Size Doesn't Matter: Diseconomies of Scale in the Mutual Fund Industry Revisited

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Abstract

The academic literature has found mixed evidence that fund size is negatively related to performance. One reason for the lack of consensus may be that the fund size and performance relation is endogenous. In this paper, we identify a set of instrumental variables that influence fund size but are unrelated to fund performance. Using this specification, we find little evidence that fund size directly affects fund performance. However, an indirect relation manifests as a result of preferential allocation of investment strategies to smaller funds within fund families.

Keywords: Mutual fund performance; Size-performance relation; Instrumental variables; Diseconomies of scale

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1. Introduction

Despite extensive research, the academic literature has been unable to conclusively establish whether fund size is negatively related to performance. This is an important issue. Research has consistently shown that, on average, fund managers appear unable to outperform passive fund benchmarks. Berk and Green (2004) argue that this is because funds managed by skilled managers attract greater portfolio flows than funds managed by unskilled managers. Hence, if fund performance is inversely related to fund size, in equilibrium, both skilled and unskilled managers will earn similar expected future returns. Therefore, Berk and Green (2004) argue that the lack of observed outperformance among fund managers is not inconsistent with the hypothesis that at least some mutual fund managers are skilled. The crucial assumption in Berk and Green's model is the assumption of diseconomies of scale in mutual fund performance.

While this assumption has been tested extensively, the literature has been unable to come to a definitive conclusion on the source (or existence) of diseconomies of scale in fund management. Chen, Hong, Huang, and Kubik (CHHK, 2004) find a negative relationship between fund size and fund performance, in particular for illiquid funds, but a positive relation between the fund family size and fund performance. They argue that increased inflow to funds with less liquid holdings increases trading costs and price pressure on the stocks held by the fund and thus impedes fund performance. However, economies of scale in marketing costs by larger fund families result in improved performance. Yan (2008) documents similar results using superior proxies for liquidity. Edelen, Evans, and Kadlec (2007) find that relative trade size subsumes fund size in regressions of fund returns, and argue that trading costs are the primary source of diseconomies of scale for funds.

In contrast, Ferreira, Keswani, Miguel, and Ramos (2013) analyze the relation between size and performance across 27 countries and find no evidence of a negative size-performance relation outside the United States. In addition, Elton, Gruber, and Blake (2012) find a *positive* relation between fund size and performance within US funds and speculate that the reduction in expense ratios for larger funds outweighs possible diseconomies of scale when the funds increase in size. Baker, Litov, Wachter, and Wurgler (2010) find that the performance of funds around earnings announcements *increases* with fund size. Bhojraj, Cho, and Yehuda (BCY, 2012) show in addition, that the positive relation between family size and performance is limited to the timeframe before 2000, prior to the SEC establishing fair disclosure regulations. They argue that large fund families received material, non-public information from investment banks giving them an unfair advantage over smaller fund families. When fair disclosure regulations were established, this advantage was eliminated.

As Reuter and Zitzewitz (2013) note, a concern with the above literature is that the fund size and performance relation is likely to be endogenous, i.e. fund size is only indirectly related to performance via other fund characteristics. For example, it is likely that larger funds and larger fund families are able to attract better qualified or skilled managers. Similarly, Petajisto (2013) shows that larger funds are more likely to be closet indexers who earn inferior returns, implying that the indexation strategies employed by larger funds drives the poor returns earned by these funds. Specifically, Petajisto (2013) performs a bi-directional sort on fund size and the level of active management, which he terms Active Share. He finds that, in general, fund size hurts performance, but this effect arises across and not within Active Share partitions. Finally, managerial compensation may vary with fund size. For example, Ma, Tang, and Gomez (2012) document manager compensation for larger and more complex funds is more likely to include explicit performance-based incentives. With the exception of Reuter and Zitzewitz (2013), the papers above control for this potential endogeneity bias by including fund characteristics as controls.[1] However the models suffer from a potential omitted variable bias if the variable which links fund performance and size has not been included.

In this paper, to control for potential endogeneity bias, we identify a set of instrumental variables (IVs) that influence fund size but are unrelated to fund performance. Specifically, our analysis draws on Phillips, Pukthuanthong, and Rau (PPR, 2013) who examine investor response to changes in holding period returns (HPR) reported by mutual funds. The change in HPR is influenced by both the most recent return which enters the horizon of calculation and the end-return which drops from the calculation. Thus, the change in HPR jointly and equally reflects the new information in the most recent return, and in the example of a 1 year HPR, stale information reflected in the return that was realized 13 months prior. PPR show that, due either to inattention

[1] Reuter and Zitzewitz (2013) analyze differences in performance between funds with different Morningstar star rankings but similar Morningstar percentile rankings under the assumption that the difference in performance is likely to be similar for firms with similar percentile rankings but the difference in flows is likely to be significantly larger. They find mixed results on the relation between size and performance. For the next six months, they find on average that funds with greater inflows have slightly better performance but slightly worse performance over the following year to two years. However, the regression discontinuity design approach they use only has a local treatment interpretation. It is not applicable away from the local cutoffs.

or naivety, investors react with equal strength to the new and stale information components of HPR changes when allocating flows.

PPR's results form the basis behind the economic intuition for our instruments. Specifically, investors observe an improvement in the fund's HPR, but fail to appreciate that the source of the improvement is a stale negative end-return dropping from the horizon of the HPR calculation. While this signal provides no new information regarding fund performance or manager ability, it disproportionately increases asset allocations to the fund from investors chasing stale performance. Hence there is an exogenous increase in fund size that is unrelated to current performance. Pollet and Wilson (2008) and Lou (2012) show that funds which realize inflows typical expand current positions as opposed to diversifying. Thus, growth from inflows increase fund size and would be expected to aggravate diseconomies of scale, to the extent they should exist.

In this sense, stale performance chasing is a nearly ideal instrumental variable as it directly influences the endogenous regressor (fund size) but has no perceivable relation with fund performance. This approach is very much in the spirit of Berk and Green (2004). However, in contrast to investors reacting to the new information in the most recent return (which arguably infers information regarding manager ability), investors are instead reacting to stale performance signals which arise as a function of the reporting format of HPRs.

Our analysis proceeds as follows. First, we contrast our sample to samples used in the prior literature. To estimate the described IVs, we are reliant on monthly frequency investor allocation (flow) data, which is available from the Center for Research in Security Prices (CRSP) mutual fund database starting in 1992 and concluding in 2010 (at the time of data collection). CHHK utilize annual frequency flow data from CRSP, and thus examine a broader timeframe (1962-1999). Replicating their models with our sample, we find results consistent with theirs. Hence, any differences in results from our IV models are unlikely to be attributable to sample differences. We next establish that our instrument variables meet both the relevance and exclusion criteria required for IV specifications. Specifically, tests in the first stage of a 2SLS regression show relevance (i.e. significant coefficients on the set of instrument variables) while cross-sectional sorts show that performance does not directly vary with any of the instruments. We also document that no other fund characteristics vary with our instruments as this could introduce endogeneity of its own.

The IV model is then implemented using the standard approach. In the first stage, we regress fund size on the instrument variables and controls drawn from the prior literature. In the second stage, we regress risk-adjusted returns on the predicted value of fund size from the first stage plus the same set of standard controls. The intuition is that fund size predicted from the first stage model is unbiased by endogenous influences (such as manager ability, compensation, Active Share or other unobserved factors, as previously discussed), allowing a cleaner examination of the relation between fund size and performance. If a relation between fund size and performance exists, it should manifest equally whether fund size or its predicted value is used in the model. In contrast, if an endogenous relation between fund size and performance is leading to a spurious association, we expect the relation between *predicted* fund size and performance to be insignificant. We find results consistent with the latter. Using the instrument variable specification, when we regress fund size on fund performance, the coefficient on fund size in the second stage is insignificant in all model specifications. Hence, the previously documented relation between fund size and performance appears to be endogenous.

Berk and Green (2004), CHHK, Yan (2008) and others stress that the source of the diseconomies of scale lie in price pressure related trading costs. Hence a negative relation between size and performance should be more pronounced for funds holding more illiquid assets. Using liquidity proxies from CHHK, Yan (2008) and the Amihud Illiquidity Ratio (Amihud, 2002) and replicating their analysis however, we again find little evidence of a negative relation between size and performance while conditioning on the liquidity of fund holdings.

An alternative possibility that has not previously been examined in the literature is that the relation between fund size and performance is non-linear. A priori, a linear relation seems reasonable, as diseconomies of scale should increase monotonically with fund size if driven by trading costs. Assuming a linear progression in price and depth in the limit order book, the price impact of trading twice as many shares should be twice as high as larger trades “walk” further up or down the book. However, in cases of extremely large trades or highly illiquid assets, the relation between price impact and trade size may be non-linear.[2] Additionally, endogenous factors related to size may influence performance in a non-linear fashion, potentially contributing to the mixed results previously reported in this literature.

[2] This situation is unlikely as mutual funds are constrained by fund mandates to hold reasonably liquid assets and can stagger trades over time to minimize trading costs. However, in extreme situations such as fire sales (Coval and Stafford, 2007) a non-linear relation between trade size and price impact can be observed.

Hence, we next test for a non-linear relation between fund size and performance. Specifically, we replicate our prior analysis, estimating the models separately by fund size quintile. This alternative approach reveals a negative and non-linear relation between size and performance isolated to funds in the largest size quintile (the relation remains insignificant for funds in the other 4 quintiles).

We show that this non-linear relation arises from the preferential allocation of investment strategies to the smaller funds in the fund family. Specifically, within fund families, managers must decide how to allocate the best ideas across funds. Some ideas will be general in application, but most ideas will be specific to certain management objectives and will have scale limitations. To minimize the price-impact related trading costs of individual strategies, the overall strategy of a large fund may consist of multiple sub-strategies being implemented with subsets of assets under management. In fund families with multiple funds in the same management objective, new ideas may be preferentially streamed to the smaller, more nimble fund (*fund favoritism*). Alternatively, just as a function of the size differential across funds, better strategies may make up a relatively larger proportion of the overall strategy for smaller funds (*strategy rationing*).

We find evidence for both. Overall, partitioning our models by funds with and without a within-family competitor in the same objective, we observe a significant negative relation between size and performance *only* for large funds with within-family competitors. For funds without such a competitor, we find no evidence of a relation between fund size and performance. For more specific evidence, we contrast the holdings of pairs of small and large funds with common investment objectives in the same family. On average, 73% of the assets held by the small fund are also held by the large fund. In contrast, only 34% of the assets held by the large fund are correspondingly held by the small fund. In other words, strategies implemented by the small fund are also implemented with a portion of the assets of the large fund, suggesting strategy rationing across funds. We find that the unique holdings of the large fund underperform relative to those held by the small fund by 7.85% per annum on average.

We also re-examine the changing relation between family size and performance, previously documented by BCY. If large fund families had access to material, non-public information from investment banks prior to fair disclosure regulation, under the fund favoritism hypothesis, we would expect that the resultant investment strategies would likewise be preferentially streamed to the smaller funds in the fund family. We estimate the IV specification at the fund family-level and then test the relation between fund performance and fund family size estimated from the first stage regression. In the baseline specification, we find marginal evidence of a positive relation between family size and fund performance in the pre-regulatory environment for gross fund returns, but find little evidence of a relation between family size and performance based on net returns or in the post-regulatory environment.

