Leading the Way? External Lead Managers and the Performance of Institutional Equity Funds*

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Abstract

It is becoming common for institutional sponsors to receive outside help in manager selection by delegating the decisionmaking to external lead managers. Yet, performance implications of this recent trend have not hitherto been examined. We fill the gap with a unique dataset compiled by Korean institutional sponsors, which enables a detailed comparison of domestic equity managers selected by the sponsors against those by lead managers. We find managers chosen by lead managers to significantly outperform in most measures. Further evidence suggests this outperformance emanates primarily from the lead managers' ability to detach themselves from internal issues within the sponsor organization.

JEL Classification: G11, G20, G23.

Keywords: Delegated portfolio management, institutional investors, intermediated investment management, outsourced CIO, investment pool.

1. Introduction

"Leadership is the art of getting someone else to do something you want done because he wants to do it." — President Dwight Eisenhower

According to a recent study by Towers Watson (2016), 19 major pension markets in the world account for over $35 trillion in assets. With additional demand emanating from purposes unrelated to pension, the asset management market for institutional investors has contributed significantly toward the growth of the overall industry (Stoughton, Wu and Zechner, 2011). It is thus no surprise that the literature on delegated portfolio management provides an extensive discussion on how to align the managers' interests with those of their institutional clients.[1]

However, a majority of the existing literature assumes the investor-manager relationship to be bilateral with a single layer of delegation. Here, the investor delegates to the manager for some exogenous reason, and then the latter directly engages in portfolio management. Another well-known strand of the literature, beginning with Coase (1937), endogenizes this delegation decision with regards to the "boundaries of the firm."[2] Yet, until recently, the literature has largely failed to incorporate the possibility of "intermediated investment management," with multiple layers of delegation between the institutional investor and the manager, and only a small number of studies have explored its performance implications (e.g., Stoughton, Wu and Zechner, 2011; Chen, Hong, Jiang and Kubik, 2013; Jenkinson, Jones and Martinez, 2016).

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[1] Prominent early studies include Bhattacharya and Pfleiderer (1985), Stoughton (1993), Admati and Pfleiderer (1997), and Ou-Yang (2003), while more recent studies on optimal contracting under delegated portfolio management include Li and Tiwari (2009), Dybvig, Farnsworth and Carpenter (2010), Kyle, Ou-Yang and Wei (2011), and He and Xiong (2013). For a theoretical survey of the early literature, refer to Stracca (2006).

[2] See Alchian and Demsetz (1972), Williamson (1975), Klein, Crawford and Alchian (1978), Grossman and Hart (1986), Hart and Moore (1990), Holmstrom and Milgrom (1991, 1994), and Holmstrom (1999).

As such, for many institutional clients lacking sufficient resources and expertise to manage their assets in-house, the existing literature poses a gap, since the practical decisions that they face are often not over *whether* to delegate, but *how*. Should they select managers directly without any external advice? Should they make use of investment consultants? Should they delegate the decisions altogether to a third party?

In fact, this gap has become even wider in recent years as the outsourced CIO (OCIO) system, whereby manager selection and monitoring are delegated to external lead managers, has become popular among pensions and endowments. This fast-growing segment of the industry thus poses an important question fund governance,[3] but they have yet to receive much academic interest, possibly due to a lack of data availability. After all, a proper examination of the OCIOs' value added requires a full-scale performance comparison of both the managers selected by OCIOs as well as those selected directly by the sponsors themselves, requiring a compilation of large proprietary dataset spanning across multiple sponsors.

In this paper, we compile an in-depth manager-level dataset spanning a large number of Korean public agency sponsors between 2010 and 2015, enabling us to engage in a detailed analysis of domestic equity managers for these institutional clients. Specifically, the data allows us to compare the performance of managers selected directly by the institutional clients against those selected by external lead managers. While a recent study by Jenkinson, Jones and Martinez (2016) explores the value added of investment consultants, their focus is solely on these consultants' advisory role, and thus our study is the first to consider the performance implications of external managers with full discretion in manager selection. Owing to the wide coverage of our dataset and interesting variations in outsourcing arrangements among the sponsors, our study allows for a clean test of the value implications of these external lead managers.

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[3] A report by the Chief Investment Officer magazine estimates full discretionary OCIO assets have increased by 860% between 2007 and 2015, with another report by Charles Skorina & Co. estimating the total assets managed by OCIO providers in 2016 to be in excess of $1.3 trillion.

Public agency sponsors in Korea have two main ways of outsourcing portfolio management. First, a small number of large-scale sponsors choose their external managers directly through an internal selection process. However, others participate in one or both of the two Investment Pools for Public Funds (IPPFs). These are not dissimilar to the local government investment pool (LGIP) system operated by various U.S. states, but with one crucial difference; whereas many LGIPs are either internally managed or maintain a mixture of internal and external management, Korean IPPFs operate strictly on a fund-of-funds basis, with external lead managers prohibited from managing assets directly. Instead, their key role is to select a group of end-level managers that would then engage in the day-to-day asset management of the pooled assets. The lead manager then charges management fees on top of the fees set by the end-level managers, usually in terms of a percentage of the assets under management. [4]

Drawing upon the terminology of Stoughton, Wu and Zechner (2011), this arrangement may be referred to as an example of "intermediated investment management." Given that an additional layer of delegation generally exacerbates potential misalignment or conflict of interest, such intermediation has hitherto been seen as detrimental to the investors' interests. For retail funds, Bergstresser, Chalmers and Tufano (2009) find that broker-sold mutual funds underperform their direct-sold peers even before the fees are taken into account. Del Guercio and Reuter (2014) further report that the well-known underperformance of active funds is largely confined to the broker-sold and not to the direct-sold segments. Similarly, Chen, Hong, Jiang and Kubik (2013) find retail funds managed in-house by fund families post superior performance in comparison with those managed by outsourced sub-advisory firms.

For institutional funds, Andonov, Eichholtz and Kok (2015) find a clear negative relation between fund

[4] In line with the global trend, three large public sponsors have recently opted for the OCIO system, delegating the manager selection process to a designated lead manager with fiduciary duties. However, as these developments have only materialized at the end of our sample period, from the second half of 2015, we ignore this structural change for the remainder of this paper.

performance and the layers of delegation, albeit with their research focus limited to the real estate market. Jenkinson, Jones and Martinez (2016) explore the value added of investment consultants that serve as advisers to pension plan sponsors; the performance of their recommended funds is either lower or at best indistinguishable from their peers. In fact, the existing evidence on intermediated investment management has been so negative to the extent that a number of hypotheses have been advanced to explain how the consultants maintain their popularity among institutional clients despite such underperformance (e.g., Goyal and Wahal, 2008; Gennaioli, Shleifer and Vishny, 2015). Yet, it is still difficult to reconcile the sheer popularity of OCIO providers with the overwhelmingly unfavorable performance implications of other forms of intermediation hitherto reported in the literature.

In contrast, we find that external managers selected by the IPPF lead managers significantly outperform those selected directly by the sponsors, even after additional lead management fees are taken into account. Their superior performance is evident across all major performance measures, including net benchmark-adjusted return and fund alphas constructed using various factor models. The difference is also significant and plausible in terms of its economic magnitude, at around 0.2 to 0.4% per month. In addition, both the statistical and economic significance remain strong when the performance is measured in terms of value added instead (e.g., Berk and van Binsbergen, 2015).

Moreover, we find various alternative explanations to be insufficient for explaining this performance differential. First, our dataset is free of survivorship or backfill bias and has excellent coverage; it spans all equity managers selected by the two IPPFs as well as all but one major sponsors who select external managers directly. Second, an alternative hypothesis may be posited that the external funds selected by the IPPF lead managers may be inherently different in their characteristics to those selected directly by the sponsors. To this end, we engage in propensity score matching (PSM), assigning for every IPPF fund-month a non-IPPF fund-month similar in all other fund-level characteristics. We find that comparing the

IPPF-selected managers against matched non-IPPF managers, if anything, increases both the economic and statistical significance of the performance differential. Third, our result is not driven by a self-selection of well-performing sponsors forming an "alliance" through the IPPFs. In contrast, the establishment of the IPPF was primarily aimed at smaller sponsors who lack the resources and expertise for in-house investment management. Thus, the direction of the selection bias, if any, would actually run contrary to our main finding. Finally, possible economies of scale arising from the pooling of investment assets are unlikely to affect our results either, because the net assets of the two IPPFs are broadly comparable to the large sponsors that select external managers directly within our sample.

To the best of our knowledge, our study is the first to document tangible performance benefits of the use of financial intermediaries in manager selection process for the institutional investors.[5] This raises a natural question: what drives such superior performance of the OCIOs? Extensive interviews with those involved suggest the use of external lead managers alleviates some of the internal organizational issues within the sponsor. In particular, employees in public agency sponsors face strong incentive to engage in short-termism due to frequent shifting of job posts and the sponsors' difficulties in matching the private sector compensation. Moreover, these employees are under intense scrutiny of the trustee committee and the public in general; this encourages them to select managers that are easier to justify to the committee ex post, i.e., those with favorable observable characteristics. Within our sample, we find some evidence supporting this conjecture; managers selected directly by the sponsors are more likely to be from large asset management firms and stay closer to their set benchmark, even if they demand higher fees.

In contrast, employees in the lead manager firm have a longer job tenure with a clear mandate. More importantly, as the trustee committee is outright prohibited from micro-management on a day-to-day basis,

[5] Cici, Kempf and Sorhage (2017) find tax management benefits of such intermediaries for retail clients, but their study reports no direct performance-driven benefit.

these lead managers enjoy greater flexibility in asset management, enabling them to select managers with more desirable "soft" characteristics. This ability to by-pass internal organizational issues, we believe, is crucial to enhanced performance. This is all the more important because such problems appear pervasive within major pension sponsors around the world; Del Guercio and Tkac (2002), for example, similarly document a strong preference among U.S. pension plan sponsors for funds that stay close to the designated benchmark as they are easier to justify to the trustee committee ex post. In an extensive survey of over 80 pension CEOs, Ambachtsheer (2016) reports similar organizational problems persist even in some of the best-known and largest pension sponsors in the world. As a result, our findings are likely to be relevant not just within the Korean market but also for sponsors in the U.S. and other developed markets subject to similar internal problems.

In this respect, it is possible to reconcile our result with the negative performance consequences of other forms of intermediation reported in existing studies such as Jenkinson, Jones and Martinez (2016). The use of investment consultants alone cannot address these internal organizational issues identified above, as it is still the case that manager selections are ultimately made by the same employee within the sponsor organization. Even though the use of investment consultants does somewhat ease outside scrutiny, the corporate treasurer making the decisions remains exposed to the same pressures from various quarters. Thus, our results suggest a full transfer of control, responsibility, and accountability for manager selection may be necessary to address the chronic agency issues within institutional sponsors.

2. Background: Outsourcing Arrangements of Korean Public Agency Sponsors

There are around 65 public agency sponsors in Korea, which are either pension funds or trust funds of various public agencies with diverse policy goals and objectives. Some of their assets are held in liquid

form, but the remainder are invested almost invariably in domestic and/or foreign equities and investment grade bonds.[6] Due to regular performance reviews of all public agency sponsors by the Korean Ministry of Strategy and Finance, with relatively homogeneous review criteria placing much weight on quantitative components such as net benchmark-adjusted return, these sponsors have similar objectives in investment management despite their varying policy objectives.

Among these, there are six major sponsors who have outsourced some or all of their domestic equity portfolio management for a prolonged period of time. Out of these, all but one sponsors have agreed to provide us with manager-level data for the purpose of our study. Until the second half of 2015, all six sponsors maintained an internal manager selection procedure for this purpose, generally by forming ad-hoc selection committees.[7] Two of them also have an in-house team that manages the remaining portion of the equity portfolio.

