Common Holdings in Mutual Fund Family

Jean Chen, Li Xie, and Si Zhou*

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ABSTRACT

This paper investigates common holding behavior across fund members as a consequence of information sharing within fund families, using a sample of US open-end equity mutual funds. We investigate the characteristics of the fund common holdings and their performance consequences upon the individual funds and affiliated fund families. Our main results suggest that common holding portfolios could reflect stellar stock selection skill due to information advantage and carry positive spillover effects on funds' overall performance, but for low holding fraction. We also identify the potential channels for achieving such superior performance, i.e. IPO allocation, industry concentration and active share. In addition, we find the positive relationship between common holding level of fund portfolios and the probabilities of creating a star fund, offering a new explanation for star fund creation from the common holding perspective.

JEL classification: G11; G12; G23
Keywords: Common holdings; Mutual fund family; Fund performance

*Jean Chen is from University of Liverpool Management School and International Business School Suzhou; Li Xie and Si Zhou are from Southampton Business School at University of Southampton. We thank Paula Tkac and participants of the Western Economic Association annual conference, we also appreciate the comments from the seminar participants at the International Business School Suzhou and University of Southampton. Send Correspondence to Si Zhou, Southampton Business School, Building 2, Highfield, University of Southampton, Southampton, SO17 1BJ, United Kingdom; E-mail: s.zhou@soton.ac.uk.

I. Introduction

Information linkages or sharing among market participants is ubiquitous in financial markets (Colla and Mele (2010)). Within the mutual fund industry, existing literature has identified that fund managers or traders can have access to common sources of information by various methods, e.g. by social networks/interactions (Cohen, Frazzini, and Malloy (2008)), by geographical proximity (Hong, Kubik, and Stein (2005);Coval and Moskowitz (1999, 2001)), or by organizations of mutual fund families (Gaspar, Massa, and Matos (2006)).

As a consequence of information sharing within fund families, common holding behavior across fund members may be widely used for operational decisions. Indeed, Elton, Gruber, and Green (2007) have provided empirical evidence that the average percentages of common holdings for funds within families are more than twice as large as those for funds outside families. However, if such common holdings are pervasive within families, is it persistent? What are their characteristics? Does such common holdings contribute positively to fund performance, due to the shared information advantage? Could such common holdings ultimately benefit the fund family, the end-investors, or both? To date, existing literature has provided little further empirical evidence in response to these important questions to facilitate our understanding of operational decisions and trading behavior of fund families.

Thus, in this paper we investigate common holding behavior across fund members within families, based on US open-end equity mutual funds during the time period from 1981 to 2014. To better examine the different degree of common holdings of the fund members in a family, we define our common holdings (CH hereafter) in three ways: the so-called Tier I CH is our benchmark for family common holdings, being defined as the holdings which contain stocks held by each member of the family; Tier II CH as the holdings including stocks held by more than half the members of the family; and Tier III CH as the holdings containing stocks held by at least two members of the family. Such definition denotes that Tier I CH could be taken as the stock set, including information mainly derived from the common view of the family members and incorporated into the practice of all individual fund decision making; while Tiers II and III CHs may reflect the increase in the opportunities of sharing CH among family members. By sorting the funds of all three Tier CHs into five quantiles in ascending order based on their monthly CH levels, and comparing the corresponding rank of each tier in a 3-, 12-, or 36-month window, we observe that funds maintain significant persistence of common holding at both short and long time horizons.

To examine whether the information set of the common view shared by the fund family carries valuable information which is able to reflect superior stock selection skills, we evaluate the corresponding performance of funds' common holding portfolios, based on the three tier

classifications. We find a general trend that the performance of the CH portfolios is negatively associated with the increase in common holding level for each Tier CH, by considering various prevalent performance evaluation measures. In addition, comparing the three tiers of CH classifications in the first quantile, Tier I CH outperforms both Tier II CH and Tier III CH. Therefore, our findings indicate that the common holdings with a small fraction of the fund's overall TNA (Total net assets) might contain stocks with superior performance. In other words, the contents in the shared information set can reflect stellar stock selection skill when it accounts for a small proportion of fund value.

Based on the identified performance patterns of CH portfolios, and to further address how stocks are slected for CH portfolios and whether such selection is able to reflect skilled investment ability due to information advantage, we analyze the fundamentals of stocks included in the CH portfolios and investigate the potential channels through which commonly held stocks could reflect stellar picking skills. First, taking our benchmark portfolio, i.e. Tier I CH portfolio as an example, we rank stocks in ascending order according to their corresponding inclusion in the Tier I CH level portfolio, to examine whether the company fundamentals have impact on stock selection within different quantile portfolios. Our main results suggest that CH portfolios with higher levels tend to select stocks with larger market value and more tangible assets, but with fewer debts, stocks with higher return on assets and Tobin's Q, and stocks with higher momentum score and better recent performance. We also find that CH portfolios with higher levels are less likely to select new IPO stocks, possibly because of concern about post IPO underperformance in the long run (Ritter and Welch (2002)). In addition, we find a significant negative association between the distance and stock ranks of Tier I CH, indicating that stock selection within lower CH level portfolios seems to reflect more confident and aggressive, based on the fact that investment in local companies might alleviate information asymmetry and offer more "soft information" of the investment target. Thus, combining these observations with our findings on lower CH portfolios carrying superior performance, we suggest that stocks included within lower level CH portfolios are more selective than those with a higher level.

Secondly, we investigate IPO allocation and underpricing (Gaspar et al. (2006)), industry concentration (Kacperczyk, Sialm, and Zheng (2005)) and proportion of active share (Cremers and Petajisto (2009)) as the three potential channels, respectively, to identify how stocks are selected for common holding portfolios due to information advantage. For IPO allocation and underpricing, our empirical results suggest that more underpriced IPO deals have been allocated to Tier I CH portfolios with the highest average first-day return. After ranking the funds into the five quantiles, based on their particular CH level of tier group, we also find that more underpriced issues are allocated to the top-quantile portfolios for each

Tier CH, and that with the increase in CH level within each Tier CH, underpriced issues decrease. Our findings from the IPO allocation imply that more underpriced issues are likely to be the target components of the shared information set, and particularly that families with a small fraction of CH portfolios held by their members are superior in harvesting from IPO underpricing. We find similar results when investigating two other channels, i.e. industry concentration and active share.

In addition, we examine the determinants of fund common holdings at both fund and family level by conducting multivariate analysis on the relation between funds' monthly CH levels and their various characteristics. We find that both Tier I and II CH levels are negatively related to family age at 1% significance level, indicating that young families are more likely to have a larger proportion of common holdings among their members. It might be due to their limited resources and efforts devoted to stock selection, or due to their strategy of "betting on the market". We also find a negative association between funds' CH and the expense ratio at both fund and family level, and that such negative association is more pronounced at the family level compared with that of the fund level, especially in the case of Tier I CH. Such a negative association may be due to the fact that a higher expense ratio can stimulate research efforts and lead to better performance consequences, based on our findings that the performance of CH portfolios are negatively related with CH levels.

Finally, we investigate the investors realized performance consequence from funds' CH portfolios to address the implication for the funds' end-users. We find that, within each tier classification, fund portfolios in the top CH quantiles significantly outperform those located in the bottom quantiles, and funds with large CHs in their portfolios carry inferior performance. Our results are also robust when considering the influence of fund size on fund performance. These findings therefore imply that small CHs might have a positive spillover effect on overall fund performance. Furthermore, in addressing family motivation of maintaining CH in individual funds we investigate the association between the probabilities of having stellar performance with fund CH level. Taking our benchmark CH as an example, we find a significant positive relation between Tier I CH level and the birth rate of the star funds at 5% significance level. A possible interpretation of this is that the increase in CH level for fund portfolios may not reflect skilled investment ability, and therefore not deliver superior performance; and families with lower ability may be more likely to follow investment strategies by enhancing the probabilities of creating a star fund to utilize the positive spillover effect from the star fund phenomenon (Nanda, Wang, and Zheng (2004)).

Our work contributes to the existing literature in several ways. First, we provide empirical evidence on both the likelihood and persistence of common holding across fund members as the consequence of information sharing within fund families and the quality of shared

information reflected in such holdings depending on the level of common holdings. This observation demonstrates that common holdings of fund members are indeed the result of prevalent operational decisions due to information linkages within families, facilitating academics' and practitioners' understanding of portfolio holdings or trading behavior of fund families. Secondly, we suggest that levels of common holdings of individual funds can be used as an alternative measure of fund performance contributing to the literature, mainly due to such holdings both carrying information advantage and reflecting the average family investment ability. Prior research has documented the performance measure based on fund managers' superior knowledge of the capital market and their activeness in constructing investment strategies[1]. We argue that funds' common holdings can be viewed as a proxy for the common wisdom of the fund complex, which could reflect the average fund manager's skill[2]. Thirdly, we suggest that pursuing a "star creating" strategy may be a motivation for family maintained common holdings, and provides a new explanation for the creation of a star fund from a common-holding perspective, based on our empirical findings that fund portfolios with high level common holdings could imply inferior investment ability at the family level.

The rest of this paper is structured as follows: Section II describes the data and summary statistics. Section III defines common holdings. Section IV identifies characteristics of funds common holdings and evaluates the performance of common holding portfolios. Section V examines the activeness of common holding portfolios. Section VI investigates the determinants of common holdings. Section VII addresses the fund performance and common holdings. Section VIII offers the conclusion.

II. Data and summary statistics

We collect the mutual fund returns and holding data from the Center for Research in Security Prices (CRSP) Survivorship Bias Free Mutual Fund Database and the Thompson Mutual Fund Holdings Database (Formerly CDA/Spectrum Mutual Fund Holdings Database), respectively. Following Wermers (2000), the two datasets are merged by using the MFLINKS files accessed from the Wharton Research Data Services. Our data sample covers the period between 1981 and 2014. We restrict our focus to open-end US domicile actively managed

[1]See for example Cohen, Coval, and Pastor (2005); Kacperczyk et al. (2005); Kacperczyk and Seru (2007); Kacperczyk, Sialm, and Zheng (2008); Cremers and Petajisto (2009) and Huang, Sialm, and Zhang (2011)

[2]Previous research such as Zhang, Ding, and Zhou (2014) and Brown and Wu (2016), from a more theoretical perspective, consider fund performance as a combination of family common skills set and individual managers' idiosyncratic contributions.

equity mutual funds and eliminate balanced, sector, bond, money market, international and index funds[3] We also exclude fund observations which have less than ten stocks in their holdings or have less than $1 million under management in the previous quarter. In addition, we follow Gaspar et al. (2006) in counting funds with multiple share classes only once by keeping the one with the highest total net assets. Given the nature of examining funds common from the same fund family, we select fund families with more than one fund. Funds within the same fund family are identified through their management company name provided by CRSP. We also check fund names and their corresponding SEC fillings to confirm their affiliated fund families.

Table 1 reports the summary statistics of the dataset. Our sample contains 3,009 funds with distinct portfolios and 560,387 fund level observations from 553 fund families in total. Durham our sample period, the families contain an average of five funds.

[***Please insert Table 1 about here***]

Table 1 also summarizes other fund (family) characteristics that we used as explanatory variables in this research, i.e. TNA, age, expenses, turnover, fund load dummy, holding/investor returns and new money growth (NMG). We follow Nanda, Wang and Zheng (2004) to define the fund level cash flow, which is the dollar change of funds TNA net of price appreciation. The fund level NMG for fund i at time t is given by:

$$NMG_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}(1 + R_{i,t})}{TNA_{i,t-1}} \tag{1}$$

The family level NMG is obtained by aggregating the NMG of all the member funds. For family j with n member funds at t, the NMG is given by:

$$NMG^{f}_{i,t} = \frac{\sum_{i=1}^{n} NMG_{i,t}}{\sum_{i=1}^{n} TNA_{i,t-1}} \tag{2}$$

To calculate fund holding returns, we define a hypothetical buy-and-hold portfolio with the stock positions from funds most recently disclosed holdings[4]. The holding return of fund

[3]We select funds with the following Lipper objectives: SP, MC, SG, MR, CA, G, GI, LSE, EMN, ABR, DL, DSB and EI. Our sampled funds fall into two macro sections of the CRSP style code system, namely, Equity Domestic Cap-based (EDC) and Equity Domestic Style (EDS).