Partitioning the model by funds with and without within-family competitors, we find however that the positive relation between family size and performance reverses for funds in the largest quintile in the pre-regulatory environment. In other words, the benefits of access to private information for large fund families appeared to be streamed predominantly (perhaps exclusively) to the smaller funds in the family. For funds with no within-family competition, the relation between family size and performance is insignificant across all 5 family size partitions. In the post-regulatory period, a negative relation between family size and performance is likewise isolated to funds in the largest size partition with within-family competitors.

Overall, we conclude that fund size does not appear to affect fund performance directly through liquidity or trading costs. The effect documented in prior literature appears to be driven by an endogenous relation between size and performance. In particular, the relation between size and performance appears to be non-linear. There is a significant, negative relation between size and performance *only* in a sub-sample of large funds with a smaller within-family competitor in the same management objective, suggesting that fund families preferentially allocate their best investment strategies to smaller funds.

The rest of the paper is organized as follows. Section 2 describes the data and summary statistics. Section 3 replicates the analysis in CHHK and BCY to show that our results are unlikely to be driven by our sample. Section 4 validates our instruments and Sections 5 and 6 analyze the relation between fund size and performance at the fund and family-level, respectively. Section 7 concludes.

2. Data and Summary Statistics

As previously discussed, our primary data source is the CRSP Mutual Fund Database, the same data source utilized by CHHK and BCY. As in those papers, we restrict our sample to include only actively managed, domestic mutual funds and apply the additional restriction that the fund must report monthly frequency returns and total net assets (TNA).[3] Multiple classes of the same fund are aggregated using a TNA-weighted approach. Our sample commences in 1992 when the CRSP database commences reporting of monthly TNA necessary to calculate monthly net asset flow (which is needed to calculate several of our instrument variables) and concludes in 2010, the end of the CRSP database at the time of data collection. The CHHK sample spans the years 1962 to 1999 as they utilize annual frequency TNA in their analysis while BCY utilize a very similar sample period of 1992 to 2008.

Table I provides descriptive statistics for the key variables used in the study. To make our analysis as comparable as possible to CHHK, whose analysis we seek to extend, the organization of our tables and models mirrors their approach as closely as possible. Panel A of Table I reports average and standard deviation values, partitioned by fund size. To calculate the values in Panel A, we compute the cross-sectional average of each variable in each month. We then report the time-series average and the standard deviation of the cross-sectional averages by size quintile. On average, our sample includes 4,240 funds, resulting in size quintiles of approximately 850 funds each. This sample size is similar to BCY whose sample includes, on average, 4,834 funds in the 2001-2008 period but is six times greater in size than CHHK whose sample, on average, includes 741 funds.[4] Focusing on cross-sectional differences across the size quintiles, and consistent with Elton, Gruber and Blake (2012), smaller funds tend to charge higher fees as a percentage of TNA, reflecting, perhaps, economies of scale (not diseconomies) that exist in the mutual fund industry. It is also possible that smaller funds focus on more specialized, boutique investment styles for which they charge a premium. Smaller funds also tend to be younger and belong to smaller families with fewer funds. Otherwise, the remaining fund characteristics are comparable across size partitions.

Contrasting our sample with CHHK, on average, funds and fund families in our sample are larger and younger, reflecting inflation and the rapid expansion of the mutual fund industry over the last two decades. For example, funds in the second smallest size quintile have an average size of 60 million USD relative to 22 million USD in the CHHK sample. This difference

[3] To identify actively managed mutual funds, we use the list of actively managed funds from Cremers and Petajisto (2009) available from Antti Petajisto's website http://www.petajisto.net/data.html.

[4] The differences in our sample relative to the sample in BCY likely arise from differences in identification of actively managed domestic funds. We utilize the list from Cremers and Petajisto (2009) which appear more reliable than the objective codes from CRSP utilized by BCY. We also apply an additional restriction requiring monthly net asset flow when they only require annual net asset flow.

does not extend to the smallest size quintile, which are comparable in the two samples, 5.1 relative to 4.7 million USD, respectively. Thus, if anything, we would expect diseconomies of scale to be more pronounced in our sample, but this expectation would be offset by coincidental growth and improved liquidity in capital markets over the same period. The magnitude of the disparity in fees charged by small relative to large funds is greater in our sample. The difference in expense ratios between Q5 and Q2 is, on average, 1.06%, relative to 0.89% per year in CHHK. The magnitude of total loads charged by funds is typically lower in our sample across all five size quintiles, reflecting a general reduction in liquidity frictions over time in the mutual fund industry. Finally, trading is more frequent in funds in our sample, with portfolio turnover values typically twice as high across all size partitions than those reported by CHHK. The remaining variables, flow and returns, are similar between the samples. Funds increased in size by approximately 25% each year and after-fee returns averaged -0.08% to -0.09% in both samples with minimal disparity across size partitions. As would be expected, given the high level of overlap between our and the BCY sample, our summary statistics are consistent with the values they report for the 2001-2008 period.

Panel B of Table I reports the correlation matrix of the time-series averages reported in Panel A. The correlations are typically small (absolute values less than 20%) with a few exceptions. Specifically, as reflected in the cross-sectional differences across size portions, smaller funds tend to charge higher fees (correlation coefficient (ρ) of -0.34). Larger funds tend to be older and belong to larger families (ρ = 0.40 and 0.43, respectively). These general relations are similarly reported by CHHK and are also reflected in Panel C which, for robustness, excludes funds in the smallest size quintile from the sample.

3. Baseline Regression Analysis

We first confirm that the results reported by CHHK for the 1962 to 1999 period hold in our sample. CHHK utilize OLS regressions in a data panel and correct residual correlation across years using the Fama and Macbeth (1973) approach. CHHK find that larger funds realize lower relative returns both before and after fees. To establish a baseline of comparison for our incremental analysis, we replicate their tests with the exception that we follow Petersen (2009) and control for across-time and fund correlations in residuals, using time fixed effects and standard errors, clustered by fund.

As in CHHK, we analyze fund risk-adjusted returns before (gross) and after (net) fees and expenses. In the unreported preliminary stage, we risk-adjust returns using 4 separate models: 1) the market model, 2) the Capital Asset Pricing Model (CAPM), 3) the Fama and French (1993) 3-factor model and 4) the 3-factor model augmented with the Carhart (1997) momentum factor (4-factor model). The risk-adjusted returns are calculated as residuals from the regression of monthly return to fund *i* on the benchmark factors from each model.[5] The results are reported in Panel A of Table II. Our results are generally consistent with CHHK. The relation between fund size and performance is negative and significant for both gross and net returns (average t-statistics 2.78 and 2.51 for gross and net returns, respectively, compared to values of 2.66 and 2.39 in CHHK). Also consistent with CHHK, we find strong evidence of return-chasing in our sample (positive and significant coefficient for fund return lagged one period). The relations between fund return and the remaining considered fund characteristics are insignificant.

An exception in the consistency between our results and CHHK is the relation between fund performance and family size. CHHK find that funds in larger families realize relatively stronger performance, which they attribute to economies of scale in marketing costs. In contrast, we find the opposite relation, that funds belonging to larger families realize incrementally worse relative performance. This finding is consistent with BCY who similarly document a negative relation between family size and fund performance in the 2001 to 2008 timeframe, which they attribute to a change in the regulatory environment in the mutual fund industry. Effective October 2000, the Securities and Exchange Commission (SEC) established the Selective Disclosure and Insider Trading regulation (SDIT) meant to address the selective release of material, non-public information.[6] BCY show that the superior performance of large families declined immediately after the establishment of the SDIT regulation. This result suggests that the superior performance of larger fund families was related to selective disclosures of material information not available to smaller families who lacked preferential relations with investment banks.

Following BCY, in Panels B and C of Table II, we partition our sample to the periods preceding (1992-1999) and following (2001-2010) the establishment of the SDIT regulation.

[5] For the purposes of the CAPM risk adjustment model, fund beta is estimated over the prior 30 months. The market proxy is the value-weighted return to all NYSE, AMEX and NASDAQ stocks as reported by CRSP and we use the one-month Treasury bill rate as the risk free rate proxy.
[6] See Securities and Exchange Commission Release Nos. 33-7881, 34-43154, IC-24599, File No. S7-31-09.

Consistent with results reported by BCY, we find a positive and significant relation between family size and performance in the pre-SDIT period and that this relation reverses in the post-SDIT period. While this result is consistent with a reversal of an informational advantage for large fund families, it is perplexing that large fund families underperform smaller families in the post-SDIT period as the SDIT regulation should have leveled the playing field, not placed larger fund families at a disadvantage. Thus, the source of the relation between family size and fund performance remains an open question.

4. Instrument Variables (IV)

The objective of this paper is to examine the causal relation between fund size and performance in greater detail. As previously discussed, a concern when interpreting the results presented in Table II is the potential for fund size to be endogenously related to expected future returns. Should this be the case, in equilibrium, fund size will be uncorrelated with future returns, confounding the estimation of the relation between fund size and performance.

The standard correction for potential endogeneity bias is identifying an instrument for the endogenous regressor which meets, what are commonly referred to as the relevance and exclusion conditions.[7] The exclusion condition requires that the correlation between the endogenous regressor and the instrument be non-zero after netting out the effects of all the exogenous variables. Drawing on equation (1) below, where fund size for fund *i* is the endogenous regressor and a matrices of exogenous fund characteristics (***X***) and IVs (***Y***) are included as independent variables, the relevance condition requires that at least one of the ***Y*** variables be statistically different from zero.

$$Size_{i,t} = \propto + \gamma \boldsymbol{X}_{i,t-1} + \delta \boldsymbol{Y}_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

The exclusion condition requires that the only way the IVs (***Y***) influence fund performance is via its effect on the endogenous variable fund size, i.e. cov($\boldsymbol{Y}$,ε)=0.

[7] The development of our instrument variable approach follows the process described and recommended in Roberts and Whited (2012) and much of our terminology draws on their discussion on implementing instrument variable models.