Many smaller sponsors have, however, historically shunned the equity market investment altogether. Worse still, when they did allocate some of their assets to equities, records of their decisions and financial accounts were opaque and poorly maintained. Following a period of public and political pressure for greater transparency and institutional formality in investment management, and also to provide these sponsors a more accessible means by which they could invest in equities, the IPPF system was introduced in 2001, with a pooled fund-of-funds structure that enables multi-manager investment on these sponsors' behalf. At its inception, there was one lead manager in charge of the entire pool, but since the second half of 2013, one additional lead manager has been selected, with the original lead manager managing around

[6] A small number of large-sized sponsors have increased their asset allocation on alternative investment such as real estate, private equity, or infrastructure funds in recent years, but we focus our attention mainly on managers investing in domestic public equity throughout this paper.

[7] Three public sponsors have adopted the OCIO framework during the second half of 2015; however, the manager selection of end-level managers by the external lead managers only properly began in 2016, which falls outside our sample period.

three-quarters of the assets and the other the remaining quarter. Their contracts with the Korean government are over a four-year horizon, at the end of which their status may be renewed or terminated. Their managed assets are valued at $5 billion and $12 billion, respectively, broadly comparable to the assets of non-IPPF sponsors for which we have access to data, ranging between $5 billion and $27 billion.

Both lead managers are major, established asset management firms in Korea. However, to prevent any potential conflict of interest, lead managers are outright prohibited from selecting any of their in-house fund managers for the purpose of IPPF management.

FIGURE 1 HERE

Each lead manager offers various funds-of-funds according to each asset class (short-term government bond, long-duration fixed income, active equity etc.), with its management structure as outlined in Figure 1. IPPF-participating sponsors then invest in these funds-of-funds according to their own asset allocation plan.[8] Each fund-of-funds then selects multiple end-level managers solely at the lead manager's discretion, who then also designs the end-level managers' benchmarks, mandates, policies, and fee structure, as well as ex post monitoring and performance evaluation.

Such unique arrangements among Korean sponsors for the outsourcing of their equity portfolio allow us to directly compare the performance implications of different delegation structures, which, until now, has been a challenge in the U.S. or other developed markets. In this respect, an in-depth examination of these Korean public sponsors provides a rare insight into the role of lead managers.

[8] In certain cases, a public agency sponsor may impose additional restrictions on investment in a particular asset class, making it difficult for their assets to be pooled together with the others'. In this instance, the lead manager may create specific fund-of-funds tailored to its individual needs. However, these are generally confined to fixed income classes, with neither lead manager currently offering individually-tailored fund-of-funds for domestic equities.

3. Data and Methodology

3.1. Data

3.1.1. Data Construction

We collect the monthly performance data of domestic equity managers either selected by the sponsors themselves or through the IPPF lead managers between 2010 and 2015. The data is proprietary, obtained directly from the public agency sponsors and IPPFs.[9] It spans all end-level funds selected by either the public agency sponsor (non-IPPF funds hereafter) or lead manager (IPPF funds) with at least one day in operation between 2010 and 2015. The rigor of the dataset has been checked meticulously by the staff at respective institutions and the legal requirements are such that the data is free of survivorship bias. As the data has to be maintained and monitored straight from a fund's inception due to government regulation, it is also free of backfill bias. The dataset contains details on each manager-level fund's returns, net assets, net flows, benchmarks, fees, and other pertinent information. Among these, we limit our focus to active managers given the scope of our research question. In total, there are 67 IPPF funds (1,437 fund-month observations) and 195 non-IPPF funds (4,189 fund-month observations).

However, to estimate the factor loadings on multi-factor models or tracking error without inducing look ahead bias, we utilize the previous twelve months of a fund's data for the purpose of computation.[10] Thus, the data for 2010 is used solely for this purpose. We further exclude any fund with net assets under KRW

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[9] We thank the Korean Ministry of Strategy and Finance, sponsors, and IPPF lead managers for providing access to this data.

[10] As a robustness check, we employ an alternative window for the purpose of factor loading calculation, namely an estimation window increasing up to the previous 36 months with 12 months as minimum cut-off, as in Hou, Karolyi and Kho (2011). In an untabulated analysis, we confirm that the results remain qualitatively unchanged.

1 billion (or $0.85 million), comparable to the $1 million threshold in most studies on U.S. retail and institutional funds.[11] Due to a relatively high attrition rate with frequent manager turnover, our final sample consists of 37 IPPF funds (totaling 694 fund-month observations) and 117 non-IPPF funds (2,183 fund-month observations) in operation between January 2011 and December 2015. While this number may appear small, applying similar screens to active equity retail funds in Korea over the same period renders only around 500 funds. Thus, the data coverage is not small compared to the size of the Korean mutual fund industry as a whole. More information is given in Panel A of Table 1, with Panel B further reporting the number of IPPF and non-IPPF funds for each calendar year.

TABLE 1 HERE

Market return is defined as the monthly return on KOSPI index. However, since the Korean market for government bonds is not as liquid as the U.S. Treasuries, it has been a common to use the interest rate on the 91-day certificates of deposit (CDs) released by the Bank of Korea as the risk-free rate, to which we adhere. Factor returns are calculated analogous to Fama and French (1992) or Carhart (1997). We also obtain the data on the aggregate net assets under management of all asset management firms to whom the end-level managers in our sample belong from the Korea Financial Investment Association.

Unlike retail managers, however, most managers in our sample do not publish their stated styles. Thus, we define their styles ex post in the following manner. For each calendar year, we estimate each fund's average *SMB* and *HML* loadings using the Fama-French three-factor model.[12] Then, we sort these funds according to their average *SMB* loading and produce two equal subsamples, "big" and "small." Similarly, based on their average *HML* loading, the top 30% and the bottom 30% are classified as "growth" and

[11] Results are robust to relaxing this minimum asset requirement.

[12] We require a minimum of four factor loading estimates in a calendar year for a fund to be included in style sorting. Raising this number to six has no effect on the results.

"value," while the remaining 40% are "neutral."

3.1.2. Performance Measures and Controls

We use seven performance measures in our empirical analysis: (i) excess return over benchmark (both gross and net of management fees), (ii) excess return over the risk-free rate, (iii) CAPM alpha, (iv) three-factor alpha, (v) four-factor alpha, (vi) Sharpe ratio, and (vii) information ratio.

Fund alphas are constructed in the standard manner. For each month t, we calculate the factor loadings of each fund using the previous 12-month window ending in month $t-1$. This allows us to calculate each fund i's realized abnormal return for each month, i.e., fund alpha, as below:

$$\alpha_{i,t}^{CAPM} = r_{i,t} - \hat{\beta}_{MKT,i,t-1} MKT_t \quad (1)$$

$$\alpha_{i,t}^{FF3} = r_{i,t} - \hat{\beta}_{MKT,i,t-1} MKT_t - \hat{\beta}_{SMB,i,t-1} SMB_t - \hat{\beta}_{HML,i,t-1} HML_t \quad (2)$$

$$\alpha_{i,t}^{Carhart} = r_{i,t} - \hat{\beta}_{MKT,i,t-1} MKT_{i,t} - \hat{\beta}_{SMB,i,t-1} SMB_{i,t} - \hat{\beta}_{HML,i,t-1} HML_{i,t} - \hat{\beta}_{UMD,i,t-1} UMD_t \quad (3)$$

A fund's tracking error at month t is the standard deviation of its excess returns over benchmark over the previous 12-month window. We also compute the information ratio for each month, namely the ratio of benchmark-adjusted excess return at month t divided by the tracking error over the past 12 months. Sharpe ratio is calculated analogously.

Other control variables are as follows. Fund size is the log of a fund's total net asset for a given month. Similarly, management firm size is the log of the total net assets of the fund manager's asset management firm. Expense ratio of a fund is its total fees divided by the total net asset value of the fund, which, for the IPPF funds, includes both the end-level management fees as well as lead management fees. We also have

information on the net fund flow for each month. Table A.1 in the Appendix provides detailed explanation on how each variable is constructed.

3.2. Estimation Methodology

In addition to a simple comparison of various performance measures between IPPF and non-IPPF funds, we engage in propensity score matching (PSM) to control for the possibility that the managers selected directly by the sponsors and those by the lead managers are inherently different in characteristics. This is likely to be the case if the non-IPPF sponsors and IPPF participants hold different preferences regarding fund styles or other characteristics (such as fund tenure or size).

To this end, we employ the following two-stage procedure. In the first stage, we estimate a logit model of the possibility of a given end-level manager being selected by the IPPF lead manager each month.[13] The following controls are used: fund size, management firm size, fund flow, expense ratio, and Fama-French three-factor loadings estimated over the previous 12-month window.[14] In the second stage, we use propensity scores estimated from the logit model to match each IPPF fund-month with the closest non-IPPF fund-month. For the baseline analysis, we use one-to-one nearest neighbor matching without caliper length restriction. However, as the results are often sensitive to the matching procedure, we engage in robustness checks using caliper length restriction, one-to-three matching, and Gaussian kernel matching.[15]

[13] Exact matching on calendar month is imposed for this purpose.

[14] In untabulated analysis, we use the Carhart four-factor loading s instead, with no qualitative change to the results.

[15] Results using local linear matching are similar to Gaussian kernel matching and thus not reported.

4. Main Result

4.1. Descriptive Statistics

Table 2 presents descriptive statistics of the full sample as well as the IPPF and non-IPPF subsamples. It is immediately apparent that managers selected by the IPPF lead managers exhibit substantially superior performance—both gross and net of fees—in comparison with those selected directly by the sponsors, with statistical significance at the 1% level in all but one performance measures. In particular, estimated mean differences in fund alphas are very similar in magnitude regardless of factor model, at around 0.25% per month. A similar pattern emerges for the risk-adjusted performance measures such as Sharpe ratio and information ratio.

TABLE 2 HERE

In addition, managers selected by the IPPF lead managers have larger tracking errors, with the difference significant at the 1% level, a finding that echoes Del Guercio and Tkac (2002). Given that the IPPF funds post higher information ratio, it appears the "closet indexer" behavior of the non-IPPF funds has negative consequences on performance. IPPF funds are also smaller in size, with the average fund sizes of the IPPF and non-IPPF funds at $14.0 million and $23.5 million, respectively. Interestingly, IPPF lead managers are more likely to select funds from a smaller asset management firm. Thus, when engaging in internal selection, decisionmakers in the sponsor organizations appear to prefer managers in large, reputable firms given their direct accountability to trustee committees. Despite an additional layer of delegation, IPPF funds have marginally lower expense ratio.[16] IPPF and non-IPPF funds also appear to have significantly

[16] This implies that the end-level managers selected by the IPPF lead manager accept a significant discount in management fees. Anecdotal evidence suggests this due to the lead manager's willingness to select managers from a smaller, "boutique" management firms, for whom being selected to manage IPPF assets represents a significant increase in firm size and reputation.

different three- and four-factor exposures, implying some difference in their preferred styles. In Table A.2 in the Appendix, we also report the Pearson correlation matrix for our variables of interest. We note that a fund's realized volatility over the past 12 months has negative correlations with performance measures, a finding in concurrence with Jordan and Riley (2015).

Above all, there appears to be substantial differences in various characteristics between the IPPF and non-IPPF funds. A simple comparison of their performance measures would therefore not suffice, further supporting our rationale for performance comparison through a range of PSM procedures.

4.2. Propensity Score Matching: Main Result

In Table 3, we present the first-stage logit estimation of the probability of a given end-level manager being selected by the IPPF lead manager. As descriptive statistics indicate, IPPF lead managers are more likely to select small-sized funds with low management fees and managers from smaller asset management firms. Moreover, funds selected by IPPF lead managers have more positive exposure to the *SMB* factor, suggesting that these funds tend to invest more in small-cap stocks.