[4]Similar settings can be found in, for example, Kacperczyk et al. (2008) and Huang et al. (2011).

i at the time t can be defined as:

$$RH_{i,t} = W'_{i,t} R_t \tag{3}$$

where $W'_{i,t} = [w^1_{1,t} \dots w^m_{i,t}]'$ is the m-dimensional vector of portfolio weight invested into the stocks held by fund i, and for each of the elements in $W'_{i,t}$ satisfies:

$$w_{i,t} = \frac{N_{j,t-\delta} P_{j,t-1}}{\sum_{j=1}^{m} N_{j,t-\delta} P_{j,t-1}}$$

where $N_{j,t-\delta}$ is the number of holdings for stock j at the most recently disclosed date after adjusting for stock splits. We require stock holdings included in our sample to be no older than four quarters; $P_{j,t-1}$ is the stock price from the previous month.

III. Common holdings

To validate the fact that individual funds are more likely to invest in stocks which are also held by other members within the same fund family, we use a direct test to examine the portfolio similarity of randomly selected pairs of funds from our sample. We follow Elton et al. (2007) in defining $Similarity_{i,t}$ as the measure of similarity of fund portfolios, which is calculated by using the sum of the minimum fraction of the portfolio held in the pair of funds. Each of the sampled funds is paired with two funds by sampling randomly among the population of funds within and outside their affiliated families, respectively. The portfolio similarity is then evaluated for each pair. To address the test on the tendency of family members to maintain similar holdings, we further create a dummy variable to indicate whether the funds in each pair belong to the same fund family. The test is conducted using following specification:

$$Similarity_{i,t} = \alpha_i + \beta_i D^{Fam}_{i,t} + X'\gamma + \epsilon_{i,t} \tag{4}$$

where $D^{Fam}_{i,t}$ is the dummy variable indicating whether the pair of funds belongs to the same family. X is the vector of control variables for the corresponding pairs of funds. We control the absolute difference on fund (family) TNA, fund (family) age and the family size between the funds of each pair. The standard error is clustered at fund level.

Table 2 reports the estimations from Equation(4). Our results provide preliminary ev-

idence to support our conjecture that fund families increase the probability of information sharing among member funds regarding investment decision-making. Specifically, in column 1 of Table 2 we observe that the portfolio similarity of funds within the same family is 18.9% higher than funds outside the family. The result is statistically significant at 1% significance level. Our findings are also robust when including a year fixed effect in column 2. In column 3 we further interact the same family dummy, $D_{i,t}^{Fam}$, with the same sector dummy which indicates whether funds belong to the same investment style. Our results suggest that the dynamics of portfolio similarity with sector dummy is enhanced by 37.3%, (8.4% + 28.9%) conditional on paired funds belonging to the same family. On the other hand, funds within the same investment style but not from the same family only drive the similarity by 8.4%.

Hong et al. (2005) show that funds clustered around the same city appear to have similar investment preferences to those located far apart. To further examine how this geographical issue interact with the in-family portfolio similarity, we incorporate an additional dummy variable to indicate whether the headquarters of the paired funds are located in the same city[5]. The results given by column 4 of Table 2 suggest that funds located in the same city yields the portfolio similarity by 16.4%, (1.6% + 14.8%), when the pair of funds are from the same fund family. It is also worth noting that the loading on $D_{i,t}^{Fam}$ is not statistically significant. A plausible explanation could be that funds from the same family are less likely to operate in different cities.

[***Please insert Table 2 about here***]

To evaluate the degree of fund common holdings, we employ a simple measure, calculating the proportion of the fraction of an individual funds common holding stocks in its total value of stock holdings. Namely, for a certain fund family we have:

$$\Omega_t = \bigcap_{i=1}^{n} H_{i,t} \tag{5}$$

Ω_t is the set of commonly held stocks in the family at time t and n is the number of funds in the family. $H_{i,t}$ is the set of stocks held by fund i at time t. The common holding level for fund i is therefore defined by:

$$CH_{i,t} = \frac{\sum_{\omega} X_{\omega,i,t}}{\sum_{h} X_{h,t,t}} \quad (\omega \in \Omega_t, h \in H_{i,t}) \tag{6}$$

[5]We also acquire the zip code of fund headquarters from CRSP and calculate the geographical distance between the paired funds by using the longitude and latitude information from the US Census Gazetter file updated in 2013. Our findings are robust when switching to this alternative measure.

where $X_{\omega,i,t}$ and $X_{h,i,t}$ is the fraction of fund i's portfolio invested in each of the stocks at time t within the set of Ω_t and/or $H_{i,t}$, respectively[6].

The fraction of commonly held stocks within fund portfolios demonstrates the intention of information sharing across the family members. We define the holdings held by all the members of a family as Tier I common holdings (Tier I CH, hereafter). The components included in the Tier I CH could be regarded as the stock set, which consists of information mainly exploited by the common view of the family members and implemented in the practice of individual fund decision-making. Multiple reasons could lead to the formation of a funds Tier I CH. For example, some fund managers within the fund family might share the same view on certain companies, or have similar insights on the entire macroeconomic environment, which could drive their investment strategies to be alike (Elton et al. (2007)).

However, it remains a possibility that the fund family might coordinate the investment decision-making of its members with the same valuable but uncertain information (Gaspar et al. (2006)). The family might conduct a strategic allocation by hedging the risk through allowing only certain members to exploit the information, or allowing others to take opposite positions. Fund families may also favor certain manager(s) or fund(s) by allocating valuable information. Motivated by such concern, we consider two additional measures, namely, Tier II CH ($\Omega_t^{(2)}$) which is defined to contain stocks which have been held by more than half the members of a family, while Tier III CH ($\Omega_t^{(3)}$) contains stocks held by at least two members of the family. Tier II and III CHs increase the opportunities of having commonalities in the holdings of the family members. In addition, since letting family members to use investment information simultaneously might enhance the risk-taking of the overall family, the formations of Tier II and III common holdings give consideration to the family conducting a strategy of sharing information within a limited scale, and could shed additional light on the consequences of various degrees of information sharing within the fund family.

Tier I CH is calculated by applying into Equation(6) while Tier II and III CH is measured by implementing the alternative stock set ($\Omega_t^{(2)}$) and ($\Omega_t^{(3)}$), respectively, both of which are also made to satisfy the following conditions that:

$$\Omega_t \cap \Omega_t^{(2)} = \emptyset$$
$$\Omega_t \cap \Omega_t^{(3)} = \emptyset$$

[6]For some of the funds in the CDA/Spectrum database, the amount of investment in held stocks does not add up to 100%. It might be due to the holding of cash in fund portfolios or simply omitted by the dataset (Elton et al. (2007)). We therefore consider an alternative measure which calculates the fraction of common holdings as the proportion of a funds TNA. Our results are consistent if switching to this alternative measure.

IV. Characterization of fund common holdings

In this section, we discuss the characteristics of funds with various degrees of common holdings and the contents inside funds common holding portfolios.

A. Descriptive statistics and persistence of common holding level

Table 3 summarizes the cross-sectional common holding level across the three tiers/types for all the sampled funds, and for funds grouped into different CRSP sectors[7]. For Tier I CH, over a quarter of fund portfolios are invested in the same fraction of stocks held by each fund member within the family through the whole sample period. In general, style-based funds hold a higher fraction of common held stocks than cap-based ones. Income, Growth & Income and Hedged funds have a higher than average common holding level. The proportion increases dramatically for particular styles. For example, Large Cap funds have extremely high common holdings, given that they are mainly selecting stocks listed in the S&P100. However, the total number of Large Cap funds accounts for less than 2% of the overall sample funds. The CH level gradually increases when turning to Tiers II and III, the only exception being for Large Cap, Hedged and Income funds, since the stocks included in Tiers II and III disappear in Type I.

[***Please insert Table 3 about here***]

In Table 4, we further examine the dynamics of the Tier I CH levels over time by sorting funds into five quantiles according to their monthly common holding level, and comparing their corresponding rank after a 3-, 12- or 36-month window, respectively. Columns 1 to 5 report the transition probabilities of funds grouped in each of the quantiles. The 6^{th} column reports the average CH level for the corresponding quantile and is followed by the Spearman rank correlation.

We find significant persistence of common holding at both short and long time horizons. Over three quarters of the sampled funds in both the first and fifth quantiles remain in the same group, three months after the portfolio formation date. Such a proportion decreases marginally to a little over 50% after a three-year window, while the Spearman rank correlation remains statistically significant at 1%. It is also worth noting that funds in the extreme CH quantiles are more likely to stay in the same groups than to move to the middle quantile groups. In particular, funds with the highest CH level maintain a more stable fraction of commonly held stocks in their portfolios at both short and long horizons. Funds located in

[7]We group funds according to their CRSP sectors. Table A1 of the Appendix explains the mapping between CRSP sectors and funds Lipper style code.

the middle of CH quantiles at short horizon are less likely to stay in the same groups when turning into long horizons. We find consistent results when adapting Tier II and III common holding levels based on our analysis[8].

[***Please insert Table 4 about here***]

B. Characteristics of funds with common holdings

To provide insights on the characteristics of funds with various levels of common holdings, we calculate the average funds characteristics by sorting funds into the five quantile groups according to their most recent CH level[9]. The results based on Table 5 suggest that the 1^{st} quantile consists of the youngest funds, but comes from the oldest families. Fund investors are more sensitive to the performance of funds with short track records, given that limited information might be more demanding on mangers skillsChevalier and Ellison (1997). Younger funds are therefore more likely to depend on their own information set in terms of picking stocks. On the other hand, younger families tend to lean towards the shared information set, since centralized holding could lead to less research costs. In addition, Table 5 also shows that families in the 1^{st} quantile have the highest average number of members, which can also serve as a reason for higher common holdings, since younger families tend to be of smaller size.

Family inflows exhibit a U pattern where the mean differences between 1^{st} (5^{th}) and 3^{rd} are both over ten basis points and statistically significant, which indicates that the funds with an extreme CH level are those of families experiencing less capital outflow. Meanwhile, we also find that the funds with higher CH tend to have a lower expense ratio, which can be partially explained by their increasing TNAs (Khorana, Servaes, and Tufano (2009)).

[***Please insert Table 5 about here***]

C. Performance of common holding portfolios

To test whether the information set shared by the fund family carries valuable information that can reflect superior stock selecting skills, we evaluate the corresponding performance of funds common holding portfolios.

We consider six measures of portfolio performance, namely, the excessed market return relative to the value-weighted market portfolio; the single factor CAPM; the Fama and French (1993) three-factor model; the Carhart (1997) four-factor model; the Pastor and Stambaugh

[8]Relevant results are given by Table A2 and A3 in the Appendix

[9]We follow Fama and Macbeth (1973) to calculate funds mean characteristics. Cross-sectional means are calculated at each time period and then averaged over time.

(2003) liquidity model and the Ferson and Schadt (1996) conditional model. The Carhart model has the following specifications:

$$R_{i,t} - Rf_t = \alpha_i + \beta_i^M (Rm_t - Rf_t) + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \beta_i^{MOM} MOM_t + \epsilon_{i,t} \quad (7)$$

where the term $R_{i,t} - Rf_t$ is the excess return of fund i relative to the risk-free rate. $Rm_t - Rf_t$ denotes the market excess return. SMB_t is the return difference between the portfolios of small and big stocks. HML_t is the return difference between the high and low book-to-market stocks. MOM_t is the return difference between the portfolios of stocks with high and low returns in the previous year. The Pastor-Stambaugh model nests the Carhart model with an additional liquidity factor. We follow Wermers (2000) to estimate Ferson-Schadt conditional model with the following specification:

$$\begin{aligned} R_{i,t} - Rf_t = {} & \alpha_i + \beta_i^M (Rm_t - Rf_t) + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \beta_i^{MOM} MOM_t \\ & + \sum_{j=1}^{5} \beta_{i,j} [z_{j,t-1} (RM_t - Rf_t)] + \epsilon_{i,t} \end{aligned} \quad (8)$$

where $z_{j,t-1}$ is one of the four demeaned values of lagged macro-economic variables and one additional indicator variable for the month of January. We follow the previous literature to include the following four macro-economic variables: the 1-month Treasury bill yield, the dividend yield of the S&P Index, the Treasury yield spread (long minus short-term bond) and the quality spread in the corporate bond market (low minus high-grade bonds)[10].

