their own funds. However, Column (6) shows that this result even holds up when removing the

their own funds have risky portfolios that are less correlated with the returns in their professionally managed funds compared with managers who invest in their own funds once mechanical correlation effects are removed. Calvet, Campbell, and Sodini (2007) circumvent the buy and hold assumption and measure Swedish households' diversification losses, not abnormal return performance, by estimating constant coefficients models for each individual asset in conjunction with assuming an asset pricing model. Under the assumption of an asset pricing model, individual returns of asset $j$ are given by $\mu_j = \mu_b \beta_j$ where $\mu_b$ is a factor return. The household portfolio expected return is then $\mu_h = w_h' \mu_j$. The variance of a household's portfolio can be estimated via $\sigma_h^2 = w_h' \Sigma w_h$ where $\Sigma$ is the variance-covariance matrix of all assets in the universe. Their relative sharpe ratio loss measures the differences in the Sharpe ratio achieved by the household ($S_h$) relative to a benchmark ($S_b$) index:

$$RSRL_h = 1 - \frac{S_h}{S_b} \tag{7}$$

In unreported results I find that the managers who invest in their own funds have lower sharpe ratio losses relative to a currency-hedged MSCI World Index. That is, according to the Sharpe ratio loss measure, their risky portfolios are more diversified. This may not come as a surprise as the managers who invest in their own funds by definition invest a part of their wealth in well diversified products.

amount invested in own funds from the dependent variable. Put differently, managers who do not invest in their own funds do not delegate their money to other active fund managers, but hold more individual stocks.

# 7 Robustness

## 7.1 Scaling the amount invested

The literature on fund manager ownership and performance has scaled the amounts managers invest in their own funds by fund size (see, e.g., Khorana, Servaes, and Wedge, 2007; Evans, 2008). Columns (1)–(2) of Table 7 replicate these specifications. Columns (1) and (2) have alphas as the dependent variable, Column (3) has information ratios. In Column (2), a 1% increase in ownership, that is managers' personal investments in their own funds scaled by fund size, is associated with a 2.15 percentage points larger future alpha.[36] The coefficient estimate is similar in magnitude compared to related U.S. studies. Khorana, Servaes, and Wedge (2007) document a 2.76- to 3.65 percentage point increase in annual four-factor alpha for every one-percentage-point increase in ownership.

The baseline specification controls for wealth differences such that a higher amount invested implies a larger portfolio share allocated to one's own fund. Alternatively, a natural way to scale managers' investments is scaling by wealth. Columns (4) and (5) of Table 7 shows that the results are in principal robust to including the share of personal (risky financial) wealth invested in one's own fund as an independent variable. In Column (5), however, once controls are included the coefficient is estimated imprecisely. Scaling by wealth is potentially problematic because all measures of wealth are imperfect and scaling personal investments by wealth, while at the same time controlling for wealth, restricts the coefficient estimate on the scaled variable to be constant across wealth levels (the interaction between the two variables is the amount invested). More specifically, essentially because my measures of wealth miss human capital, the specifications in Columns (4) and (5) of Table 7 assume that a 100% increase in the share of wealth allocated to one's fund is associated with the same effect on fund performance regardless of whether a manager's wealth is \$1,000 or \$1,000,000 (corresponding to an increase in absolute investments of \$1,000 and \$1,000,000, respectively).

[36] Following the logic of Berk and Green (2004), regressing fund performance on ownership is potentially problematic: Holding the absolute amount invested constant, a small fund mechanically has high ownership and large returns in the subsequent period, whereas a large fund has low ownership and low returns.

Column (6) of Table 7 restimates Column (2) of Table 3 but restricts the sample to managers with positive risky financial wealth to rule out that the above scaling results are driven by sample selection. By restricting the sample to managers with positive risky financial wealth, I also rule out that the results are driven by liquidity constraint managers who potentially cannot invest in their own funds not because they do not want to but because they do not have any liquid wealth available.

## 7.2 Alphas, alternative benchmarks and tracking error

Table 8 replicates Table 3 but uses yearly fund alphas as the dependent variable. The results are robust, although the coefficients for the specification with firm fixed effects and for the piecewise constant specification are estimated imprecisely. In Column (2) of Table 8 a one million SEK increase in the amount invested is associated with a 3.7 percentage points larger future annual fund alpha.

Table 9, Columns (1)–(4) replicate Column (2) of Table 3 but with information ratios estimated relative to the alternative benchmark models. The results are robust. Table 9, Columns (5) and (6) predict a fund's root mean square error (RMSE), more commonly known as tracking error, relative to the prospectus benchmark. Deviating from the benchmark is a necessary but not sufficient condition for outperforming the benchmark. Thus, it is not surprising that funds with larger personal investments deviate more from their benchmarks. Consistently, Cremers and Petajisto (2009) show that funds that deviate more from their benchmarks outperform. In Column (5), a one million SEK increase in the amount invested is associated with a 0.97% larger annual tracking error. The significant coefficient in Column (5) is, however, estimated imprecisely once a firm fixed effect is added in Column (6). The firm fixed effect in Column (6) is a dummy that equals one in case the fund belongs to one of the four large commercial banks. Funds at the large commercial banks track their benchmarks more closely.

## 7.3 Team management and busy managers

In case a fund is managed by multiple managers, the reasoning that a manager investing in her own fund has "superior information about her fund's future performance and thus—since she is the one managing the fund—superior information about her own ability" does not hold up, since she is not managing the fund alone. Columns (1) and (2) of Table 10 exclude team managed funds from the relevant specifications in Table 3 and show that the

results persist.

The managers managing multiple funds allow me to study whether managers invest more in those funds that subsequently perform better. Column (3) adds manager fixed effects in addition to year fixed effects to Column (2) of Table 10 to account for any characteristics that are constant across time and funds (for instance, unobserved managerial ability). The coefficients are now identified from variation of personal investments to fund performance around the time-series mean of the managers who manage multiple funds. Column (4) of Table 10 controls for manager times year fixed effects. The coefficients are now identified from variation across funds for a given manager-year. The coefficient estimates on the amount invested in Columns (3) and (4) remain positive but are insignificant. In contrast, the estimates with manager fixed effects in Khorana, Servaes, and Wedge (2007) remain statistically significant. My results indicate that some of the variation in fund alphas related to managers' personal investments is driven by cross-sectional variation in unobserved manager characteristics (albeit the set of managers managing multiple funds may be a special subset for identification) and they are consistent with the hypothesis that a manager's investment in her own fund merely reveals her unobserved ability, which supposedly is such an unobserved manager characteristic.

### 7.4 Equity funds and other investment categories

Table 11 shows Column (2) of Table 3 by investment category.[37] Most of the literature on mutual funds focuses on equity mutual funds. Column (1) of Table 11 constrains the sample to equity funds and shows that the results hold up and are in fact strongest among equity mutual funds.

## 8 Conclusion

I collect a dataset of Swedish fund managers' personal portfolio holdings and find large amounts of cross-sectional dispersion in the composition of these portfolios. While some managers invest in their own funds, the majority of managers do not. The managers who do invest in their own funds subsequently earn larger abnormal returns. The paper highlights that managers have superior information, relative to fund investors, about their ability to earn abnormal returns with their funds and invest their personal wealth accordingly.

[37] The "Rest" category, which contains only 47 fund-year observations, is omitted.

The results are relevant for policy makers in evaluating the benefits and costs of disclosure policies and policies that require managers to invest in their own funds. If Swedish fund managers have to publicly file the investments in their own funds, my results imply that it is costly for the managers who lack ability to feign ability to investors. Ultimately, the cost of signaling may drive some of the managers who lack ability out of the market. Whether this effect is desirable, and from which perspective, is an interesting question for future research.

Finally, the results are relevant for fund investors. Actively managed mutual funds remain the primary investment vehicle of households and French (2008) estimates that the typical investor would increase his average annual return by 67 basis points if he switched to a passive market portfolio. Ceteris paribus, investors would have earned larger returns from Swedish mutual funds in the past had they been able to differentiate between managers who "eat their own cooking" and those who do not.

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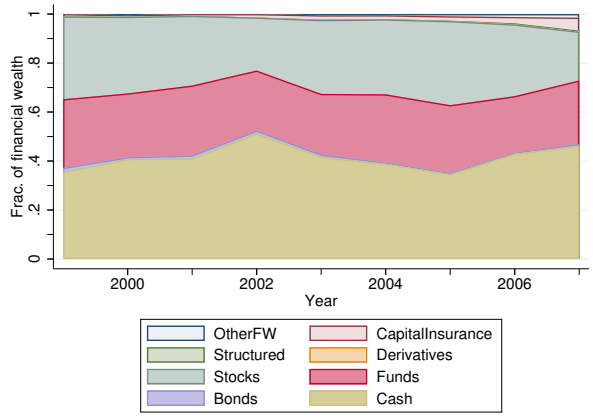
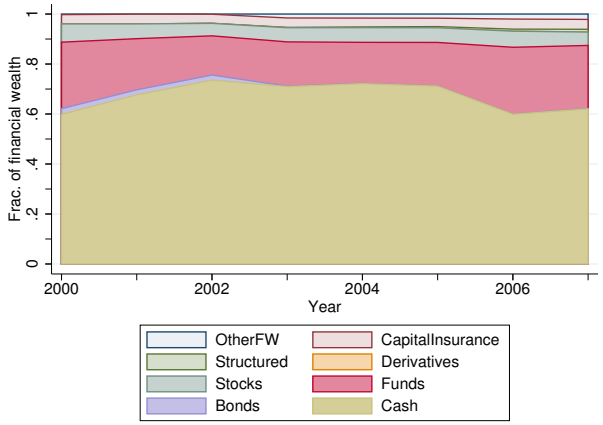
Figure 1: Evolution of average portfolio compositon

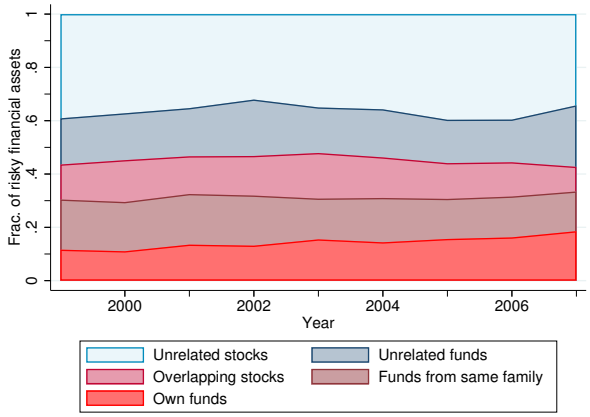
(a) Financial wealth composition




(b) Financial wealth composition (Swedish pop.)