TABLE 3 HERE

Panels A and B of Table 4 reports the results for one-to-one and one-to-three matching without caliper length restriction.[17] In an untabulated analysis, we confirm that, when one-to-one matching is used, the differences-in-mean between IPPF and matched non-IPPF funds for all but one first-stage controls, namely fund size, turn insignificant, suggesting that the matching procedure mostly manages to take into

[17] Since we impose exact matching on calendar month, it is not possible to find three matches for a given IPPF fund-month in some instances, leading to a loss of observations for the case of one-to-three matching.

account of inherent differences in observable fund characteristics.

TABLE 4 HERE

Both panels in Table 4 indicate that the performance differential between the IPPF and non-IPPF funds remain robust even after we control for the inherent differences in fund characteristics. In Panel A, the mean differences for all performance measures, both gross and net of fees, remain broadly similar to Table 2; the average difference in excess return over benchmark continues to be around 0.35% per month, while the differences in fund alphas are between 0.2 and 0.3% per month and remain significant at the 1% level. The fact that the alphas of IPPF funds are always significantly higher regardless of the factor model used suggests that the performance differential appears not to be market- or style-driven. When one-to-three matching is employed in Panel B, qualitative results remain unchanged, both in terms of economic and statistical significance.

We then pool together the IPPF and matched non-IPPF fund-months and engage in regression analysis, with various performance measures as the dependent variable in each case. This further controls for any remaining effect of fund characteristics on performance. Our main variable of interest is the IPPF dummy that takes value of 1 if a fund is selected by the IPPF lead manager and 0 otherwise. Controls are the same as those used in the first-stage matching procedure plus each fund's realized volatility estimated over the previous 12-month window. Whenever the four-factor alpha is the dependent variable, we use the funds' four-factor exposures instead of Fama-French three-factor exposures. We use the heteroscedasticity- and autocorrelation-consistent standard errors of Newey and West (1987). Table 5 presents our results.

TABLE 5 HERE

Across all five performance measures, the IPPF dummy turns out to be significantly positive at the 1% level except for one case where significance is obtained at the 5% level. In addition to the IPPF dummy,

fund size has a positive contribution toward performance within our IPPF and matched non-IPPF sample. Furthermore, in accordance with Jordan and Riley (2015), we document a negative relationship between past fund volatility and fund performance.

4.3. Propensity Score Matching: Robustness

However, PSM-based results are often sensitive to the matching procedure. As a result, we employ two alternative matching techniques. First, to ensure that the matched non-IPPF fund-month is close to the IPPF counterpart in terms of the observed characteristics, we impose caliper length restrictions. We use two cut-offs, namely 0.1 and 0.25 pooled standard deviations of propensity score. The lower the cut-off point, the more stringent the requirement for a "close match." Table 6 re-estimates Panel A of Table 4 for these two cases.[18]

TABLE 6 HERE

In both instances, the point estimates for the differences-in-mean or -median are similar to those obtained in Table 4, with excess return over benchmark between 0.3 and 0.4% per month and fund alphas between 0.2 and 0.3% per month. Once again, these estimates are statistically significant at the 1% level in all but one case. Crucially, imposing a more stringent restriction, i.e., 0.1 pooled standard deviations, actually increases the point estimates, further supporting our hypothesis that the performance differential is not driven by the inherent differences in fund characteristics.

Then, using the caliper length restriction at 0.25 pooled standard deviations, we also engage in one-to-three matching and re-estimate the regression results in Table 5.[19] Table 7 presents our results.

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[18] In an untabulated analysis, we also confirm that the post-matching difference in control variables between IPPF and matched non-IPPF funds become markedly less prominent once caliper length restrictions are placed.

[19] Regression results for the case of caliper length restriction at 0.1 pooled standard deviation remain qualitatively unchanged.

TABLE 7 HERE

Once again, the IPPF dummy turns out to be statistically significant across all performance measures; for a majority of cases, the estimates are significantly positive at the 1% level, and the remaining few are always significant at the 10% level.

Instead of nearest neighbor matching, we also consider whether our results remain robust when Gaussian kernel method is employed instead. Table 8 presents our results when the bandwidth is set at 0.05. Once again, both the economic and statistical significance of various performance measures unchanged.

TABLE 8 HERE

5. Discussion

5.1. Differences in Fund Performance by Size, Style, and Activeness

In order to explore further into the performance characteristics of IPPF and non-IPPF funds, we engage in a set of portfolio analyses. First, using the fund net asset at each month-end for the entire sample, we determine the respective cut-offs and assign each fund into one of four size-based quartile portfolios. We then compare the performance of these size-based portfolios in Table 9.

TABLE 9 HERE

For IPPF funds, the third quartile performs the best when we focus on the excess return over benchmark or fund alphas. However, when we consider Sharpe ratio or information ratio, the largest quartile performs the best, closely followed by the third quartile. Thus, overall, funds with large assets under management fare better. A possible interpretation for this is that better-performing end-level managers are gradually allocated more assets by the lead manager.

We also observe a weak improvement in performance among non-IPPF funds as fund size increases.

However, the economic magnitudes of these differences are not as sizeable as in IPPF funds. As a result, when we compare the IPPF and non-IPPF portfolios, it appears the superior performance of the IPPF funds stem primarily from the large-sized funds. Panel C reveals that the statistical significance of performance differential between IPPF and non-IPPF funds are the strongest for the top two quartiles in fund size, with the third quartile exhibiting the strongest statistical significance. This suggests that the lead managers are better either at discerning end-level managers with superior capabilities and allocate more assets or at providing help to the end-level managers in handling potential diseconomies associated with larger funds than employees at the sponsor organization.

TABLE 10 HERE

In Table 10, we repeat the analysis above for the monthly rebalanced 2×3 portfolios sorted on the size and book-to-market exposures of each fund-month estimated over the previous 12 months. The median value of the *SMB* at each month-end is the cut-off, and the sorting for value exposure is based on each fund's estimated *HML* using the standard definition: top 30%, middle 40%, and bottom 30%.

For IPPF funds, strong performance is observed especially among funds in large-value, small-neutral, and small-value portfolios. For non-IPPF funds, a different picture emerges; while growth-oriented funds are able to match the performance of IPPF funds, performance is much weaker among funds that exhibit strong exposure to the book-to-market factor. When we compare the difference between the two in Panel C, small-neutral portfolio yields the strongest difference in terms of statistical significance, followed by the small-value and large-value portfolios.

TABLE 11 HERE

Lastly, in Table 11, we repeat the analysis in Table 9, but with monthly portfolio sorting based on the fund's tracking error estimated over the previous 12 months. Once again, we form quartile portfolios from the least to the most active. For both IPPF and non-IPPF funds, a clear U-shaped pattern is observed, with

superior performance of portfolios with either the smallest or largest tracking errors. However, when we compare the relative performance of the two groups, superior performance of IPPF funds relative to non-IPPF funds seems to be driven by the top two quartiles, i.e., funds with large tracking errors.

5.2. Alternative Explanations

Despite the consistency of our results obtained in Section 4, a number of alternative explanations may still be advanced for the performance differential between the IPPF and non-IPPF funds. While we have highlighted the implausibility of some in the introduction, we now discuss the remaining possibilities.

First, superior performance may be attributable to the uniqueness of a particular lead manager rather than the delegation structure as a whole. For example, in a relatively small market as in Korea, a firm may develop a "monopolistic" position and hoard employees with superior talent. However, no firm enjoys such a position in Korea. Further circumstantial evidence suggests these firms' respective performances as end-level managers are not extraordinarily stellar compared to others; the performance of their domestic equity retail funds over the same sample period places them only in the second quartile (i.e., between top 25% and top 50%) of their peers in Korea. Moreover, in an untabulated analysis, we confirm that *both* lead managers outperform, i.e., performance differential does not emanate entirely from any one particular lead manager. [20]

The discussion above, however, raises another question; while the lead managers are prevented from allocating their IPPF assets to their own in-house team or that of the other lead manager's, public agency sponsors may still choose them as end-level managers for some portion of their domestic equity portfolios. It is thus conceivable that the performance differential may be driven by this discrepancy in the manager

[20] While we do not publish the results directly given their sensitive nature, they are available upon request.

universe. Thus, in an untabulated analysis, we repeat the PSM procedures in Section 4, albeit with the non-IPPF end-level managers belonging to either of the IPPF lead management firms excluded from the sample. They constitute fewer than 100 fund-months in total, and all qualitative results remain unchanged.

Second, among the five major non-IPPF-participating sponsors, two opted for a mixture of in-house and outsourced management while the other three delegated the entirety of their equity asset management for the entirety of our sample period. If so, these sponsors' in-house teams may hold onto more profitable opportunities while delegating "lemons" to external managers; in other words, the seemingly superior performance of lead managers may be a by-product of these sponsors' internal considerations. Thus, we repeat the baseline PSM analysis in Table 12, but this time for the two separate subsamples. First, we limit the non-IPPF subsample to those selected by the sponsors with an in-house management team. Then, we repeat the procedure for the non-IPPF subsample with the outsourcing-only sponsors.

TABLE 12 HERE

In Panel A, we find that the superior performance of IPPF funds somewhat disappear against non-IPPF funds selected by the sponsors with in-house management. While the information ratio of IPPF funds is significantly higher at the 1% level, non-IPPF funds outperform at the 5% level when we focus on the excess return over risk-free rate. In contrast, the outperformance of IPPF lead managers is much more pronounced against outsourcing-only sponsors, as can be seen from Panel B.

The main reason for this, we believe, is that sponsors with an in-house team exhibit greater awareness of internal organizational issues detrimental to their performance and take requisite measures to minimize their impact. For example, they set aside dedicated staff in charge of investment management, with longer tenure at their job posts compared to those at the outsourcing-only sponsors, and install various measures aimed at employee retention. This in turn enables them to select managers in a comparable manner to the IPPF lead managers. However, this result does not necessarily reduce the relevance of lead managers' role

in manager selection; when viewed conversely, for sponsors with limited resources and attention to take the requisite measures to enhance their manager selection procedure, our result also clearly highlights the performance-enhancing potential of the lead managers.

Third, given the rapid growth of the IPPFs over the past decade, as various trust funds have experienced a large increase in their excess reserves, it may be argued that the influx of new assets into these funds may create excess demand in the equity market, culminating in superior performance. While this cannot be categorically ruled out, we are skeptical. First, even though the two IPPFs have grown in size, their presence in the Korean equity market amounts to around less than 0.1% of market capitalization. Second, there is no evidence of sponsors participating in the IPPFs experiencing relatively larger inflows than the non-participating sponsors. Finally, for most regression specifications, fund flow has very little influence on performance, casting further doubt on this alternative story.

Fourth, as Berk and van Binsbergen (2015) argue, the percentage return measure used throughout our empirical analysis may be inadequate, particularly given that IPPF funds tend to be smaller in size, because a "manager who adds a gross alpha of 1% on a $10 billion fund adds more value than a manager who adds a gross alpha of 10% on a $1 million fund (Berk and van Binsbergen, 2015, p. 2)." It is thus conceivable that the return measures used in Section 4 are overstating the value added of IPPF funds. In Table 13, we estimate the value added of managers following their methodology, either in terms of excess value added over benchmark or factor benchmark returns, both for the cases of baseline PSM and PSM with caliper length restriction. We find that our results remain unchanged. Depending on the matching procedure, it appears IPPF funds add around KRW 80 to 120 million (roughly around $70,000 to $100,000) on average every month in excess of benchmark compared to their non-IPPF peers, a plausible figure with significant economic magnitude once annualized.