Table 6 tests the performance of strategies based on the trading of funds common holding portfolios. We use Equation(3) to compute the returns of funds' common holding portfolios. Sampled funds are then formed into five portfolios according to their most recent quantile ranks based on their CH level. We therefore calculate returns from each of the five portfolios and apply them into the six aforementioned measures to evaluation their performance.

In general, our results show that the performance of the common holdings portfolio is negatively related with the increasing scale of the CH level. Panel A of Table 6 reports the performance consequence of the trading strategy when we update the rank of funds CH level every quarter. We observe that the portfolio with the lowest CH level contain the best

[10]The risk-free rate, market, size, book-to-market and momentum factors are obtained from Kenneth Frenchs website (`http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html`). The liquidity factor is obtained from Lubos Pastors website (`http://faculty.chicagobooth.edu/lubos.pastor/research/`). The dividend yield is obtained from Robert Shillers website (`http://www.econ.yale.edu/~shiller/data.htm`). The Treasury yield spread is the difference between a 10-year Treasury bond yield and the 3-month Treasury bill yield provided by CRSP. The quality spread is the difference between Moodys BAA-rated corporate bond yield and the AAA-rated corporate bond yield.

performed common holdings. For example, within Tier I rank, the portfolio ranked into the first quantile delivers a Carhart alpha of 9.83%, which is over 12% higher than the portfolio ranked at the third quantile. Although common holdings in the first quantile of Tier II (Tier III) rank still outperform other portfolios with higher CH levels, the margin between the 1^{st} and 3^{rd} quartile reduced by 4% (7%) for Carhart alpha, compared with that of Tier I. By extending the portfolio formation period to 12 months, we observe similar results (given by Panel B), that the first quantile CH portfolios exhibit significant positive alphas, whereas CH portfolios with higher quantile ranks deliver significant negative alphas. According to Panel B of Table 6, for example, the CH portfolio in the first quantile of Tier I rank has a Carhart alpha of 1.96% and it drops significantly to -1.55% for common holdings in the fifth quantile. A similar trend of decreasing portfolio alphas is also documented in Panel B among the three tier ranks.

Our results in Table 6 imply that common holdings, which only attribute a small fraction of funds' overall portfolio value, might contain stocks with superior performance. In other words, the contents in the shared information set can reflect stellar stock selection skill, but only for a small number of stocks. This may be partially due to the fact that family research engagement can only be allocated among a small number of equities, given their limited resource input. The results from Table 5, which observe that younger and smaller fund families tend to maintain larger common holdings, also support the argument that the high levels of common holdings are driven by families' attempts to cut research expenditure. Additionally, since the contents within the CH portfolio can reflect the prevailing view on the capital market held by managers within the same family, we argue that CH level could serve as an indicator of the average skill of the fund complex. Therefore, the negative relation between CH level and the performance of CH portfolios documented in our findings implies that a fund family with low CH might have advantages in terms of information gathering and stock picking.

[***Please insert Table 6 about here***]

Figure 1 depicts the cumulative distribution of the performance ranking of individual common holding portfolios at different degrees of CH level. We sort funds into five quantiles in similar fashion to Table 4. We then compute the percentile ranks for all the common holding portfolios based on their Carhart alphas over the subsequent 12 months. For brevity, Figure 1 only plots the cumulative distributions for three groups of common holding portfolios. Namely, CH1 represents the curve of common holding portfolios belonging to the first quantile which maintain the lowest CH level, whereas CH5 corresponds to those from the bottom quantile that keep the highest CH level, and CH3 those from the third quantile

which fall between the two extreme groups.

Common holding portfolios from funds with a low CH level are more likely to be ranked at the top of the performance distribution. For example, more than 20% of the common holding portfolios from CH1, but less than 3% from CH5, can be ranked at the top 10^{th} percentile of the performance distribution. On the other hand, low CH level also enhances the probability of being ranked at the bottom of the performance distribution, with a disproportionate amount compared with those in the top percentile. For example, around 10% of common holdings from CH1, but 5% from CH5, are ranked at the bottom 10^{th} percentile of the performance distribution. Therefore, our results indicate that funds with lower CH level contain more commonly held equities with better performance.

[***Please insert Figure 1 about here***]

V. Characterizations of commonly held stocks

Our results from the previous section suggest that contents within the commonly shared information set may represent stellar stock selection skill, but then a question arises: how can stocks be selected for this common holding portfolio? To provide further insights on this issue, we begin by analyzing the fundamentals of the stocks included in the common holding portfolios, and then investigate the three channels used to construct the CH portfolio to detect the quality of shared information included in the common holding portfolios, namely, IPO allocation and underpricing, industry concentration and proportion of active share.

A. Stock fundamentals

To explore whether the company fundamentals might be considered as factors of selecting stocks within the common holding portfolio, we perform multivariate analysis by regressing quarterly based firm fundamentals on the classification of stocks which are associated with the five CH portfolios. We rank stocks in ascending order according to their corresponding inclusion in the Tier I CH level portfolio, i.e. stocks with higher ranks suggests that they are contained in high CH level portfolios. The regression model is specified as:

$$\begin{aligned} Rank_{i,j,t} = {} & \beta_{0,i} + \beta_{1,i}(Size)_{i,t-1} + \beta_{2,i}(ROA)_{i,t-1} + \beta_{3,i}(TobinQ)_{i,t-1} \\ & + \beta_{4,i}(Tangibility)_{i,t-1} + \beta_{5,i}(Leverage)_{i,t-1} + \beta_{6,i}(Dividend)_{i,t-1} \\ & + \beta_{7,i}(Mom)_{i,t} + \beta_{8,i}(Return)_{i,t-1} + \beta_{9,i}(IPO)_{i,t} \\ & + \beta_{10,i,j}(Distance)_{i,t} + \epsilon_{i,t} \end{aligned} \tag{9}$$

where *Rank* is the quantile rank of stock i in portfolio j based on its CH scale; *Size* is the log value of company market size; *ROA* is the return on assets; *TobinQ* is the log value of a companys Tobin's Q; *Tangibility* is the fraction of tangible assets over total assets; *Leverage* is the book value of both short-term and long-term debt; *Dividend* is companys dividend payout ratio; *Mom* is the momentum score which is given by the cross-sectional percentile ranks of average stock returns over the previous 11 months; *Return* is the stock return from the most recent quarter; *IPO* is a dummy variable which equals to 1 if the company is floated within the last four quarters and 0 otherwise; *Distance* is the log value of the geographical distance between the headquarters of the firm and the fund company.

Table 7 shows the results of estimating Equation(9) by using an ordinal logistic regression. We find that high CH portfolios tend to include stocks with larger market value and more tangible assets, but fewer debts. Meanwhile, stocks with high return on assets and Tobin's Q are more likely to be considered for the intake of high CH portfolios. Our results also show the tendency of selecting stocks with high momentum score and better recent performance for the high CH portfolios. For example, one unit increasing in mom and equity returns enhances the odds of stocks being promoted to higher CH portfolios by 1.2% and 23%, respectively, when controlling both year and stock industry fixed effects. In particular, the inclusion of stocks with better recent performance might raise the suspicion of fund managers window dressing in their holdings. Further, we find that high CH portfolios are less likely to select new IPO stocks, given the concern of post IPO underperformance in the long run (Ritter and Welch (2002)). Combining these observations with our finding of lower CH portfolios reflecting stock with superior performance, we argue that stocks included within lower level CH portfolios are more selective than those with higher level.

Motivated by the research of Coval and Moskowitz (1999, 2001), who find that fund managers tend to invest in companies that are geographically close to them and can achieve significant abnormal performance from such investment, we accordingly calculate the physical distance between the fund company headquarters and each of its holding stocks, and the log value of the distance is then incorporated in Equation(9) as an additional explanatory variable. We observe a significant negative relation between distance and stock Tier I CH ranks. This suggests that holding companies are located in the furthest reaches of the low CH portfolios. Given the argument that investment in local companies might mitigate information asymmetry and could provide more "soft information" on the investment target, low CH portfolios seem to be more confident and aggressive in terms of choosing stocks. Further, this might also be driven by the strenuous research efforts devoted to constructing the shared information set[11].

[11]Our results are robust when switching to an alternative measure of geographical distance, the same

[***Please insert Table 7 about here***]

B. IPO allocations

Institutional investors are likely to receive preferential treatment in IPO from underwriters, given that underwriters are better informed about offer demand and are capable of allocating more IPO shares to favorable investors (See for example, Aggarwal, Prabhala, and Puri (2002); Reuter (2006)). Previous research also finds evidence to support that fund families are entitled to such favors as the allocation of hotter IPO deals (Gaspar et al. (2006)). We therefore conduct a test for whether common holding portfolios contain IPO deals with better returns.

We follow Reuter (2006) and Gaspar et al. (2006) in collecting all IPO deals during the time period 1985 to 2014 from Thomson SDC database. We then estimate the first-day return of each IPO case by calculating the percentage increase from its IPO offer price to the first-day closing price. Each of the IPO deals is therefore merged with our fund holding dataset to enable the evaluation of the corresponding returns from IPO allocations[12].

Table 8 summarizes the results of IPO allocations across the three tiers of CH portfolios. Panel A reports that the sampled fund held 5,708 IPO stocks among all the 9,260 IPO deals collected from SDC, and the fund-held IPO stocks deliver higher average first-day returns (25.41%) than the whole sample IPO cases (19.88%). In Panel B, we compare the first-day returns among the three tiers of CH level. Our test suggests that more underpriced IPO deals have been allocated to Tier I common holding portfolios, with an average first-day return of 37.26%, which is over 12% higher than the IPO deals held by all the sample funds. The margin between Tiers I and II is also positive and statistically significant. IPO deals included in the Tier II common holding portfolios have the second highest average first-day return of 30.61% which also exceeds the average return from all fund-held IPO deals.

We also calculate the dollar amount of IPO underpricing and its contribution to TNA shown in Panel C to better address the magnitude of our findings. We find that the amount of "underpricing dollar" in Tier I common holding portfolios is systematically higher ($3.65 billion) than those received by Tier II and III portfolios, which are $3.17 billion and $3.01 billion, respectively. Our results also suggest that the contribution of IPO underpricing to TNA from Tier I common holding portfolios is higher (0.72%) than those from Tier II (0.49%) and III (0.36%) portfolios.

region dummy, considered by Chen, Hong, Huang, and Kubik (2004).

[12]IPO cases in the fund holdings are identified if the IPO stocks are included in the reported quarter-end holding date of a certain fund. We follow Reuter (2006) to use the positive reported holdings of the IPO stock as the best approximation of funds trading on IPO stocks.

In Panel D we further examine the returns received from IPO underpricing across different quantile groups. We rank the funds into the five quantiles according to the CH level of certain tier groups. We find that more underpriced issues are allocated to the top-quantile portfolios, and this remains the fact for all of the three tiers. It is worth noting that the average first-day return of the bottom Tier I quantile is lower (23.66%) than that of all of the fund-held IPO issues. Our findings from the IPO allocations indicate that more underpriced issues are likely to be the target components of the shared information set, and, in particular, that families with a small fraction of CH portfolios held by their members are superior in harvesting from IPO underpricing.

[***Please insert Table 8 about here***]

C. Industry concentration

Fund managers might concentrate their holdings on certain sectors due to their superior knowledge of specific industries. Previous research has found a significant positive relation between the scale of industry concentration and fund performance (Kacperczyk et al. (2005)). In this section, we extend the research to examine whether industry concentration is one of the strategies considered in the common holding portfolios.

We adapt the measure proposed by Kacperczyk et al. (2005) to estimate the industry concentration index (ICI hereafter) of the common holding portfolio, which is derived from the sum of squared deviation between value weights of each industry held by the portfolios relative to the weights of entire market. The specification is as following:

$$ICI_{i,t} = \sum_{j=1}^{n} (w_{i,j,t} - \bar{w}_{j,t})^2 \tag{10}$$

where $w_{i,j,t}$ is the value weights of industry j held by portfolio i at time t and $\bar{w}_{j,t}$ is the weights relative to the market. To adjust the upside biases of ICI being negatively correlated with the portfolio size, is calculated relative to the fund value. We sort funds holding stocks into ten sectors by grouping the 48-industry specifications based on their SIC code[13]. The ICI is therefore calculated for each of the common holding portfolios by aggregating the squared deviations for the ten sectors.