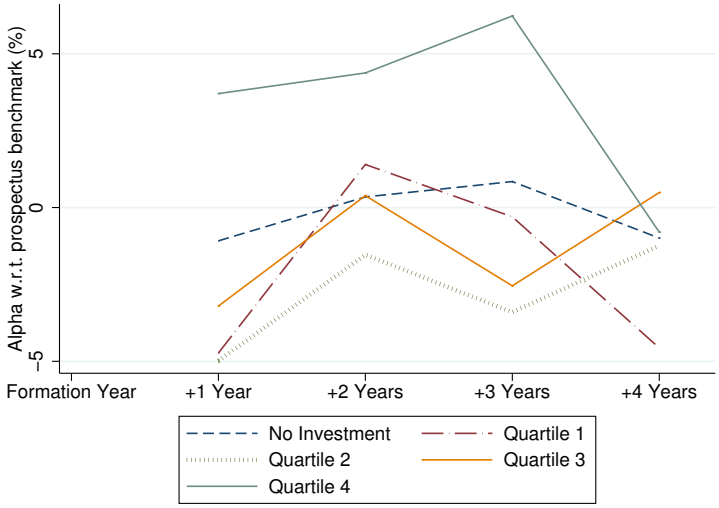

(c) Risky financial assets composition



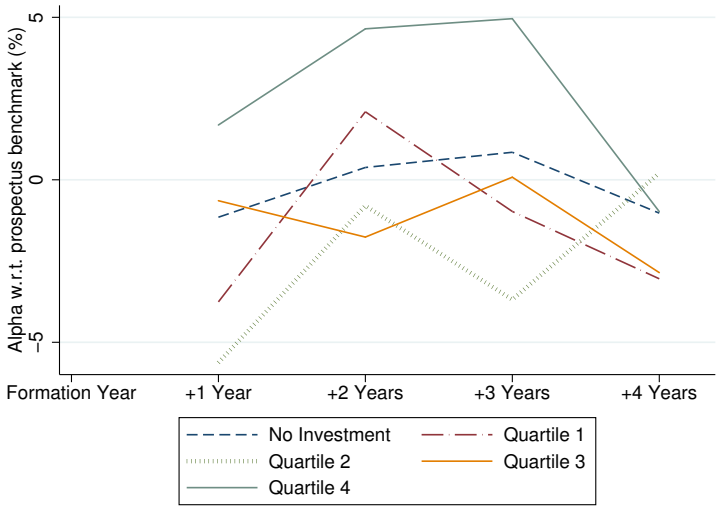

Panel (a) shows the average composition of personal managerial financial wealth over time. Panel (b) is similar to Panel (a) but shows the average composition of financial wealth for the whole Swedish population. Panel (c) shows the average composition of the sum of non money–market mutual funds and direct stock holdings over time. Own funds are professionally managed funds by the manager in question that are in the manager's personal portfolio. Funds from the same family are funds from the manager's fund family (her employer). Unrelated funds are funds in the personal portfolio that are not own funds and not from the same family. Overlapping stocks are direct stock holdings in managers' personal portfolios that are also held in their professionally managed mutual funds. Unrelated stocks are direct stock holdings that are not overlapping.

Figure 2: Persistence in fund returns

(a) Sorting based on amount invested

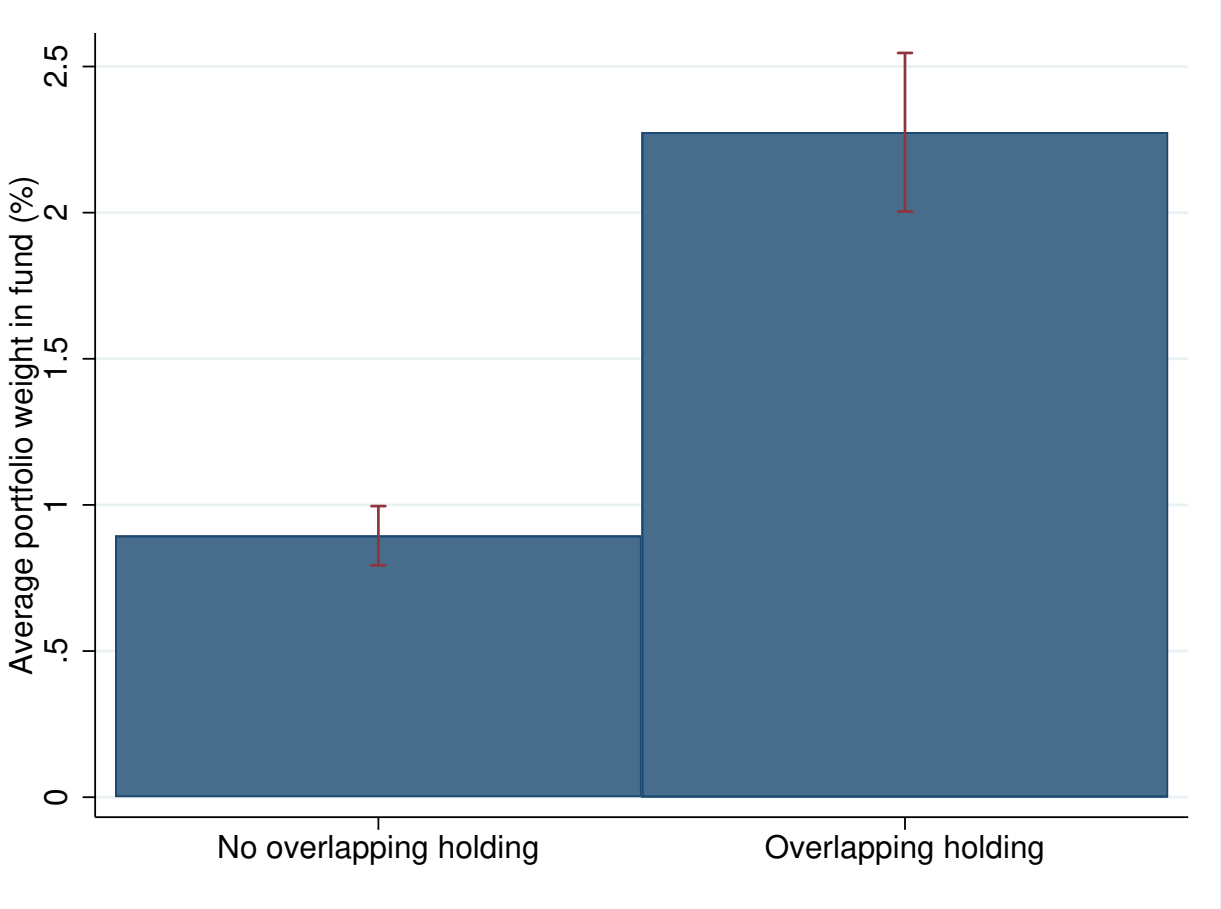



(b) Sorting based on percentage of financial wealth invested




Panel (a) plots average annual fund alphas (after costs) relative to the prospectus benchmark for a no investment group and quartiles formed on the amount a manager initially, that is in the year she starts appearing in the data, allocates to a particular fund she manages. Panel (b) is similar to Panel (a), but the sorting is based on the percentage of financial wealth a manager allocates to her own fund.

Figure 3: Fund weights




The figure plots the portfolio weights of individual securities in active mutual funds conditional on whether the manager holds the security in her personal portfolio or not. The red bars indicate 95% confidence intervals with standard errors clustered at the fund level for the test that the means are different from zero allowing for different residual variances across the two groups.