TABLE 13 HERE

Finally, seemingly superior performance of IPPF funds compared to their non-IPPF peers may reflect lead manager's preference for end-level managers that could generate outperformance immediately. For example, an end-level manager may share school ties with the board member of a firm about to engage in a major corporate event and boast superior access to information (e.g., Cohen, Frazzini and Malloy, 2008); lead manager may anticipate this and hire her, hoping to "bet on big" in the upcoming event. However, in this instance, the manager's subsequent performance could conceivably be indistinguishable from others or even poorer. To check whether this is the case, we pool together IPPF and non-IPPF funds at the end of a calendar year, sort them on their annual benchmark-adjusted return, and form quartile portfolios on previous year's benchmark-adjusted return in untabulated analysis. Our sample is far too short to make any definitive statement on performance persistence, but we note that the top quartile of IPPF funds appear to perform well subsequently, with the average monthly benchmark-adjusted returns of the top and bottom quartiles at 0.37% and 0.11%, respectively, with statistical significance?

5.3. Managerial Implications: Why Do Lead Managers Matter?

Our empirical analysis in the previous sections still leaves one question unanswered: how does the shift in the delegation structure from direct manager selection to a selection process that utilizes lead managers help the sponsors enhance their performance? With this in mind, we conduct extended interviews and surveys of relevant parties that reveal various internal issues within the sponsor organization.

First, employees in the sponsor organizations are subject to sustained public scrutiny. Such pressure from the public also means that their decisions have to be ex post justifiable to the trustee board, especially when the board has a propensity to micro-manage. As a result, employees rely on more readily observable "hard information" measures when engaging in manager selection. Table A.3 in the Appendix provides a comparison of manager selection criteria of one of the non-IPPF-participating sponsors and the IPPF lead

manager. It is immediately apparent that easily quantifiable measures such as total equity, leverage ratio, and assets under management, and the number of managers of an asset management firm are utilized by the sponsors but not by the IPPF lead manager. Our sample further supports this hypothesis; non-IPPF managers are drawn from larger firms and, on average, stay closer to their stated benchmark. This is not a coincidence; such managers offer the decision-making personnel within the sponsor organization a "safe choice." However, as we argue throughout this paper, these non-performance-related considerations may have an adverse consequence on the manager's subsequent performance.

Second, many sponsors face a plethora of policy objectives with a diverse group of stakeholders. Thus, they find it difficult to devote their resources and attention to portfolio management, engaging instead in a wide-ranging set of operations. Moreover, employees are subject to frequent job rotations in an attempt to improve their perceptions about internal procedural justice. As a result, the staff in charge of portfolio management finds it challenging to develop their expertise in asset management. Given that the sponsors find further difficulties in staff retention due to their inability to match the private sector compensation, it is not surprising that those in the IPPF lead management firm have around 50% longer tenure than their counterparts at the sponsor organizations, as our separate survey of the sponsors and the lead managers reveals.[21] This poses a problem as it induces the short-termism of employees in the sponsor organization. The government's emphasis on the annual benchmark-adjusted return in its annual review of sponsors worsens the problem, further discouraging the sponsors from taking a long-term perspective.

In theory, if the sponsor can address these issues through an appropriate change in its internal structure and incentives, the use of external lead managers may not be necessary. In reality, it is difficult to do so. Close scrutiny over its day-to-day management by the public, along with the need to maintain internal employee relations, makes a complete overhaul difficult. If so, delegating manager selection to an external

[21] A brief overview of this survey is available upon request.

body altogether, while increasing the layers of delegation within the overall structure, may be considered a second-best solution in the face of these internal agency problems for the following reasons.

The lead management firm has a clear focus, with most of its areas of operation bearing a close relation to portfolio management. With their employees gaining longer work experience in related fields, they tend to have a competitive edge over their peers in the sponsor organizations. Moreover, as the lead manager is not directly answerable to the board on a day-to-day basis, with a more formal delegation of roles and responsibilities, it helps address various issues associated with the organizational dysfunctions between the board and the employees. Consequently, employees in the lead management firm feel more confident in utilizing both quantitative and qualitative characteristics of the potential manager pool in the selection procedure; Table A.3 reveals that, whereas the sponsors focus more on visible quantitative measures such as benchmark-adjusted return, lead managers aim to identify finer aspects of portfolio management such as the end-level managers' propensity to engage in style drifts. This is aided by the fact that employees in the lead management firm can make use of their access to the existing infrastructure, which, for many sponsors, may simply be too costly to build.

It is therefore possible to reconcile our results with Jenkinson, Jones and Martinez's (2016) inability to find the investment consultants' value added for the institutional clients. Crucially, their analysis of the recommended funds focuses on the consultants' role as advisors. While these advisers' recommendations make it easier for the decision-makers to ex post justify their manager selection to the board, the decision-making process remains unchanged. Without a formal delegation of responsibilities and discretionary powers, it is ultimately up to the sponsor employees to follow up on the recommendations, with all the organizational issues, dysfunctions, and internal pressures from the board the same as before. Thus, our results suggest a full transfer of discretionary powers and a formal delegation of roles and responsibilities are critical for enhanced manager selection.

At this point, the reader may be left with the impression that such problems are confined to the Korean market for institutional asset management. However, according to the qualitative evidence provided by Ambachtsheer (2016), they appear pervasive across most major pensions around the world. In successive surveys of around 80 CEOs of major pensions in 1997, 2005, and 2014, the following issues are invariably highlighted as main challenges for the pension governance: high employee turnover due to uncompetitive levels of compensation, dysfunctions between the trustee board and the staff in manager selection and termination, discontinuities arising from frequent board turnover, and the lack of expertise displayed by some board members. These are almost identical to the problems that we have identified with the relevant members of the industry in our sample. To the extent that a full transfer of powers for manager selection to an external body resolves many of the issues identified above, we believe our results have important ramifications beyond the Korean market, further stressing the need for future researches on the issue.

6. Conclusion

In contrast to the existing literature that reports negative performance implications of additional layers of delegation in portfolio management, we document superior performance of equity managers selected by the IPPF external lead managers compared to those selected directly by the sponsors using a unique dataset on Korean institutional clients. Both the economic and statistical significance of such performance differential remain strong after controlling for inherent differences in fund characteristics through PSM, and are robust to a wide range of additional analyses intended to rule out various alternative explanations.

We contend that a full transfer of discretionary powers in manager selection to the lead managers is the key to alleviating various internal organizational problems inherent within the sponsor. In other words, when the internal structure itself is susceptible to short-termism, frequent turnovers, various organizational dysfunctions, and reliance on “hard” information in the face of public scrutiny, distancing itself from the

manager selection decisions through an additional layer of delegation can be performance-enhancing. In other words, the use of external lead managers may be viewed as a second-best approach for sponsors with practical difficulties in overhauling these internal issues. In this respect, the explosive growth of the market for OCIOs in recent years needs not be viewed as a conundrum; when one's hands are tied, it may make sense for others to lead the way.

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Figure 1. Delegation structure of Korean IPPFs

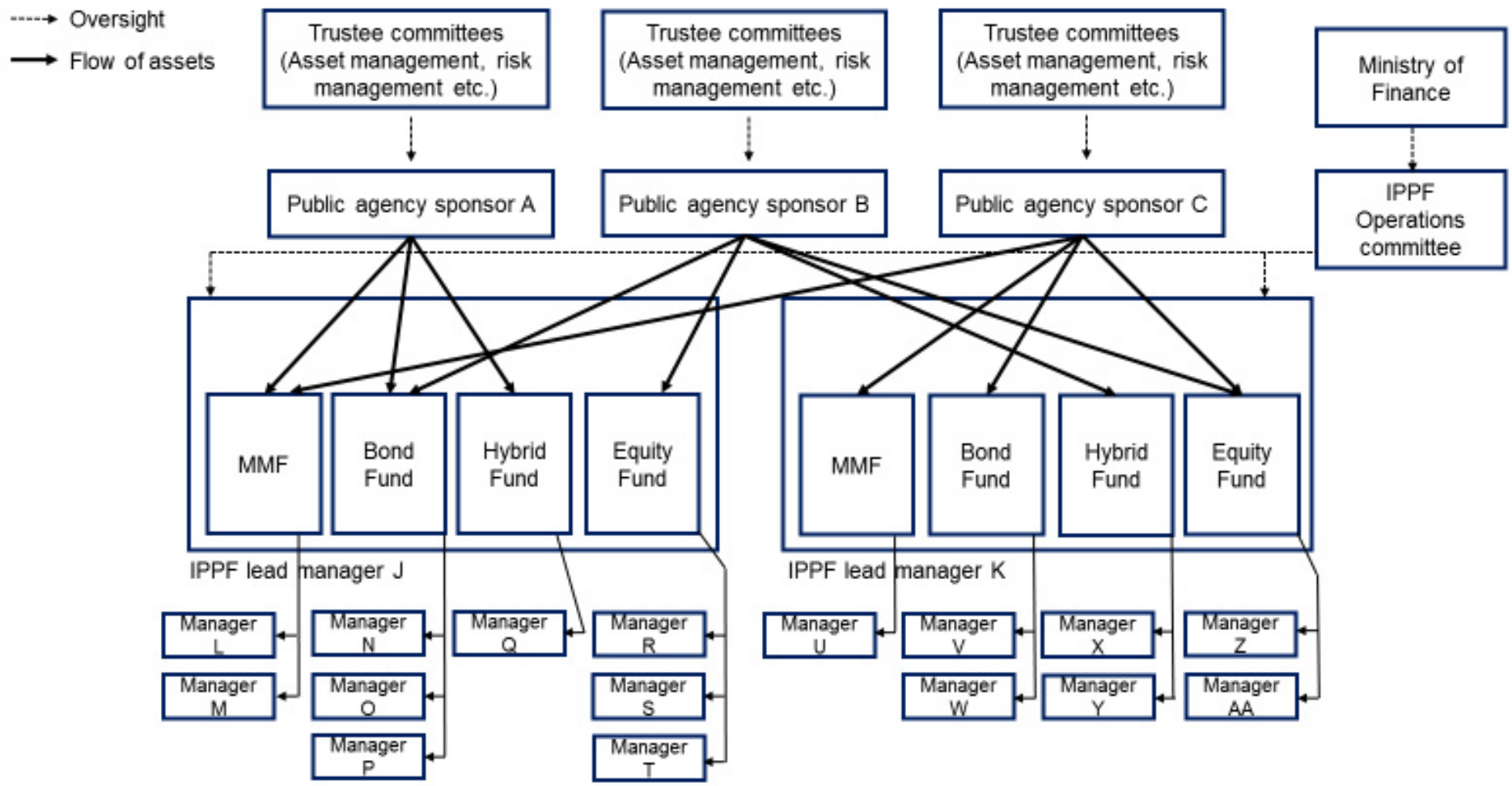

Table 1. Basic Information about the Sample

This table reports the number of fund-month observations, separately for the initial sample and the final sample with a minimum availability of 12 months of previous observations. Panel B then reports the numbers of funds used by the IPPFs and public agency sponsors for each calendar year.