Table 9 shows that the annual ICI from Tier I common holding portfolio is systematically higher than those from Tiers II and III. For example, Panel B reports that Tier I common

[13]We follow Kacperczyk et al. (2005) to map the holding stocks into 10 macro sectors according to their SIC classifications.The SIC codes are collected from Kenneth French's website (`http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html`)

holding portfolio has an ICI with 5.13%, and is significantly higher than Tier III with a margin of 1.43%. However, no significant difference is spotted between Tiers II and III. Following the analysis in Table 8, we also examine the annual ICI of funds with different CH level. We find funds ranked at the top quantile contain the most industry concentrated common holding portfolios across the three tiers. For Tiers I and II holdings, ICI decreases monotonically with the increasing of CH level. Our results in Table 9 therefore provide some evidence for our conjecture that common holding portfolios are more likely to focus on certain industries as a result of the superior knowledge from the common information set.

[***Please insert Table 9 about here***]

D. Active share

Following the measure of industry concentration in the common holdings, we further evaluate the funds activeness when constructing the common holding portfolios. Previous research argues that funds maintaining holdings which are more deviated than the market benchmark outperform funds with less deviated holdings (Cremers and Petajisto (2009)). We therefore follow their research to examine whether the components included in the CH portfolio can be characterized as a consequence of active management. The specification of the measure can be found as following:

$$AS_{i,t} = \frac{1}{2}\sum_{j=1}^{n}|w_{i,j,t}^{fund} - w_{j,t}^{index}| \tag{11}$$

where $w_{i,j,t}^{fund}$ is the value weight of stock j held by portfolio i relative to fund value while $w_{j,t}^{index}$ is the market value weight of stock j relative to a certain market index. Our selection of the market indices includes S&P 500, S&P 500/Barra Growth, S&P 500/Barra Value, S&P MidCap400, S&P SmallCap 600 and an additional value-weighted index created by including stocks held by funds within the same investment style.

Results in Table 10 indicate that Tier I common holdings contains the highest proportion of active share (AS hereafter) among the three tiers. Specifically, in Panel B the annual AS for Tier I is 35.81% which is significantly higher than the all sample AS (23.95%) in Panel A and then those from Tier II (32.62%) and III (28.96%)[14]. Similar results are found in Panel D when switching to the style index[15]. For example, Tier I portfolio maintains an

[14]We define the annual AS in Panel A and B by calculating the percentage of active share relative to each of the 5 indexes in the S&P family and take the average of the five AS given the concern that funds might focus on different benchmark index.

[15]The style index includes all the holding stocks by funds within the same investment style. $w_{j,t}^{index}$ is

AS proportion of 45.48%, which is systematically higher than the all sample cases and the portfolios from other tiers.

[***Please insert Table 10 about here***]

In addition, Table 11 presents the results of AS across different CH quantile groups. We find that both S&P and style index funds ranked at the top quantile consist of the common holding portfolios with the highest percentage of AS, and this drops significantly with growth of CH level. It is worth noting that the style AS (reported in Panel B) is systematically higher than the S&P AS (reported in Panel A), especially for those ranked at the top quantile, indicating that the stocks contained in common holdings are more actively combined. Consequently, our results support the argument that the inclusion of more active share can be another channel leading to the superior performance of the common holding portfolios.

[***Please insert Table 11 about here***]

VI. The determinants of common holdings

This section analyses the different determinants of fund common holdings using panel regression of funds' monthly CH level on various characteristics. For each of the funds we compute the three tiers of monthly CH level following Equation(6). Table 12 summarizes the results from the two types of specifications, namely, the first three columns use fund level CH to regress on the fund characteristics, while columns 4-6 report the results on family characteristics. Fund family expense ratio, turnover and return are calculated by averaging the corresponding value from its members. Family level capital inflow is obtained by Equation(2). The family load dummy equals to 1 if any member within the family has a load. Family age is set to be the age of the oldest fund within the family.

The first determinant we investigate is age. Our results in Table 12 suggest that Tiers I and II CH levels are negatively related to family age at 1% significance level. For example, the coefficient estimates of family age for Tier I CH is at -0.05, indicating a 1% increase in the family age and decrease in its member fund's CH level by around 5 basis points per month. A similar result is documented when turning to Tier II CH, where the coefficient estimate is at -0.07 and it is statistically significant from zero at 1% significance level. It is not surprising to have a positive sign of the coefficient estimates of family age for Tier III CH,

therefore given by the fraction of total holding value of stock j relative to the aggregated value of portfolio holdings from all funds within the same investment style.

since it allows stocks, which are held by at least two member funds, to be included in common holding portfolios. Therefore, combining results given by Tiers I and III, we argue that older families tend to maintain a relatively small fraction of investment in commonly held stocks (Tier I CH), but might have large holdings in a "stock pool" with limited members within the same family (Tier III CH). On the contrary, young families are more likely to have a larger proportion of common holdings among their members. It might be due to their limited resources and efforts devoted to stock selection, or be the result of their strategies of "betting on the market", which will be further examined in the next section.

The second determinant of interest is the expense ratio. Our result shows a negative relation between funds' CH and both fund and family level expense ratio. In addition, the negative coefficient of this variable is more pronounced at the family level compared with those for the fund level, especially in the case of Tier I CH. Gaspar et al. (2006) suggest that a fund family might allocate their resources to benefit members, charging high fees at a cost to those with low expenses. Thus, an explanation for such a negative relation could be the consequence of families' strategic allocation between high and low value funds, since the performance of a CH portfolio is negatively related with CH level. Alternatively, we conjecture that the higher expense ratio can stimulate research efforts and lead to better performance consequences. The negative relation documented between load dummy and CH level can also support such an argument.

[***Please insert Table 12 about here***]

The third determinant is the fund/family size. We observe a positive relation between fund size, i.e. Log (TNA) and the CH level from both Tiers I and II. For example, based on the coefficient estimated for Tier I CH, a 1% increase in the log value of fund size prompts the fund to increase its common holding level by five basis points. Prior research suggests that fund performance decreases with fund size, but increases with family size, due to the impact of diseconomies of scale in active management (Nanda, Narayanan, and Warther (2000); Berk and Green (2004); Chen et al. (2004)). Therefore, our results are consistent with their findings, given that we observe superior performance from the common holding portfolio with low CH level. In addition, Chen et al. (2004) argue that large families are more likely to have a decentralized decision-making process, so that individual managers have more freedom in picking stocks and need not worry about resources being taken away from the family. Our results provide additional evidence suggesting that large families are also able to provide a high-quality common information set for sharing amongst the members. The existence of such a common set can benefit all members by constructing a fundamental portfolio, which the fund managers can then use to run their own assets.

In addition, the regression results also indicate that funds with high turnover tend to have less CH level for all three tiers. Following Kacperczyk et al. (2008) we also include the variable of transparency of fund investment strategy as the one of the determinants for CH level. We find some evidence to support a negative relation between CH and family-level transparency which is given by the correlation between average holding returns and investor returns within the family for the previous year. However, we do not find significant evidence of fund-level opaqueness to be related to their CH level.

VII. Fund performance and common holdings

In this section, we discuss the performance consequences of funds' common holding portfolios, since it is only the fund's actual return that the end-investors can obtain from investing in the fund industry. We start with analyzing the performance consequence of trading portfolios containing groups of funds sorted by their CH level. We also examine the performance implication of various CH levels on the family level.

A. Performance consequences

Following a similar fashion to that of the settings in section IV.B, we form the five portfolios by sorting funds into five quantiles based on their most recent CH level. Each of the five portfolios is rebalanced on a quarterly basis. We then apply the returns from each portfolio in the six aforementioned performance evaluation models[16].

Table 13 reports the results of performance from trading for the five portfolios. In general, we observe that portfolios containing high CH funds tend to deliver inferior performance, especially those including funds with median CH level, compared with the low CH ones. For example, in Panel A the portfolio consisting of funds ranked in the top quantile delivers a monthly Carhart alpha of -0.04%, which then drops by around nine basis points when turning to the third quantile portfolio. Although it further increases to -0.10%, such changes remain statistically insignificant. Similar facts are found in the results estimated by the other five performance measures. In unreported tests, we find that the inferior performance persists for funds located in high quantiles when considering rebalancing the trading portfolio on an annual basis. We observe similar results in Panel B when portfolios are formed following funds' Tier II CH level. However, results given by Panel C no longer show significant negative performance estimates in the bottom quantile.

[16]We also conduct a similar test of trading fund portfolios on an annually rebalancing strategy, and find the results to be consistent with the current findings.

[***Please insert Table 13 about here***]

The negative relation between CH level and performance of the CH portfolio documented in previous sections might be the main trigger of the findings in Table 13. Although CH portfolios at the top quantile are capable of delivering superior performance, on average they only account for around 5% (Tier I CH level) of the funds portfolio value. Meanwhile, the poor performance from funds ranked at the bottom quantile might be driven by their underperforming CH portfolios which account for over 70% on average (Tier I CH level). However, despite the small fraction of value within the overall portfolio, funds with low CH level still outperform the high CH ones by around 17 basis points for CAPM alphas. We observe similar results when using alternative performance measures. Our findings provide additional evidence to support the previous argument of CH level being a sign of average managers' skill. Given that funds with low CH level might contain more valuable and reliable information in the CH portfolio, we argue that funds with low CH level might benefit from the spillover effects of the common information set.

Meanwhile, previous research by Kacperczyk and Seru (2012) suggests that fund families with decentralized organizational settings significantly outperform those with a centralized structure. Our results therefore provide additional empirical evidence to support the argument that fund managers with more flexibility might deliver better performance. Moreover, given the vigorous efforts devoted to constructing the shared information set, we argue that managers from low CH families might benefit from the spillover effects of CH portfolios, so as to manage their own assets more effectively.

To further analyze whether such a negative relation between CH level and fund performance is driven by the size of the mutual funds, we segregate the mutual funds into three size portfolios and compare the performance of fund with various degrees of CH level.

The results presented in Table 14 suggest that fund performance decreases with the increase of CH level in each of the group sizes. For example, the Carhart alpha for the top quantile CH portfolio within the low TNA group is -0.002% and is statistically insignificant; it reduces to -0.09% for the bottom quantile within the same size group and it is significant at 5%. Meanwhile, our results also provide support the findings of Chen et al. (2004) that small mutual funds outperform large funds. Specifically, the Carhart alpha is -0.13% for the bottom CH quantile in the high TNA group, while it increases to -0.09% for those within the same CH quantile but located in the low TNA group. Both of the alphas are statistically significant.

[***Please insert Table 14 about here***]

B. Common holding and star fund creation

Given our findings observed in the previous sections, one may be skeptical about the motivation of maintaining high CH funds in the fund complex, as they should cease to exist in the equilibrium. We further investigate this concern by examining the implication of common holdings for fund families. Previous literature finds evidence that family members benefit from increasing cash inflow when other members within the family produce stellar performance (Nanda et al. (2004)). Given the inferior performance spotted in funds with high CH level, our test is motivated by the argument that fund families without strong skill sets are more likely to pursue investment strategies which can enhance the odds of creating star funds. We therefore examine the connection between the probabilities of having stellar performance with fund common holding level. The specification of the test can be found as follows:

$$\begin{aligned} \textit{Star fund}_{i,t} = {} & \beta_{0,i} + \beta_{1,i} CH_{i,t-1} + \beta_{2,i} (\textit{Fund return})_{i,[t-3,t-1]} \\ & + \beta_{3,i} (\textit{Return transparency})_{i,[t-12,t-1]} + \beta_{4,i} (\textit{Fund TNA})_{i,t-1} \\ & + \beta_{5,i} (\textit{Fam TNA})_{i,t-1} + \beta_{6,i} (\textit{NMG})_{i,t-1} \\ & + \beta_{7,i} (\textit{Fund age})_{i,t-1} + \beta_{8,i} (\textit{Fam age})_{i,t-1} \\ & + \beta_{9,i} (\textit{Expense})_{i,t-1} + \beta_{10,i} (\textit{Turnover})_{i,t-1} \\ & + \beta_{11,i} (\textit{Load})_{i,t-1} + u_{i,t} \end{aligned} \tag{12}$$

We estimate the Carhart alpha for each fund i using Equation(7), and the monthly fund adjusted performance is defined as $\alpha_{i,t} = \alpha_i + \epsilon_{i,t}$. We rank funds' 12-month average $\alpha_{i,t}$ in descending order to generate the cross-sectional fund performance distribution for each month; star funds are then defined as those ranked at the top 5% within the cross-sectional performance distribution. CH_i is the CH level of fund i. The other control variables are similar to those included in section IV.B. In addition, we also control for fund performance given by the return from the most recent quarter, *Fund return*; the return transparency, *Return transparency*, which is defined as the correlation between a fund's investor returns and its portfolio holding returns; fund turnover ratio, *Turnover*; and the load indicator which equals to 1 if the fund has either front or rear load. Equation(12) is then estimated by logistic regression with standard error clustered at fund level.