Table 1: Summary statistics at the fund level

| | 10% | 25% | 50% | 75% | 90% | Mean | Sd | N |
|---|---|---|---|---|---|---|---|---|
| **Part I: Full Sample** | | | | | | | | |
| **A. AUM, TER and no. of managers** | | | | | | | | |
| $AUM_{i,t}$ (mio. SEK) | 56.53 | 178.07 | 591.53 | 2,118.67 | 6,554.89 | 2,149.58 | 3,918.29 | 2416 |
| $TER_{i,t}$ (%) | 0.48 | 0.74 | 1.40 | 1.55 | 1.80 | 1.26 | 0.68 | 2416 |
| $NumManagers_{i,t}$ | 1.00 | 1.00 | 1.00 | 2.00 | 3.00 | 1.44 | 0.86 | 2416 |
| **B. Gross performance** | | | | | | | | |
| $12 \times \widehat{\alpha}_{i,t}^{BM,gross}$ | -7.86 | -2.76 | -0.00 | 2.86 | 9.22 | 0.25 | 9.72 | 2416 |
| $\widehat{IR}_{i,t}^{BM,gross}$ | -4.89 | -2.51 | -0.00 | 2.89 | 5.58 | 0.22 | 4.48 | 2416 |
| **C. Net performance** | | | | | | | | |
| $12 \times \widehat{\alpha}_{i,t}^{BM}$ | -9.36 | -4.12 | -0.98 | 1.69 | 7.89 | -0.99 | 9.73 | 2416 |
| $\widehat{IR}_{i,t}^{BM}$ | -7.14 | -4.10 | -1.34 | 1.47 | 4.17 | -1.66 | 5.28 | 2416 |
| **D. Managerial commitment and controls** | | | | | | | | |
| *Amount in* $MF_{i,t}$ (TSEK) | 0.00 | 0.00 | 0.00 | 0.01 | 61.08 | 67.72 | 443.61 | 2416 |
| $Wealth_{i,t}$ (TSEK) | -349.44 | 549.79 | 1,954.44 | 3,997.25 | 8,000.84 | 3,758.70 | 7,796.07 | 2416 |
| $Income_{i,t}$ (TSEK) | 626.72 | 927.71 | 1,328.28 | 1,854.92 | 2,588.90 | 1,574.06 | 1,290.32 | 2416 |
| $Age_{i,t}$ | 34.00 | 37.58 | 41.00 | 44.50 | 49.00 | 41.46 | 5.92 | 2416 |
| $Exper_{i,t}$ | 1.08 | 2.33 | 4.38 | 7.25 | 12.08 | 5.65 | 4.71 | 2416 |
| $NumCategories_{i,t}$ | 1.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.45 | 0.64 | 2416 |
| $NumFunds_{i,t}$ | 1.00 | 2.00 | 3.00 | 7.00 | 11.00 | 4.89 | 4.16 | 2416 |
| $RiskyShare_{i,t}$ | 3.04 | 25.39 | 63.24 | 86.67 | 98.76 | 56.41 | 33.78 | 2416 |
| **Part II: Restricted Sample** | | | | | | | | |
| $RiskyShare_{i,t}$ (%) | 4.44 | 27.49 | 64.89 | 87.95 | 98.92 | 57.71 | 33.54 | 1830 |
| $Wealth_{i,t}$ (TSEK) | -239.15 | 608.97 | 1,968.37 | 3,929.83 | 7,382.29 | 3,616.53 | 7,724.32 | 1830 |
| *Amount in* $MF_{i,t}$ (TSEK) | 0.00 | 0.00 | 0.00 | 0.20 | 53.00 | 53.25 | 381.28 | 1830 |
| *Amount in* $OH_{i,t}$ (TSEK) | 0.00 | 0.00 | 0.00 | 181.56 | 783.13 | 462.41 | 2,515.24 | 1830 |
| $Number\ of\ positions_{i,t}$ | 20.00 | 35.00 | 60.00 | 138.00 | 283.00 | 110.67 | 126.97 | 1830 |

Part I of the table shows summary statistics for the fund-year observations that enter the final sample. $AUM$ is fund size, $TER$ is a fund's total expense ratio, and $NumManagers$ is the number of managers working for the fund. Panels B and C show performance measures gross respectivley net of costs relative prospectus benchmark return in excess of the one-month STIBOR rate. Fund alphas are estimated according to Equation (5). IR is a fund's information ratio, that is alpha scaled by residual volatility. *Amount in MF* the absolute amount managers invest in their funds in thousands of SEK. $Wealth$ is the average net wealth (worth) of managers at a particular fund in thousands of SEK. $Income$ is labor income, $Age$ is managerial age, $Exper$ is manager experience in years, $NumCategories$ is the number of investment categories managers manage, $NumFunds$ the number of funds managers manage, and $RiskyShare$ is the proportion of the sum of non–money market fund, direct stock holdings, and cash invested in non–money market funds and stocks. Part II shows summary statistics for selected variables for the restricted sample (missing fund holdings data). *Amount in OH* the absolute amount managers invest in overlapping holdings, that is securities both held in the fund and in the personal account, in thousands of SEK. $Number\ of\ positions$ is the number of individual securities a fund holds in a given year.

Table 2: Summary statistics at the manager level

| | 10% | 25% | 50% | 75% | 90% | Mean | Sd | N |
|---|---|---|---|---|---|---|---|---|
| **Part I: Full Sample** | | | | | | | | |
| **A. Characteristics** | | | | | | | | |
| $Age_{m,t}$ | 34.00 | 37.00 | 41.00 | 46.00 | 50.50 | 41.74 | 6.54 | 1380 |
| $Exper_{m,t}$ | 0.83 | 1.75 | 3.79 | 6.71 | 10.75 | 4.99 | 4.65 | 1380 |
| $NumCategories_{m,t}$ | 1.00 | 1.00 | 1.00 | 1.00 | 2.00 | 1.23 | 0.49 | 1380 |
| $NumFunds_{m,t}$ | 1.00 | 1.00 | 2.00 | 3.00 | 5.50 | 2.73 | 2.69 | 1380 |
| **B. Income & wealth (1000s of SEK)** | | | | | | | | |
| $Income_{m,t}$ | 519.01 | 786.75 | 1,196.20 | 1,739.70 | 2,630.04 | 1,487.73 | 1,385.23 | 1380 |
| $FinWealth_{m,t}$ | 50.30 | 237.96 | 709.00 | 2,104.23 | 5,591.75 | 2,876.09 | 8,529.00 | 1380 |
| $RiskyFW_{m,t}$ | 0.78 | 42.41 | 318.00 | 1,339.16 | 3,876.27 | 1,880.99 | 6,551.63 | 1380 |
| $Wealth_{m,t}$ | -557.91 | 458.49 | 1,954.25 | 4,362.37 | 9,919.49 | 4,337.16 | 10,121.81 | 1380 |
| **C. Personal portfolio composition** | | | | | | | | |
| $RiskyShare_{m,t}$ (%) | 0.56 | 22.69 | 64.81 | 91.20 | 99.28 | 56.94 | 35.68 | 1380 |
| *Amount in* $MF_{m,t}$ (TSEK) | 0.00 | 0.00 | 0.00 | 34.46 | 318.80 | 174.19 | 734.74 | 1380 |
| *RiskyFW in* $MF_{m,t}$ (%) | 0.00 | 0.00 | 0.00 | 13.57 | 63.44 | 15.09 | 29.03 | 1267 |
| *FinWealth in* $MF_{m,t}$ (%) | 0.00 | 0.00 | 0.00 | 4.72 | 26.95 | 8.02 | 18.96 | 1380 |
| *Wealth in* $MF_{m,t}$ (%) | 0.00 | 0.00 | 0.00 | 1.03 | 10.07 | 3.97 | 120.42 | 1380 |
| **D. Fund-level controls (%)** | | | | | | | | |
| $AUM_{m,t}$ (mio. SEK) | 93.20 | 331.88 | 1,213.15 | 3,536.49 | 8,071.55 | 3,658.52 | 7,687.61 | 1380 |
| $TER_{m,t}$ (%) | 0.55 | 0.96 | 1.39 | 1.60 | 1.89 | 1.35 | 0.77 | 1380 |
| $NumManagers_{m,t}$ | 1.00 | 1.00 | 1.00 | 2.00 | 3.00 | 1.66 | 0.93 | 1380 |
| **Part II: Restricted Sample** | | | | | | | | |
| $RiskyShare_{m,t}$ (%) | 1.87 | 25.77 | 65.80 | 91.51 | 99.30 | 57.97 | 35.09 | 1076 |
| $Wealth_{m,t}$ (TSEK) | -535.56 | 496.03 | 1,890.07 | 3,905.05 | 8,418.66 | 3,897.17 | 8,851.93 | 1076 |
| *Amount in* $MF_{m,t}$ (TSEK) | 0.00 | 0.00 | 0.00 | 24.78 | 233.32 | 135.67 | 641.77 | 1076 |
| *Amount in* $OH_{m,t}$ (TSEK) | 0.00 | 0.00 | 0.00 | 131.12 | 841.26 | 611.76 | 3,522.30 | 1076 |

Part I of the table shows summary statistics for the manager-year observations in the final sample. *RiskyShare* is the proportion of the sum of non–money market fund, direct stock holdings, and cash invested in non–money market funds and stocks. The rest of Panel C shows different measures of how committed a manager is to her own fund. Part II shows summary statistics for selected variables for the restricted sample (missing fund holdings data). *Amount in MF* the absolute amount managers invest in their funds in thousands of SEK. *Amount in OH* the absolute amount managers invest in overlapping holdings, that is securities both held in the fund and in the personal account, in thousands of SEK.