Panel A. Number of Observations

	IPPFs	Non-IPPFs	Total
Initial Sample			
No. of fund-month observations	1,437	4,189	5,626
No. of funds	67	195	262
Final Sample			
No. of fund-month observations	694	2,183	2,877
No. of funds	37	117	154

Panel B. Number of Funds by Calendar Year

Initial sample		
No. of Funds	IPPFs	Non-IPPFs
2011	19	46
2012	23	48
2013	23	59
2014	33	100
2015	38	129
Final sample		
No. of Funds	IPPFs	Non-IPPFs
2011	13	37
2012	13	36
2013	15	26
2014	12	45
2015	24	85

Table 2. Descriptive Statistics

This table provides descriptive statistics separately for IPPF and non-IPPF funds as well as the subsample difference-in-mean and the corresponding *t*-statistics. All returns and volatility estimates are in per cent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

Variable	IPPF						Non-IPPF						Difference-in-Mean (IPPF – Non-IPPF)	
	Min	Median	Mean	Max	St. Dev.	Obs.	Min	Median	Mean	Max	St. Dev.	Obs.	Difference	*t*-statistic
Performance Measures														
Excess BM (net of fees)	-4.852	0.184	0.218	6.553	1.758	694	-8.620	-0.081	-0.137	5.930	1.480	2182	0.355***	4.804
Excess BM (gross of fees)	-4.834	0.203	0.237	6.571	1.758	694	-8.560	-0.063	-0.116	5.967	1.479	2182	0.352***	4.772
Excess RF	-15.015	-0.022	-0.192	10.109	3.723	694	-15.231	-0.138	-0.360	12.021	3.686	2182	0.167	1.033
CAPM alpha	-3.568	0.097	0.115	5.091	1.285	694	-7.502	-0.120	-0.106	8.822	1.493	2182	0.221***	3.789
FF3 alpha	-3.644	0.030	0.051	5.138	1.150	694	-7.947	-0.123	-0.179	9.073	1.432	2182	0.230***	4.308
Carhart alpha	-4.041	0.005	0.023	4.805	0.974	694	-6.804	-0.151	-0.250	7.238	1.197	2182	0.273***	6.066
Sharpe ratio	-0.476	0.045	0.093	0.872	0.228	694	-0.602	-0.010	0.010	0.862	0.227	2182	0.082***	8.272
Information ratio	-0.989	0.201	0.215	1.044	0.338	694	-0.917	0.000	-0.006	0.916	0.275	2182	0.221***	15.626
Other Fund Characteristics														
Tracking error	0.463	1.387	1.465	2.899	0.516	694	0.097	1.250	1.346	5.009	0.625	2182	0.119***	5.030
1YR_VOL	1.556	3.095	3.524	7.496	1.424	694	0.578	3.113	3.614	7.462	1.456	2182	-0.089	-1.431
1YR_RET	-19.899	3.863	5.629	43.526	11.166	694	-24.874	1.280	3.094	47.519	12.005	2182	2.536***	5.115
Fund size	21.132	23.806	23.552	25.485	1.034	694	22.264	24.202	24.063	26.403	0.862	2182	-0.511***	-11.784
FF3_MKT	0.341	0.920	0.895	1.230	0.162	694	-0.222	0.931	0.905	1.238	0.171	2182	-0.010	-1.423
FF3_SMB	-0.376	0.025	0.035	0.493	0.108	694	-0.479	0.007	0.021	1.086	0.162	2182	0.013**	2.478
FF3_HML	-0.799	0.046	0.044	0.777	0.196	694	-1.143	0.057	0.060	1.555	0.206	2182	-0.017*	-1.916
Carhart_MKT	0.436	0.953	0.924	1.278	0.158	694	0.001	0.943	0.929	1.406	0.166	2182	-0.005	-0.688
Carhart_SMB	-0.491	-0.027	-0.029	0.324	0.119	694	-0.699	-0.025	-0.014	0.621	0.142	2182	-0.015***	-2.669
Carhart_HML	-0.715	0.011	0.019	0.704	0.195	694	-1.010	0.034	0.037	1.578	0.200	2182	-0.018**	-2.126
Carhart_UMD	-0.233	0.124	0.127	0.585	0.135	694	-0.391	0.096	0.130	1.147	0.186	2182	-0.003	-0.518
Management firm size	26.995	31.585	31.596	34.253	1.232	694	25.820	31.632	31.797	35.585	1.713	2182	-0.201***	-3.385
Expense ratio	0.127	0.220	0.223	0.887	0.041	694	0.004	0.205	0.247	0.506	0.126	2182	-0.024***	-7.726
Fund flow	-92.505	-0.013	2.247	670.100	36.320	694	-54.066	-0.017	0.718	185.968	10.747	2182	1.529	1.094

Table 3. Logit Regression for Propensity Score Matching

This table reports the results of the first-stage logit regression for the purpose of propensity score matching (PSM). The dependent variable is a binary indicator that takes the value of 1 if the fund is selected by one of the IPPF lead managers and 0 otherwise. In addition to the controls, exact matching is imposed for each calendar month. All returns and volatility estimates are in per cent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

	Coefficient	*z*-value
Intercept	23.588***	12.325
Fund size	-0.774***	-13.289
Management firm size	-0.158***	-4.425
Fund flow	0.004*	1.720
Expense ratio	-3.024***	-6.305
FF3_MKT	-0.530	-1.632
FF3_SMB	1.858***	5.046
FF3_HML	-0.580**	-2.150
Time fixed effect	YES	
Pseudo-R^2	0.099	

Table 4. Baseline PSM Results (Nearest Matching, No Caliper Length Restriction)

This table presents the results of tests of difference between IPPF funds and matched non-IPPF funds, with one-to-one and one-to-three matching performed using the nearest neighbor method without any caliper length restriction. Difference-in-mean and difference-in-median tests (Wilcoxon-Mann-Whitney rank signed tests) are performed. All returns and volatility estimates are in percent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

Panel A. One-to-One Matching

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Excess BM (net)	0.218	0.184	694	-0.138	-0.080	694	0.356***	4.834	0.265***	4.212
Excess BM (gross)	0.237	0.203	694	-0.119	-0.055	694	0.355***	4.829	0.258***	4.208
Excess RF	-0.192	-0.022	694	-0.389	-0.153	694	0.197***	2.844	0.131***	2.634
CAPM alpha	0.115	0.097	694	-0.096	-0.122	694	0.210***	3.325	0.218***	3.222
FF3 alpha	0.051	0.030	694	-0.206	-0.176	694	0.257***	4.693	0.206***	4.885
Carhart alpha	0.023	0.005	694	-0.269	-0.171	694	0.292***	5.885	0.175***	5.672
Sharpe ratio	0.093	0.045	694	0.009	-0.017	694	0.083***	10.848	0.062***	9.643
Information ratio	0.215	0.201	694	-0.033	-0.035	694	0.248***	16.915	0.236***	14.302

Panel B. One-to-Three Matching

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Excess BM (net)	0.143	0.146	563	-0.161	-0.134	1689	0.304***	4.488	0.280***	4.196
Excess BM (gross)	0.161	0.165	563	-0.141	-0.119	1689	0.302***	4.458	0.284***	4.157
Excess RF	-0.065	0.023	563	-0.234	-0.175	1689	0.169***	2.932	0.198**	2.181
CAPM alpha	0.069	0.030	563	-0.107	-0.136	1689	0.176***	3.230	0.166***	2.742
FF3 alpha	-0.011	-0.031	563	-0.189	-0.197	1689	0.178***	3.717	0.166***	3.477
Carhart alpha	-0.020	-0.039	563	-0.255	-0.208	1689	0.234***	5.508	0.169***	5.146
Sharpe ratio	0.081	0.032	563	0.008	-0.017	1689	0.074***	10.375	0.049***	7.402
Information ratio	0.203	0.192	563	-0.008	0.000	1689	0.211***	14.464	0.192***	12.249

Table 5. Baseline Matched Sample Regression

This tables reports the regression of various performance measures on the IPPF dummy and other fund characteristics, for the pooled subsample of IPPF fund-month and matched non-IPPF fund-month observations identified through either (i) one-to-one or (ii) one-to-three matching using the nearest neighbor method without caliper length restriction. All standard errors in parentheses are adjusted by Newey-West (1987) heteroscedasticity- and autocorrelation-consistent standard errors with three lags. All returns and volatility estimates are in per cent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

	One-to-one matched sample					One-to-three matched sample				
	Dependent variable					Dependent variable				
	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha
Intercept	-0.258	-7.416***	-1.489	-1.254	-3.242**	1.258	-6.459***	-0.877	-0.266	-1.298
	(1.614)	(1.643)	(1.512)	(1.392)	(1.348)	(1.147)	(1.297)	(1.144)	(1.032)	(0.856)
IPPF dummy	0.343***	0.196***	0.218***	0.253***	0.280***	0.252***	0.144**	0.158***	0.196***	0.251***
	(0.074)	(0.068)	(0.064)	(0.058)	(0.054)	(0.073)	(0.065)	(0.060)	(0.053)	(0.047)
Management firm size	-0.005	0.020	0.001	-0.022	-0.020	-0.014	0.000	-0.004	-0.034*	-0.030*
	(0.033)	(0.034)	(0.032)	(0.030)	(0.028)	(0.021)	(0.023)	(0.022)	(0.020)	(0.017)
Fund size	0.052	0.071*	0.069**	0.093***	0.148***	0.010	0.057*	0.062**	0.073***	0.094***
	(0.040)	(0.038)	(0.035)	(0.034)	(0.031)	(0.033)	(0.033)	(0.030)	(0.027)	(0.022)
Expense ratio	0.192	0.599	0.304	0.315	0.517	-0.001	0.481*	0.268	0.317	0.467**
	(0.542)	(0.568)	(0.517)	(0.451)	(0.425)	(0.257)	(0.280)	(0.248)	(0.229)	(0.213)
Lagged fund flow	0.000	0.000	0.000	0.001	0.000	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1YR_VOL	-0.463***	-0.431***	-0.288**	-0.168	0.009	-0.457***	-0.428***	-0.390***	-0.220**	-0.049
	(0.159)	(0.157)	(0.128)	(0.116)	(0.110)	(0.097)	(0.133)	(0.098)	(0.089)	(0.074)
FF3_MKT	1.103**	0.802*	0.707	0.031		1.111***	0.948**	0.983***	0.269	
	(0.480)	(0.466)	(0.435)	(0.362)		(0.273)	(0.377)	(0.321)	(0.285)	
FF3_SMB	1.623***	2.098***	1.563***	-0.245		0.705**	1.027***	0.791***	-1.124***	
	(0.412)	(0.407)	(0.372)	(0.322)		(0.288)	(0.337)	(0.305)	(0.243)	
FF3_HML	-0.004	-0.228	-0.200	-0.173		-0.167	-0.592***	-0.493**	-0.703***	
	(0.308)	(0.296)	(0.281)	(0.232)		(0.216)	(0.220)	(0.211)	(0.189)	
Carhart_MKT					-0.371					-0.320
					(0.343)					(0.252)
Carhart_SMB					-0.865***					-0.923***
					(0.326)					(0.227)
Carhart_HML					-0.163					-0.594***
					(0.221)					(0.181)
Carhart_UMD					-0.757***					-1.123***
					(0.265)					(0.161)
Time fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.421	0.893	0.340	0.367	0.309	0.32	0.875	0.312	0.342	0.302
No. of Obs.	1388	1388	1388	1388	1388	2252	2252	2252	2252	2252

Table 6. PSM Robustness Check (Caliper Length Restriction)

This table presents the results of tests of difference in performance measures between IPPF funds and matched non-IPPF funds, with one-to-one matching based on the nearest neighbor method albeit with a caliper restriction, either at (i) 0.25 pooled standard deviations or (ii) 0.1 pooled standard deviations of the propensity scores. Difference-in-mean and difference-in-median tests (Wilcoxon-Mann-Whitney rank signed tests) are performed. All returns and volatility estimates are in per cent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

Panel A. Caliper Restriction at 0.25 Pooled Standard Deviations

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Excess BM (net)	0.207	0.170	554	-0.110	-0.082	554	0.317***	3.770	0.252***	3.955
Excess BM (gross)	0.226	0.191	554	-0.091	-0.061	554	0.317***	3.774	0.252***	3.963
Excess RF	-0.155	-0.118	554	-0.347	-0.288	554	0.192**	2.479	0.170**	2.437
CAPM alpha	0.108	0.097	554	-0.094	-0.115	554	0.202***	2.823	0.212***	3.079
FF3 alpha	0.049	0.022	554	-0.184	-0.180	554	0.234***	3.474	0.202***	3.797
Carhart alpha	0.033	0.025	554	-0.241	-0.163	554	0.275***	4.744	0.188***	4.496
Sharpe ratio	0.117	0.066	554	0.013	-0.013	554	0.104***	12.863	0.078***	11.098
Information ratio	0.266	0.265	554	-0.028	-0.013	554	0.295***	18.079	0.278***	14.742