The results documented in Table 15 suggest a significant positive relation between Tier I common holding level and the birth rate of the star funds at 5% significance level. Specifically, model (1) suggests that one unit increasing in the CH level promotes the odds of being a star fund by a factor of 1.23, $e^{0.21}$. Our findings indicate that funds with high Tier I CH in their

holding portfolio have a better chance of beating 95% of their competitors in performance. Therefore, families containing such star funds might benefit from the positive spillover effect of the star phenomenon by attracting additional cash inflow to other members of the fund family (Nanda et al. (2004)), which consequently leads to their intention of maintaining high CH level. From fund managers' perspectives, they would experience better coordination from a more centralized fund family (Kacperczyk and Seru (2012)). Such a centralized holding can be regarded as group behavior of betting on the market; skilled managers will therefore devote much attention to building a more harmonious combination to cope with the CH portfolio, which might increase the odds of outperforming their competitors. However, the factor loading on fund common holding is statistically insignificant when switching to Tier II CH in model (3). We further observe a negative relation between star creation and CH level from the estimations of model (5) when using Tier III CH as the main regressor. It is not surprising, as Tiers I and III are two mutually exclusive classifications. The result of sharing less within small groups could drive a high intention of family-wide common holding, which is indeed consistent with the findings from model (1). An alternative explanation could be that since both Tier II and III CH increase the discretion of individuals, funds following such CH classifications might not pursue the star fund strategy as they might tend to make their presence felt.

Given our previous results that funds with high CH level deliver inferior performance when they account for a large fraction of their TNA, one might wonder through which channel the corresponding family could create star funds. We further examine this issue by incorporating the family overall risk level as an additional explanatory variable when estimating Equation (12). The family risk level is calculated by averaging the returns of individual funds within the same family and then computing the standard deviation of the series of returns for six continuous months. Model (2) of Table 15 reports the results when including the family risk level and its interaction term with CH level. It shows the factor loading for the interaction term is statistically significant at 5% significance level. Specifically, families with high CH could increase the odds of creating a star fund by promoting their average portfolio risk from their member funds. We therefore extend the discussion from Nanda et al. (2004) on enlarging cross-fund return deviation for star creation by arguing that families with concentrated holdings pursue star creating strategy by increasing their average risk level across the member funds.

[***Please insert Table 15 about here***]

VIII. Conclusion

In this paper we investigated the common holding behavior across members within the fund families based on US open-end equity mutual funds during the time period from 1981 to 2014. By defining fund common holding to be a fraction of the commonly held stocks by all members of the fund family, we find significant persistence of such common holding behavior at both short and long time horizons.

Our findings show that funds' common holdings carry valuable information which is able to reflect superior stock selection skills. We evaluate the corresponding performance of funds' common holding portfolios by considering six prevailing performance measures. We find a general trend that the performance of the common holding portfolios is negatively related with the increase in common holding. In other words, the contents in the shared information set can reflect stellar stock selection skill, but for a small number of stocks. We further investigate the potential channels through which commonly held stocks could reflect stellar stock selection skill. We consider IPO allocation and underpricing, industry concentration and proportion of active share as three channels of identifying how stocks are selected in common holding portfolios. Our findings therefore suggest that common holding portfolios, which account for a small fraction of funds total value, contain more underpriced IPO deals and more active shares. Meanwhile, such portfolios also appear to be more industry concentrated.

Our results also indicate that the investor returns of a mutual fund are negatively associated with the fund's common holding level. Funds with large CH level deliver inferior performance and also significantly underperform against funds with low CH level. However, when examining the relation between the probabilities of having stellar performance with fund CH level, we find a significant positive relation between Tier I CH level and the birth rate of the star funds.

Our findings provide empirical evidence on funds' common holding behavior and performance consequences. We argue that common holdings can be viewed as the joint wisdom of the fund family, which could have influential power on individual managers' investment decisions. From the family perspective, a fund family may pursue "star creating" strategy to utilize the spillover effects of the star fund phenomenon. Our findings therefore shed additional light on explaining such motivation by arguing that the increase in CH level of funds' portfolios could be a reflection of inferior investment ability at the family level, and drive the family to follow a more centralized investment strategy of putting all their eggs into one basket.

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Table 1 Summary statistics

	Mean	Median	Standard deviation
Fund total net assets (in millions)	1,360.39	238.10	5386.66
Fund family total net assets	40,816.73	7,865.10	116,009
Fund age	12.93	9.33	12.84
Fund family age	40.24	33.92	25.40
Expense ratio (in % per month)	1.12	1.11	0.51
Turnover ratio (in % per month)	90.82	63.00	129.62
Fund new money growth (in % per month, winsorized at 1%)	0.51	-0.36	8.47
Family new money growth (in % per month, winsorized at 1%)	-0.16	-0.22	1.86
Proportion of load funds (in %)	32.69		
Investor return (in % per month)	0.60	1.09	5.36
Holding return (in % per month)	0.58	0.83	12.61
Common holding portfolio return (in % per month)	0.78	0.75	37.20
Number of fund per month	915	922	213.68
Number of fund family per month	128	135	24.512
Number of funds within the fund family	5.27	4	5.72
Number of mutual funds with distinct portfolios	3,009		
Number of fund family	553		
Number of fund-month observations	560,387		

This table presents the summary statistics of the sampled mutual funds over the period between 1981 and 2014.

Table 2 Tests of commonly held stocks within fund families

	(1)	(2)	(3)	(4)
FAM_D	0.189***	0.187***	0.040***	0.024
	(0.00)	(0.00)	(0.00)	(0.28)
SEC_D	-	-	0.084***	-
			(0.00)	
FAM_D*SEC_D	-	-	0.289***	-
			(0.00)	
CITY_D	-	-	-	0.016**
				(0.02)
FAM_D*CITY_D	-	-	-	0.148***
				(0.00)
DIFF(FUND_TNA)	-0.067***	-0.066***	-0.046***	-0.066***
	(0.00)	(0.00)	(0.00)	(0.00)
DIFF(FAM_TNA)	0.030***	0.030***	0.013***	0.031***
	(0.00)	(0.00)	(0.00)	(0.00)
DIFF(FUND_AGE)	-0.113***	-0.120***	-0.087***	-0.119***
	(0.00)	(0.00)	(0.00)	(0.00)
DIFF(FAM_AGE)	-0.005	-0.011*	-0.007	-0.010
	(0.44)	(0.09)	(0.17)	(0.12)
DIFF(FAM_SIZE)	-0.002***	-0.001***	0.003***	-0.001***
	(0.00)	(0.00)	(0.00)	(0.00)
CON.	0.210***	0.242***	0.173***	0.240***
	(0.00)	(0.00)	(0.00)	(0.00)
YEAR FIX	No	Yes	Yes	Yes
Obs.	560,387	560,387	560,387	210, 848
R^2 (%)	15.76	16.02	34.24	16.07

This table presents the estimation results from Eq(4) by regressing the portfolio similarity of paired funds on the indicator of belonging to the same family. Fund pairs are created by matching each unique fund with a randomly selected paired fund from the fund population. *Fam_D* (*SEC_D*) is the indicator variable that equals to 1 if the two paired funds are from the same fund family (investment style) and 0 otherwise. *CITY_D* is the indicator of whether the paired funds are located in the same city. P-value of the coefficients are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 3 Summary of family common holdings

	Tier I			Tier II			Tier III		
	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.
All sample	27.30	15.49	29.30	31.19	26.53	23.54	60.70	63.21	30.14
Large Cap	99.88	100	0.42	0.05	0.03	0.03	0.05	0.03	0.03
Mid Cap	16.53	6.51	24.45	25.76	18.16	23.77	56.53	54.09	32.34
Small Cap	16.63	6.17	24.95	25.58	16.57	24.41	56.59	56.47	32.23
Micro Cap	27.17	19.42	26.29	35.57	34.32	15.08	35.57	34.32	15.08
Growth & Income	34.43	26.85	28.98	34.98	32.09	21.92	56.02	57.02	26.16
Growth	27.30	17.43	27.09	33.40	29.39	23.21	64.86	69.58	29.33
Hedged	30.49	19.21	28.93	27.15	22.20	23.25	72.48	85.56	29.74
Short	26.35	20.56	24.97	29.61	28.66	23.17	38.47	40.45	25.69
Income	44.89	40.40	28.62	26.31	26.40	14.21	41.62	35.39	24.46

This table presents the summary statistics of monthly common holding level evaluated by Eq(6) for the mutual funds over the sampled period. Funds are sorted into 9 groups based on their CRSP investment style code. The measures of common holding are classified into three tiers, i.e. Tier I common holding portfolio only contain stocks held by all of the members within the fund family; Tier II contains stocks held by more than half members of the family; Tier III includes stocks held by at least two members of the family. All results are presented in percentage value.

Table 4 Persistence of common holding

Tier I CH Quantiles	3 month lag					Mean CH	Spearman
Panel A	1	2	3	4	5		
1	75.99	18.81	3.58	0.90	0.71	4.20*** (0.00)	
2	18.31	63.71	14.87	2.25	0.87	8.23*** (0.00)	
3	3.83	14.86	67.31	12.39	1.62	17.91*** (0.00)	0.88*** (0.00)
4	1.18	1.76	12.51	75.84	8.70	35.32*** (0.00)	
5	0.79	0.79	1.72	8.67	88.03	76.26*** (0.00)	
Panel B	12 month lag						
1	60.37	28.08	6.92	2.71	1.92	6.55*** (0.00)	
2	27.56	46.33	18.90	5.19	2.02	10.21*** (0.00)	
3	8.19	20.15	49.95	18.47	3.25	20.62*** (0.00)	0.79*** (0.00)
4	3.12	3.66	20.57	60.13	12.52	35.52*** (0.00)	
5	1.04	1.58	3.68	13.56	80.14	73.11*** (0.00)	
Panel C	36 month lag						
1	50.07	28.32	11.27	6.18	4.15	9.07*** (0.00)	
2	29.53	37.55	18.95	8.91	5.06	12.86*** (0.00)	
3	13.00	21.56	36.84	21.35	7.25	22.61*** (0.00)	0.65*** (0.00)
4	5.04	8.82	25.22	45.77	15.16	33.69*** (0.00)	
5	2.76	3.64	7.61	17.97	68.03	64.68*** (0.00)	

This table presents the persistence of Tier I common holding level over various periods. Five quantile groups are formed according to funds' annual averaged common holding level evaluated by Eq(6). The CH level of each group members are re-calculated over a 3-,12- or 36-month window. The percentage value of the transaction probability of funds switching between groups are reported in each panel of the table. The mean CH level for each group and spearman rank coefficient are also reported for each quantile group. P-value of the t test results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 5 Fund characteristics by common holding level

	Tier I CH								
CH Quantile	CH (%)	Age	Fam-age	TNA	Fam-size	NMG (%)	Fam-NMG (%)	Exp (%)	Turnover (%)
1	3.04	11.72	37.05	912.86	4.08	0.87	-0.07	1.13	89.82
2	7.51	11.99	36.16	949.45	3.69	0.93	-0.08	1.19	91.88
3	16.50	12.07	36.00	1014.20	3.24	0.75	-0.20	1.16	87.79
4	33.84	14.09	35.77	2057.89	2.99	0.78	-0.16	1.10	74.50
5	75.14	14.10	35.51	2179.26	2.49	0.72	-0.10	1.07	84.61
(1)-(3)	-13.46***	-0.34	1.05***	-101.35	0.83***	0.12	0.14***	-0.03***	2.03
	(0.00)	(0.29)	(0.02)	(0.23)	(0.00)	(0.40)	(0.00)	(0.01)	(0.47)
(5)-(3)	58.64***	2.03***	-0.50**	1165.06***	-0.75***	0.03	0.10***	-0.10***	3.18
	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.86)	(0.01)	(0.00)	(0.44)