Table 3: Predictive regressions of information ratios on manager and fund characteristics

| | (1) $\widehat{IR}^{BM}_{i,t}$ | (2) $\widehat{IR}^{BM}_{i,t}$ | (3) $\widehat{IR}^{BM}_{i,t}$ | (4) $\widehat{IR}^{BM}_{i,t}$ | (5) $\widehat{IR}^{BM}_{i,t}$ |
|---|---|---|---|---|---|
| *Amount in* $MF_{i,t}$ | 0.882*** | 0.528*** | 0.888** | 0.552** | |
| | (0.176) | (0.141) | (0.399) | (0.261) | |
| $Wealth_{i,t}$ | 0.0257* | 0.0168 | -0.0391 | -0.00522 | 0.0172 |
| | (0.0135) | (0.0145) | (0.0240) | (0.0173) | (0.0141) |
| *Amount in* $MF_{i,t,1}$ | | | | | 0.0142 |
| | | | | | (0.476) |
| *Amount in* $MF_{i,t,2}$ | | | | | 0.0274 |
| | | | | | (0.478) |
| *Amount in* $MF_{i,t,3}$ | | | | | 0.413 |
| | | | | | (0.399) |
| *Amount in* $MF_{i,t,4}$ | | | | | 1.099** |
| | | | | | (0.447) |
| $AUM_{i,t}$ | | -0.0551* | -0.282*** | -0.0457 | -0.0586* |
| | | (0.0327) | (0.0660) | (0.0331) | (0.0329) |
| $TER_{i,t}$ | | -0.542*** | -0.224 | -0.490** | -0.577*** |
| | | (0.181) | (0.405) | (0.224) | (0.178) |
| $NumManagers_{i,t}$ | | 0.0491 | -0.219 | -0.0733 | 0.0382 |
| | | (0.180) | (0.154) | (0.186) | (0.183) |
| $Income_{i,t}$ | | -0.143* | -0.145 | -0.133 | -0.154* |
| | | (0.0798) | (0.126) | (0.117) | (0.0786) |
| $Age_{i,t}$ | | -0.0106 | 0.0222 | -0.0149 | -0.0105 |
| | | (0.0279) | (0.0325) | (0.0251) | (0.0279) |
| $Exper_{i,t}$ | | -0.0113 | -0.0529 | 0.00381 | -0.0122 |
| | | (0.0343) | (0.0443) | (0.0357) | (0.0346) |
| $NumCategories_{i,t}$ | | -0.908** | -0.357 | -1.068*** | -0.940** |
| | | (0.443) | (0.490) | (0.394) | (0.442) |
| $NumFunds_{i,t}$ | | 0.0178 | -0.00454 | 0.0420 | 0.0266 |
| | | (0.0396) | (0.0622) | (0.0418) | (0.0405) |
| $RiskyShare_{i,t}$ | | -0.00190 | -0.00559 | -0.00428 | -0.00264 |
| | | (0.00351) | (0.00376) | (0.00365) | (0.00356) |
| $Female_{i,t}$ | | -0.620 | -0.0509 | -0.494 | -0.590 |
| | | (0.516) | (0.584) | (0.527) | (0.518) |
| Constant | -1.812*** | | | | |
| | (0.181) | | | | |
| Year FE | No | Yes | Yes | Yes | Yes |
| Category FE | No | Yes | Yes | Yes | Yes |
| Fund FE | No | No | Yes | No | No |
| Firm FE | No | No | No | Yes | No |
| $N$ | 2416 | 2416 | 2303 | 2405 | 2416 |
| Adjusted $R^2$ | 0.007 | 0.135 | 0.339 | 0.146 | 0.134 |

The table shows predictive regressions of information ratios, that is alphas scaled by residual volatility, on manager and fund characteristics. Information ratios are estimated relative to the fund's prospectus benchmark according to Equation (5). *Amount in* $MF$ is the absolute amount managers invest in their funds in millions of SEK. $Wealth$ is managerial net wealth in millions of SEK. $AUM$ (fund size) is scaled in billions of SEK. Column (5) estimates a piecewise-constant specification. Standard errors are clustered by funds.

Table 4: Predictive regressions of information ratios on manager and fund characteristics

| | (1) $\widehat{IR}^{BM}_{i,t}$ | (2) $\widehat{IR}^{BM}_{i,t}$ | (3) $\widehat{IR}^{BM}_{i,t}$ | (4) $\widehat{IR}^{BM}_{i,t}$ |
|---|---|---|---|---|
| *Amount in* $MF_{i,t}$ | 0.836*** | 0.459** | 1.451*** | 0.732** |
| | (0.215) | (0.203) | (0.305) | (0.343) |
| *Amount in* $OH_{i,t}$ | 0.104 | 0.0273 | 0.0203 | 0.0359 |
| | (0.0644) | (0.0497) | (0.0602) | (0.0414) |
| $Wealth_{i,t}$ | 0.0117 | 0.0166 | -0.0376 | -0.00143 |
| | (0.0180) | (0.0169) | (0.0245) | (0.0203) |
| Constant | -1.877*** | | | |
| | (0.207) | | | |
| Year FE | No | Yes | Yes | Yes |
| Category FE | No | Yes | Yes | Yes |
| Fund FE | No | No | Yes | No |
| Firm FE | No | No | No | Yes |
| $N$ | 1830 | 1830 | 1786 | 1829 |
| Adjusted $R^2$ | 0.006 | 0.143 | 0.358 | 0.168 |

The table shows predictive regressions of information ratios, that is alphas scaled by residual volatility, on manager and fund characteristics. Information ratios are estimated relative to the fund's prospectus benchmark according to Equation (5). The sample is restricted to funds for which detailed holdings data is available. *Amount in MF* is the absolute amount managers invest in their funds in millions of SEK. *Amount in OH* is the absolute amount managers personally invest in overlapping holdings in millions of SEK, that is individual securities held both in a manager's personal account and in her fund. *Wealth* is managerial net wealth in millions of SEK. Standard errors are clustered by funds.

Table 5: Regression of fund weights on amount in overlapping holdings

| | (1) | (2) | (3) |
|---|---|---|---|
| | $Weight_{i,j,t}$ | $Weight_{i,j,t}$ | $Weight_{i,j,t}$ |
| *Amount in* $OH_{i,j,t}$ | 0.442*** | 0.364*** | 0.130*** |
| | (0.149) | (0.117) | (0.0478) |
| Constant | 0.893*** | | |
| | (0.0521) | | |
| Year FE | No | Yes | Yes |
| Controls | No | Yes | Yes |
| Category FE | No | Yes | Yes |
| Security FE | No | No | Yes |
| $N$ | 215256 | 215256 | 211842 |
| Adjusted $R^2$ | 0.000 | 0.053 | 0.587 |

$Weight_{i,j,t}$ is the weight of security $j$ (identified by an ISIN) in fund $i$ at the end of year $t$ in percent, that is the amount invested in the security by the fund divided by fund size times 100 (fund weight). *Amount in* $OH_{i,j,t}$ is the average amount the manager(s) of fund $i$ personally invest in security $j$ at the end of year $t$ in millions of SEK. The table shows regressions of fund weights on the amount managers invest in overlapping holdings. Controls include fund-level wealth and the fund-level controls from Table 3. The sample is restricted to funds for which detailed holdings data is available. Standard errors are clustered by funds.

Table 6: Portfolio compositions

| | (1) $RiskyShare_{m,t}$ | (2) $RiskyShare_{m,t}$ | (3) $RiskyShare_{m,t}$ | (4) $\%RiskyFW\ indexfunds_{m,t}$ | (5) $\%RiskyFW\ indexfunds^{-}_{m,t}$ | (6) $\%RiskyFW\ funds^{-}_{m,t}$ |
|---|---|---|---|---|---|---|
| *Amount in* $MF_{m,t}$ | 5.746*** | 6.988*** | 7.535** | -0.602** | -0.623** | 6.513** |
| | (2.200) | (2.518) | (3.066) | (0.293) | (0.304) | (2.638) |
| *Amount in* $OH_{m,t}$ | 1.477*** | 1.063** | 1.187** | -0.165 | -0.178 | -0.798* |
| | (0.526) | (0.451) | (0.481) | (0.111) | (0.112) | (0.405) |
| $Wealth_{m,t}$ | 0.128 | 0.0226 | -0.793*** | 0.0590 | 0.0583 | -0.535** |
| | (0.290) | (0.240) | (0.300) | (0.0748) | (0.0746) | (0.211) |
| Constant | 55.82*** | | | | | |
| | (2.187) | | | | | |
| $N$ | 1076 | 1076 | 1019 | 996 | 991 | 991 |
| Adjusted $R^2$ | 0.038 | 0.119 | 0.552 | 0.033 | 0.026 | 0.092 |
| Year FE | No | Yes | Yes | Yes | Yes | Yes |
| Category FE | No | Yes | Yes | Yes | Yes | Yes |
| Manager FE | No | No | Yes | No | No | No |

The table investigates cross-sectional differences in the composition of managers' personal portfolios. The risky share is defined as a manager's fund and direct stock investments over the sum of cash, fund, direct stock investments times 100. Risky financial wealth is the sum of fund and direct stock investments. $\%RiskyFW\ indexfunds$ is the percentage of risky financial wealth that is invested in index funds or ETFs. $\%RiskyFW\ indexfunds^{-}$ is the percentage of risky financial wealth excluding investments into funds a manager manages herself that is invested in index funds or ETFs. $\%RiskyFW\ funds^{-}$ is the percentage of risky financial wealth excluding investments into funds a manager manages herself that is invested in funds. *Amount in* $MF$ is the absolute amount managers invest in their funds in millions of SEK. The sample is restricted to managers who manage funds for which detailed holdings are available. Standard errors are clustered by managers.