4.1. Instrument Variable Description

The Investment Company Act of 1940 requires mutual fund companies to make quarterly disclosures to the SEC, reporting fees, past performance and portfolio holdings.[8] The National Association of Securities Dealers (NASD) notice number 94-60 specifies that past performance must be reported in the form of an HPR over the horizons of 1, 3, 5, and 10 years for funds in existence over those horizons. The horizon must be at least one year long and must end with the latest calendar quarter. These requirements are designed to standardize performance reporting across funds and ensure that fund managers are not selecting reporting horizons which optimize disclosed performance. PPR observe that the change in reported HPRs for a mutual fund over any period has only two influences, the magnitude of the return in the current period and the magnitude of the oldest return which drops from the horizon of calculation. These two returns have a similar impact on the HPR, though only the former is new information. The following five quarter return time series from PPR illustrates our approach:

Period	-1	-2	-3	-4	-5
Return	-2%	3%	4%	5%	-4%

The annual HPR for periods -2 to -5 is 8%. And the corresponding annual HPR for periods -1 to -4 is 10%.

$$HPR_{t-2} = [(1 + -0.02)(1 + 0.03)(1 + 0.04) + (1 + 0.05)] - 1 = 0.079$$
$$HPR_{t-1} = [(1 + 0.03)(1 + 0.04)(1 + 0.05) + (1 + -0.04)] - 1 = 0.102$$

Even though the fund experienced a negative return in the most recent period (*t*=-1), the HPR increased as the end-return which dropped from the sample was more negative than the most recent period. This example illustrates that the change in the HPR is a function of the most recent return (-2%) which enters the horizon and the end-return (-4%) which drops from the horizon. As all other intervening returns are common in the return sequences (*t*-2, *t*-3, and *t*-4 in this example), they have no influence on the change in the HPR. Thus, the change in HPR is

[8] Prior to 2004, disclosures were semi-annual.

influenced by the new information reflected in the most recent fund return, and stale information that was disclosed to investors 1 year prior. Modeling investor response to the change in HPR, it then follows that $flow_t$ becomes a function of the new and end-return, linearly approximated by equation (2). All intervening returns are common between adjacent HPRs and have no influence on ΔHPR. Thus, equation (2) allows the decomposition of the change in the HPR into its only influences, the current return and end-return components, allowing us to differentiate stale performance chasing from the well documented investor response to the most recent return.

$$Flow_{i,t} = \alpha_i + \beta_{i,1} R_{i,t-1} + \beta_{i,n} R_{i,t-n} + \epsilon_{i,t} \qquad (2)$$

Equation (2) is estimated by year, separately for n= 13, 37 and 61 months (end-returns related to the 1, 3 and 5 year HPR), where flow for fund i in month t is calculated as the percentage change in TNA while controlling for return (R) effects:

$$Flow_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1} \times (1 + R_{i,t})}{TNA_{i,t-1}} \qquad (3)$$

The economic interpretation is as follows. While controlling for the magnitude of the new return ($R_{i,t-1}$), the more negative the end-return which drops from the horizon of the HPR calculation, the greater the resultant increase in the HPR. Thus, if investors interpret this signal as new information, a negative and significant relation is expected for the $\beta_{i,n}$ coefficients which coincide with required HPR reporting periods (as only HPRs for these periods are disclosed to investors). Consistent with this premise, PPR show that the β_n coefficients in equation (2), which relate to the end of the 1, 3, and 5 year HPR horizons, are negatively related to future flows. The coefficients for all other periods are not statistically different from the mean. PPR show that the sensitivity of investors to these stale information signals (i.e. the magnitude of the β_n coefficients) varies across time as a function uncertainty and stress in financial markets. Further, investor sensitivity varies across funds as a function of the visibility of HPR information due to advertising and investor sophistication. Hence following PPR, we obtain three separate instrument variables, the annual time series of β_{13}, β_{37}, and β_{61}.

Our fourth IV draws on additional discussion in PPR regarding the Morningstar rating method. Morningstar ratings are based on HPRs over the horizons of 3, 5, and 10 years, adjusted for the volatility of fund returns, with greater emphasis on downward variations.[9] Thus, Morningstar ratings inadvertently promote stale performance chasing, as ratings are most likely to increase following an increase in HPR which could correspond with a large negative end-return dropping from the sample. PPR and others document a strong relation between Morningstar ratings and net asset flows but note that the predictive ability of the star ratings for returns fails to beat a random walk.[10] Motivated by these observations and the findings of Del Guercio and Tkac (2008) who document symmetry in the response of investors to changes in Morningstar rating upgrades and downgrades, as our fourth IV, we use an indicator equal to 1, 0, or -1 for upgrades, no change and downgrades in Morningstar rating, respectively.

4.2. Exclusion Condition Tests

To validate the selected IVs, we first examine the exclusion condition requirement. It is not possible to directly test the exclusion condition as the error term ε is unobservable. A common approach is to utilize falsification tests, examining the relation between the proposed instrument variable(s) and the dependent variable of analysis.[11] In our setting, the exclusion condition requires that no direct relation exist between stale return chasing or changes in Morningstar rating and subsequent fund performance except indirectly via fund size. The falsification tests are presented in Table III. In Panel A, since we sort fund characteristics by the return chasing coefficients estimated in equation (2) lagged one period, we are examining fund characteristics in year *t*, following return chasing in year *t*-1. As discussed, we are primarily interested in the relation between stale return chasing and fund performance, but we include the other variables in our analysis to analyze how these variables relate to stale return chasing and thus, potentially indirectly with fund performance.

It should be noted that the larger the end-return which drops from the HPR sample, the greater the *decrease* in the HPR. Hence the more negative the return chasing coefficient, the

[9] See "The Morningstar Rating for Funds" 2008 factsheet.

[10] See, for example, Del Guercio and Tkac (2008) who document that changes in Morningstar ratings generate abnormal flow following both upgrades (positive flow) and downgrades (negative flow). Kraussl and Sandelowsky (2007) examine the predictive performance of Morningstar ratings over a ten-year period and conclude they have limited predictive ability of future performance and the predictive ability of the ratings worsens after changes to the rating methodology in 2002. Blake and Morey (2000) find similar results.

[11] See, for example, Bennedsen, Nielsen, Perez-Gonzalez, and Wolfenzon (2007).

greater the stale return chasing reaction by investors. Thus, we expect a negative average value of the stale return chasing coefficient. Further, we also expect a negative relation between fund size and the stale return chasing coefficients. Focusing first on fund return, in fulfillment of the exclusion condition criteria, we fail to find a significant relation between fund performance and stale return chasing across all three measures, for both gross and net returns. The t-statistic for the difference in means t-test comparing the fifth and first quintiles of stale return chasing is less than 0.10 for all six of the fund return sorts. The difference in the top and bottom quintile average values are similarly not statistically different from zero for all of the other fund characteristics considered - with the exception that stale return chasing is typically greater for larger fund families and for larger funds in relation to the β_{61} coefficient sorts. This result is consistent with greater advertising expenditures by larger fund families, which PPR show to be the primary driver of stale return chasing. We also find some evidence that funds which experience greater stale return chasing tend to charge higher total loads, but this relation is only significant in the β_{13} coefficient sorts with marginal significance in the β_{37} sorts.

Panel B of Table III reports the falsification tests for the change in Morningstar ratings. As noted for the stale return chasing coefficients and consistent with the previously discussed literature, we find no evidence of a statistically significant relation between Morningstar rating changes and subsequent fund performance. Returns are similar between funds that are upgraded and downgraded and are similar in cross-section within upgrade and downgrade subsamples (for example, returns between funds upgraded from 4 to 5 stars are statistically indistinguishable from funds upgraded from 1 to 2 stars). Similarly, we find little evidence of statistically significant differences in the other fund characteristics across the Morningstar ratings changes with the exception that larger funds from larger families tend to realize a greater number of both upgrades and downgrades into and out of the higher star ratings, perhaps reflecting the greater amount of time necessary to realize a 5 star rating or greater managerial skill in funds from larger families.

4.3. Relevance Condition Tests

To examine the relevance of our selected instruments, we report the first stage of the 2SLS specification in Panel A of Table IV, in which we relate fund size at the end of year t to the IVs and fund characteristic controls in year t-1 (see equation (1)). As required by the relevance condition criteria, while controlling for the relation between fund size and the exogenous fund characteristics, we find a significant relation between each of the IVs and fund size (average t-statistic 2.69, min 1.98). The correlations between the four IV coefficients (by fund) are very low (max value 0.12 in the unreported 4×4 Pearson correlation coefficient matrix), suggesting each variable represents a unique mutual fund flow determinant. Correspondingly, VIF values for the coefficients in the regression are all below 2 (where a value of 5 is typically recognized to indicate potential collinearity bias), implying that collinearity does not appear to be an influence in this regression. Briefly examining the control variables, consistent with the univariate sorts in Table III, we find that larger funds typically charge lower fees and belong to larger families. Consistent with contemporaneous return chasing effects, funds with larger gross returns receive disproportionate flows and are relatively larger in the subsequent period. Larger funds tend to realize greater fund and family-level flows in the prior period. As a second relevance condition test, we utilize the weak instrument test developed by Stock and Yogo (2005) which is based on the Cragg and Donald F statistic for an under-identified model. The Cragg and Donald F statistic in our model is 26.72 which is above the Stock-Yogo bias significance critical level of 24.58 (α=0.05), providing further confidence in the relevance of the selected instrument variables.

5. Fund Size and Performance – IV Analysis

The 2SLS regression results of the IV analysis are reported in Panel B of Table IV. The first stage output from the model is reported in Panel A to allow IV relevance analysis. For the actual estimation, the first and second stage is estimated simultaneously, minimizing the impact of the two stage process on the standard errors of the estimated regressors in the second stage. The 2SLS IV model is executed in the standard manner - the endogenous regressor (fund size) is estimated in the first stage and fund performance is regressed on the predicted fund size value in the second stage, including the exogenous fund characteristics as controls in both stages. In the second stage regression, we find little evidence of fund size influencing subsequent fund performance. For gross returns, the average t-statistic on the predicted fund size coefficient across the four risk adjustment methods is 1.18 (max 1.41). Similarly, for net returns, the average t-statistic is 1.41 (max 1.80 when the market model is used to calculate risk adjusted returns). This contrasts with our results from Table II in which we find average t-statistics of 2.78 and

2.51 for gross and net returns, respectively and the comparable model in CHHK (Table 3) who report average t-statistics of 2.66 and 2.39, respectively. These results suggest that the negative relation between fund size and fund performance previously noted in the literature is actually indirect, and attributable to an endogenous relation between fund size and other fund characteristics that influence fund performance. The remainder of the results are consistent between Tables II and Panel B of Table IV. We find limited predictive power for the remaining fund characteristic variables with the exception of persistence in performance (positive and significant relation between risk adjusted performance and lagged gross performance) and a negative and significant relation between lagged family size and fund size. We explore potential explanations for the relation between family size and fund performance in greater detail further in the paper.

5.1. The Role of Asset Liquidity

CHHK and Yan (2008) find that diseconomies of scale are most pronounced amongst funds that hold more illiquid assets in their portfolios. They argue that this is because of the greater transaction costs and price impacts associated with trading these assets. Thus, while the results in Table IV suggest no statistically significant relation between fund size and performance on average, it is possible that a relation exists for funds that hold less liquid assets. To test this hypothesis, we draw jointly from CHHK and Yan (2008) and use three separate proxies for fund liquidity: 1) funds that self-identify as belonging to the small market cap investment objective, 2) portfolio return loading on the Fama and French (1993) SMB factor and 3) TNA-weighed Amihud Illiquidity Ratio (AIR, Amihud, 2002). To code the investment objective liquidity proxy, we set an indicator variable equal to 1 for all funds that self-identify as belonging to the Lipper Objective codes of SCCE, SCGE, SCVE or SC.[12] The portfolio return loading on the SMB factor is estimated by year using monthly returns. To estimate the Amihud Illiquidity Ratio, we obtain portfolio holdings data jointly from CRSP and the Thomson Institutional Ownership 12s databases. In the timeframe of our sample, portfolio holdings disclosures were made either semi-annually or quarterly at the discretion of the fund until 2004, at which time quarterly holdings disclosures became mandatory. Using this data we calculate the

[12] Lipper forms the objective classifications based on language in the fund prospectus. Funds classified as small cap typically invest in companies with market capitalization less than $1 billion at the time of purchase.

average weight of each asset held in the portfolio by year. Stock level AIRs are calculated as the annual (T) average of the ratio of daily (t) absolute stock return (R) standardized by the dollar value of trading volume ($\$VOL$):

$$AIR_T = ave[\ |R_t|/\$Vol_t\ ] \tag{4}$$

Portfolio level AIRs are then calculated as:

$$AIR_{j,T} = \sum_k w_{k,j,T} AIR_{k,T} \tag{5}$$

where $AIR_{j,T}$ is the AIR for portfolio j, $w_{k,j}$ is the average weight of stock k in portfolio j and AIR_k is the average daily AIR of asset k from equation (4), all in year T. Since AIR captures the average price impact of trading one share, a larger AIR reflects a greater level of illiquidity.[13]

The results of the IV specification testing the cross-sectional relation between fund size and performance, conditioning on liquidity, are reported in Table V, with results for each proxy reported in separate panels.[14] To capture the cross-sectional effect of portfolio liquidity, in the second stage of the IV specification, we interact the liquidity proxy with the fund size estimate from the first stage. Focusing first on the small market cap indicator (SCI, Panel A) and the SMB factor loading (Panel B) liquidity proxies, we find that funds in the small cap style and with high loadings on the SMB factor realize lower relative performance. However this relation is not significant, nor is the general relation between fund size and performance. More importantly, the interaction term between fund size and the two fund liquidity proxies, although negative, is also not significant (average t-statistic 1.20 and 1.42 in the net return models for the SCI and SMB loading liquidity proxies, respectively).