This table presents the funds characteristics over the sampled period. Five quantile groups are formed according to funds' annual averaged common holding level evaluated by Eq(6). CH is the averaged common holding level of the group. Age is individual fund age. Fam-age is the age of the oldest fund within the fund family. TNA is the individual fund' total net asset. Fam-size is the number of funds within the fund family. NMG (Fam-NMG) is the new money growth estimated by Eq1 (Eq2). Exp and Turnover is the individual fund's expense ratio and turnover ratio, respectively. P-value of the t test results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 6 Performance of common holding portfolio

Panel A: Quarterly balanced equally weighted common holding portfolio

	Tier I						Tier II						Tier III					
CH	R-MKT	CAPM	FF	Carhart	P-S	F-S	R-MKT	CAPM	FF	Carhart	P-S	F-S	R-MKT	CAPM	FF	Carhart	P-S	F-S
1	10.49***	10.56***	10.12***	9.83***	8.58***	10.33***	7.06***	7.10***	6.75***	6.49***	5.68***	6.93***	4.72***	4.72***	4.48***	4.25***	3.77***	4.61***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
2	-0.95	-0.95	-0.98	-1.05	-0.94	-1.21	0.19	1.87	0.11	0.03	0.00	0.14	0.15	0.16	0.06	-0.01	-0.12	0.06
	(0.17)	(0.17)	(0.16)	(0.14)	(0.22)	(0.11)	(0.62)	(0.64)	(0.78)	(0.94)	(1.00)	(0.75)	(0.31)	(0.61)	(0.84)	(0.98)	(0.72)	(0.86)
3	-2.46***	-2.45***	-2.43***	-2.41***	-2.35***	-2.556***	-1.81***	-1.83***	-1.79***	-1.80***	-1.80***	-1.82***	-0.79***	-0.80***	-0.85***	-0.87***	-0.91***	-0.80***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
4	-2.53***	-2.54***	-2.35***	-2.31***	-2.27***	-2.40***	-1.86***	-1.89***	-1.81***	-1.81***	-1.80***	-1.80***	-1.11***	-1.15***	-1.17***	-1.18***	-1.14***	-1.15***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
5	-3.11***	-3.17***	-3.12***	-3.05***	-3.03***	-3.19***	-2.32***	-2.34***	-2.30***	-2.25***	-2.12***	-2.31***	-1.03***	-1.05***	-1.03***	-1.05***	-1.05***	-1.05***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(3)-(1)	-12.95***	-13.01***	-12.55***	-12.24***	-10.93***	-12.88***	-8.87***	-8.93***	-8.55***	-8.29***	-7.47***	-8.75***	-5.50***	-5.51***	-1.32***	-5.11***	-4.67***	-5.41***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(5)-(3)	-0.65	-0.72	-0.69	-0.64	-0.68	-0.64	-0.51	-0.51	-0.50	-0.46	-0.32	-0.50	-0.25	-0.26	-0.19	-0.18	-0.14	-0.24
	(0.40)	(0.33)	(0.35)	(0.36)	(0.34)	(0.37)	(0.12)	(0.23)	(0.23)	(0.26)	(0.41)	(0.24)	(0.23)	(0.43)	(0.58)	(0.57)	(0.66)	(0.46)
	Panel B: Annually balanced equally weighted common holding portfolio																	
1	2.43***	2.29***	2.07**	1.96**	1.66*	2.14**	1.97***	2.01***	1.73***	1.65***	1.54**	1.83***	1.78***	1.79***	1.60***	1.51***	1.43**	1.85***
	(0.01)	(0.01)	(0.03)	(0.04)	(0.10)	(0.03)	(0.00)	(0.00)	(0.01)	(0.01)	(0.02)	(0.01)	(0.00)	(0.00)	(0.01)	(0.01)	(0.03)	(0.00)
2	-0.01	0.06	0.11	0.04	-0.36	-0.21	-0.08	-0.07	-0.12	-0.15	-0.47	-0.04	-0.01	-0.03	-0.16	-0.19	-0.15	-0.06
	(0.99)	(0.94)	(0.89)	(0.96)	(0.68)	(0.80)	(0.84)	(0.86)	(0.77)	(0.72)	(0.30)	(0.92)	(0.97)	(0.93)	(0.57)	(0.48)	(0.61)	(0.85)
3	-0.88*	-0.79	-0.89	-0.86	-0.87	-1.04*	-0.97***	-1.00**	-1.02***	-1.05***	-1.07***	-1.02***	-0.32	-0.31	-0.44*	-0.48*	-0.38	-0.30
	(0.06)	(0.15)	(0.11)	(0.13)	(0.16)	(0.08)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.23)	(0.425)	(0.100)	(0.08)	(0.21)	(0.29)
4	-1.10**	-1.11**	-1.04**	-1.03**	-0.97*	-0.98*	-0.88***	-0.92***	-0.85***	-0.86***	-0.75**	-0.85***	-0.49**	-0.52**	-0.52**	-0.55**	-0.48*	-0.45*
	(0.03)	(0.03)	(0.04)	(0.04)	(0.08)	(0.07)	(0.00)	(0.00)	(0.01)	(0.01)	(0.03)	(0.01)	(0.05)	(0.04)	(0.04)	(0.03)	(0.08)	(0.10)
5	-1.45***	-1.50***	-1.60***	-1.55***	-1.44***	-1.47***	-0.78***	-0.81***	-0.86***	-0.87***	-0.70**	-0.83***	-0.46**	-0.48***	-0.51**	-0.53**	-0.53**	-0.48**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.03)	(0.01)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.04)
(1)-(3)	3.32***	3.078***	2.96***	2.82***	2.53***	3.18***	2.94***	3.01***	2.75***	2.70***	2.61***	2.86***	2.10***	2.10***	2.04***	1.98***	1.81***	2.15***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(5)-(3)	-0.56	-0.71	-0.71	-0.70	-0.57	-0.43	0.20	0.19	0.15	0.18	0.36	0.20	-0.14	-0.17	-0.07	-0.05	-0.15	-0.18
	(0.43)	(0.32)	(0.31)	(0.30)	(0.38)	(0.53)	(0.63)	(0.64)	(0.72)	(0.66)	(0.35)	(-0.65)	(0.69)	(0.63)	(0.84)	(0.88)	(0.65)	(0.61)

This table presents the adjusted performance of trading funds' common holding portfolios. Five quantile portfolios are formed according to funds' most recently common holding level evaluated by Eq(6). Performance score based on six measures are given in the table, namely, excess-market return, CAPM alphas, Fama French three-factor adjusted alphas; Carhart four-factor adjusted alphas; Pastor-Stambaugh liquidity-adjusted alphas and alphas estimated by Ferson-Schadt conditional model. Panel A (Panel B) reports the trading performance based on the quarterly (annually) balanced portfolio. P-value of the evaluation results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 7 Stock fundamentals in common holding portfolios

	Tier I CH		
	(1)	(2)	(3)
Log(Size)	0.77***	0.81***	0.85***
	(0.00)	(0.00)	(0.00)
ROA	0.08***	0.06***	0.11***
	(0.00)	(0.00)	(0.00)
Tobin Q	0.93***	0.66****	0.27***
	(0.00)	(0.00)	(0.00)
Tangible assets	0.23***	0.20***	0.04***
	(0.00)	(0.00)	(0.01)
Total leverage	-0.28***	-0.28***	-0.40***
	(0.00)	(0.00)	(0.00)
Dividend payment	-0.02***	-0.01	-0.03***
	(0.00)	(0.12)	(0.00)
MOM score	0.01***	0.01***	0.00***
	(0.00)	(0.00)	(0.00)
Equity return in t-1	0.20***	0.26***	0.23***
	(0.00)	(0.00)	(0.00)
Newly IPO	-0.39***	-0.20***	-0.24***
	(0.00)	(0.00)	(0.00)
Log(Distance)	-0.01**	-0.01***	-0.01**
	(0.02)	(0.00)	(0.03)
Obs.	3,271,847	3,271,639	3,271,639
LR p-value	0.00	0.00	0.00
Year fixed effect	No	No	Yes
Industry fixed effect	No	Yes	Yes

This table presents the estimation results of Eq(9) for the Tier I CH portfolio. P-value of the coefficients are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 8 IPO allocation in the common holding portfolios

Panel A			
All IPO issues	N=9260	Average 1st day return (%) Median 1st day return (%)	19.88 4.60
Funds hold IPOs	N=5,708	Average 1st day return (%) Median 1st day return (%)	25.41 7.02
Panel B	**Tier I**	**Tier II**	**Tier III**
IPO issues	717	1123	1476
Average 1st day return (%)	37.26	30.61	27.45
Median 1st day return (%)	18.04	14.71	13.28
Return difference with fund-hold IPO deals (%)	12.84*** (0.00)	4.20*** (0.00)	2.03*** (0.00)
Return difference between Tier I and II (%)	6.65*** (0.01)		
Return difference between Tier II and III (%)	3.16** (0.05)		
Panel C			
Dollar amount of IPO Underpricing (in billions)	$3.65	$3.17	$3.01
Contribution to TNA (%)	0.72	0.49	0.36
Mean difference between Tier I and II (%)	0.23** (0.02)		
Mean difference between Tier II and III (%)	0.13*** (0.02)		
Panel D (in %)			
1	38.44*** (0.00)	31.79*** (0.00)	30.24*** (0.00)
2	37.82*** (0.00)	24.08*** (0.00)	25.05*** (0.00)
3	24.10*** (0.00)	24.77*** (0.00)	24.08*** (0.00)
4	23.69*** (0.00)	24.58*** (0.00)	23.98*** (0.00)
5	23.66*** (0.00)	20.84*** (0.00)	24.84*** (0.00)
(3)-(1)	-14.34** (0.03)	-7.01** (0.05)	-6.16** (0.05)
(5)-(3)	-0.438 (0.46)	-3.93** (0.04)	0.763 (0.66)

This table presents the IPO allocation in the funds' common holding portfolios. Panel A reports the number of IPO deals and its 1st returns for companies within the sample period and for companies held by the sample mutual funds. Panel B and C reports the returns and the dollar value of IPO contributed to TNA from IPOs included in the common holding portfolios, respectively. Panel D reports the average returns from IPO by sorting funds into five quantile portfolios according to their previous 12-month CH level. P-value of the t test results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 9 Industry concertation in common holding portfolios

Panel A			
All sample	Average ICI (%)	3.38	Obs: 182,593
	Median ICI (%)	3.25	
Panel B	**Tier I**	**Tier II**	**Tier III**
Average ICI (%)	5.13	3.61	3.70
Median ICI (%)	4.62	2.01	2.23
Mean difference with all sample ICI (%)	1.74**	0.22	0.32
	(0.03)	(0.27)	(0.36)
Mean ICI difference between Tier I and II (%)	1.43***		
	(0.00)		
Mean ICI difference between Tier II and III (%)	-0.08		
	(0.00)		
Obs.	111,416	172,158	178,127
Panel C (annually ranked CH & annual ICI, %)			
1	7.93***	7.27***	5.06***
	(0.00)	(0.00)	(0.00)
2	5.93***	7.82***	6.45***
	(0.00)	(0.00)	(0.00)
3	2.69***	6.48***	7.05***
	(0.00)	(0.00)	(0.00)
4	0.89***	3.97***	6.29***
	(0.00)	(0.00)	(0.00)
5	0.27***	1.11***	2.23***
	(0.00)	(0.00)	(0.00)
(3)-(1)	-5.24***	-0.79***	1.99***
	(0.00)	(0.00)	(0.00)
(5)-(3)	-2.41***	-5.37***	-4.81***
	(0.00)	(0.00)	(0.00)