Table 7: Scaling the amount invested

| | (1) $12 \times \widehat{\alpha}_{i,t}^{BM}$ | (2) $12 \times \widehat{\alpha}_{i,t}^{BM}$ | (3) $\widehat{IR}_{i,t}^{BM}$ | (4) $\widehat{IR}_{i,t}^{BM}$ | (5) $\widehat{IR}_{i,t}^{BM}$ | (6) $\widehat{IR}_{i,t}^{BM}$ |
|---|---|---|---|---|---|---|
| $\%Ownership\ in\ MF_{i,t}$ | 2.257* | 2.143** | 0.228** | | | |
| | (1.200) | (1.042) | (0.0918) | | | |
| $Wealth_{i,t}$ | | 0.0277 | 0.0216 | 0.0357*** | 0.0248* | 0.0198 |
| | | (0.0318) | (0.0144) | (0.0131) | (0.0145) | (0.0145) |
| $\%RiskyFW\ in\ MF_{i,t}$ | | | | 0.0205*** | 0.00842 | |
| | | | | (0.00621) | (0.00539) | |
| $Amount\ in\ MF_{i,t}$ | | | | | | 0.533*** |
| | | | | | | (0.140) |
| Constant | -1.098*** | | | -1.902*** | | |
| | (0.230) | | | (0.195) | | |
| Year FE | No | Yes | Yes | No | Yes | Yes |
| Controls | No | Yes | Yes | No | Yes | Yes |
| Category FE | No | Yes | Yes | No | Yes | Yes |
| $N$ | 2416 | 2416 | 2416 | 2291 | 2291 | 2291 |
| Adjusted $R^2$ | 0.031 | 0.078 | 0.134 | 0.007 | 0.133 | 0.135 |

The table shows predictive regressions of alphas and information ratios, that is alphas scaled by residual volatility, on manager and fund characteristics. Alphas and information ratios are estimated relative to the fund's prospectus benchmark according to Equation (5). $\%Ownership\ in\ MF$ is the percentage of the fund's assets under management personally owned by the manager. $Wealth$ is managerial net wealth in millions of SEK. $\%RiskyFW\ in\ MF$ is the percentage of a manager's risky financial wealth invested in her own fund. Standard errors are clustered by funds.

Table 8: Predictive regressions of alphas on manager and fund characteristics

| | (1) $12 \times \widehat{\alpha}_{i,t}^{BM}$ | (2) $12 \times \widehat{\alpha}_{i,t}^{BM}$ | (3) $12 \times \widehat{\alpha}_{i,t}^{BM}$ | (4) $12 \times \widehat{\alpha}_{i,t}^{BM}$ | (5) $12 \times \widehat{\alpha}_{i,t}^{BM}$ |
|---|---|---|---|---|---|
| *Amount in* $MF_{i,t}$ | 4.183** | 3.745** | 3.670** | 1.986 | |
| | (1.937) | (1.869) | (1.486) | (1.216) | |
| $Wealth_{i,t}$ | 0.0153 | -0.00547 | -0.163** | -0.0200 | 0.0186 |
| | (0.0261) | (0.0374) | (0.0721) | (0.0343) | (0.0335) |
| *Amount in* $MF_{i,t,1}$ | | | | | -0.146 |
| | | | | | (0.839) |
| *Amount in* $MF_{i,t,2}$ | | | | | -0.834 |
| | | | | | (1.030) |
| *Amount in* $MF_{i,t,3}$ | | | | | -0.729 |
| | | | | | (0.955) |
| *Amount in* $MF_{i,t,4}$ | | | | | 2.111 |
| | | | | | (1.491) |
| Constant | -1.335*** | | | | |
| | (0.246) | | | | |
| Year FE | No | Yes | Yes | Yes | Yes |
| Controls | No | Yes | Yes | Yes | Yes |
| Category FE | No | Yes | Yes | Yes | Yes |
| Fund FE | No | No | Yes | No | No |
| Firm FE | No | No | No | Yes | No |
| $N$ | 2416 | 2416 | 2303 | 2405 | 2416 |
| Adjusted $R^2$ | 0.037 | 0.076 | 0.184 | 0.160 | 0.052 |

The table shows predictive regressions of alphas on manager and fund characteristics. Alphas are estimated relative to the fund's prospectus benchmark according to Equation (5). *Amount in MF* is the absolute amount managers invest in their funds in millions of SEK. $Wealth$ is managerial net wealth in millions of SEK. $AUM$ (fund size) is scaled in billions of SEK. Column (5) estimates a piecewise-constant specification. Standard errors are clustered by funds.

Table 9: Alternative benchmarks

| | (1) $\widehat{IR}_{i,t}^{GF5}$ | (2) $\widehat{IR}_{i,t}^{BM,gross}$ | (3) $\widehat{IR}_{i,t}^{CAPM}$ | (4) $\widehat{IR}_{i,t}^{FF4}$ | (5) $RMSE_{i,t}^{BM}$ | (6) $RMSE_{i,t}^{BM}$ |
|---|---|---|---|---|---|---|
| *Amount in* $MF_{i,t-1}$ | 0.326** | 0.451*** | 0.465*** | 0.489*** | 0.973** | 0.648 |
| | (0.129) | (0.134) | (0.139) | (0.165) | (0.495) | (0.482) |
| $Wealth_{i,t-1}$ | 0.0271** | 0.0176 | 0.0278** | 0.00639 | 0.0152 | -0.0207 |
| | (0.0118) | (0.0128) | (0.0112) | (0.0106) | (0.0211) | (0.0218) |
| $Big4_{i,t-1}$ | | | | | | -1.015*** |
| | | | | | | (0.388) |
| Constant | | | | | 5.287*** | |
| | | | | | (0.211) | |
| Year FE | Yes | Yes | Yes | No | Yes | Yes |
| Controls | Yes | Yes | Yes | Yes | No | Yes |
| Category FE | Yes | Yes | Yes | Yes | No | Yes |
| $N$ | 2399 | 2416 | 2416 | 2416 | 2416 | 2416 |
| Adjusted $R^2$ | 0.197 | 0.055 | 0.182 | 0.197 | 0.007 | 0.325 |

Columns (1)–(4) replicate Column (2) of Table 3 using alternative benchmarks to estimate information ratios. Columns (1) uses returns adjusted relative a global five-factor model (GF5), Column (2) uses gross instead of net benchmark returns, Column (3) uses a Swedish market model (CAPM), and Column (4) uses a Swedish four-factor model (FF4). All models are described in detail in Appendix A.3. Columns (5) and (6) employ a fund's root mean square error (tracking error) as the dependent variable. *Amount in MF* is the absolute amount managers invest in their funds in millions of SEK. *Wealth* is managerial net wealth in millions of SEK. Standard errors are clustered by funds.

Table 10: Team management and busy managers

| | (1) $\widehat{IR}^{BM}_{i,t}$ | (2) $\widehat{IR}^{BM}_{i,t}$ | (3) $\widehat{IR}^{BM}_{i,t}$ | (4) $\widehat{IR}^{BM}_{i,t}$ |
|---|---|---|---|---|
| *Amount in* $MF_{i,t-1}$ | 0.894*** | 0.596*** | 0.474 | 5.023 |
| | (0.188) | (0.176) | (0.403) | (3.349) |
| $Wealth_{i,t-1}$ | 0.0204 | 0.0176 | -0.0758* | 2.033*** |
| | (0.0215) | (0.0176) | (0.0418) | (0.237) |
| Constant | -2.018*** | | | |
| | (0.222) | | | |
| Year FE | No | Yes | Yes | No |
| Controls | No | Yes | Yes | Yes |
| Category FE | No | Yes | Yes | Yes |
| Manager FE | No | No | Yes | No |
| Manager FE X Year FE | No | No | No | Yes |
| $N$ | 1750 | 1750 | 1750 | 1750 |
| Adjusted $R^2$ | 0.005 | 0.172 | 0.248 | 0.388 |

The table shows predictive regressions of information ratios, that is alphas scaled by residual volatility, on manager and fund characteristics restricting the sample to funds managed by one manager, that is excluding team managed funds. Information ratios are estimated relative to the fund's prospectus benchmark according to Equation (5). *Amount in MF* is the absolute amount managers invest in their funds in millions of SEK. *Wealth* is managerial net wealth in millions of SEK. Standard errors are clustered by funds.

Table 11: Differences across investment categories

| | (1) $\widehat{IR}_{i,t}^{BM}$ | (2) $\widehat{IR}_{i,t}^{BM}$ | (3) $\widehat{IR}_{i,t}^{BM}$ | (4) $\widehat{IR}_{i,t}^{BM}$ |
|---|---|---|---|---|
| *Amount in* $MF_{i,t-1}$ | 0.541*** | 0.705 | 0.255 | 2.542 |
| | (0.163) | (0.751) | (0.278) | (7.927) |
| $Wealth_{i,t-1}$ | 0.00851 | 0.0444* | 0.0492 | -0.175 |
| | (0.0161) | (0.0231) | (0.0387) | (0.191) |
| Year FE | Yes | Yes | Yes | Yes |
| Controls | Yes | Yes | Yes | Yes |
| Category FE | Equity | Allocation | Alternative | Fixed Income |
| $N$ | 1556 | 378 | 119 | 316 |
| Adjusted $R^2$ | 0.087 | 0.139 | 0.015 | 0.209 |

The table replicates Column (2) of Table 3 and shows predictive regressions of information ratios, that is alphas scaled by residual volatility, on manager and fund characteristics across different investment categories. Information ratios are estimated relative to the fund's prospectus benchmark according to Equation (5). *Amount in MF* is the absolute amount managers invest in their funds in millions of SEK. *Wealth* is managerial net wealth in millions of SEK. Standard errors are clustered by funds.