Turning to the tests which utilize the AIR as the liquidity proxy in Panel C, we find a positive and typically significant relation between portfolio illiquidity and fund performance. This result is consistent with Dong, Feng, and Sadka (2011) who find that funds with high liquidity-risk exposure typically outperform funds with low exposure, which they attribute to a correlation between liquidity risk exposure and manager ability. However, the interaction coefficient of the interaction of fund AIR and fund size predicted from the first stage is negative

[13] While the literature identifies a host of liquidity measures, to ensure consistency with CHHK, we utilize the objective classifications which is the primary liquidity proxy utilized in their paper. In addition, we also use the loading on the SMB factor which they also explore in their paper. Finally we follow Lynch and Yan (2012) and Dong, Feng, and Sadka (2011) who utilize the Amihud liquidity measure in their analysis of liquidity risk in the mutual fund industry.

[14] The first stage of the 2SLS specification is as reported in Panel A of Table IV.

in all models, suggesting that larger funds which hold more illiquid stocks tend to underperform relative to their peers. This relation is significant in the market and beta risk adjustment models, but becomes insignificant once we control for the size risk premium in the 3- and 4-factor risk adjustment models (average t-statistic 1.67 in the net return models). To summarize the liquidity cross-sectional analysis, we find little evidence to suggest that fund size influences performance. Conditioning on liquidity does not alter this conclusion. Large funds that hold less liquid assets realize similar cross-sectional performance to smaller stocks holding similarly illiquid assets.

5.2. Non-linearity in the fund size and performance relation

Our results thus far suggest that, on average, the relation between fund size and performance is insignificant, even for illiquid funds. However, as noted in the introduction, this conclusion is dependent on a linear relation between fund size and performance. Although it is unlikely that trading costs have a non-linear effect on performance, endogenous factors related to size may have a non-linear effect on performance. To test for a non-linear relation, we replicate Panel B of Table IV, partitioning the sample into fund size quintiles, and report the results in Panel A of Table VI. In the interest of brevity, we report only net return results for the 4-factor model, since results for gross returns and the other factor models are similar. The first row of the table reports average log fund size (measured as total net assets under management) by quintile, which increases in a reasonably monotonic fashion from 1.64 million USD in the first quintile to 9.22 million USD in the fifth quintile. Focusing on the coefficient on fund size from the first stage, we find that the relation between fund size and performance exhibits step function properties. For the smallest two quintiles, the coefficient on fund size is -0.03 and insignificant (t-statistics less than 1.0). The fund size coefficient doubles in magnitude (-0.06) for the third and fourth quintiles, while remaining insignificant (average t-statistic 1.47) and doubles again in magnitude for the largest fund size quintile (-0.11) and is significant only for the largest quintile (t-statistic 2.16). The selection of quintile partitions, although common in the literature, is admittedly arbitrary. Thus, as a robustness test, we replicate the model for the full sample augmented with fund size from the first stage squared as an alternative method. The coefficient on squared fund size is negative and significant (-0.13, t-statistic 2.38), confirming a non-linear relation between fund size and performance. We explore potential explanations for this relation in the next section.

6. An alternative hypothesis

Why is the fund-size performance relation limited to only the largest funds in our sample? One possible explanation is suggested by recent analyst commentary from John Spence and Timothy Stauts.[15] The PIMCO Total Return exchange traded fund (ETF) was launched by PIMCO on March 1, 2012. PIMCO marketed this fund as the ETF version of the PIMCO Total Return Bond Fund. Contrasting the size, performance, and comovement of the ETF and mutual fund versions of the funds, the ETF version attracted 4.3 billion USD in assets relative to the 285.6 billion USD of capital invested in the mutual fund. One year total returns were 12.62% relative to 7.61% for the ETF and mutual fund, respectively. Surprisingly, the R^2 from the regression of ETF return on the mutual fund return was only 0.49.[16] Discussing the low commonality in performance between apparent clones of the same fund, Morningstar analyst Timothy Stauts comments:

> *"When BOND (the ETF version of the fund) was launched with about $100 million in assets, Bill Gross was able to start fresh with a brand new portfolio. The recent outperformance shows how a highly skilled manager can add tremendous value in a little portfolio. It pays to be small… Because the ETF's portfolio is relatively lean and nimble, PIMCO's best individual bond ideas can make up a relatively larger portion of BOND than PIMCO Total Return. Effectively, the ETF is performing like Bill Gross' best ideas list."*

The essence of this idea is that within fund families, managers must decide how to allocate the best ideas across funds. As discussed, some ideas will be general in application, but most ideas will be specific to certain management objectives and will have scale limitations. To minimize the price impact related trading costs of individual strategies, the overall strategy of a large fund may consist of multiple sub-strategies, each being implemented with a portion of assets under management. In fund families with multiple funds in the same management objective, new ideas may be preferentially streamed to the smaller, more nimble fund.

[15] See "PIMCO Total Return ETF Trounces Benchmark, Mutual Fund in First Year", ETFtrends.com, March 1, 2013, http://www.etftrends.com/2013/03/pimco-total-return-etf-trounces-benchmark-mutual-fund-in-first-year/.

[16] These statistics are reported by Ron Rowland, "The Successful Failure of PIMCO Total Return ETF", March 1, 2013, http://investwithanedge.com/the-successful-failure-of-pimco-total-return-etf.

Alternatively, just as a function of the size differential across funds, as noted in the commentary, better strategies may make up a relatively larger proportion of the overall strategy for smaller funds.

6.1. Predictions

The concept of favoritism in mutual fund families has been previously examined. For example, Gaspar, Massa, and Matos (2006) find that fund families strategically transfer performance across funds, preferentially allocating underpriced IPOs to funds which are younger, have higher prior performance or higher fees (high value funds). Fund families also organize offsetting trades between low and high value funds, reducing price pressure effects of the trades of high value funds. Guidj and Papastaikoudi (2004) find that better performing funds receive a disproportionate allocation of family resources by being assigned additional managers. Contributing to this literature, we hypothesize that the apparent inverse relation between size and fund performance stems from fund families preferentially allocating the best investment strategies to smaller funds. This hypothesis gives rise to a series of testable predictions.

> *P1: If fund families are preferentially allocating the best investment ideas to smaller funds, a negative relation between size and performance should only be observed for large funds with a smaller within-family competitor in the same management objective.*

Fund families will typically avoid having competing funds in the same management objective, the exception being families that have closed (or anticipate closing) their primary fund in a given objective to new investment, perhaps due to fund size impeding effective management. Fund companies also often leverage the success of popular funds or star managers by starting a new fund, typically marketed as having similar investment strategies to attract new investors. In either case, the effects of investment strategy allocation or concentration across funds in the same family should only manifest in extremely large funds, which would be consistent with our previously discussed results.

Second, when examining the holdings of within-family competing funds in the same management objective, the holdings of the small fund should reflect the family's best investment strategies. Thus, the holdings of the large fund can be decomposed into the best investment ideas (holdings which overlap with the small fund) and secondary investment ideas (holdings unique to the large fund). Drawing on this expectation:

> *P2: Examining the holdings of the large and small fund, focusing on the degree of overlap in holdings, we expect a high degree of overlap between the small and large fund (i.e. a large proportion of the holdings of the small fund are also held by the large fund). Reflecting the broader number of strategies implemented by the large fund, a small proportion of the holdings of the large fund will be held by the small fund. Performance differences arise as the best strategies comprise a smaller relative proportion of the large fund portfolio.*

The null prediction for *P2* is that the large and small fund competitors implement unique strategies, with each fund receiving an equal allocation of investment ideas when they arise. Under the null, performance differences arise due to higher price pressure effects for the large fund.

To test *P1*, we partition the sample into funds with and without a within-family competitor fund in the same management objective. Management objective matches are made using the Lipper classification system, from which we exclude funds with generic classifications to ensure that the funds we examine are true competitors with overlapping risk exposures.[17] In our sample, 68% of funds have a within-family competitor in the same management objective. If the fund size-performance relation manifests as a result of preferential distribution of investment ideas across funds in the same family, we expect superior performance by smaller funds in families with multiple funds in the same objective. Conversely, fund size should have little bearing on performance for families with only one fund in a given objective.

[17] Specifically, we focus on classifications that specify the market capitalization and risk objectives of the fund including LCCE, LCGE, LCVE, MCCE, MCGE, MCVE, SCCE, SCGE, SCVE and sector focused funds and exclude funds with generic classifications such as G and GI. Lipper classifications become available in our dataset starting in 1999, thus by necessity the regressions in Panel B of Table VI are restricted to 1999 – 2010.

6.2. Competitor fund sub-sample analysis

The results of the competitor fund regressions are presented in Panel B of Table VI. The models mirror those in Panel A, replicated by sub-sample. In the interest of brevity, we report coefficient values only for the variable of interest, fund size from the 2nd stage. Model (1) reports output for the sub-sample of funds with a within-family competitor in the same management objective. For this sub-sample, the relation between fund size and performance is significant only for the largest size partition (t-statistic 2.68) and the coefficient is of significantly greater magnitude than the other partitions (-0.18 relative to -0.07 in the adjacent partition). Contrasting the magnitude and precision of estimation of the size coefficient between the full and competing fund sub-sample, the coefficient is larger in the sub-sample and of greater significance, suggesting refinement in our modeling of the relation between fund size and performance.

Model (2) presents results for the sub-sample of funds with no within-family competitor in the same management objective. In support of the stated hypotheses, there is no discernible relation between fund size and performance for any of the size partitions and the magnitude of the coefficient on fund size is statistically indistinguishable between the three largest size partitions. In other words, the effect of fund size on performance is isolated to funds with within-family competitors in the same family.

A possible alternative explanation is argued by Petajisto (2013) who shows that the portion of the portfolio actively managed (Active Share) decreases with fund size. As previously discussed, Petajisto finds that active share has significant explanatory power for fund performance across Active Share partitions. However, within Active Share partitions performance across size partitions is indistinguishable. Regardless, to ensure our size sorts are not endogenously capturing performance differences attributable to active share, we replicate model (1) augmented with Active Share measured as:

$$Active\ Share = \frac{1}{2}\sum_{i=1}^{N}\left|w_{fund,i} - w_{index,i}\right| \qquad (6)$$

where $w_{fund,i}$ is the weight of stock i in the fund's portfolio and $w_{index,i}$ is the weight of stock i in the benchmark of the fund.[18] As reported by Petajisto (2013), we find that the effects of Active Share are most pronounced for small stocks. Importantly, inclusion of Active Share in our

[18] Active share data is obtained from Antti Petajisto's website (as used in Cremers and Petajisto (2009)), but is only available from 1990 to 2006. Hence, the robustness test in model (3) of Panel B, Table VI is similarly restricted to this timeframe.

models, if anything, improves the strength of our results (the magnitude of the coefficient on fund size is larger and the precision of the estimate is higher).