This table presents the industry concertation of funds' common holding portfolios. The industry concertation index (ICI) is estimated by Eq(10). Panel A summarize the ICI for companies held by all sampled funds. Panel B reports the ICI for the common holding portfolios across the three tiers. Panel C reports the average ICI by sorting funds into five quantile portfolios according to their previous 12-month CH level. P-value of the t test results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 10 Active share in common holding portfolios

Panel A			
All sample	Average AS (%) Median AS (%)	23.95 25.07	Obs: 182,099
Panel B	**Tier I**	**Tier II**	**Tier III**
Average AS (%)	35.81	32.62	28.96
Median AS (%)	38.28	34.43	29.75
Mean difference with all sample AS (%)	11.86*** (0.00)	8.67*** (0.00)	5.01*** (0.00)
Mean AS difference between Tier I and II (%)	3.19*** (0.00)		
Mean AS difference between Tier II and III (%)	3.66*** (0.00)		
Obs.	109,740	170,446	176,624
Panel C			
All sample	Average style AS (%) Median style AS (%)	40.35 41.75	Obs: 183,490
Panel D			
Average style AS (%)	45.48	43.73	42.18
Median style AS (%)	48.10	45.82	44.02
Mean difference with all sample style AS (%)	5.13*** (0.00)	3.38*** (0.00)	1.84*** (0.00)
Mean Sector AS difference between Tier I and II (%)	1.75*** (0.00)		
Mean Sector AS difference between Tier II and III (%)	1.55*** (0.00)		
Obs.	113,665	173,694	179,304

This table presents the active share of funds' common holding portfolios. The active share (AS) is estimated by Eq(11). Two benchmark index are used to calculate the AS, namely, the S&P family index and the index included all stocks held by funds within each of the investment style. Panel A and B summarize the AS based on S&P family index for companies held by all sampled funds and for the common holding portfolios across the three tiers, respectively. Panel C and D summarize the AS based on the index created by holdings of funds within the same investment style. P-value of the t test results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 11 Active share in common holding

Panel A (S&P index)	Tier I	Tier II	Tier III
1	39.70***	34.67***	30.66***
	(0.00)	(0.00)	(0.00)
2	37.29***	34.54***	30.73***
	(0.00)	(0.00)	(0.00)
3	36.10***	33.81***	29.22***
	(0.00)	(0.00)	(0.00)
4	35.47***	31.97***	28.12***
	(0.00)	(0.00)	(0.00)
5	29.38***	27.23***	24.98***
	(0.00)	(0.00)	(0.00)
(3)-(1)	-3.61***	-0.85***	-1.44***
	(0.00)	(0.00)	(0.00)
(5)-(3)	-6.71***	-6.58***	-4.24***
	(0.00)	(0.00)	(0.00)
Panel B (Style index)			
1	49.11***	48.91***	48.18***
	(0.00)	(0.00)	(0.00)
2	48.56***	46.82***	44.83***
	(0.00)	(0.00)	(0.00)
3	46.73***	44.08***	41.57***
	(0.00)	(0.00)	(0.00)
4	44.02***	40.93***	39.23***
	(0.00)	(0.00)	(0.00)
5	38.15***	37.02***	36.01***
	(0.00)	(0.00)	(0.00)
(3)-(1)	-2.39***	-4.83***	-6.61***
	(0.00)	(0.00)	(0.00)
(5)-(3)	-8.57***	-7.06***	-5.56***
	(0.00)	(0.00)	(0.00)

This table presents the active share of funds' common holding portfolios. Two benchmark index are used to calculate the AS, namely, the S&P family index and the index included all stocks held by funds within each of the investment style. Funds are sorted into five quantile portfolios according to their previous 12-month CH level. Panel A and B report the averaged AS based on the two benchmark index, respectively. P-value of the t test results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 12 Determinants of common holdings

	Fund level			Family level		
	Tier I	**Tier II**	**Tier III**	**Tier I**	**Tier II**	**Tier III**
Fund age	0.01 (0.26)	0.02 (0.20)	-0.01 (0.49)	-	-	-
Family age	-0.05*** (0.00)	-0.07*** (0.00)	0.06*** (0.00)	-0.05*** (0.01)	-0.03* (0.07)	0.06*** (0.00)
Expense	-2.40*** (0.00)	-4.30*** (0.00)	-2.19*** (0.00)	-3.84*** (0.01)	-4.30*** (0.00)	0.32 (0.76)
Turnover	-0.02*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.02*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)
Log(TNA)	0.05*** (0.00)	0.02*** (0.00)	-0.03*** (0.00)	-	-	-
Log(Fam-TNA)	-0.11*** (0.00)	-0.06*** (0.00)	0.10*** (0.00)	-0.05*** (0.00)	-0.03*** (0.00)	0.05*** (0.00)
NMG	0.00 (0.67)	-0.00 (0.54)	-0.02 (0.21)	0.00** (0.02)	0.00* (0.06)	0.00** (0.03)
Correlation between holding and investor return	-0.01 (0.20)	0.00 (0.18)	0.00 (0.14)	-0.03*** (0.00)	-0.01*** (0.00)	-0.01** (0.02)
Load dummy	-0.04*** (0.00)	-0.01** (0.05)	-0.02*** (0.01)	-0.04*** (0.00)	-0.04*** (0.00)	0.01 (0.42)
Fund return	0.02 (0.15)	-0.00 (0.69)	-0.05*** (0.00)	0.02 (0.39)	0.01 (0.56)	-0.04* (0.07)
Con.	0.72*** (0.00)	0.73*** (0.00)	0.23*** (0.00)	0.67*** (0.00)	0.68*** (0.00)	0.30*** (0.00)
Year fix effect	Yes	Yes	Yes	Yes	Yes	Yes
Adj-R-square	0.80	0.79	0.83	0.75	0.80	0.81
Obs.	74,721	117,772	120,939	16,378	17,371	17,467

This table presents the determinants of CH level at both fund and family level across the three tiers of CH measures. P-value of the coefficients are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 13 Performance consequences for end-investors (in %)

	Quarterly balanced					
A: Tier I	R-MKT	CAPM	FF	Carhart	P-S	F-S
1	0.12*	0.10	-0.04	-0.04	-0.00	-0.04
	(0.09)	(0.26)	(0.51)	(0.44)	(0.96)	(0.54)
2	0.06	0.05	-0.07	-0.07	-0.05	-0.06
	(0.47)	(0.56)	(0.29)	(0.25)	(0.43)	(0.31)
3	-0.06	-0.08	-0.14***	-0.14***	-0.12**	-0.14**
	(0.14)	(0.18)	(0.01)	(0.01)	(0.03)	(0.01)
4	-0.04	-0.04	-0.07*	-0.07*	-0.07*	-0.08*
	(0.17)	(0.33)	(0.07)	(0.07)	(0.10)	(0.06)
5	-0.08**	-0.07*	-0.11***	-0.10***	-0.11***	-0.10**
	(0.04)	(0.10)	(0.01)	(0.01)	(0.01)	(0.02)
(3)-(1)	-0.18**	-0.17*	-0.10**	-0.09**	-0.12**	-0.10*
	(0.04)	(0.09)	(0.02)	(0.03)	(0.02)	(0.10)
(5)-(3)	-0.02	0.00	0.03	0.04	0.01	0.04
	(0.83)	(0.97)	(0.64)	(0.60)	(0.88)	(0.57)
B: Tier II						
1	0.18*	0.15	-0.05	-0.05	-0.02	-0.04
	(0.06)	(0.20)	(0.49)	(0.47)	(0.83)	(0.57)
2	0.01	-0.01	-0.09	-0.09	-0.06	-0.08
	(0.85)	(0.94)	(0.12)	(0.11)	(0.35)	(0.18)
3	-0.02	-0.04	-0.10**	-0.10**	-0.09*	-0.11**
	(0.60)	(0.40)	(0.05)	(0.05)	(0.10)	(0.03)
4	-0.05	-0.05	-0.08**	-0.08**	-0.08*	-0.08**
	(0.26)	(0.19)	(0.05)	(0.040	(0.07)	(0.05)
5	-0.02	-0.03	-0.06*	-0.06*	-0.07*	-0.07*
	(0.30)	(0.49)	(0.09)	(0.10)	(0.07)	(0.08)
(3)-(1)	-0.21**	-0.19	-0.05**	-0.05*	-0.07**	-0.07**
	(0.05)	(0.13)	(0.03)	(0.10)	(0.03)	(0.04)
(5)-(3)	0.01	0.02	0.04	0.037	0.02	0.04
	(0.54)	(0.82)	(0.55)	(0.56)	(0.77)	(0.50)
C: Tier III						
1	0.14*	0.11	-0.06	-0.07	-0.04	-0.06
	(0.09)	(0.29)	(0.30)	(0.26)	(0.53)	(0.33)
2	0.02	0.00	-0.09*	-0.09*	-0.06	-0.08
	(0.78)	(0.99)	(0.08)	(0.10)	(0.28)	(0.12)
3	-0.00	-0.01	-0.08*	-0.08*	-0.07	-0.07
	(0.98)	(0.80)	(0.10)	(0.09)	(0.19)	(0.17)
4	-0.04	-0.06	-0.08**	-0.08**	-0.09**	-0.09**
	(0.35)	(0.19)	(0.05)	(0.05)	(0.05)	(0.04)
5	0.02	0.01	-0.05	-0.06	-0.05	-0.07
	(0.77)	(0.88)	(0.26)	(0.23)	(0.34)	(0.17)
(3)-(1)	-0.14	-0.13	-0.01	-0.01	-0.02	-0.01
	(0.12)	(0.29)	(0.87)	(0.90)	(0.77)	(0.96)
(5)-(3)	0.02	0.02	0.03	0.02	0.02	0.00
	(0.83)	(0.78)	(0.70)	(0.73)	(0.81)	(0.99)

This table presents the adjusted performance of trading actual funds' return. Five quantile portfolios are formed according to funds' most recently common holding level. Performance score based on six measures are given in the table, namely, excess-market return, CAPM alphas, Fama French three-factor adjusted alphas; Carhart four-factor adjusted alphas; Pastor-Stambaugh liquidity-adjusted alphas and alphas estimated by Ferson-Schadt conditional model. Each of the panel reports results of one of the three CH tiers. P-value of the coefficients are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table 14 Size adjusted performance consequences for end-investors (in %)

TNA	CH	Tier I		Tier II		Tier III	
		Carhart	FS	Carhart	FS	Carhart	FS
Low	1	-0.00	-0.01	-0.05	-0.06	-0.06	-0.06
		(0.71)	(0.64)	(0.49)	(0.40)	(0.37)	(0.45)
	2	-0.02	-0.01	-0.02	-0.02	-0.01	-0.02
		(0.84)	(0.88)	(0.75)	(0.79)	(0.91)	(0.84)
	3	-0.01	-0.00	-0.06	-0.05	-0.06	-0.05
		(0.86)	(0.96)	(0.40)	(0.45)	(0.34)	(0.41)
	4	-0.05	-0.01	-0.04	-0.03	-0.02	0.01
		(0.39)	(0.26)	(0.66)	(0.54)	(0.78)	(0.92)
	5	-0.09**	-0.08*	-0.08**	-0.09**	-0.07*	-0.09*
		(0.04)	(0.10)	(0.05)	(0.03)	(0.05)	(0.08)
Med	1	-0.04	-0.02	-0.04	-0.01	-0.08	-0.06
		(0.55)	(0.72)	(0.56)	(0.87)	(0.25)	(0.37)
	2	-0.08	-0.05	-0.14**	-0.13*	-0.10*	-0.09
		(0.28)	(0.51)	(0.05)	(0.08)	(0.10)	(0.17)
	3	-0.20***	-0.20***	-0.12**	-0.12**	-0.13**	-0.12*
		(0.00)	(0.00)	(0.02)	(0.32)	(0.04)	(0.07)
	4	-0.08*	-0.10*	-0.17***	-0.18***	-0.13***	-0.14***
		(0.10)	(0.10)	(0.00)	(0.01)	(0.00)	(0.01)
	5	-0.10**	-0.08*	-0.04	-0.05	-0.05	-0.06
		(0.05)	(0.10)	(0.28)	(0.25)	(0.36)	(0.28)
High	1	-0.03	-0.02	-0.07	-0.05	-0.07	-0.06
		(0.67)	(0.75)	(0.24)	(0.46)	(0.25)	(0.33)
	2	-0.09	-0.09	-0.06	-0.07	-0.10**	-0.09*
		(0.12)	(0.17)	(0.34)	(0.31)	(0.04)	(0.07)
	3	-0.09	-0.10*	-0.08*	-0.09*	-0.10**	-0.10**
		(0.13)	(0.10)	(0.10)	(0.10)	(0.04)	(0.04)
	4	-0.15***	-0.16***	-0.09**	-0.09**	-0.07*	-0.08*
		(0.00)	(0.00)	(0.05)	(0.05)	(0.10)	(0.08)
	5	-0.13***	-0.13***	-0.10***	-0.11***	-0.07	-0.10*
		(0.00)	(0.00)	(0.00)	(0.00)	(0.21)	(0.07)