# Appendices

# A Data

## A.1 AUM and TER imputation algorithms

### A.1.1 Imputing AUM at the share-class level

Only missing values in the middle of AUM series are imputed by using their past values, fund share class returns, and a factor adjusted for flow rates. Specifically, let $[t_0, t]$ and $[t+n, T]$ be periods when a share class has data on AUM. The missing values are filled as follows:

$$AUM_k = F \times AUM_{k-1}(1 + r_k), \quad \text{for } k \in [t+1, t+n-1], \tag{A8}$$

$$F \equiv \left( \frac{1}{\prod_{k=t+1}^{t+n}(1+r_k)} \frac{AUM_{t+n}}{AUM_t} \right)^{\frac{1}{n}} \tag{A9}$$

where $F$ is the factor adjusted for flow rate, and $r_k$ is share class net return.

### A.1.2 Imputing TER at the fund level

Missing TER values are imputed for every period funds have a return, using the following steps. First, for funds whose TER series are almost constant (the ratio of the smallest to the largest TER values larger than 0.95), the missing TER values are filled with the mean of the observed values. However, the number of imputations must be less than or equal to the number of periods when a fund has TER data.

Second, I use a fund's management fee (MNG) information to impute for missing TER as follows. For funds that have missing TER at time $t$ but have data on MNG at this time, as well as other times when TER is available, I replace a missing TER with the product of MNG and the mean of the TER-to-MNG ratio. This step is used only if these ratios are not too volatile.

For funds that do not have TER at all but have data on MNG, I rely on other funds that belong to the same Morningstar investment category to fill the missing values as follows:

$$imputed\_TER_{ijt} = MNG_{ijt} \left( \frac{1}{N_{jt}} \sum_{h \in \Omega_{jt}^{-i}} \frac{TER_{hjt}}{MNG_{hjt}} \right) \tag{A10}$$

where $TER_{hjt}$ is the TER of fund $h$ in Morningstar category $j$, $\Omega_{jt}^{-i}$ is the set of funds (excluding fund $i$) belonging to category $j$ in year $t$, and $N_{jt} = |\Omega_{jt}|$. If $\Omega_{jt}^{-i}$ is empty, I use

this imputation:

$$imputed\_TER_{ijt} = MNG_{ijt}\left(\frac{1}{T}\sum_{\substack{k\in\Gamma\\k\neq t}}\frac{1}{N_{jk}}\sum_{h\in\Omega_{jk}^{-i}}\frac{TER_{hjk}}{MNG_{hjk}}\right) \tag{A11}$$

where $\Gamma$ is the set of periods other funds in category $j$ have data on both TER and MNG, and $T = |\Gamma|$.

These first two steps account for 44% of the total number of imputations.

Third, for funds that have missing values in the middle of the TER series, the missing numbers are imputed by using their lag values and the TER growth rates. Precisely, let $0 \leq H_1, H_2 \leq 2$ such that funds have TER at any periods in $[t-H_1, t]$ and $[t+n, t+n+H_2]$. The missing TERs are imputed for each fund as follows:

$$imputed\_TER_k = \left(\frac{\overline{TER}_{[t+n,t+n+H_2]}}{\overline{TER}_{[t-H_1,t]}}\right)^{\frac{1}{n}} \times TER_{k-1}, \quad \text{for } k \in [t+1, t+n-1], \tag{A12}$$

where

$$\overline{TER}_{[t-H_1,t]} = \frac{1}{H_1+1}\sum_{k=t-H_1}^{t} TER_k \tag{A13}$$

$$\overline{TER}_{[t+n,t+n+H_2]} = \frac{1}{H_2+1}\sum_{k=t+n}^{t+n+H_2} TER_k \tag{A14}$$

Fourth, for funds that have missing TER at the tails of the series, I test whether TER series follow the linear time trend. If they do, I replace the missing TER with the forecast values from the model. To be specific, let $[t_0, t]$ and $[t+n, T]$ be periods when TER are missing, and let TER of fund $i$ have the specification:

$$\log TER_{ik} = a_i + b_i k + \varepsilon_{ik}, \quad \forall k \in [t_0, T] \tag{A15}$$

The missing TERs are filled as follows:

$$imputed\_TER_{ik} = \exp(\hat{a}_i + \hat{b}_i k), \quad \forall k \in [t_0, t] \cup [t+n, T] \tag{A16}$$

only if the $p$-value of $\hat{b}_i$ is less than or equal to 5% and $n \geq 6$. If these conditions are violated, I replace all of the missing TER at the left (right) tail of the series with the mean values of the first (last) three TER values.

## A.2 Finding social security numbers

Whenever possible, I first confirm the spelling of first and last names in the Morningstar data by comparing them with the fund company's annual report or the fund company's website. From the same sources, I try to find the fund manager's age or year of birth. If

this is not possible, I narrow down the age range by using information about the person's career from Morningstar. I assume that active fund managers are between 25 and 67 years old. For example, if the fund manager has been active as a fund manager for ten years and is active to this date, I adjust the age range to 35 to 67 years. I search the internet for information on recruitment, fund performance, career history, LinkedIn profiles, pictures, comments in annual reports, and so on. This search may provide additional information about year of graduation and earlier jobs. For example, information about an earlier job can make it possible to further increase the minimum age of the fund manager. I flag managers with inconsistent spelling, for example between the fund report and Morningstar. When there are obvious spelling mistakes or erroneous data entry of manager names, I correct for it. Sometimes there is also confusion regarding which is the last name and which the first name, which I sort out using secondary sources, such as websites.

Based on the first name and last name, and if available the year of birth, I collect social security numbers using the websites www.upplysning.se and www.ratsit.se. In the best-case scenario, I find exactly one social security number that fits the first name, last name, and age bracket. For some first and last name pairs, I cannot find any social security number using our data source. I send these names as well as those with spelling inconsistencies to the Swedish Tax Authority. The tax authority investigates whether a person with that first and last name lives in Sweden at any time between 1995 and 2013 and reports back to us one of four possibilities: (i) tax and income information is present, (ii) the person has a social security number but is not paying taxes, (iii) there are more than 100 matches, or (iv) there is no match. In case (i), I receive the social security number. In cases (ii) and (iv), I am now certain that this manager was not a Swedish taxpayer at any point between 1995 and 2013, and therefore has had no labor income in Sweden. In case (3), I assign the manager as being "unidentified."

For many names and age ranges, I obtain multiple social security numbers. For some common names, I may get more than 50 matches on first name, last name, and age range. In such cases, if the manager is still active and I know her or her fund company's office is located in Stockholm, I refine the search to include only the greater Stockholm area. This may allow me to narrow down the number of socials to just one, in which case I get a perfect match, or it may leave me with multiple but fewer matches. If I still get more than 50 hits after including the area information, I classify the fund manager as "unidentified." Based on this procedure, 84 managers remain unidentified.

For these 84 managers I try to find information about which university they attended. If I find such information, I request the manager's transcript from the university in question. This transcript usually contains the social security number as well as the person's address. This allows me to obtain another 32 matches, reducing the unidentified ones to 52.

For managers with multiple candidate social security numbers, I rate each social security number in terms of how likely it is to belong to the fund manager in question. Any available information from websites or other places is used. The rating scale goes from 0 to 3, where 0 means no match at all and 3 represents the most reliable category. Along with this rating, I ask Statistics Sweden to provide information about occupation and industry of employment for each candidate social. I rank all observed occupations and industries based on their appropriateness on a scale from 1 to 3. I then construct an algorithm that picks the most appropriate social based on our rating, the occupation, and the industry. In most cases, it

Table A1: Sample selection criteria

| Panel A: Sample selection | Managers | Funds |
|---|---|---|
| Morningstar sample 1990–2015 | | 1,744 |
| Drop "Team Management" and "Not Disclosed" | 1,324 | 1,600 |
| Present at some point during 2000–2008 | 862 | 1,103 |
| Drop index, money market and pension funds | 832 | 1,019 |
| Assign social security number candidate | 535 | 838 |
| Uniquely identify social security number | 383 | 664 |
| Final sample | | |
| Require nonmissing controls and fund alphas | 361 | 556 |
| Require fund holdings | 260 | 377 |

The table shows how I arrive at the final sample. A fund is included in the sample if at least one of its managers is identified. In case of missing fund holding data, a manager is included in the sample if at least one of her funds has holdings data.

is evident which the best match is. In the few cases where there are ties, I ask Statistics Sweden to internally check whether the registered employer name matches with the fund complex registered in Morningstar Direct.

Table A1 shows how I arrive at the final sample used for the main regressions.

## A.3 Benchmark and factor models

### A.3.1 Morningstar prospectus benchmark

The main performance measure in this paper is the average abnormal return over the benchmark. Morningstar reports a Primary Prospectus Benchmark for 74% of the funds. Some funds have linear combinations of indices as their benchmark. There are more than 300 different benchmark indices present in the sample. I find monthly return information for most of them on Morningstar, Bloomberg, and Datastream. For funds with no assigned benchmark or an irretrievable benchmark, I assign a benchmark by hand.[38]

[38]In those cases, I use the Morningstar variable Category, assigning the most common benchmark for that category to the remaining funds. When the benchmark is a linear combination of indices, and I lack return information on some of the component indices, I assign an alternative only to that component, keeping the other components and the index weighting.