To test *P2*, we form matched fund pairs, matching funds in the large size quintile with their smaller within-family competitor in the same management objective. The small fund match is drawn from the smallest two size quintiles. Where multiple matches are available, we select the smallest fund. Holdings data is obtained from CRSP and is available from 2004 – 2012. We utilize the holdings filings closest to the end of the year and then calculate fund returns over the following year calculated from monthly fund returns. The matching process results in non-overlapping, annual frequency holdings and return observations for each fund pair. Results of the holdings comparison and return analysis are reported in Table VII. We first examine the proportional overlap in holdings between the small and large fund based on coinciding holdings declarations in each year. We focus on the proportion of individual assets in common between funds ignoring the proportional weight of each asset. The weight of individual assets may vary across funds as a function of differing diversification requirements, funds size and the covariance matrix of the asset mix. Given that the gross majority of funds in our sample implement long only strategies, differing weights of the same asset across competitor funds likely does not reflect differing strategies but the influence of these other factors. On average, 73% of the assets held by the small fund in the fund pair are also held by the large fund. However, while the strategy of the small fund to a large degree is mirrored in the large fund, this strategy comprises a relatively small proportion of the large fund's overall allocations. On average, only 34% of the holdings of the large fund are mirrored in the small fund. In other words, the strategy of the small fund is shared across funds but comprises a relatively small proportion of the overall strategy of the large fund.

We next examine the return implications of strategy allocation across within-family competitor funds. We focus on raw returns as funds in the same detailed management objective share common risk exposures. Thus, risk-adjusting returns by the average return to the management objective, as is common in the mutual fund literature, would have no effect on our inferences. The average annual returns to the small and large funds in the matched pairs are 5.48% and 3.92%, respectively, reflecting statistically superior performance by small funds of 2.07% per annum.[19] Isolating the unique holdings of the large fund, the asset-weighted return of

[19] T-test statistics are calculated with standard errors clustered by fund pair.

the strategies implemented by the large fund in excess of the small fund strategy is -2.37%, reflecting a 7.87% performance differential between the best strategy implement by the small fund and the secondary strategies implemented by the large fund or a 5.98% differential between the actual return and the return to the unique holdings of the large fund.

In sum, our evidence suggests that fund families preferentially allocate investment strategies across funds. Holdings are not unique between small and large within-family competitors. The holdings of the small fund are mirrored in the holdings of the large fund. However, due to their size, large funds implement additional strategies which, on average, underperform those of the small fund by a significant margin. Our findings are consistent with fund families preferentially allocating their best investment strategies to smaller funds, resulting in these strategies comprising a relatively small proportion of the overall strategy of the larger funds in the family.

7. Family Size and Fund Performance – IV Analysis

We now return to the question of the changing influence of family size on fund performance. As previously discussed, BCY attribute the superior fund performance of larger fund families to preferential information disclosure by investment banks which ended with the establishment of the Selective Disclosure and Insider Trading regulation by the SEC in 2000. A perplexing feature of their results is the apparent underperformance of larger fund families in the post-regulation environment. While relationships between large fund families and investment banks may explain superior pre-regulation performance, it is unclear why large fund families would underperform in the post-regulatory environment.

To explore this relation in more detail we implement the same IV specification at the family-level. PPR show that stale return chasing occurs at both the fund and fund objective-level, thus we extend their approach to measure stale return chasing at the family-level. Specifically, we use an adapted version of equation (2):

$$Flow_{j,t} = \alpha_i + \beta_{j,1}R_{j,t-1} + \beta_n R_{j,t-n} + \varepsilon_{i,t} \tag{7}$$

where $Flow_{j,t}$ is the net asset flow to family j in month t, calculated as:

$$Flow_{j,t} = \frac{TNA_{j,t} - TNA_{j,t-1} \times (1 + R_{j,t})}{TNA_{j,t-1}} \quad (8)$$

where *TNA* is aggregate TNA and *R* is the TNA-weighted average return to all funds in family *j* excluding the fund of interest. The Morningstar rating change IV is calculated as the TNA-weighted Morningstar rating indicator for all funds in the fund family, excluding the fund of interest.

Table VIII reports the fund family IV regression results. We first replicate the first stage regression (Panel A) to ensure the relevance condition holds in the fund family context. As noted at the fund-level in Panel A of Table IV, we find a significant relation between family size and the four family-level instrument variables (average t-statistic 3.81, min 2.18). In addition, the average size of the standardized IV coefficients is similar between the fund and family-level specifications.

To examine the effect of the regulatory change on the relation between family size and fund performance, we partition the second stage estimates to the pre and post-regulation periods. In the pre-regulatory period, the relation between family size and fund performance is positive but only weakly significant. In the gross fund return estimates, the relation is statistically significant using an alpha of 10% in three of the four model specifications (none are significant using an alpha of 5%). Significance is reduced in the net fund return specification, with one specification (beta risk adjustment model) significant with a p-value of less than 10% (again, none are significant using an alpha of 5%). In the post-regulatory period, the relation between family size and fund performance is negative but insignificant in all specifications (average t-statistic 1.11 and 1.02 in the gross and net return specifications, respectively). In summary, we find weak evidence of superior performance for funds in large families in the pre-regulatory period based on returns pre-fees and find no evidence of a relation between fund family size and performance in the post-regulatory period.

7.1.Competitor Fund Subsample analysis

As in the fund-level analysis, it is possible that the relation between fund performance and family size is non-linear. Further, if large fund families have access to non-public information from investment banks, under the hypotheses discussed in Section 6, we expect the resulting investment strategies to be implemented within the smaller funds in the family. To test these predictions, we partition the sample by fund family size, replicating the model by size partition. As in the fund-level analysis, in the interest of brevity, we focus on net fund returns adjusted using the 4-factor model. Our results are reported in Table IX. The results for gross returns and net returns adjusted using the other factor models are similar and lead to the same conclusions.

Panel A reports IV regression estimates of fund performance related to family size partitioned by family size, estimated separately before and after establishment of fair disclosure requirements by the SEC. In contrast to the fund-level size partition tests, the effect of family size on fund performance is more homogeneous across partitions. Absolute coefficient values range from 0.06 to 0.09 and do not increase monotonically across size partitions. However, when the sample is further partitioned by funds with and without a within-family competitor (as described in Section 6), substantial differences across partitions emerge (reported in Panel B and C). In the pre-regulatory environment, the coefficient on family size for funds with smaller competitors in the same management objective is negative and statistically different from zero (reversing from a positive value in the aggregate model specification in Panel A). The family size coefficient remains insignificant and of a similar magnitude for the other partitions relative to Panel A. For funds without a within-family competitor, the coefficient on family size is insignificant across all five partitions. In particular, the family size coefficient is positive but insignificant for the large family partition (t-statistic 1.26). Our results are largely similar in the post-regulatory environment. For funds in the large family partition with within-family competitors, the coefficient on family size is -0.28 (t-statistic 3.71), while being insignificant in the other partitions. For funds without within-family competitors, there is no statistically significant relation between fund performance and family size.

In sum, we find results broad consistent with preferential allocation of superior strategies to smaller funds within fund families driving the relation between size and performance. Our evidence is also consistent with a structural shift in the relation between family size and performance coincidental with establishment of fair disclosure regulation by the SEC. However, our analysis suggests the magnitude of the competitive advantage enjoyed by large fund families is smaller than previously documented. Additionally, preferential allocation of investment strategies derived from non-public information to smaller funds results in a persistent negative relation between family size and fund performance across regulatory regimes for large funds with within-family competitors.

8. Conclusions

The academic literature has found mixed evidence that fund size is negatively related to performance. One reason for the lack of evidence may be that that the fund size and performance relation is likely to be endogenous, i.e. fund size is only indirectly related to performance via other fund characteristics. In this paper, we identify a set of instrumental variables (IVs) that influence fund size but are unrelated to fund performance. These variables are based on the stale return chasing behavior identified by Phillips, Pukthuanthong, and Rau (2012) who show that investors strongly react to lagged returns which relate to the end of commonly reported and advertised holding periods (1, 3 and 5 year HPRs). Since these changes in HPRs resulting from end-returns dropping from the sample are mechanical and only give the perception of changed fund performance, they are nearly ideal instrumental variables as they directly influence fund size but have no perceivable relation with fund performance.

Using the instrument variable specification, we find little evidence that fund size affects fund performance. We also find little evidence of a relationship when we examine illiquid funds specifically or when we examine the period after the SEC established fair disclosure regulation, levelling the playing field for small and large families. Overall, we conclude that fund size does not appear to affect fund performance directly through liquidity or trading costs. The effect documented in prior literature appears to be driven by an endogenous relation between size and performance. In particular, the relation between size and performance appears to be non-linear. The significant negative relation between size and performance in the sub-sample of large funds with a smaller within-family competitor in the same management objective suggests that fund families preferentially allocate their best investment strategies to smaller funds, resulting in a negative size-performance relationship in the largest fund families.

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Table I
Summary Statistics

This table reports descriptive statistics for the mutual fund sample. Fund size is total net assets (TNA) under management by the fund in million USD, and family size is TNA under management by all funds in the fund family, excluding the assets of the fund of interest, also in million USD. Expense ratio is the total annual management fees and expenses charged by the fund scaled by year-end TNA. Turnover is the minimum of annual aggregate sales or purchases of securities scaled by average monthly TNA in each year. Total load is the total front, deferred and rear-end load fees charged by the fund as a percentage of investment. Gross and net fund return, is the monthly market-adjusted fund return before (gross) and after (net) expenses and fees. Fund age is the number of years the fund was in operation at the beginning of the year. Fund flow is calculated as $(TNA_{i,t} - TNA_{i,t-1} \times (1+R_{i,t}))/TNA_{i,t-1})$ where TNA is total net assets to fund i at the end of month t and R is fund return. Family flow is calculated in the same manner utilizing aggregate TNA and the TNA-weighted average return for all funds in the family, excluding the fund of interest. Panel A reports time-series averages of monthly cross-sectional values with standard deviations of monthly values reported in brackets. Panel B reports the correlation matrix of the time-series averages of the monthly values and Panel C reports the same correlation matrix excluding funds in the smallest size quintile. In Panels B and C, statistically significant correlation coefficients (α=0.05) appear in bold face.

