Very preliminary draft

Please do not quote without permission

Asset Allocation and Active Management in Italian Closed Pension Funds

Mirko Cardinale[†]
Giacomo Nocera[*]
Andrzej Pioch[‡]

This draft: January 15, 2014

ABSTRACT

This paper aims at empirically investigating whether the investment management structure of a pension plan sponsor, in particular, its degree of complexity, does affect the investment managers' behavior and, consequently, the funds' financial performances.
Using a data set on 100 sub-funds from 31 closed pension funds operating in Italy in the 1998-2010 period, we find evidence of an impact of the number of both investment managers and mandates on the fund active risk, showing that a specific investment objective calls for the design of a specific investment management structure.

[†] Russell Investments, E-mail: mcardinale@russell.com.
[*] Audencia Nantes School of Management, E-mail: gnocera@audencia.com (corresponding author).
[‡] Aviva Investors, E-mail: andrzej.pioch@avivainvestors.com.

1. Introduction

According to the Italian Law, contractual pension funds must delegate investment management activities to an investment management firm, chosen by the funds according to certain guidelines.[1] Therefore, delegated investment management is the rule in the Italian contractual pension funds' experience.[2] Italian contractual pension funds are independent legal entities having their own capital and organization. In particular, their boards of directors are responsible for establishing strategies, investment policies and the choice of the investment management firm(s), the depositary bank and the provider of administrative services.

As far as the investment management activities are concerned, the Italian contractual pension funds act as plan sponsors with two main purposes: (*i*) to conduct strategic asset allocation and (*ii*) to hire managers to deliver benchmarked returns, monitor, and if necessary, substitute investment managers.

Interestingly, in spite of the short experience of the Italian complementary pension system, these activities have been carried out by the various plan sponsors through the implementation of different investment management structures. By investment management structure we mean the combination of (*i*) the number of investment managers involved in the investment management process and (*ii*) the number of different types of investment mandates[3] stated by the plan sponsor. In fact, at one extreme a fund sponsor may employ a single investment management firm with a "balanced mandate" across all asset classes, while at the other extreme the fund sponsor might employ multiple managers, each with a "specialist mandate" within each asset class.

---

[1] Contractual pension funds are one out of the three types of complementary pension schemes admitted in Italy. The other two are the open pension funds (with collective or individual membership) and the individual pension plans.
Contractual pension funds are also called closed pension funds, since they offer the possibility of joining the fund only to a specific group of people. For instance, in case of employees, membership is reserved to workers regulated by a collective agreement. In case of self-employed, funds are usually promoted by a professional association and restricted to its members. Conversely, open funds are potentially addressed to all categories of workers. They are open, in sense that membership is not restricted to a specific group as in the case of closed ones. Open funds are established by the same subjects that can be admitted to manage financial resources of pension funds.
Finally, individual pension plans operate exclusively on an individual base and consist of insurance contracts compliant with rules related to the complementary pension schemes.

[2] Interestingly, in the more than ten years long experience of contractual pension funds in Italy, some delegated investment management firms have in turn delegated asset management activities to other financial institutions. Therefore, as contractual pension funds are concerned, two types of delegated investment management relationships might be examined: "direct delegation" and "sub-delegation".

[3] The investment mandate is the agreement that defines all the terms (e.g., the objective, the boundaries, the fees, etc.) of the investment management firm's assignment. It can be either broad (e.g., domestic equity) or narrow (e.g., small-cap equity value).

The number of investment managers

Typically, a plan sponsor hires more than one financial manager. This practice, referred to by Sharpe (1981) as *decentralized investment management*, is common in the Italian closed pension fund experience.[4] As pointed out by Blake et al (2013), even if such a solution might at first appear to be surprising, there are many potential benefits from employing multiple managers, especially as funds grow larger. In discussions of the practice two themes dominate: diversification and specialization.[5] For example, Barry and Starks (1984) argue that risk-sharing considerations (namely, a diversification of a mismanagement risk) may be a motivation to employ more than one manager. On the contrary, pension funds can use multiple managers to diversify the skills of specialist active managers having superior knowledge of a particular asset class (Sharpe, 1981; van Binsbergen et al., 2008). A third, slightly different, motivation is suggested by Shleifer (1985): fund sponsors might employ multiple managers to induce a "yardstick competition" and benefit from the resulting higher effort exerted by these managers. Regardless their rationale, the benefits from using multiple managers can be particularly important for a sponsor with a large fund, given the significant diseconomies of scale in pre-fee returns in asset management.