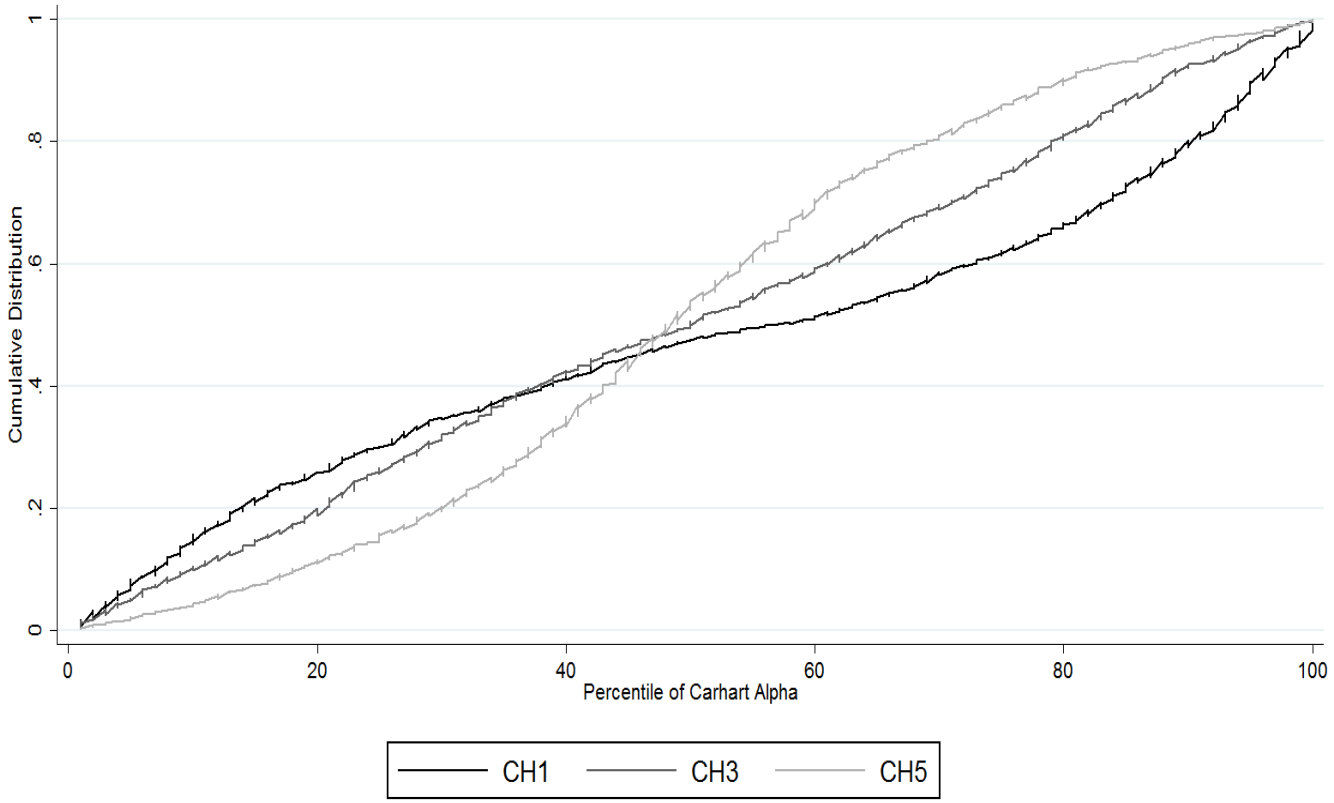
This table presents the adjusted performance of trading actual funds' return. Funds are groups into and three size portfolio according to their TNA and then further sorted into five quantiles according to their most recently common holding level. Performance score are based on Carhart four-factor model and Ferson-Schadt conditional model. P-value of the coefficients are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance level.

Table 15 Star fund phenomenon

	Tier I		Tier II		Tier III	
	(1)	(2)	(3)	(4)	(5)	(6)
Common holding	0.21**	0.15	0.01	-0.13	-0.17***	-0.22**
	(0.03)	(0.33)	(0.85)	(0.21)	(0.01)	(0.03)
Family risk	-	-1.68*	-	-2.75***	-	-1.79*
		(0.08)		(0.00)		(0.09)
CH*Family risk	-	4.51**	-	4.83***	-	1.65
		(0.05)		(0.01)		(0.28)
Fund return	5.99***	6.14***	5.53***	5.64***	5.56***	5.63***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Return_transparency	-0.01	-0.03	0.02	0.01	0.02	0.02
	(0.77)	(0.45)	(0.52)	(0.83)	(0.39)	(0.64)
Log(TNA)	-0.35***	-0.36***	-0.28***	-0.29***	-0.28***	-0.29***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Log(FamTMA)	0.10*	0.11	0.09**	0.08*	0.11***	0.10**
	(0.10)	(0.11)	(0.04)	(0.10)	(0.01)	(0.03)
NMG	-0.28	-0.35	-0.12	-0.13	-0.05	-0.04
	(0.15)	(0.11)	(0.37)	(0.39)	(0.72)	(0.78)
Fund age	0.03	0.09	0.04	-0.01	0.05	0.01
	(0.82)	(0.53)	(0.69)	(0.95)	(0.57)	(0.91)
Family age	-0.18	-0.08	-0.29**	-0.11	-0.30**	-0.15
	(0.28)	(0.68)	(0.02)	(0.44)	(0.02)	(0.28)
Expense	-11.84	-23.00*	-7.39	-16.58*	-10.60	-19.80**
	(0.29)	(0.07)	(0.40)	(0.09)	(0.23)	(0.04)
Turnover	0.00	0.02	-0.02	-0.01	-0.02	-0.02
	(1.00)	(0.41)	(0.43)	(0.57)	(0.26)	(0.37)
Load dummy	0.15	0.24	0.05	0.08	0.00	0.02
	(0.37)	(0.18)	(0.66)	(0.55)	(0.99)	(0.89)
Likelihood ratio	318.93***	276.80***	438.45***	377.67***	464.26***	390.09***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Obs.	55,766	46,470	92,077	78,688	94,792	81,143

This table presents the estimation results from Eq(12) by conducting the logistic regression. The dependent variable is an indicator variable which equals to 1 if the corresponding fund is a star fund and 0 otherwise. Star funds are defined as funds ranked at the top 5% of the performance distribution. The table also shows the estimation results based on three types of tiers. P-value of the coefficients are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Figure 1 Tier I Cumulative Distribution of Carhart Alpha



Appendix

Table A1 Mapping Lipper style with CRSP style code

CRSP style code	CRSP style	Lipper style code	Lipper style
EDCL	Equity Domestic Cap-based Large Cap	SP	S&P 500 Index Objective Funds
EDCM	Equity Domestic Cap-based Mid Cap	MC	Mid-Cap Funds
EDCS	Equity Domestic Cap-based Small Cap	SG	Small-Cap Funds
EDCI	Equity Domestic Cap-based Micro Cap	MR	Micro-Cap Funds
EDYG	Equity Domestic Style Growth	CA	Capital Appreciation Funds
		G	Growth Funds
EDYB	Equity Domestic Style Growth & Income	GI	Growth and Income Funds
EDYH	Equity Domestic Style Hedged	LSE	Long/Short Equity Funds
		EMN	Equity Market Neutral Funds
		ABR	Absolute return Funds
		DL	Equity Leverage Funds
EDYS	Equity Domestic Style Short	DSB	Dedicated Short Bias Funds
EDYI	Equity Domestic Style Income	EI	Equity Income Funds

This table provides the mapping between the CRSP style code and the Lipper style code. The abbreviation and the full name of the corresponding style are presented for both style codes.

Table A2 Persistence of common holding

Tier II CH Quantiles	3 month lag					Mean CH	Spearman
Panel A	1	2	3	4	5		
1	77.52	16.78	3.18	1.59	0.93	8.12*** (0.00)	
2	17.02	59.46	17.31	4.41	1.81	17.30*** (0.00)	
3	3.15	18.21	58.66	17.11	2.88	27.94*** (0.00)	0.85*** (0.00)
4	1.31	4.06	17.74	64.16	12.74	40.25*** (0.00)	
5	1.12	1.42	3.12	12.77	81.57	64.60*** (0.00)	
Panel B	12 month lag						
1	65.49	22.70	6.65	3.37	1.80	11.16*** (0.00)	
2	22.51	44.00	22.01	8.00	3.47	19.60*** (0.00)	
3	7.22	22.46	42.41	22.51	5.40	28.93*** (0.00)	0.74*** (0.00)
4	2.85	7.95	23.58	48.05	17.56	39.77*** (0.00)	
5	2.14	2.77	5.33	18.15	71.60	61.80*** (0.00)	
Panel C	36 month lag						
1	54.33	25.62	10.41	5.85	3.78	15.19*** (0.00)	
2	24.81	33.80	22.24	12.69	6.47	22.52*** (0.00)	
3	11.01	22.19	34.02	24.19	8.59	30.26*** (0.00)	0.60*** (0.00)
4	5.63	11.83	23.84	38.34	20.35	38.58*** (0.00)	
5	4.59	6.49	9.34	19.11	60.46	57.66*** (0.00)	

This table presents the persistence of Tier II common holding level over various periods. Five quantile groups are formed according to funds' annual averaged common holding level evaluated by Eq(6). The CH level of each group members are re-calculated over a 3-,12- or 36-month window. The percentage value of the transaction probability of funds switching between groups are reported in each panel of the table. The mean CH level for each group and spearman rank coefficient are also reported for each quantile group. P-value of the t test results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.

Table A3 Persistence of common holding

Tier III CH Quantiles	3 month lag					Mean CH	Spearman
Panel A	1	2	3	4	5		
1	85.09	10.86	1.84	1.30	0.90	22.13*** (0.00)	
2	11.06	70.76	14.43	2.18	1.57	46.48*** (0.00)	
3	1.93	14.73	69.92	11.92	1.50	65.38*** (0.00)	0.89*** (0.00)
4	0.93	2.30	12.24	74.31	10.22	83.92*** (0.00)	
5	1.04	1.29	1.61	10.31	85.75	95.70*** (0.00)	
Panel B	12 month lag						
1	74.85	17.37	4.20	2.02	1.56	26.26*** (0.00)	
2	16.45	57.71	21.22	4.79	2.83	48.38*** (0.00)	
3	4.06	19.50	54.29	18.57	3.57	64.55*** (0.00)	0.80*** (0.00)
4	2.45	5.33	16.42	60.10	15.71	81.45*** (0.00)	
5	2.34	3.04	3.83	14.62	76.18	93.03*** (0.00)	
Panel C	36 month lag						
1	62.77	22.59	7.42	4.59	2.63	33.95*** (0.00)	
2	19.51	40.77	25.69	8.68	5.33	52.30*** (0.00)	
3	8.51	21.85	40.43	22.15	7.06	65.28*** (0.00)	0.67*** (0.00)
4	5.41	8.83	18.60	46.01	21.15	79.30*** (0.00)	
5	4.06	5.95	7.73	18.79	63.47	89.55*** (0.00)	

This table presents the persistence of Tier III common holding level over various periods. Five quantile groups are formed according to funds' annual averaged common holding level evaluated by Eq(6). The CH level of each group members are re-calculated over a 3-,12- or 36-month window. The percentage value of the transaction probability of funds switching between groups are reported in each panel of the table. The mean CH level for each group and spearman rank coefficient are also reported for each quantile group. P-value of the t test results are given in parentheses. The significance levels are denoted by *, **, and *** and indicate whether the results are statistically different from zero at the 10-, 5-, and 1-percent significance levels.