Panel A: Time-series Averages of Cross-sectional Averages and Standard Deviations

	Size quintile						
	1	2	3	4	5	All funds	Quintiles 2-5
Number of funds	847	849	849	848	848	4240	3394
Log fund size	1.64	4.10	5.52	6.22	9.22	5.34	6.27
	[1.52]	[0.79]	[0.73]	[0.83]	[0.73]	[2.08]	[1.81]
Expense ratio (%)	1.55	1.46	1.17	0.86	0.75	1.16	1.06
	[1.31]	[0.64]	[0.39]	[0.37]	[0.30]	[1.11]	[0.51]
Turnover	0.67	1.06	1.05	1.16	0.99	0.99	1.07
	[2.80]	[1.91]	[1.70]	[0.66]	[0.52]	[1.93]	[0.68]
Total load (%)	2.34	2.89	3.04	3.13	4.00	3.08	3.27
	[1.80]	[2.31]	[2.57]	[2.76]	[3.18]	[2.59]	[2.38]
Gross fund return (%)	0.12	0.05	0.04	-0.09	-0.03	0.02	-0.01
	[2.08]	[2.36]	[2.40]	[2.18]	[1.80]	[2.75]	[2.06]
Net fund return (%)	-0.09	-0.03	-0.08	-0.13	-0.10	-0.09	-0.09
	[3.25]	[2.26]	[3.47]	[2.33]	[2.06]	[2.67]	[2.33]
Log age	1.61	2.14	2.44	3.02	3.57	2.56	2.79
	[0.60]	[0.89]	[0.92]	[1.17]	[1.11]	[0.82]	[1.04]
Fund flow	0.35	0.34	0.32	0.27	0.15	0.29	0.27
	[1.16]	[1.18]	[1.15]	[0.88]	[0.52]	[1.07]	[0.94]
Log family size	7.48	7.66	9.02	10.93	11.82	9.38	9.86
	[2.54]	[2.55]	[2.20]	[2.20]	[1.98]	[2.50]	[2.48]
Family flow	1.54	1.36	1.33	0.98	0.72	1.19	1.10
	[13.71]	[9.86]	[8.45]	[5.08]	[3.94]	[10.26]	[7.17]
Funds in family	2.03	3.19	4.04	4.60	4.62	3.70	4.11
	[3.31]	[4.71]	[7.70]	[8.35]	[9.36]	[6.75]	[5.11]

Panel B: Correlation Matrix of Time-series Averages

	Log fund size	Exp. ratio	Turn over	Total load	Age	fund flow	Log family size	Family flow	Funds in family
Log fund size	1	**-0.34**	0.05	0.21	**0.40**	-0.06	**0.43**	-0.02	0.12
Expense ratio		1	0.15	-0.05	-0.12	0.09	-0.17	0.06	-0.11
Turnover			1	0.06	0.01	-0.01	0.09	-0.02	0.07
Total load				1	0.20	-0.04	0.27	-0.03	0.31
Age					1	-0.17	0.09	-0.07	-0.12
fund flow						1	-0.01	0.23	-0.02
Log family size							1	-0.09	0.27
Family flow								1	0.10
Funds in family									1

Panel C: Correlation Matrix of Time-series Averages Excluding Funds in the Smallest Size Quintile

	Log fund size	Exp. ratio	Turn over	Total load	Age	fund flow	Log family size	Family flow	Funds in family
Log fund size	1	**-0.37**	-0.04	0.14	**0.38**	-0.07	**0.40**	-0.02	0.14
Expense ratio		1	0.23	0.01	-0.20	0.10	-0.16	0.07	-0.10
Turnover			1	0.03	-0.04	0.01	0.08	-0.02	0.06
Total load				1.00	0.18	-0.05	0.20	-0.03	0.27
Age					1	-0.20	0.03	-0.07	-0.10
fund flow						1	-0.01	0.21	-0.02
Log family size							1	-0.09	0.19
Family flow								1	0.14
Funds in family									1

Table II
Fund Size and Performance: Base Line Regression Models

This table reports OLS panel regression results of fund return related to fund characteristics lagged one month. Fund returns are calculated before (gross) and after (net) expenses and fees and are adjusted using: 1) the market model (Market-adj.), 2) the Capital Asset Pricing Model (Beta-adj.), 3) the Fama-French 3 factor model and 4) the Fama and French (1993) 3-factor model augmented with the Carhart (1997) momentum factor (4-factor). Fund size is total net assets (TNA) under management by the fund in million USD and family size is TNA under management by all funds in the fund family, excluding the assets of the fund of interest, also in million USD. Expense ratio is the total annual management fees and expenses charged by the fund scaled by year-end TNA. Turnover is the minimum of annual aggregate sales or purchases of securities scaled by average monthly TNA in each year. Total load is the total front, deferred and rear-end load fees charged by the fund as a percentage of investment. Gross and net fund return, is the monthly market-adjusted fund return before (gross) and after (net) expenses and fees. Fund age is the number of years the fund was in operation at the beginning of the year. Fund flow is calculated as $(TNA_{i,t} - TNA_{i,t-1} \times (1+R_{i,t}))/TNA_{i,t-1})$ where *TNA* is total net assets to fund *i* at the end of month *t* and *R* is fund return. Family flow is calculated in the same manner utilizing aggregate TNA and the TNA-weighted average return for all funds in the family, excluding the fund of interest. Panel A reports results for the full sample (1992-2010), Panel B and C report results for time-series subsamples before (1992-1999) and after (2001-2010) the introduction of the Fair Disclosure (FD) regulation, separately for gross and net returns. Number of funds in the fund family is measured at the end of the year. The table reports standardized regression coefficients with t-statistics reported in brackets. The regressions include year fixed effects and standard errors are clustered by fund.

Panel A: Full Sample 1992-2010

Dependent Variable	Gross fund return$_t$				Net fund return$_t$			
	Market-adj.	Beta-adj.	3-factor	4-factor	Market-adj.	Beta-adj.	3-factor	4-factor
Log fund size $_{t-1}$	-0.19	-0.17	-0.15	-0.13	-0.17	-0.18	-0.13	-0.12
	(3.19)	(2.82)	(2.71)	(2.38)	(2.69)	(2.74)	(2.44)	(2.18)
Expense ratio $_{t-1}$	-0.04	-0.05	-0.07	-0.07	-0.06	-0.04	-0.06	-0.03
	(0.09)	(0.11)	(0.16)	(0.12)	(1.63)	(1.36)	(1.57)	(1.18)
Turnover $_{t-1}$	0.03	0.06	0.04	0.02	0.03	0.03	0.05	0.05
	(0.60)	(1.24)	(1.11)	(1.04)	(0.82)	(0.60)	(0.93)	(1.11)
Total load $_{t-1}$	0.16	0.13	0.13	0.12	0.09	0.14	0.10	0.08
	(1.24)	(1.15)	(1.25)	(1.19)	(1.16)	(1.09)	(1.32)	(0.88)
Gross fund return $_{t-1}$	0.36	0.36	0.33	0.26	0.33	0.30	0.28	0.25
	(5.11)	(4.93)	(4.33)	(3.70)	(5.19)	(5.03)	(4.84)	(3.69)
Log age $_{t-1}$	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	0.01
	(0.59)	(0.66)	(0.54)	(0.86)	(0.55)	(0.51)	(0.47)	(0.47)
Fund flow $_{t-1}$	0.02	0.02	0.01	0.01	0.02	0.05	0.05	0.04
	(0.72)	(0.63)	(0.52)	(0.58)	(0.44)	(0.43)	(0.75)	(0.46)
Log family size $_{t-1}$	-0.15	-0.12	-0.14	-0.10	-0.12	-0.11	-0.11	-0.09
	(2.66)	(2.37)	(2.15)	(2.12)	(2.59)	(2.13)	(2.25)	(1.86)
Family flow $_{t-1}$	0.09	0.12	0.06	0.04	0.09	0.14	0.07	0.04
	(2.09)	(2.37)	(1.56)	(1.11)	(1.61)	(2.19)	(2.00)	(1.11)
Funds in family $_{t-1}$	-0.07	-0.03	-0.04	-0.15	-0.12	-0.10	-0.14	-0.14
	(1.49)	(0.72)	(0.96)	(2.34)	(1.75)	(1.57)	(2.64)	(2.75)
Adjusted R^2	12.77	13.08	11.85	14.20	13.11	13.35	12.44	12.79

Panel B: Gross Return Subsamples

	Dependent variable: Gross fund return$_t$							
	Before FD: 1992-1999				After FD: 2001-2010			
	Market-adj.	Beta-adj.	3-factor	4-factor	Market-adj.	Beta-adj.	3-factor	4-factor
Log fund size $_{t-1}$	-0.20	-0.19	-0.17	-0.13	-0.18	-0.16	-0.15	-0.13
	(3.12)	(3.06)	(2.83)	(2.49)	(3.16)	(2.65)	(2.78)	(2.46)
Expense ratio $_{t-1}$	-0.05	-0.05	-0.07	-0.08	-0.05	-0.04	-0.06	-0.07
	(0.12)	(0.10)	(0.14)	(0.14)	(0.11)	(0.10)	(0.14)	(0.14)
Turnover $_{t-1}$	0.03	0.07	0.04	0.02	0.03	0.06	0.03	0.02
	(0.54)	(1.53)	(1.00)	(1.29)	(0.55)	(1.55)	(0.92)	(1.32)
Total load $_{t-1}$	0.16	0.15	0.13	0.13	0.15	0.13	0.13	0.10
	(1.10)	(1.37)	(1.08)	(1.45)	(1.08)	(0.96)	(1.07)	(1.06)
Gross fund return $_{t-1}$	0.43	0.36	0.35	0.31	0.38	0.29	0.23	0.26
	(5.79)	(4.43)	(4.29)	(3.95)	(4.33)	(3.27)	(3.30)	(3.83)
Log age $_{t-1}$	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.44)	(0.52)	(0.47)	(0.66)	(0.51)	(0.59)	(0.45)	(0.73)
Fund flow $_{t-1}$	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01
	(0.60)	(0.73)	(0.43)	(0.73)	(0.85)	(0.55)	(0.47)	(0.51)
Log family size $_{t-1}$	0.18	0.17	0.12	0.09	-0.12	-0.12	-0.12	-0.11
	(3.21)	(3.05)	(2.39)	(1.78)	(2.38)	(2.26)	(1.96)	(1.92)
Family flow $_{t-1}$	0.11	0.10	0.06	0.03	0.09	0.12	0.06	0.03
	(2.14)	(1.99)	(1.55)	(1.01)	(2.08)	(2.15)	(1.61)	(0.84)
Funds in family $_{t-1}$	0.07	0.03	0.04	-0.10	0.07	0.03	0.04	-0.10
	(1.49)	(0.72)	(0.96)	(1.86)	(1.49)	(0.72)	(0.96)	(1.79)
Adjusted R^2	12.25	13.49	12.25	13.84	12.74	13.61	12.98	14.27