Panel B. Caliper Restriction at 0.1 Pooled Standard Deviations

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Excess BM (net)	0.217	0.194	477	-0.160	-0.113	477	0.377***	4.310	0.307***	3.996
Excess BM (gross)	0.236	0.212	477	-0.141	-0.099	477	0.377***	4.310	0.311***	3.990
Excess RF	-0.179	-0.075	477	-0.445	-0.291	477	0.265***	3.262	0.216***	2.958
CAPM alpha	0.126	0.116	477	-0.131	-0.121	477	0.257***	3.438	0.238***	3.270
FF3 alpha	0.052	0.012	477	-0.202	-0.186	477	0.254***	3.609	0.197***	3.505
Carhart alpha	0.073	0.072	477	-0.230	-0.172	477	0.304***	5.067	0.244***	4.700
Sharpe ratio	0.111	0.066	477	0.004	-0.008	477	0.107***	11.543	0.073***	10.047
Information ratio	0.273	0.269	477	-0.017	-0.022	477	0.290***	16.304	0.291***	13.394

Table 7. Matched Sample Regression (Caliper Restriction at 0.25 Pooled Standard Deviations)

This tables reports the regression of various performance measures on the IPPF dummy and other fund characteristics, for IPPF fund-month and matched non-IPPF fund-month observations identified through one-to-one and one-to-three nearest neighbor matching, but with caliper restriction at 0.25 pooled standard deviations. All standard errors in parentheses are adjusted by Newey-West (1987) heteroscedasticity- and autocorrelation-consistent standard errors with three lags. All returns and volatility estimates are in per cent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

	One-to-one matched sample					One-to-three matched sample				
	Dependent variable					Dependent variable				
	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha
Intercept	-2.540	-10.028***	-4.032*	-2.024	-3.637**	0.466	-6.495***	-0.818	-0.632	-0.793
	(2.174)	(2.233)	(2.069)	(2.024)	(1.765)	(2.237)	(2.490)	(2.226)	(2.011)	(1.749)
IPPF dummy	0.294***	0.162**	0.178**	0.231***	0.248***	0.346***	0.147*	0.174**	0.263***	0.268***
	(0.081)	(0.074)	(0.070)	(0.064)	(0.058)	(0.092)	(0.085)	(0.080)	(0.073)	(0.064)
Management firm size	-0.012	0.004	-0.013	-0.043	-0.048*	-0.022	-0.015	-0.032	-0.065**	-0.055**
	(0.035)	(0.036)	(0.034)	(0.033)	(0.029)	(0.032)	(0.035)	(0.032)	(0.028)	(0.025)
Fund size	0.158**	0.195***	0.197***	0.148***	0.187***	0.015	0.044	0.062	0.079	0.074
	(0.066)	(0.064)	(0.059)	(0.054)	(0.048)	(0.065)	(0.068)	(0.062)	(0.058)	(0.051)
Expense ratio	-0.315	0.454	0.238	0.203	0.609	0.731	0.916*	0.718	0.667	0.583
	(0.774)	(0.766)	(0.684)	(0.619)	(0.602)	(0.487)	(0.531)	(0.487)	(0.469)	(0.419)
Lagged fund flow	-0.001	0.000	0.000	0.000	-0.001	-0.001	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
1YR_VOL	-0.118	-0.182	-0.179	-0.014	0.229*	-0.345**	-0.287*	-0.253*	0.066	0.019
	(0.130)	(0.258)	(0.217)	(0.217)	(0.124)	(0.139)	(0.171)	(0.144)	(0.127)	(0.098)
FF3_MKT	-0.499	-0.221	0.099	-0.550		1.082**	0.603	0.895**	-0.160	
	(0.466)	(0.860)	(0.699)	(0.706)		(0.423)	(0.509)	(0.429)	(0.399)	
FF3_SMB	0.768	1.006**	0.603	-0.919**		0.259	0.590	0.264	-1.783***	
	(0.476)	(0.485)	(0.451)	(0.435)		(0.385)	(0.420)	(0.416)	(0.368)	
FF3_HML	-0.124	-0.202	0.009	-0.119		0.027	-0.591*	-0.394	-0.583**	
	(0.355)	(0.361)	(0.331)	(0.290)		(0.252)	(0.318)	(0.312)	(0.295)	
Carhart_MKT					-1.083***					-0.129
					(0.388)					(0.347)
Carhart_SMB					-1.200***					-1.984***
					(0.389)					(0.367)
Carhart_HML					-0.191					-0.384
					(0.225)					(0.297)
Carhart_UMD					-0.690**					-1.098***
					(0.289)					(0.245)
Time fixed effect	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Adjusted R^2	0.409	0.887	0.331	0.37	0.319	0.312	0.866	0.291	0.337	0.305
No. of Obs.	1108	1108	1108	1108	1108	1228	1228	1228	1228	1228

Table 8. PSM Robustness Check (Gaussian Kernel Method)

This table presents the results of tests of difference between IPPF funds and matched non-IPPF funds, with Gaussian kernel method at bandwidth 0.05. Unreported analyses confirm that using bandwidths 0.01 or 0.1 leads to similar results. Difference-in-mean and difference-in-median tests (Wilcoxon-Mann-Whitney rank signed tests) are performed. All returns and volatility estimates are in per cent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

	Difference (IPPF – non-IPPF)			
	Mean		Median	
Variable	Difference	*t*-statistic	Difference	*z*-score
Excess BM (net)	0.300***	4.864	0.231***	4.955
Excess BM (gross)	0.299***	4.849	0.237***	4.941
Excess RF	0.156***	2.990	0.287***	2.685
CAPM alpha	0.177***	3.715	0.114***	3.763
FF3 alpha	0.227***	5.405	0.165***	5.596
Carhart alpha	0.272***	7.430	0.207***	7.112
Sharpe ratio	0.082***	13.260	0.055***	10.691
Information ratio	0.244***	18.939	0.224***	15.674

Table 9. Portfolio Approach (By Fund Size)

This table yields portfolio analysis results with portfolios sorted on fund size. At each month-end, we sort our full sample of funds into four quartile portfolios based on fund size and form equal- or value-weighted portfolios separately for the IPPF and non-IPPF funds. Panel A reports our results for the IPPFs, Panel B for the non-IPPFs, and Panel C reports the difference between the IPPF and non-IPPF portfolios. Newey-West (1987) heteroscedasticity- and autocorrelation-consistent standard errors are used. *t*-statistics are in the parentheses. All returns and volatility estimates are in percent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

Panel A. IPPFs

Sorted By	Quartiles	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Fund Size (Equal-weighted)	Q1 (Small)	0.004	-0.320	-0.080	-0.082	-0.163	0.021	0.003
	Q2	0.178	-0.163	0.045	-0.020	-0.085	0.109	0.057
	Q3	0.411	0.082	0.370	0.315	0.264	0.259	0.121
	Q4 (Large)	0.274	-0.046	0.165	0.093	0.068	0.317	0.155
	Q4-Q1 difference	0.270**	0.275**	0.245**	0.175*	0.230**	0.296***	0.152***
	t-statistic	2.207	2.222	2.050	1.693	2.483	12.572	11.052
Fund Size (Value-weighted)	Q1 (Small)	0.001	-0.321	-0.077	-0.082	-0.171	0.013	-0.001
	Q2	0.153	-0.174	0.042	-0.023	-0.093	0.115	0.058
	Q3	0.428	0.098	0.385	0.333	0.278	0.264	0.125
	Q4 (Large)	0.308	-0.014	0.198	0.122	0.095	0.329	0.163
	Q4-Q1 difference	0.307**	0.307**	0.275**	0.203*	0.267***	0.315***	0.163***
	t-statistic	2.413	2.362	2.209	1.894	2.794	12.216	10.352

Panel B. Non-IPPFs

Sorted By	Quartiles	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Fund Size (Equal-weighted)	Q1 (Small)	-0.138	-0.412	-0.157	-0.196	-0.282	-0.052	-0.012
	Q2	-0.029	-0.296	-0.061	-0.119	-0.215	0.075	0.044
	Q3	-0.148	-0.375	-0.105	-0.262	-0.376	-0.037	0.017
	Q4 (Large)	-0.036	-0.226	0.009	-0.026	-0.108	0.044	0.045
	Q4-Q1 difference	0.101	0.186**	0.166**	0.169**	0.175***	0.096***	0.057***
	t-statistic	1.346	2.413	2.202	2.392	2.857	6.010	6.519
Fund Size (Value-weighted)	Q1 (Small)	-0.125	-0.395	-0.139	-0.188	-0.264	-0.043	-0.009
	Q2	-0.056	-0.324	-0.082	-0.154	-0.238	0.071	0.043
	Q3	-0.139	-0.362	-0.094	-0.253	-0.374	-0.037	0.017
	Q4 (Large)	-0.049	-0.216	0.021	0.018	-0.048	0.055	0.044
	Q4-Q1 difference	0.075	0.178***	0.160**	0.206***	0.216***	0.098***	0.053***
	t-statistic	1.021	2.629	2.448	3.211	3.790	5.687	7.595

Table 9. Portfolio Approach (By Fund Size, Continued)

Panel C. IPPF – Non-IPPF Comparison

Sorted By	Quartiles	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Fund Size (Equal-weighted)	Q1 (Small)	0.142	0.092	0.078	0.114	0.120	0.073	0.015
		(0.764)	(0.136)	(0.507)	(0.790)	(0.937)	(1.653)	(0.394)
	Q2	0.208	0.133	0.106	0.100	0.130	0.034	0.014
		(0.935)	(0.198)	(0.603)	(0.590)	(0.913)	(0.727)	(0.364)
	Q3	0.559**	0.457	0.475**	0.577***	0.640***	0.295***	0.104***
		(2.541)	(0.652)	(2.583)	(3.294)	(4.417)	(6.747)	(2.826)
	Q4 (Large)	0.311	0.181	0.156	0.119	0.175	0.273***	0.110***
		(1.459)	(0.272)	(0.927)	(0.731)	(1.369)	(6.416)	(3.079)
Fund Size (Value-weighted)	Q1 (Small)	0.126	0.073	0.063	0.106	0.092	0.057	0.008
		(0.659)	(0.108)	(0.394)	(0.707)	(0.699)	(1.328)	(0.223)
	Q2	0.209	0.150	0.124	0.131	0.145	0.044	0.015
		(0.911)	(0.221)	(0.692)	(0.759)	(0.999)	(0.961)	(0.402)
	Q3	0.567**	0.460	0.478**	0.587***	0.652***	0.301***	0.108***
		(2.555)	(0.656)	(2.535)	(3.250)	(4.367)	(6.811)	(2.923)
	Q4 (Large)	0.357*	0.202	0.178	0.104	0.143	0.274***	0.119***
		(1.706)	(0.304)	(1.114)	(0.679)	(1.141)	(6.257)	(3.303)

Table 10. Portfolio Approach (By Style)

This table yields portfolio analysis results with portfolios sorted on fund style. At the end of each month, we sort our full sample into either (i) big or (ii) small funds depending on its exposure to the Fama-French *SMB* factor over the previous 12 months, and (i) value, (ii) neutral, and (iii) growth depending on the exposure to the *HML* factor. Thus, each fund is sorted into one of $2 \times 3 = 6$ style portfolios. We form equal- or value-weighted style portfolios separately for the IPPF and non-IPPF funds. Panel A reports our results for the IPPFs, Panel B for the non-IPPFs, and Panel C for the IPPF – non-IPPF difference. Newey-West (1987) heteroscedasticity- and autocorrelation-consistent standard errors are used. *t*-statistics are in the parentheses. All returns and volatility estimates are in percent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