It goes without saying that as the number of investment managers increases, the financial management activities become more complex, because of the higher monitoring costs.

The number of distinct investment mandates

However, given the number of asset managers hired, the complexity of the investment management structure depends also on the differentiation degree of the investment activities of those managers.

In fact, at one extreme a plan sponsor might hire several investment managers and regulate their activities with a similar mandate. In such a case the investment managers are required to perform the same task and will be evaluated similarly. This investment management structure could be designed to diversify the risk of mismanagement and/or to induce competition among the investment managers that would be also evaluated against each other. At the other extreme, each investment manager is regulated

[4] In our sample the average number of investment firms per fund is 4.75.

[5] Williams (1980) refers to diversification and specialization as "pure diversification" (whose aim is "... to have more than one manager in case a manager makes a large error") and "diversification of styles" (which consists on hiring experts on different sets of securities), respectively.

by a distinct mandate. This option could be preferable if the plan sponsor wants to divide the assets under management of the fund into different sub-portfolios requiring a specific investment management approach for each of them and eventually delegating their management to specialized investment firms.

All other things being equal, this second solution would lead the investment management structure of the plan sponsor to a higher degree of complexity, as the monitoring activity would need to be differentiated according to the different investment management approaches. Hence, the degree of differentiation of the investment activities carried out by the managers might be captured by the number of different types of mandates adopted by the plan sponsor.

Following Goyal and Wahal (2008), who claim that "organizational structure and incentives can generate tremendous variation in behavior across plan sponsors", in this paper we aim at empirically investigating whether the investment management structure of the plan sponsor, in particular, its degree of complexity, does indeed affect the investment managers' behavior and, consequently, the funds' financial performances.

Our paper is similar to the one by Blake et al. (2013), who test whether particular types of mandates lead to differential performance and/or risk-taking, controlling for asset class and manager characteristics. Differently from their paper, we do not have accurate information on the type of mandate (balanced or specialist) followed by each pension fund sponsor-fund manager pairing at each point in time[6]. Indeed, we know the number of managers and mandates employed at any time by each fund sponsor, i.e., our proxies for the complexity of the investment management structure.

Additionally, we focus on a peculiar effect of the investment management structure: its impact on the active risk. As asserted by Brinson et al. (1986) and Brinson et al. (1991), strategic asset allocation accounts for more than 90% of the time-series variation in portfolio performance, this phenomenon applying especially to cases that examine multiple funds holding diverse assets (Sharpe, 1992). Parwada and Faff (2005) highlight that asset allocation and the ability of a fund manager to adhere to the agreed-upon fund objective is an important input in the decision to award an investment mandate.

As is Brinson et al. (1986), we focus only on the *variability* of returns rather than on return levels and employ a heteroscedastic regression model to test whether the complexity of the investment management structure does affect the return variance not explained by the benchmark returns. Finally,

[6] Most of the mandates in the Italian experience are balanced. A detailed description of the investment mandates is provided in section 3.

since most Italian pension schemes are constituted in the form of "*multicomparto*" funds, i.e., they offer more than one investment option to their members and the possibility to choose among different sub-funds[7], our analysis is conducted at the sub-fund level.

The rest of this paper proceeds as follows. Section 2 describes our empirical strategy and Section 3 discusses the data sources and summarizes the empirical sample characteristics. Section 4 presents the empirical results and their economic interpretation and Section 5 concludes.

2. Research Methodology

To determine whether the investment management structure of the plan sponsor affects the dispersion of pension fund returns around their benchmarks, we employ the heteroscedastic regression proposed by Harvey (1976). This model extends the linear regression by parameterizing also the unexplained variance as a function of exogenous variables. This model can be regarded as made up of two equations, with the first one explaining the mean of the dependent variable and the second one representing the residual variance of the dependent. The sub-fund's return is the dependent variable of the first equation with the benchmark's return and risk category dummies as explanatory variables. We will refer to this equation as to the *return equation*. The second equation determines the factors affecting the precision of the return model; it is therefore called the *variance equation*. Since the parameters of the return and variance equations are assumed to be uncorrelated, they can be treated separately as far as selection and interpretation are concerned. Cerqueiro, Degryse and Ongena (2011) use this approach to identify the determinants of the dispersion of loan rates. Iannotta (2011) uses this heteroscedastic regression model to determine whether bond investors price hidden information. Iannotta, Nocera, and Resti (2013) also use this approach to determine whether the information content of ratings changes according to bond market conditions, i.e., whether different degrees of opaqueness in the market affect the bond spread's unexplained dispersion.