Panel C: Net Return Subsamples

	Dependent variable: Net fund return$_t$							
	Before FD: 1992-1999				After FD: 2001-2010			
	Market-adj.	Beta-adj.	3-factor	4-factor	Market-adj.	Beta-adj.	3-factor	4-factor
Log fund size $_{t-1}$	-0.19	-0.15	-0.14	-0.13	-0.16	-0.17	-0.11	-0.12
	(2.86)	(2.38)	(2.23)	(2.25)	(2.74)	(2.81)	(2.09)	(2.12)
Expense ratio $_{t-1}$	-0.07	-0.05	-0.07	-0.04	-0.05	-0.04	-0.05	-0.02
	(1.90)	(1.63)	(1.86)	(1.56)	(1.35)	(1.81)	(1.41)	(1.03)
Turnover $_{t-1}$	0.03	0.03	0.05	0.05	0.02	0.03	0.04	0.06
	(0.69)	(0.46)	(0.76)	(0.96)	(0.75)	(0.77)	(0.71)	(1.47)
Total load $_{t-1}$	0.08	0.15	0.09	0.09	0.10	0.16	0.11	0.07
	(1.02)	(1.30)	(1.05)	(1.03)	(1.48)	(1.42)	(1.68)	(0.69)
Gross fund return $_{t-1}$	0.35	0.33	0.26	0.26	0.38	0.29	0.27	0.28
	(6.35)	(5.91)	(4.87)	(3.94)	(6.57)	(6.49)	(3.91)	(4.41)
Log age $_{t-1}$	-0.01	-0.01	0.01	0.01	-0.01	-0.01	0.01	0.01
	(0.66)	(0.63)	(0.42)	(0.60)	(0.63)	(0.66)	(0.38)	(0.42)
Fund flow $_{t-1}$	0.02	0.05	0.06	0.03	0.02	0.04	0.06	0.04
	(0.38)	(0.55)	(1.01)	(0.37)	(0.34)	(0.36)	(0.89)	(0.61)
Log family size $_{t-1}$	0.09	0.10	0.11	0.07	-0.11	-0.09	-0.12	-0.08
	(1.93)	(2.27)	(2.26)	(1.71)	(2.17)	(1.62)	(2.84)	(1.66)
Family flow $_{t-1}$	0.09	0.13	0.07	0.03	0.11	0.07	0.06	0.03
	(1.85)	(1.97)	(1.56)	(0.98)	(1.86)	(1.59)	(1.54)	(0.95)
Funds in family $_{t-1}$	0.07	0.03	0.04	-0.12	0.07	0.03	0.04	-0.12
	(1.49)	(0.72)	(0.96)	(1.86)	(1.49)	(0.72)	(0.96)	(1.82)
Adjusted R^2	12.83	13.74	12.65	12.62	13.42	14.06	12.93	12.51

Table III
Instrument Variable Falsification Tests

This table reports fund characteristics sorted by lagged instrument variables. Four instrument variables are considered; Panel A: the three return chasing coefficients (n=13, 37, and 61) obtained from the regression $Flow_{i,t} = \alpha_i + \beta_{i,1}R_{i,t-1} + \beta_n R_{i,t-n} + \varepsilon_{i,t}$ where $Flow_{i,t}$ is net asset flow to fund i in month t, calculated as $(TNA_{i,t} - TNA_{i,t-1} \times (1+R_{i,t}))/TNA_{i,t-1})$ where TNA is total net assets and R is fund return (The regression is estimated by year utilizing monthly frequency fund flow and returns), Panel B: the change in Morningstar Rating for fund i, partitioned by upgrades and downgrades. Fund size is total net assets (TNA) under management by the fund in million USD at year end, and family size is TNA under management by all funds in the fund family, excluding the assets of the fund of interest, also in million USD at year end. Expense ratio is the total annual management fees and expenses charged by the fund scaled by year-end TNA. Turnover is the minimum of annual aggregate sales or purchases of securities scaled by average monthly TNA in each year. Total load is the total front, deferred and rear-end load fees charged by the fund as a percentage of investment. Gross and net fund return, is the monthly market-adjusted fund return before (gross) and after (net) expenses and fees. Fund age is the number of years the fund was in operation at the beginning of the year. Family flow is calculated in the same manner as fund flow, utilizing aggregate TNA and the TNA-weighted average return for all funds in the family, excluding the fund of interest.

Panel A: Return Chasing Instrument Variables

Coefficient	Fund size	Family size	Expense ratio	Total load	Turnover	Fund Flow	Family Flow	Fund return (gross)	Fund return (net)
Return Chasing Coefficient β_{13}									
-0.29	246.68	255.27	1.19	2.47	35.20	35.06	101.36	0.08	-0.03
-0.31	292.33	402.11	0.97	4.44	71.25	24.44	85.78	-0.04	-0.12
-0.31	261.24	263.02	1.01	4.33	63.75	31.97	86.58	0.04	-0.07
-0.36	318.77	465.28	0.56	5.81	47.25	17.52	48.68	-0.04	-0.13
-0.41	298.57	439.86	0.91	4.50	46.80	20.47	69.69	0.05	-0.05
Q5-Q1	51.89	184.59	-0.28	2.03	11.6	-14.59	-31.67	-0.03	-0.02
t-stat	(1.12)	(2.44)	(1.69)	(2.78)	(1.43)	(1.50)	(1.41)	(0.02)	(0.01)
Return Chasing Coefficient β_{37}									
-0.31	222.21	158.79	1.34	2.96	38.80	36.36	89.53	0.03	-0.06
-0.36	240.95	308.16	1.30	3.63	63.64	32.51	87.7	0.10	-0.01
-0.39	305.05	344.33	0.78	4.65	55.92	25.38	80.18	0.02	-0.03
-0.43	333.64	542.11	0.54	5.28	52.97	10.12	61.74	-0.06	-0.13
-0.47	315.75	472.16	0.69	5.03	53.04	25.09	72.95	-0.07	-0.14
Q5-Q1	93.54	313.37	-0.65	2.07	14.24	-11.27	-16.58	-0.10	-0.08
t-stat	(1.81)	(3.29)	(1.72)	(1.87)	(1.44)	(1.38)	(1.16)	(0.04)	(0.02)
Return Chasing Coefficient β_{61}									
-0.26	152.79	140.62	1.11	3.70	46.75	32.55	98.22	0.00	-0.05
-0.29	259.90	369.54	0.95	4.29	65.94	26.1	91.08	-0.09	-0.11
-0.30	217.85	252.43	1.06	4.13	49.93	31.77	92.41	0.01	-0.07
-0.31	405.83	588.30	0.79	4.95	56.38	15.35	50.43	-0.07	-0.14
-0.36	381.23	474.67	0.73	4.47	45.25	23.67	59.95	0.09	-0.02
Q5-Q1	228.44	334.05	-0.38	0.77	-1.50	-8.88	-38.27	0.09	0.03
t-stat	(2.61)	(3.72)	(1.57)	(1.44)	(0.75)	(1.51)	(1.69)	(0.05)	(0.01)

Panel B: Morningstar Rating Change Instrument Variables

Stars	Fund size	Family size	Expense ratio	Total load	Turnover	Fund Flow	Family Flow	Fund return (gross)	Fund return (net)
					Downgrade				
2 to 1	160.29	225.43	1.05	3.33	41.76	39.10	100.74	0.07	-0.03
3 to 2	192.39	278.65	1.04	3.72	64.15	32.82	97.04	0.02	-0.07
4 to 3	278.97	428.78	0.89	4.03	55.64	28.91	84.44	0.02	-0.06
5 to 4	292.04	485.19	0.87	4.14	63.26	26.36	82.57	0.01	-0.09
Q4-Q1	131.75	259.76	-0.18	0.81	21.5	-12.74	-18.17	-0.06	-0.06
t-stat	(2.89)	(3.13)	(1.47)	(1.54)	(1.89)	(1.42)	(1.09)	(0.04)	(0.03)
					Upgrade				
1 to 2	198.64	248.44	1.01	3.86	41.57	29.66	84.48	0.01	-0.07
2 to 3	334.69	404.57	0.69	4.77	52.34	21.58	66.88	-0.08	-0.13
3 to 4	326.72	397.62	0.70	4.37	63.64	24.50	80.69	0.06	-0.03
4 to 5	422.42	585.80	0.63	5.37	52.28	17.96	52.14	-0.07	-0.13
Q4-Q1	223.78	337.36	-0.38	1.51	10.71	-11.70	-32.34	-0.08	-0.06
t-stat	(3.26)	(3.42)	(1.61)	(1.67)	(1.59)	(1.72)	(1.70)	(0.04)	(0.06)

Table IV
Instrument Variable Regression Analysis

This table reports coefficients for instrument variable 2SLS regressions relating fund size to performance. $\beta_{13,}$ β_{37}, and β_{61} are coefficient estimates from the regression: $Flow_{i,t} = \alpha_i + \beta_{i,1}R_{i,t-1} + \beta_n R_{i,t-n} + \varepsilon_{i,t}$ where $Flow_{i,t}$ is net asset flow to fund i in month t, calculated as $(TNA_{i,t} - TNA_{i,t-1} \times (1+R_{i,t}))/TNA_{i,t-1}$, TNA is total net assets and R is fund return. The instrument variables are estimated by year utilizing monthly frequency fund flow and returns. Morningstar threshold is an indicator variable set to 1, 0, -1 corresponding with an increase, no change or decrease in Morningstar Rating. The remaining variables are as defined in Table II with the addition of the number of funds in the fund family. In the second stage reported in Panel B, fund returns are calculated before (gross) and after (net) expenses and fees and are adjusted using: 1) the market model (Market-adj.), 2) the Capital Asset Pricing Model (Beta-adj.), 3) the Fama-French 3 factor model and 4) the Fama and French (1993) 3-factor model augmented with the Carhart (1997) momentum factor (4-factor). The table reports standardized regression coefficients with t-statistics reported in brackets. The regressions include year fixed effects and standard errors are clustered by fund.

Panel A: First Stage

Dependent variable: Log fund size $_t$	
Fund $\beta_{13,\ t-1}$	-0.21
	(1.98)
Fund $\beta_{37,\ t-1}$	-0.51
	(2.76)
Fund $\beta_{61,\ t-1}$	-0.40
	(3.40)
Fund Morningstar threshold $_{t-1}$	0.36
	(2.61)
Expense ratio $_{t-1}$	-0.16
	(2.36)
Turnover $_{t-1}$	0.02
	(1.51)
Total load $_{t-1}$	0.03
	(1.41)
Gross fund return $_{t-1}$	0.28
	(2.77)
Log age $_{t-1}$	0.13
	(1.43)
Fund flow $_{t-1}$	0.21
	(3.15)
Log family size $_{t-1}$	0.14
	(2.74)
Family flow $_{t-1}$	0.11
	(2.30)
Number of funds in family $_{t-1}$	0.08
	(1.71)
Adjusted R^2	19.12

Panel B: Second Stage

Dependent variable	Gross return$_t$				Net return$_t$			
	Market -adj	Beta-adj	3-factor	4-factor	Market -adj	Beta-adj	3-factor	4-factor
Fund size from 1st stage $_{t\text{-}1}$	-0.12	-0.12	-0.09	-0.12	-0.12	-0.09	-0.07	-0.05
	(1.16)	(1.19)	(0.96)	(1.41)	(1.80)	(1.36)	(1.31)	(1.17)
Expense ratio $_{t\text{-}1}$	-0.05	-0.04	-0.08	-0.08	-0.05	-0.03	-0.05	-0.03
	(0.14)	(0.12)	(0.19)	(0.18)	(1.16)	(0.74)	(0.95)	(0.63)
Turnover $_{t\text{-}1}$	0.03	0.04	0.03	0.02	0.02	0.03	0.05	0.05
	(0.90)	(0.82)	(0.68)	(0.75)	(0.58)	(0.54)	(1.03)	(0.66)
Total load $_{t\text{-}11}$	0.17	0.12	0.11	0.14	0.08	0.14	0.08	0.09
	(1.71)	(0.74)	(1.19)	(1.20)	(1.10)	(1.20)	(0.86)	(0.94)
Gross fund return $_{t\text{-}1}$	0.37	0.34	0.25	0.44	0.28	0.25	0.31	0.41
	(6.81)	(4.43)	(4.53)	(7.49)	(5.40)	(3.62)	(4.93)	(9.21)
Log age $_{t\text{-}1}$	-0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	0.01
	(0.93)	(0.48)	(0.51)	(0.54)	(0.51)	(0.69)	(0.51)	(0.49)
Fund flow $_{t\text{-}1}$	0.02	0.02	0.01	0.01	0.02	0.04	0.05	0.05
	(0.70)	(0.43)	(0.37)	(0.37)	(0.44)	(0.48)	(0.75)	(0.69)
Log family size $_{t\text{-}1}$	-0.11	-0.12	-0.11	-0.08	-0.11	-0.13	-0.12	-0.09
	(2.46)	(1.69)	(2.21)	(1.67)	(2.34)	(2.61)	(1.96)	(1.66)
Family flow $_{t\text{-}1}$	0.09	0.11	0.06	0.05	0.08	0.10	0.07	0.05
	(2.36)	(1.60)	(1.31)	(1.69)	(1.15)	(1.41)	(1.14)	(1.08)
Number of funds in family $_{t\text{-}1}$	-0.07	-0.03	-0.04	-0.06	-0.15	-0.14	-0.13	-0.12
	(1.49)	(0.72)	(0.96)	(1.51)	(2.23)	(1.97)	(1.72)	(1.67)
Adjusted R^2	13.26	13.64	12.89	12.45	13.34	11.08	14.27	10.20