Panel A. IPPFs

Sorted by	Style	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Style (Equal-weighted)	Big - Growth	-0.037	-0.249	-0.078	-0.004	-0.168	0.068	0.022
	Big - Neutral	-0.197	-0.496	-0.240	-0.259	-0.331	0.067	0.042
	Big - Value	0.398	-0.101	0.122	0.188	0.205	0.324	0.067
	Small - Growth	0.139	-0.067	0.074	-0.020	-0.032	0.170	0.095
	Small - Neutral	0.415	0.092	0.315	0.198	0.130	0.255	0.117
	Small - Value	0.452	-0.010	0.256	0.043	0.011	0.305	0.149
Style (Value-weighted)	Big - Growth	-0.054	-0.261	-0.088	-0.030	-0.188	0.088	0.027
	Big - Neutral	-0.178	-0.470	-0.220	-0.235	-0.312	0.100	0.048
	Big - Value	0.570	0.071	0.266	0.310	0.322	0.370	0.106
	Small - Growth	0.122	-0.082	0.059	-0.057	-0.066	0.184	0.107
	Small - Neutral	0.479	0.154	0.367	0.273	0.208	0.307	0.142
	Small - Value	0.500	0.023	0.288	0.038	0.010	0.362	0.177

Panel B. Non- IPPFs

Sorted by	Style	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Style (Equal-weighted)	Big - Growth	-0.021	-0.238	-0.028	0.143	-0.019	-0.031	0.000
	Big - Neutral	-0.130	-0.358	-0.093	-0.065	-0.152	0.081	0.042
	Big - Value	-0.214	-0.426	-0.189	-0.209	-0.369	-0.001	0.005
	Small - Growth	0.106	-0.210	0.162	0.034	0.057	0.020	0.088
	Small - Neutral	-0.056	-0.268	-0.059	-0.204	-0.257	-0.021	0.008
	Small - Value	-0.054	-0.279	-0.047	-0.332	-0.391	0.086	0.078
Style (Value-weighted)	Big - Growth	-0.024	-0.174	0.035	0.193	0.061	0.027	0.010
	Big - Neutral	-0.130	-0.321	-0.058	-0.030	-0.093	0.096	0.043
	Big - Value	-0.230	-0.422	-0.186	-0.183	-0.354	0.010	0.003
	Small - Growth	0.111	-0.178	0.195	0.053	0.102	0.039	0.104
	Small - Neutral	-0.062	-0.262	-0.047	-0.211	-0.258	-0.014	0.017
	Small - Value	-0.075	-0.264	-0.022	-0.285	-0.342	0.103	0.085

Table 10. Portfolio Approach (By Style, Continued)

Panel C. IPPF – Non-IPPF Comparison

Sorted by	Style	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Style (Equal-weighted)	Big - Growth	-0.017	-0.011	-0.050	-0.147	-0.148	0.099*	0.022
		(-0.065)	(-0.015)	(-0.227)	(-0.786)	(-0.977)	(1.912)	(0.560)
	Big - Neutral	-0.067	-0.138	-0.146	-0.194	-0.179	-0.014	-0.000
		(-0.295)	(-0.162)	(-0.802)	(-1.126)	(-1.207)	(-0.247)	(-0.003)
	Big – Value	0.612	0.325	0.311	0.397	0.575***	0.325***	0.062
		(1.562)	(0.507)	(1.088)	(1.612)	(2.790)	(7.081)	(1.394)
	Small - Growth	0.034	0.143	-0.088	-0.054	-0.089	0.150***	0.007
		(0.107)	(0.181)	(-0.335)	(-0.214)	(-0.457)	(2.835)	(0.172)
	Small - Neutral	0.471**	0.360	0.374**	0.402**	0.387***	0.277***	0.109***
		(2.088)	(0.514)	(2.032)	(2.162)	(2.664)	(5.733)	(2.815)
	Small - Value	0.507	0.268	0.302	0.375	0.402*	0.220***	0.070
		(1.633)	(0.402)	(1.102)	(1.470)	(1.751)	(4.059)	(1.630)
Style (Value-weighted)	Big - Growth	-0.030	-0.087	-0.123	-0.223	-0.249	0.061	0.017
		(-0.124)	(-0.118)	(-0.584)	(-1.207)	(-1.570)	(1.216)	(0.426)
	Big - Neutral	-0.048	-0.149	-0.161	-0.205	-0.219	0.003	0.005
		(-0.211)	(-0.175)	(-0.871)	(-1.170)	(-1.441)	(0.063)	(0.102)
	Big – Value	0.800*	0.493	0.452	0.493*	0.676***	0.361***	0.102**
		(1.812)	(0.760)	(1.405)	(1.766)	(2.892)	(7.704)	(2.249)
	Small - Growth	0.011	0.096	-0.137	-0.110	-0.167	0.146**	0.003
		(0.032)	(0.123)	(-0.484)	(-0.404)	(-0.822)	(2.657)	(0.084)
	Small - Neutral	0.541**	0.416	0.413**	0.484**	0.465***	0.322***	0.125***
		(2.244)	(0.582)	(2.049)	(2.421)	(2.908)	(6.706)	(3.197)
	Small - Value	0.575*	0.287	0.311	0.323	0.353	0.259***	0.092**
		(1.750)	(0.422)	(1.116)	(1.274)	(1.524)	(4.140)	(2.013)

Table 11. Portfolio Approach (By Tracking Error)

This table yields portfolio analysis results with portfolios sorted on tracking error. At each month-end, we sort our full sample of funds into four quartile portfolios based on tracking error and form equal- or value-weighted portfolios separately for the IPPF and non-IPPF funds. Panel A reports our results for the IPPFs, Panel B for the non-IPPFs, and Panel C for the IPPF – non-IPPF difference. Newey-West (1987) heteroscedasticity- and autocorrelation-consistent standard errors are used. *t*-statistics are in the parentheses. All returns and volatility estimates are in per cent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

Panel A. IPPFs

Sorted By	Quartiles	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Tracking error (Equal-weighted)	Q1 (Small)	0.206	-0.122	0.100	0.085	0.055	0.147	0.036
	Q2	0.113	-0.218	-0.036	-0.021	-0.097	0.119	0.030
	Q3	0.093	-0.242	0.012	-0.017	-0.141	0.104	0.054
	Q4 (Large)	0.317	-0.007	0.228	0.102	0.065	0.278	0.181
	Q4-Q1 difference	0.111	0.115	0.128	0.017	0.010	0.132***	0.145***
	t-statistic	(0.708)	(0.750)	(0.825)	(0.124)	(0.084)	(4.348)	(7.163)
Tracking error (Value-weighted)	Q1 (Small)	0.231	-0.084	0.129	0.142	0.091	0.203	0.045
	Q2	0.070	-0.262	-0.079	-0.062	-0.103	0.152	0.046
	Q3	0.185	-0.150	0.095	0.029	-0.102	0.141	0.071
	Q4 (Large)	0.373	0.049	0.290	0.138	0.118	0.311	0.199
	Q4-Q1 difference	0.141	0.133	0.161	-0.004	0.028	0.108***	0.153***
	t-statistic	(0.867)	(0.827)	(1.022)	(-0.026)	(0.222)	(3.383)	(7.112)

Panel B. Non-IPPFs

Sorted By	Quartiles	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Tracking error (Equal-weighted)	Q1 (Small)	-0.024	-0.281	-0.023	-0.023	-0.064	0.031	0.019
	Q2	-0.069	-0.320	-0.058	-0.089	-0.166	-0.017	0.007
	Q3	-0.195	-0.475	-0.225	-0.314	-0.421	-0.052	0.006
	Q4 (Large)	-0.072	-0.249	-0.017	-0.173	-0.327	0.059	0.060
	Q4-Q1 difference	-0.049	0.032	0.007	-0.150	-0.263*	0.028	0.040***
	t-statistic	(-0.273)	(0.157)	(0.034)	(-0.793)	(-1.855)	(1.589)	(3.448)
Tracking error (Value-weighted)	Q1 (Small)	-0.042	-0.239	0.010	0.030	-0.002	0.062	0.026
	Q2	-0.047	-0.257	-0.007	-0.012	-0.086	0.011	0.014
	Q3	-0.196	-0.446	-0.201	-0.325	-0.406	-0.068	0.008
	Q4 (Large)	-0.042	-0.177	0.068	-0.111	-0.254	0.084	0.078
	Q4-Q1 difference	-0.000	0.061	0.057	-0.142	-0.252*	0.022	0.052***
	t-statistic	(-0.001)	(0.267)	(0.265)	(-0.656)	(-1.683)	(0.958)	(3.212)

Table 11. Portfolio Approach (By Tracking Error, Continued)

Panel C. IPPF – Non-IPPF Comparison

Sorted By	Quartiles	Excess BM	Excess RF	CAPM alpha	FF3 alpha	Carhart alpha	Info. ratio	Sharpe ratio
Tracking error (Equal-weighted)	Q1 (Small)	0.229	0.159	0.123	0.108	0.119	0.115**	0.017
		(1.572)	(0.237)	(1.207)	(1.090)	(1.315)	(2.516)	(0.494)
	Q2	0.182	0.102	0.022	0.068	0.070	0.137***	0.023
		(1.024)	(0.154)	(0.158)	(0.540)	(0.626)	(3.439)	(0.633)
	Q3	0.288	0.233	0.237	0.297*	0.280**	0.157***	0.048
		(1.234)	(0.344)	(1.308)	(1.770)	(2.026)	(3.196)	(1.269)
	Q4 (Large)	0.389	0.242	0.245	0.275	0.392*	0.219***	0.121***
		(1.325)	(0.351)	(0.909)	(1.039)	(1.876)	(4.470)	(2.933)
Tracking error (Value-weighted)	Q1 (Small)	0.274*	0.154	0.118	0.111	0.093	0.141***	0.019
		(1.851)	(0.228)	(1.112)	(1.039)	(0.932)	(3.257)	(0.534)
	Q2	0.117	-0.005	-0.072	-0.050	-0.017	0.141***	0.032
		(0.626)	(-0.008)	(-0.495)	(-0.389)	(-0.146)	(3.338)	(0.887)
	Q3	0.381	0.297	0.296	0.354**	0.304**	0.209***	0.063*
		(1.603)	(0.436)	(1.625)	(2.084)	(2.106)	(4.113)	(1.658)
	Q4 (Large)	0.415	0.226	0.222	0.249	0.373*	0.227***	0.121***
		(1.347)	(0.322)	(0.790)	(0.915)	(1.786)	(4.581)	(2.935)

Table 12. Non-IPPF Sponsors with and without In-House Equity Management Team

This table re-estimates the baseline PSM tests of difference in Table 4, albeit separately for non-IPPF sponsors with and without an in-house equity management team. Difference-in-mean and difference-in-median tests (Wilcoxon-Mann-Whitney rank signed tests) are performed. All returns and volatility estimates are in per cent. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

Panel A. Non-IPPF Sponsors with In-House Equity Management

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Excess BM (net)	-0.033	0.034	180	0.000	-0.012	180	-0.033	-0.235	0.046	0.501
Excess BM (gross)	-0.014	0.054	180	0.032	0.019	180	-0.046	-0.331	0.035	0.604
Excess RF	-0.398	-0.294	180	-0.071	-0.102	180	-0.327**	-2.199	-0.192**	-2.257
CAPM alpha	-0.072	-0.053	180	0.172	0.084	180	-0.243*	-1.842	-0.137*	-1.784
FF3 alpha	-0.043	0.002	180	-0.079	-0.020	180	0.037	0.317	0.022	0.929
Carhart alpha	-0.063	-0.059	180	-0.198	-0.111	180	0.136	1.287	0.051	1.553
Sharpe ratio	0.082	0.023	180	0.093	0.033	180	-0.011	-0.760	-0.010	-1.516
Information ratio	0.189	0.134	180	0.079	0.071	180	0.109***	4.156	0.062***	3.550