The return equation is the following:

$$\mathrm{RET}_{i,t} = f(\mathrm{RET\_BENCH}_{i,t}, \text{Category dummies}_{i,t}) + \varepsilon_{i,t} \qquad [1]$$

The dependent variable is RET, that is the return of the sub-fund *i* in month *t*.

[7] Typically, one of the sub-funds provides a guaranteed minimum return.

RET_BENCH is the return in month t of the benchmark associated to the sub-fund i. The category dummies are added to capture any systematic effect of either a different strategic allocation (through the set of dummies CAT[8]) or a different investment style due to the provisioning of a guaranteed minimum rate of return (through the dummy MRG).

More relevant for the purpose of this paper is the variance equation of the heteroscedastic regression model:

$$Ln(\text{RETVAR}_{i,t}) = f(\text{RET\_BENCH}_{i,t}, \text{MANAG}_{i,t}, \text{MAND}_{i,t}, \text{AGE}_{i,t}, \text{NAV}_{i,t}, \text{FUND\_NAV}_{i,t}, \text{Category dummies}_{i,t}) + \varepsilon_{i,t} \quad [2]$$

The dependent variable is RETVAR, i.e., the return variance unexplained by the return equation. The key explanatory variables here are those which summarize the features of the investment management structure at the sub-sample level, namely the number of investment management firms employed (MANAG) and the number of (different) mandates (MAND) used to regulate their activities. We also control for the sub-fund age (AGE) and, in certain specifications of the model and for a subset of sub-funds for which the information is available, the sub-fund and fund size (NAV and FUND_NAV, respectively).

3. Data Sources and Sample

Our paper studies a data set on 31 closed pension funds (100 sub-funds) operating in Italy in 2010[9] that, for each sub-fund, uniquely contains, in addition to monthly returns[10], information on the benchmark[11] (which enables us to classify the sub-funds into different risk categories[12]), the monthly

[8] CAT1 is omitted to avoid collinearity.

[9] We could not cover all the sub-funds operating till 2010 because for some of them the information on either the investment management structure or the benchmarks was not available. However, we miss the observations of only 7 sub-funds, 5 of which belong to the only fund (Previvolo) for which we do not have any information.

[10] These returns are net of the management fees paid by the fund sponsor to the investment firms and taxes but gross of the (transaction) fees that might be directly charged to the plan members.

[11] The benchmark is usually a mix of different benchmarks.

[12] The risk classification is described in Table 1.2. Furthermore, we identify the sub-funds that offer a minimum-return guaranteed.

total assets under management (AUM) at both the sub-fund and the fund level, the number of investment management firms and the number of distinct investment mandates[13], the amount of yearly investment management, custodian, and administrative expenses, and the sub-fund's age (expressed in number of months after the start of the sub-fund's investment activities).

Our data are from pension funds' annual reports and prospectuses and cover the 1998-2010 period. The resulting panel is an unbalanced one though, because most of the closed funds were constituted or started their investment activities at any time after 1998. Table 1 and Table 2 provide further information on the sample.

Insert Table 1.1 and Table 1.2 approximately here

Insert Table 2 approximately here

4. Empirical Results

We conduct a multivariate analysis to check for any effect of the investment management structure on the unexplained variance in sub-funds' returns. We run multiplicative heteroscedastic regressions of spreads (reported in Table 3 and Table 4) on the sets of covariates described in Section 2. Table 3 shows the results for the return equation, while Table 4focuses on the variance equation.

Moving from model (1) to model (2) in Table 3 we keep the return equation unchanged and try two different specifications for the variance equation. In Model (2) we just control for the size of both the fund (FUND_NAV) and the sub-fund (NAV). As this information is not available for all the sub-funds in our sample period, the number of observations is lower. In model (3) we run the same regression as in model (2) but on a shorter period (2005-2010), as the number of pension funds (and sub-funds) operating increased significantly since 2005. Model (4) and (5) limit the analysis on sub-funds belonging to the extreme risk categories, 6 (if they invest all the financial resources in bonds) and 1 (if they invest at least 55% of their financial resources in stocks), respectively

[13] Detailed information on mandates is not publicly available, being the mandate a private bilateral contract with no public knowledge ("publicity") requirements. Hence, the differences among mandates have been deducted indirectly from the publicly available information (such as the attribution of different benchmarks to different investment management firms).