### A.3.2 CAPM

For Equity, Alternative, and Allocation funds, the CAPM model employs a one-factor market model with the Swedish all-share index (SIXPRX) in excess of the one-month STIBOR rate as the market proxy. For Fixed Income and the rest, I use the Swedish government bond index return (OMRX) in excess of the one-month STIBOR as the CAPM market factor.

### A.3.3 FF4

The Fama and French four-factor model (Fama and French, 1993; Carhart, 1997) has the stock market factor, the size factor (SMB), the value factor (HML), and the momentum factor (MOM). These are constructed from all Swedish stocks and are the same as in Betermier, Calvet, and Sodini (2017).

### A.3.4 GF5

The Global five-factor model uses five global indices to risk-adjust returns. For Equity, Alternative, and Allocation funds, these are (i) the Swedish stock market index return (SIXPRX) in excess of the one-month STIBOR rate, (ii) the global equity index (MSCI) in excess of the one-month U.S. Treasury bill rate, (iii) the North American equity index (MSCI) in excess of the one-month U.S. Treasury bill rate, (iv) the European equity index (MSCI) in excess of the one-month EURIBOR rate, and (v) the Asia ex-Japan equity index (MSCI) in excess of the BOJ basic discount rate. For Fixed Income and the rest, the five factors are (i) the Swedish government bond index return (OMRX) in excess of the one-month STIBOR rate, (ii) the global bond aggregate index (Barclays) in excess of the one-month U.S. Treasury bill rate, (iii) the U.S. bond aggregate index (Barclays) in excess of the one-month U.S. Treasury bill rate, (iv) the euro bond aggregate index (Barclays) in excess of the one-month EURIBOR rate, and (v) the Asian Pacific bond aggregate index (Barclays) in excess of the BOJ discount rate.

All returns are converted into Swedish krona.

# B Manager Flows

This appendix investigates whether managers systematically update the investments in their own funds following good or bad past performance. This mirrors the well-known flow-performance regressions in the mutual fund literature (Sirri and Tufano (1998), Chevalier and Ellison (1997)). The unit of observation in this appendix is manager-fund-year, in principle allowing me to investigate whether managers managing multiple funds differ in updating the investments across the multiple funds they are managing.

Column (1) of Table B1 regresses the the difference in number of shares invested in one's own fund from $t-1$ to $t$ times the price at the beginning of year $t$ on past performance. Column (2) regresses the amount invested in one's own fund in year $t$ on the amount invested in year $t-1$.[39] Column (3) uses the change in the fraction of risky financial assets allocated

[39] I acknowledge that the inclusion of a lagged dependent variable may bias the standard errors.

to one's own fund as the dependent variable. Column (4) again estimates a model with the lagged fraction of risky financial assets allocated to one's own fund as an independent variable. Overall, the results indicate that the amount invested appears to be rather persistent but unrelated to past performance.

Managers may have learned about their ability/the fund's ability by observing (i) past fund returns before they have been assigned to a particular fund and (ii) their own realized returns in other funds before being assigned to a new fund. Moreover, some managers manage funds in the sample before 1999, which is the first year in which personal allocations are observed. Column (5) of Table B1 runs a cross-sectional regression of manager-fund observations on manager and fund characteristics. The dependent variable is the initial amount a manager invests in a particular fund, that is at the end of the year she is first assigned to the fund (or the allocation at the end of 1999 if a manager manages funds before 1999). The independent variables are (i) the past alpha in a fund in case a manager has been assigned to a fund that already existed before she was assigned to it, (ii) the equal-weighted average alpha in other funds a manager was managing before being assigned to a new fund in case she has managed other funds before, and (iii) past fund alpha before 1999 in case a manager has been assigned to a fund before 1999. All three variables are not significant determinants of the amount a manager initially invests in a particular fund.

# C Fund Flows

One major advantage of investing in one's own fund may be to signal commitment to fund investors to attract fund flows. Although the data in this paper is not available for the general public and I have found no evidence that funds publicly advertise their managers' commitment, commitment may be privately signaled to a subset of investors (e.g. large institutional investors). Columns (1)–(3) of Table C1 regress fund flows on managers' investments in their own funds but, in short, find no evidence that more committed managers attract more inflows. Columns (4)–(6) of Table C1 test whether there is heterogeneity in the flow-performance relation conditional on the amount managers invest in their own funds, but finds no statistically robust evidence. The coefficient on the interaction between past performance and the amount invested is consistently positive. If personal investments were used as a signal, if anything one would expect a negative coefficient estimate on the interaction between past performance and managerial commitment since the personal investment reveals a manager's type and, hence, resolves uncertainty about her ability which should lead to lower flow-performance sensitivities for those managers that invest in their own funds.

# D Personal Portfolio Performance

## D.1 Performance in overlapping holdings

To assess performance in overlapping holdings, I first compare a manager's performance in overlapping holdings relative to positions that are not overlapping in her personal portfolio. I do not focus on the performance relative to a particular factor model because the factor

Table B1: Manager flow-performance regressions

| | (1) $FLOW_{m,i,t}$ | (2) *Amount in* $MF_{m,i,t}$ | (3) $\Delta RiskyFW_{m,i,t}$ | (4) $\%RiskyFW$ *in* $MF_{m,i,t}$ | (5) *Amount in* $MF_{m,i}$ |
|---|---|---|---|---|---|
| $\widehat{IR}^{BM}_{m,i,t-1}$ | 0.00101 | 100.4 | -0.000130 | 0.0000419 | |
| | (0.00136) | (8950731.9) | (0.000452) | (0.399) | |
| *Amount in* $MF_{m,i,t-1}$ | | 0.670*** | | | |
| | | (0.129) | | | |
| $\%RiskyFW$ *in* $MF_{m,i,t-1}$ | | | | 0.772*** | |
| | | | | (0.0404) | |
| $New\ Fund_i$ | | | | | 0.0803** |
| | | | | | (0.0335) |
| $Existing\ Fund_i \times 12 \times \widehat{\alpha}^{BM,pre}_{m,i}$ | | | | | -0.000185 |
| | | | | | (0.00128) |
| $New\ Manager_m$ | | | | | -0.0381 |
| | | | | | (0.0285) |
| $Existing\ Manager_m \times 12 \times \widehat{\alpha}^{BM,pre}_{m}$ | | | | | 0.00190 |
| | | | | | (0.00464) |
| $After\ 2000_{m,i}$ | | | | | 0.129 |
| | | | | | (0.826) |
| $Before\ 2000_{m,i} \times 12 \times \widehat{\alpha}^{BM}_{m,i}$ | | | | | 0.0505 |
| | | | | | (0.0468) |
| Year FE | Yes | Yes | Yes | Yes | No |
| Category FE | Yes | Yes | Yes | Yes | Yes |
| Controls | Yes | Yes | Yes | Yes | Yes |
| $N$ | 2108 | 2125 | 2101 | 1964 | 1034 |
| Adjusted $R^2$ | 0.003 | 0.429 | 0.003 | 0.637 | 0.40 |

The table shows flow-performance regressions of personal money a manager flows in her professionally managed fund. $FLOW_{m,i,t}$ is the yearly flow of personal money in a fund, measured in millions of SEK. *Amoun in* $MF_{m,i,t}$ is the a amount a manger invests in her own fund in millions of SEK. $\Delta RiskyFW_{m,i,t}$ is the change in the percentage of risky financial wealth that the professionally managed fund makes up of a manager's personal portfolio from one year to another. Column (5) runs a cross-sectional regression of the amount a manager initially, that is when she first appears in the data, invests in her own fund on measures of past fund and manager performance.

Table C1: Fund flows

| | (1) $\%Flow_{i,t}$ | (2) $\%Flow_{i,t}$ | (3) $\%Flow_{i,t}$ | (4) $\%Flow_{i,t}$ | (5) $\%Flow_{i,t}$ | (6) $\%Flow_{i,t}$ |
|---|---|---|---|---|---|---|
| *Amount in* $MF_{i,t-1}$ | -1.710 | -0.906 | -0.0335 | -3.179 | -1.578 | 0.783 |
| | (4.205) | (4.842) | (2.365) | (6.817) | (7.299) | (9.600) |
| $Wealth_{i,t-1}$ | 0.213 | 0.384* | 0.110 | -0.0137 | 0.185 | -0.227 |
| | (0.224) | (0.232) | (0.265) | (0.158) | (0.186) | (0.161) |
| $\widehat{IR}^{BM}_{i,t-1}$ | | | | -0.207 | 0.0518 | 0.149 |
| | | | | (0.574) | (0.605) | (0.837) |
| $\widehat{IR}^{BM}_{i,t-1} \times$ *Amount in* $MF_{i,t-1}$ | | | | 3.037 | 2.641 | 3.415 |
| | | | | (2.719) | (2.529) | (3.357) |
| Constant | 16.77*** | | | 13.00*** | | |
| | (2.000) | | | (2.415) | | |
| Year FE | No | Yes | Yes | No | Yes | Yes |
| Category FE | No | Yes | Yes | No | Yes | Yes |
| Fund FE | No | No | Yes | No | No | Yes |
| $N$ | 1798 | 1798 | 1697 | 1347 | 1347 | 1286 |
| Adjusted $R^2$ | -0.001 | 0.030 | 0.099 | 0.005 | 0.040 | 0.039 |