Panel B. Non-IPPF Sponsors without In-House Equity Management

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Excess BM (net)	0.306	0.234	514	-0.186	-0.142	514	0.492***	5.740	0.376***	5.140
Excess BM (gross)	0.324	0.252	514	-0.171	-0.139	514	0.496***	5.793	0.391***	5.195
Excess RF	-0.121	0.051	514	-0.501	-0.172	514	0.380***	5.006	0.224***	4.438
CAPM alpha	0.180	0.167	514	-0.189	-0.224	514	0.369***	5.233	0.391***	4.840
FF3 alpha	0.084	0.061	514	-0.250	-0.244	514	0.334***	5.426	0.305***	5.135
Carhart alpha	0.053	0.046	514	-0.294	-0.192	514	0.347***	6.218	0.238***	5.686
Sharpe ratio	0.096	0.053	514	-0.020	-0.029	514	0.116***	13.432	0.082***	11.917
Information ratio	0.224	0.224	514	-0.073	-0.061	514	0.296***	17.423	0.285***	14.222

Table 13. Measuring IPPF vs. Non-IPPF Manager Skill in Terms of Value Added

This table re-estimates the baseline PSM and caliper-restricted PSM tests of difference in Tables 4 and 6, albeit with performance measured in terms of value added rather than percentage returns. All monthly value added are expressed in terms of constant 2011 millions of won (not dollars). Difference-in-mean and difference-in-median tests (Wilcoxon-Mann-Whitney rank signed tests) are performed. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

Panel A. Baseline One-To-One PSM

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Value added (Excess BM)	16.646	47.562	694	-12.284	-61.605	694	109.166***	3.706	28.93***	3.471
Value added (Excess RF)	-1.939	-81.076	694	-36.674	-146.027	694	64.951	1.614	34.735*	1.705
Value added (CAPM)	8.290	31.072	694	-15.029	-42.925	694	73.997***	2.916	23.319***	2.654
Value added (FF3)	2.588	17.874	694	-32.151	-63.155	694	81.029***	3.469	34.74***	3.982
Value added (Carhart)	1.049	12.300	694	-29.740	-64.747	694	77.047***	4.079	30.788***	4.539

Panel B. One-to-One PSM with Caliper Restriction (0.25 Pooled Standard Deviations)

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Value added (Excess BM)	29.149	53.128	554	-19.946	-28.941	554	82.069***	2.858	49.095***	3.633
Value added (Excess RF)	-18.195	-98.885	554	-47.718	-153.191	554	54.306*	1.725	29.523**	2.436
Value added (CAPM)	18.389	35.288	554	-21.942	-25.652	554	60.941**	2.392	40.331***	2.986
Value added (FF3)	2.673	20.439	554	-37.288	-54.529	554	74.968***	3.127	39.962***	3.760
Value added (Carhart)	5.762	15.656	554	-32.301	-68.208	554	83.864***	3.877	38.063***	4.609

Panel C. One-to-One PSM with Caliper Restriction (0.1 Pooled Standard Deviations)

	IPPF			**Non-IPPF**			**Difference (IPPF – non-IPPF)**			
							Mean		Median	
Variable	Mean	Median	No. of Obs.	Mean	Median	No. of Obs.	Difference	*t*-statistic	Difference	*z*-score
Value added (Excess BM)	45.413	54.384	477	-21.565	-70.793	477	125.177***	3.298	66.978***	3.545
Value added (Excess RF)	-7.889	-108.687	477	-50.294	-202.275	477	93.588**	2.136	42.405**	2.137
Value added (CAPM)	28.374	39.448	477	-32.619	-60.195	477	99.643***	3.156	60.993***	3.097
Value added (FF3)	1.560	17.175	477	-37.274	-71.167	477	88.342***	2.821	38.834***	3.008
Value added (Carhart)	13.210	23.181	477	-34.286	-62.357	477	85.539***	3.889	47.496***	4.350

Table A.1. Variable Definition

This table provides a detailed definition of each variable. Unless otherwise stated, all variables are constructed using the data provided by the public agency sponsors and IPPF lead management firms.

Panel A. Variable Definition

Variable	Details	Source(s)
Excess return over benchmark (Excess BM)	Monthly fund return net of its benchmark return, either net or gross of management fees.	Proprietary dataset
Excess return over the risk-free rate (Excess RF)	Monthly fund return net of the risk-free rate, with the latter defined as the return on 91-day certificate of deposits (CD).	Proprietary dataset, Bank of Korea
CAPM alpha	Monthly fund alpha, defined as a calendar month's abnormal return estimated using the CAPM model using the previous 12 months' return data, with the market return defined as the return on KOSPI index.	Proprietary dataset, FnGuide
FF3 alpha	Monthly fund alpha estimated using the Fama-French (1992) three-factor model computed in the analogous manner to CAPM alpha.	Proprietary dataset, FnGuide
Carhart alpha	Monthly fund alpha estimated using the Carhart (1997) four-factor model computed in the analogous manner to CAPM alpha.	Proprietary dataset, FnGuide
Tracking error	Standard deviation of a fund's excess return over benchmark during the previous 12-month window.	Proprietary dataset
Sharpe ratio	A fund's Sharpe ratio, defined as its average pre-12-month monthly excess return over the risk-free rate over its standard deviation during the previous 12-month window.	Proprietary dataset, FnGuide
Information ratio	A fund's Information ratio, defined its average pre-12-month monthly excess return over benchmark over tracking error.	Proprietary dataset
Previous 1-year volatility (1YR_VOL)	A fund's previous 1-year volatility at each month, defined as the standard deviation of its monthly returns over the previous 12-month window.	Proprietary dataset
Previous 1-year return (1YR_RET)	A fund's previous 1-year return.	Proprietary dataset
Fund size	Log of a fund's total net asset at each month-end.	Proprietary dataset
FF3_MKT	A fund's exposure to the market factor using the three-factor model.	FnGuide
FF3_SMB	A fund's exposure to the size factor using the three-factor model.	FnGuide
FF3_HML	A fund's exposure to the book-to-market factor using the three-factor model.	FnGuide
Carhart_MKT	A fund's exposure to the market factor using the four-factor model.	FnGuide
Carhart_SMB	A fund's exposure to the size factor using the four-factor model.	FnGuide
Carhart_HML	A fund's exposure to the book-to-market factor using the four-factor model.	FnGuide
Carhart_UMD	A fund's exposure to the momentum factor using the four-factor model.	FnGuide
Management firm size	Log of the total net asset under management of the fund manager's asset management firm.	Korea Financial Investment Association
Expense ratio	A fund's total expenses (both end-level management fees and lead management fees included) divided by its total net asset.	Proprietary dataset
Fund flow	Net fund flow at each month, calculated in the identical manner to Sirri and Tufano (1998)	Proprietary dataset

Table A.2. Correlation Matrix

This table reports the correlation matrix of our variables of interest. * denotes significance at the 10% level, ** at the 5% level, *** at the 1% level respectively.

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Excess BM (gross)	1											
(2)	Excess RF	0.27***	1										
(3)	CAPM alpha	0.85***	0.40***	1									
(4)	FF3 alpha	0.78***	0.36***	0.89***	1								
(5)	Carhart alpha	0.61***	0.34***	0.73***	0.82***	1							
(6)	Tracking error	-0.04*	-0.03	-0.06**	-0.11***	-0.13***	1						
(7)	Sharpe ratio	0.25***	0.22***	0.28***	0.27***	0.19***	0.17***	1					
(8)	Information ratio	0.30***	0.06***	0.26***	0.27***	0.25***	0.14***	0.65***	1				
(9)	1YR_VOL	-0.13***	-0.09***	-0.10***	-0.10***	-0.16***	0.25***	0.02	-0.08***	1			
(10)	1YR_RET	0.23***	0.26***	0.28***	0.26***	0.16***	0.15***	0.88***	0.59***	0.00	1		
(11)	Fund size	0.01	0.02	0.02	0.02	0.03	0.03	0.14***	0.13***	0.10***	0.14***	1	
(12)	FF3_MKT	-0.07***	-0.02	-0.02	-0.04*	-0.04*	-0.38***	-0.22***	-0.14***	0.34***	-0.21***	0.12***	1
(13)	FF3_SMB	0.02	0.08***	0.06**	-0.13***	-0.07***	0.31***	0.06***	-0.03	-0.05*	0.02	0.05**	-0.13***
(14)	FF3_HML	-0.01	-0.09***	-0.09***	-0.07***	-0.09***	0.27***	0.02	0.08***	0.18***	0.05*	-0.03	-0.20***
(15)	Carhart_MKT	-0.10***	-0.02	-0.06***	-0.09***	-0.06***	-0.24***	-0.23***	-0.16***	0.30***	-0.22***	0.16***	0.90***
(16)	Carhart_SMB	0.04*	0.08***	0.08***	-0.04*	-0.10***	0.05*	-0.07***	-0.15***	0.14***	-0.14***	0.00	0.10***
(17)	Carhart_HML	0.02	-0.09***	-0.06**	-0.03	-0.10***	0.21***	-0.03	0.04*	0.16***	-0.03	-0.05**	-0.19***
(18)	Carhart_UMD	-0.01	-0.01	-0.02	-0.06***	-0.11***	0.64***	0.29***	0.19***	0.21***	0.33***	0.09***	-0.30***
(19)	Management firm size	-0.03*	-0.03**	-0.03	-0.07***	0.00	0.10***	-0.21***	-0.11***	-0.31***	-0.25***	-0.01	-0.21***
(20)	Expense ratio	-0.03*	0.02	-0.01	-0.01	-0.02	0.02	0.14***	0.05*	0.29***	0.15***	0.11***	0.11***
(21)	Fund flow	0.09***	0.02	0.07***	0.05**	0.03	-0.01	0.07***	0.09***	0.01	0.06***	0.11***	0.03

Table A.2. Correlation Matrix (Continued)

		(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
(13)	FF3_SMB	1								
(14)	FF3_HML	-0.02	1							
(15)	Carhart_MKT	0.05*	-0.18***	1						
(16)	Carhart_SMB	0.64***	0.05**	0.05**	1					
(17)	Carhart_HML	-0.08***	0.93***	-0.21***	0.12***	1				
(18)	Carhart_UMD	0.26***	0.11***	-0.06**	-0.22***	-0.01	1			
(19)	Management firm size	0.16***	-0.08***	-0.12***	-0.09***	-0.10***	0.11***	1		
(20)	Expense ratio	0.02	0.06***	0.09***	0.05*	0.02	0.09***	-0.26***	1	
(21)	Fund flow	0.01	-0.02	0.02	0.01	-0.01	0.00	-0.03	-0.10***	1

Table A.3. Comparison of Manager Selection Criteria

In this table, we compare the (i) manager selection criteria of a representative non-IPPF-participating public agency sponsor engaging in direct manager selection and (ii) the manager selection criteria employed by one of the IPPF lead managers.

IPPF non-participant	IPPF participant
Quantitative factors	
1) Financial stability of asset management firm Total equity / Paid-in capital ROE Net income over the past 3 years Leverage ratio Assets under management 2) Organization and personnel No. of fund managers Average manager tenure Assets under management per manager 3) Return performance BM excess return Information ratio	1) Return performance Up-follow ratio Hit ratio 1 Hit ratio 2 2) Style stability Style-adjusted alpha R-squared 3) Risk adjusted return Information ratio Sortino ratio M-squared 4) Return volatility Standard deviation Tracking error Downside standard deviation Maximum loss during the previous 6 months Down-follow ratio
Qualitative factors	
1) Operating system and strategy	1) Operating strategy Momentum strategy (equity) / Duration strategy (bonds) Sector allocation (equity) / Curve position (bonds) Security selection
2) Risk management	2) Risk management Risk management of systematic and idiosyncratic risk Compliance system
3) Fund manager	3) Fund manager Style persistence Alpha creation ability 4) Market forecast Domestic and global economy Investment demand and supply Investment environment