Regarding the *return* equation, the coefficient of the RET_BENCH variable is positive and strongly significant, as expected, confirming that returns are mainly driven by the strategic asset allocation decisions.

Insert Table 3 approximately here

Table 4 reports results for the variance equation of the heteroscedastic regression model.

The MANAG and MAND variables have a significant negative and positive sign, indicating lower and greater unexplained variance when the number of managers and mandates increases, respectively.

Insert Table 4 approximately here

Models (2) – (5) in Table 4 introduce another factor that might affect investment mandates, the size of the sub-fund and the fund.

Our analysis seems to show that the active risk of Italian funds (as measured by the variance of the funds' returns of not explained by benchmarks' returns) decreases with the increase of the number of operators but increases with the number of (different) mandates employed. While the impact of other control variables is more unstable (for example, changes depending on the type of funds considered), the previous result appears robust indeed.

In particular, the fact that the pension funds' active risk decreases with the number of active managers the risk may support either the "diversification hypothesis" and the risk-sharing consideration made by Barry and Starks (1984) to justify the use of multiple managers or a particular "yardstick competition" argument in which competition among asset managers would induce them to take less active risk to reduce the possibility to be fired if deviations from the benchmark would lead to underperformances. Conversely, the fact that an increase in the number of distinct investment mandates has a positive impact on the active risk, might support Sharpe (1981)'s "specialization hypothesis". In fact, the number of mandates would increase if plan sponsor wanted to assign different goals and incentives to its investment managers (their number being equal) in order, probably, to take advantage of their specific skills.

5. Empirical Results

Our paper makes two contributions to the literature. First, we provide further evidence of the relevance of the management structure for the performance of an investment vehicle relying on a delegated investment approach. Second, our paper represents is the first, to our knowledge, that evaluates the impact of the investment management structure on the variability of fund's returns relative to benchmarks'.

Our findings of an impact of the number of both investment managers and mandates on the fund active risk indicate that the organizational structure of the investment activities does affect managers' incentives, thus reinforcing the evidence in Goyal and Wahal (2008). Consequently, a specific investment objective calls for the design of a specific investment management structure.

References

Barry, Christopher B. and Laura T. Starks (1984). "Investment Management and Risk Sharing with Multiple Managers". *Journal of Finance* 39(2). 477-491.

Blake, David, Alberto G. Rossi, Allan Timmermann, Ian Tonks, and Russ Wermers (2013), "Decentralized Investment Management: Evidence from the Pension Fund Industry", *Journal of Finance* 68(3): 1133-1178.

Brinson, Gary P., Brian D. Singer, and Gilbert L. Beebower (1991), "Determinants of Portfolio Performance II: An Update", *Financial Analysts Journal* 47 (May-June): 40-48.

Brinson, Gary P., L. Randolph Hood, and Gilbert L. Beebower (1986), "Determinants of Portfolio Performance", *Financial Analysts Journal* 42 (July-August): 39-44.

Cerqueiro, Geraldo, Hans Degryse, and Steven Ongena (2011), "Rules versus Discretion in Loan Rate Setting", *Journal of Financial Intermediation* 20(4): 503-529.

Goyal, Amit and Sunil Wahal (2008), "The Selection and Termination of Investment Management Firms by Plan Sponsors", *Journal of Finance* 63(4): 1805-1847.

Harvey, Andrew C. (1976), "Estimating Regression Models with Multiplicative Heteroscedasticity", *Econometrica* 44(3): 462-465.

Iannotta, Giuliano (2011), "Market Discipline in the Banking Industry. Evidence from Spread Dispersion", *European Journal of Finance* 17(2): 111-131.

Iannotta, Giuliano, Giacomo Nocera, and Andrea Resti (2013) "Do Investors Care about Credit Ratings? An Analysis through the Cycle", *Journal of Financial Stability*, forthcoming.