The table shows regression of fund flows on manager and fund characteristics. $\%Flow_{i,t}$ is the percentage change in assets under management, that is $\%Flow_{i,t} = (AUM_{i,t} - AUM_{i,t-1} \times (1 + R_{i,t}))/AUM_{i,t-1} \times 100$. Flows are winsorized at the 1% and 99% level. *Amount in* $MF$ is the absolute amount managers invest in their funds in millions of SEK. $Wealth$ is managerial net wealth in millions of SEK. Standard errors are clustered by funds.

models may be misspecified. Specifically, for a given manager I estimate the following factor regression:[40]

$$R^{p,OH}_{m,s} - R^{p,-}_{m,s} = \alpha^{FF4}_m + \beta^{FF4,\prime}_m FF4_s + \epsilon^{FF4}_{m,s} \tag{D1}$$

where $FF4_s = \begin{bmatrix} MKT_s & SMB_s & HML_s & MOM_s \end{bmatrix}'$, $r^{p,OH}_{m,s}$ is the value-weighted portfolio return of the subportfolio of overlapping holdings in her personal account each month, and $r^{p,-}_{m,s}$ is the value-weighted portfolio return in a manager's personal portfolio excluding overlapping holdings and investments in her own funds in each month. Personal portfolio data is observed at the end of each year, whereas fund holdings (which are used to determine overlapping holdings) are usually observed quarterly. I assume that the composition of personal portfolios is unchanged from one year to the next and that the composition of fund portfolios is unchanged from one quarter to the next (buy and hold assumptions).

The alpha in Equation (D1) exists for 123 managers and is on average positive at 3.3% (FF4), 3.07% (GF5), and 0.7% (CAPM). While these estimates are economically large, none of the alphas is statistically different from zero.

Next, I compare a manager's performance in overlapping holdings relative to her fund's performance. Since a manager can manage multiple funds and funds can be team managed, I define a manager's monthly return in her professionally managed funds as the value-weighted average of the returns in her funds:

$$R_{m,s} = 1/AUM_{m,s-1} \sum_{i=1}^{N_{m,s-1}} \frac{AUM_{i,s-1}}{N_{i,s-1}} R_{i,s} \tag{D2}$$

I then estimate the factor regression:

$$R^{p,OH}_{m,s} - R_{m,s} = \alpha^{BM}_m + \beta^{BM}_m (R^{BM}_{m,s} - R_{f,s}) + \epsilon^{BM}_{m,s} \tag{D3}$$

where $R^{BM}_{m,s}$ is defined similar as in Equation (D2). The alpha in this regression measures how much more or less risk-adjusted returns fund investors—all else equal—had earned had the fund's portfolio been exchanged with the subportfolio of overlapping holdings in a manager's personal account. The alpha in Equation (D3) exists for 127 managers and is on average positive at 135 basis points, but again not statistically different from zero.

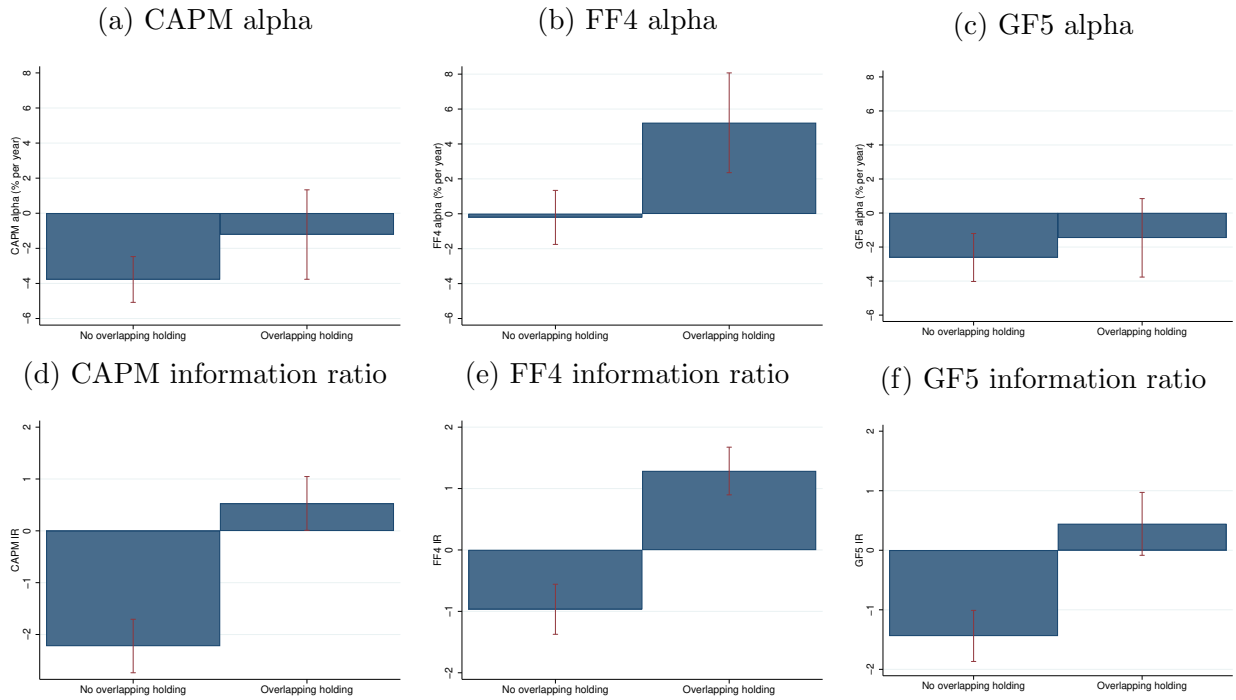
An alternative way to assess performance in overlapping holdings is to evaluate performance on the individual security level before individual security returns are aggregated to form a portfolio return. While such tests have more power, the caveat is of course that a manager may outperform with a subset of individual securities but that the outperformance disappears in her portfolio because the subset of outperforming securities enters with an insufficient portfolio weight. I estimate alphas and information ratios over the entire period an individual security is held in a manager's personal portfolio, conditional on whether the security was also held in a manager's fund or not. Again, the focus is not on whether overlapping holdings do better than a factor model but whether they do better than non-overlapping holdings. Figure D1 plots the alphas and information ratios for the three factor models and

[40] I require at least 12 monthly observations to estimate the coefficients.

shows that overlapping holdings consistently do better than non-overlapping holdings. All differences in means are statistically significant at least at the 10% level, except the estimates for the GF5 alphas.

In conclusion, there is evidence that managers indeed have superior information about individual securities when they invest in overlapping holdings.

Figure D1: Performance individual security level




The figure plots alphas and information ratio relative to three different factor models. Alphas and information ratios are estimated over the entire period a manager holds a particular security in her personal account, conditional on whether the security is also held in her professionally managed fund or not. Because personal portfolios are only observed at the yearly frequency and fund holdings at the quarterly frequency, all missing intermediate monthly data is imputed using a buy and hold assumption. The red bars indicate 90% confidence intervals with standard errors clustered at the manager level for the test that the means are different from zero allowing for different residual variances across the two groups.

## D.2 Front running

The previous subsection has indicated that managers perform particularly well in the stocks in their personal portfolios that overlap with their professionally managed funds. This suggests that managers are particularly well informed about a subset of stocks, but it also raises concerns of insider trading. This subsection investigates whether managers front run their funds, that is whether they buy individual stocks in their personal portfolios which

are then at some later point in time also bought by their funds. While just investing in stocks that are also held by one's fund may be technically legal, front running one's fund would almost certainly be classified as insider trading in most jurisdictions. The caveat of the analysis in this appendix is the frequency of observations. While fund holdings are observed quarterly, personal portfolio holdings are only observed at the end of every year. I classify a manager as front running her own fund if an individual security appears in her personal portfolio for the first time at the end of year $t-1$ (which means that it could have been bought at any time during $t-1$) and is then bought by at least one of her professionally managed funds over the course of year $t$. Surprisingly, according to this definition around 50 managers front run their funds at least once over their careers. Managers do extraordinary well if they front run. The average four-factor and CAPM alphas over the course of year $t$ for a security that is held in a manager's personal portfolio at the end of year $t-1$ and then bought by her fund over the course of year $t$ are 9.21% and 7.23%, respectively. Likely due to the very small sample size, these differences are, however, again not significantly different from zero in a statistical sense. Front running potentially comes at the cost of fund investors and these findings, although not part of the main contribution of this paper, should leave more than a bad taste in the mouths of investors and regulators.

## D.3 Entire personal portfolio

This appendix assumes that managers follow a buy and hold strategy in their personal portfolios throughout a year and investigates managers' personal portfolio performance in stocks and funds. Personal portfolio returns are a value-weighted average of individual stock and fund positions. Specifically, I estimate a personal portfolio alpha similar to Equation (5). The benchmark model to estimate alphas is the Swedish four-factor model. Across 1,281 manager-year observation and with standard errors clustered by manager, the average four-factor alpha is 1.5% and statistically different from zero at the 5% level, whereas the the average information ratio is on average –0.055 and not statistically different from zero. Personal portfolio performance, however, depends on the benchmark model employed to risk-adjust returns. Alphas relative to a simple Swedish market model are on average negative at –3.34% (information ratio –1.03), both statistically different from zero.