Parwada, Jerry T. and Robert W. Faff (2005), "Pension Plan Investment Management Mandates: An Empirical Analysis of Manager Selection". *Journal of Financial Services Research* 27(1): 77-98.

Sharpe, William F. (1981), "Decentralized Investment Management", *Journal of Finance* 36(2): 217-234.

Sharpe, William F. (1992), "Asset Allocation: Management Style and Performance Measurement", *Journal of Portfolio Management* 18 (Winter): 7-19.

Shleifer, Andrei (1985), "A Theory of Yardstick Competition", *RAND Journal of Economics* 16(3): 319-327.

van Binsbergen, Jules H., Michael W. Brandt, and Ralph S. J. Koijen (2008), "Optimal Decentralized Investment Management", *Journal of Finance* 63(4): 1849-1895.

Williams, Arthur III (1980), *Managing Your Investment Manager*, Homewood, Ill.: Dow-Jones Irwin.

Table 1.1. Pension funds and sub-funds in the sample

Fund	Obs.	No. of sub-funds
Agrifondo	41	1
Alifond	102	3
Arco	165	3
Astri	92	2
Byblos	114	3
Capi e Quadri Fiat	243	3
Cometa	347	4
Concreto	113	2
Cooperlavoro	195	3
Espero	39	2
Eurofer	111	3
Filcoop	124	2
Fon.te	183	4
Foncer	190	3
Fonchim	373	4
Fondapi	147	3
Fondav	277	5
Fondoposte	88	2
Fopadiva	127	4
Fopen	457	6
Gommaplastica	183	3
Laborfonds	222	4
Pegaso	218	4
Prev.i.log	76	2
Prevaer	181	4
Previambiente	100	2
Previmoda	174	4
Priamo	144	3
Sanità	357	3
Solidarietà Veneto	338	4
Telemaco	352	5
Total	*5,873*	*100*

Table 1.2. Pension funds and sub-funds in the sample

Risk category	Description	No. of sub-funds([a])
CAT1	At least 55% of financial resources are invested in stocks	15
CAT2	Asset allocation is 67-45% bonds and 33-55% stocks	18
CAT3	Asset allocation is 75-68% bonds and 25-32% stocks	18
CAT4	Asset allocation is 90-76%% bonds and 10-24% stocks	17
CAT5	Asset allocation is less than 10% stocks	22
CAT6	100% of financial resources are invested in bonds	16
MRG	Sub-fund's members are provided with a minimum-return guarantee	29([b])

([a]) Some of the sub-funds changed their asset allocation over the sample period.
([b]) of which: 11 belong to risk category 6, 18 to risk category 5, 1 to risk category 4, and 1 to risk category 2 (some of the minimum-return guaranteed sub-funds changed their asset allocation (and their risk category) over the sample period.

Table 2. Sample descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RET	5,873	0.0024	0.0136	-0.0943	0.1704
RET_BENCH	5,873	0.0030	0.0166	-0.1234	0.1154
MANAG	5,873	2.34	1.63	1	7
MAND	5,873	2.03	1.36	1	7
AGE	5,873	35.84	26.92	0	154
NAV	5,533	177.98	399.73	0.0012	3,335.67
FUND_NAV	5,533	562.39	876.61	0.3646	5,635.62

The sample includes 100 sub-funds belonging to 31 pension funds in the 1998–2010 period. The variables are defined as follows:

RET is the monthly return of the sub-fund.
RET_BENCH is the monthly return of the sub-fund's benchmark.
MANAG is the number of investment companies in charge of the management of the sub-fund's assets.
MAND is the number of distinct asset management mandates set at the sub-fund level.
AGE is the number of previous monthly observations.
NAV is the net asset value of the sub-fund divided by 1,000,000.
FUND_NAV is the net asset value of the fund divided by 1,000,000.

Table 3. Multiplicative heteroscedastic regression of RET on RET_BENCH and risk categories (return equation)

	1998-2010 sample		2005-2010 sub-sample	CAT6 only, 2005-2010 sub-sample	CAT1 only, 2005-2010 sub-sample
	(1)	(2)	(3)	(4)	(5)
RET_BENCH	0.735***	0.740***	0.745***	0.603***	0.832***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D_CAT2	-0.00093***	-0.00091***	-0.00068**	-	-
	(0.00149)	(0.00221)	(0.0289)		
D_CAT3	-5.20e-05	-0.00017	-0.00014	-	-
	(0.839)	(0.510)	(0.626)		
D_CAT4	-0.00015	-0.00031	-0.00023	-	-
	(0.535)	(0.214)	(0.395)		
D_CAT5	3.76e-05	-0.00013	-0.00012	-	-
	(0.883)	(0.619)	(0.684)		
D_CAT6	-0.0002	-0.0003	-0.0003	-	-
	(0.546)	(0.261)	(0.390)		
D_MRG	-0.0001	-4.72e-05	1.14e-05	-	-
	(0.571)	(0.797)	(0.954)		

This table reports the regression coefficients and *p*-values (in parentheses). The dependent variable is the monthly return of the sub-fund (RET). Equations are estimated with the (maximum likelihood) multiplicative heteroscedastic regression model.

The explanatory variables are defined as follows:

RET_BENCH is the monthly return of the sub-fund's benchmark.
D_CAT1… D_CAT6 are dummy variables that equal one if sub-fund's asset allocation falls in the corresponding category and zero otherwise.
D_MRG is a dummy which equals 1 if the sub-fund offers a minimum-return guaranteed and 0 otherwise.

We also control for year fixed effects. We do not report these variables' coefficients for ease of exposition. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4. Multiplicative heteroscedastic regression of RETVAR on investment management structure variables (variance equation)

	1998-2010 sample		2005-2010 sub-sample	CAT6 only, 2005-2010 sub-sample	CAT1 only, 2005-2010 sub-sample
	(1)	(2)	(3)	(4)	(5)
MANAG	-0.297***	-0.348***	-0.352***	-0.397***	-0.306***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MAND	0.315***	0.375***	0.336***	1.070***	0.214***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000258)
AGE	-0.000170	-0.00303***	-0.00295***	0.025***	-0.0081***
	(0.834)	(0.002)	(0.00288)	(0.000)	(0.006)
NAV	-	8.34e-05	0.000216**	-0.0045***	-0.011***
		(0.309)	(0.0110)	(0.000)	(0.0005)
FUND_NAV	-	0.00011***	6.08e-05**	0.001***	0.0007***
		(0.0004)	(0.044)	(0.000)	(0.000)
D_CAT2	-0.0181	-0.0848	-0.219***	-	-
	(0.789)	(0.232)	(0.003)		
D_CAT3	-0.343***	-0.260***	-0.247***	-	-
	(0.000)	(0.0005)	(0.002)		
D_CAT4	-1.244***	-1.213***	-1.220***	-	-
	(0.000)	(0.000)	(0.000)		
D_CAT5	-2.793***	-2.709***	-2.642***	-	-
	(0.000)	(0.000)	(0.000)		
D_CAT6	-1.020***	-0.908***	-0.789***	-	-
	(0.000)	(0.000)	(0.000)		
D_MRG	1.084***	0.981***	0.883***	1.112***	-
	(0.000)	(0.000)	(0.000)	(0.000)	
Observations	5,873	5,533	4,988	763	762
Prob > χ^2	0.000	0.000	0.000	0.000	0.000
Pseudo R^2	-0.3192	-0.3163	-0.3261	-0.2177	-0.5486
VWLS R^2	0.7694	0.7801	0.7889	0.3707	0.9188

This table reports the regression coefficients and *p*-values (in parentheses). The dependent variable is the unexplained variance of the monthly return of the sub-fund (RETVAR). Equations are estimated with the (maximum likelihood) multiplicative heteroscedastic regression model. The term χ^2 denotes the *p*-value of the chi-squared test for the null hypothesis that all the coefficients jointly equal zero. The explanatory variables are defined as follows:
The explanatory variables are defined as follows:

MANAG is the number of investment companies in charge of the management of the sub-fund's assets.

MAND is the number of distinct asset management mandates set at the sub-fund level.

AGE is the number of previous monthly observations.

NAV is the net asset value of the sub-fund divided by 1,000,000.

FUND_NAV is the net asset value of the fund divided by 1,000,000.

D_CAT1… D_CAT6 are dummy variables that equal one if sub-fund's asset allocation falls in the corresponding category and zero otherwise

D_MRG is a dummy which equals 1 if the sub-fund offers a minimum-return guaranteed and 0 otherwise.

We also control for year fixed effects. We do not report these variables' coefficients for ease of exposition. The superscripts ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.