Table V
Fund Liquidity Cross-sectional Analysis

This table reports the second stage estimates of instrument variable 2SLS regressions relating fund size to performance while partitioning by fund portfolio liquidity. The fund size first stage estimates are obtained from the model in Panel A of Table IV. The small cap indicator variable is set to 1 (and otherwise 0) for funds which self-declare small market capitalization stocks as part of its investment style. SMB loading is the loading of fund return on the Fama and French (1993) SMB factor, estimated by year using monthly frequency returns. Amihud is the asset-weighted average Amihud Illiquidity Ratio (Amihud, 2002) of the stocks held by the fund. The stock level Amihud Illiquidity Ratio is estimated as the mean annual value of daily absolute return divided by trading volume. All other variables are as defined in Table IV. The table reports standardized regression coefficients with t-statistics reported in brackets. The regressions include year fixed effects and standard errors are clustered by fund.

Panel A: Small Market Cap Style

Dependent variable	Gross return$_t$				Net return$_t$			
	Market -adj	Beta-adj	3-factor	4-factor	Market -adj	Beta-adj	3-factor	4-factor
Small cap. indicator (SCI)	-0.08	-0.06	-0.05	-0.06	-0.07	-0.04	-0.05	-0.06
	(1.54)	(1.32)	(1.11)	(1.39)	(1.64)	(1.49)	(1.09)	(1.57)
1st stage fund size × SCI $_{t-1}$	-0.06	-0.03	-0.05	-0.02	-0.03	-0.03	-0.03	-0.03
	(1.59)	(0.98)	(1.45)	(1.11)	(1.14)	(1.37)	(1.33)	(0.97)
1st stage fund size $_{t-1}$	-0.04	-0.08	-0.08	-0.09	-0.07	-0.06	-0.06	-0.07
	(1.56)	(1.12)	(0.90)	(0.97)	(1.52)	(1.22)	(1.01)	(1.35)
Expense ratio $_{t-1}$	-0.06	-0.04	-0.10	-0.09	-0.06	-0.02	-0.06	-0.02
	(0.16)	(0.11)	(0.20)	(0.19)	(1.42)	(0.61)	(1.05)	(0.59)
Turnover $_{t-1}$	0.03	0.05	0.04	0.02	0.02	0.02	0.04	0.07
	(0.68)	(1.02)	(0.77)	(0.93)	(0.66)	(0.44)	(0.93)	(0.75)
Total load $_{t-1}$	0.15	0.15	0.13	0.11	0.09	0.13	0.07	0.08
	(1.39)	(0.92)	(1.31)	(1.01)	(1.19)	(1.00)	(0.67)	(0.73)
Gross fund return $_{t-1}$	0.55	0.32	0.32	0.33	0.42	0.36	0.29	0.15
	(6.63)	(4.46)	(4.57)	(4.02)	(5.08)	(4.16)	(3.64)	(2.40)
Log age $_{t-1}$	-0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	0.01
	(1.15)	(0.38)	(0.57)	(0.45)	(0.63)	(0.83)	(0.59)	(0.58)
Fund flow $_{t-1}$	0.02	0.02	0.01	0.01	0.02	0.05	0.05	0.04
	(0.76)	(0.34)	(0.46)	(0.41)	(0.39)	(0.54)	(0.70)	(0.56)
Log family size $_{t-1}$	-0.13	-0.09	-0.07	-0.07	-0.10	-0.14	-0.11	-0.07
	(2.93)	(2.02)	(1.87)	(1.84)	(1.84)	(2.17)	(1.92)	(1.68)
Family flow $_{t-1}$	0.06	0.14	0.06	0.03	0.08	0.07	0.06	0.04
	(1.82)	(2.69)	(1.00)	(0.44)	(0.97)	(1.18)	(1.00)	(1.00)
Number of funds in family $_{t-1}$	-0.10	-0.03	-0.04	-0.05	-0.18	-0.11	-0.15	-0.12
	(2.06)	(0.65)	(0.83)	(1.17)	(2.76)	(1.96)	(2.39)	(1.99)
Adjusted R^2	14.33	14.75	13.28	13.05	12.33	12.22	15.17	10.92

Panel B: SMB Factor Loading

Dependent variable	Gross $return_t$				Net $return_t$			
	Market -adj	Beta-adj	3-factor	4-factor	Market -adj	Beta-adj	3-factor	4-factor
SMB loading (SMBL) $_{t-1}$	-0.10	-0.07	-0.04	-0.07	-0.08	-0.08	-0.07	-0.07
	(1.66)	(1.40)	(1.37)	(1.89)	(1.38)	(1.83)	(1.74)	(1.65)
1st stage fund size × SMBL $_{t-1}$	-0.04	-0.03	-0.03	-0.04	-0.06	-0.03	-0.04	-0.04
	(1.18)	(0.88)	(1.20)	(1.27)	(1.64)	(1.24)	(1.42)	(1.39)
1st stage fund size $_{t-1}$	-0.03	-0.09	-0.09	-0.05	-0.07	-0.07	-0.07	-0.05
	(1.27)	(0.95)	(1.20)	(0.74)	(1.68)	(1.24)	(1.56)	(1.45)
Expense ratio $_{t-1}$	-0.03	-0.03	-0.07	-0.09	-0.08	-0.03	-0.05	-0.04
	(0.13)	(0.11)	(0.17)	(0.21)	(1.24)	(0.79)	(0.88)	(0.71)
Turnover $_{t-1}$	0.03	0.05	0.03	0.02	0.01	0.03	0.05	0.06
	(1.00)	(0.95)	(0.78)	(0.67)	(0.49)	(0.43)	(0.89)	(0.80)
Total load $_{t-1}$	0.14	0.11	0.13	0.09	0.09	0.18	0.10	0.09
	(1.56)	(0.67)	(1.43)	(1.12)	(1.33)	(1.31)	(1.03)	(0.81)
Gross fund return $_{t-1}$	0.37	0.34	0.30	0.34	0.44	0.38	0.26	0.28
	(4.72)	(4.42)	(3.53)	(4.44)	(5.73)	(5.10)	(3.88)	(3.92)
Log age $_{t-1}$	-0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	0.01
	(1.05)	(0.40)	(0.60)	(0.63)	(0.57)	(0.61)	(0.47)	(0.47)
Fund flow $_{t-1}$	0.02	0.01	0.01	0.01	0.02	0.04	0.05	0.05
	(0.58)	(0.37)	(0.43)	(0.40)	(0.33)	(0.54)	(0.59)	(0.79)
Log family size $_{t-1}$	-0.11	-0.15	-0.13	-0.11	-0.16	-0.10	-0.10	-0.11
	(2.12)	(2.40)	(2.44)	(2.08)	(2.67)	(2.03)	(2.10)	(1.79)
Family flow $_{t-1}$	0.14	0.15	0.08	0.06	0.08	0.09	0.05	0.05
	(2.50)	(2.41)	(1.95)	(1.45)	(0.97)	(1.24)	(1.06)	(0.85)
Number of funds in family $_{t-1}$	-0.08	-0.03	-0.03	-0.06	-0.16	-0.12	-0.14	-0.09
	(1.81)	(0.65)	(0.82)	(1.31)	(2.65)	(2.53)	(2.52)	(1.95)
Adjusted R^2	14.08	14.12	13.85	12.92	11.82	12.04	14.93	11.25

Panel C: Portfolio Amihud Illiquidity

Dependent variable	Gross return$_t$				Net return$_t$			
	Market -adj	Beta-adj	3-factor	4-factor	Market -adj	Beta-adj	3-factor	4-factor
Amihud $_{t-1}$	0.17	0.14	0.15	0.05	0.16	0.12	0.09	0.07
	(3.01)	(2.53)	(2.43)	(1.40)	(2.70)	(2.45)	(1.84)	(1.71)
1st stage fund size × Amihud $_{t-1}$	-0.16	-0.10	-0.08	-0.07	-0.20	-0.18	-0.09	-0.07
	(2.55)	(2.15)	(1.69)	(1.65)	(3.07)	(2.78)	(1.71)	(1.63)
1st stage fund size $_{t-1}$	-0.07	-0.08	-0.08	-0.10	-0.07	-0.07	-0.06	-0.05
	(1.09)	(1.26)	(1.06)	(1.58)	(1.79)	(1.73)	(1.54)	(1.58)
Expense ratio $_{t-1}$	-0.02	-0.01	-0.01	-0.02	-0.04	-0.04	-0.05	-0.04
	(0.10)	(0.12)	(0.17)	(0.26)	(0.65)	(0.68)	(0.79)	(0.63)
Turnover $_{t-1}$	0.04	0.02	0.02	0.02	0.02	0.02	0.03	0.06
	(1.12)	(0.60)	(0.50)	(0.74)	(0.41)	(0.42)	(0.46)	(0.87)
Total load $_{t-1}$	0.09	0.06	0.10	0.10	0.10	0.10	0.08	0.08
	(0.72)	(0.66)	(0.79)	(0.81)	(1.60)	(1.37)	(0.85)	(1.05)
Gross fund return $_{t-1}$	0.46	0.21	0.26	0.59	0.39	0.30	0.19	0.15
	(5.69)	(2.95)	(3.42)	(5.92)	(4.61)	(3.54)	(3.10)	(2.65)
Log age $_{t-1}$	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.95)	(0.47)	(0.49)	(0.40)	(0.37)	(0.74)	(0.67)	(0.51)
Fund flow $_{t-1}$	0.02	0.02	0.01	0.01	0.02	0.03	0.05	0.06
	(0.62)	(0.58)	(0.32)	(0.53)	(0.32)	(0.35)	(0.78)	(0.63)
Log family size $_{t-1}$	-0.09	-0.09	-0.10	-0.07	-0.13	-0.10	-0.11	-0.11
	(1.75)	(1.93)	(2.09)	(1.52)	(2.18)	(1.93)	(2.07)	(2.05)
Family flow $_{t-1}$	0.12	0.09	0.06	0.05	0.07	0.10	0.06	0.04
	(2.18)	(1.91)	(1.46)	(1.57)	(1.03)	(1.29)	(1.00)	(0.73)
Number of funds in family $_{t-1}$	-0.05	-0.05	-0.04	-0.05	-0.14	-0.11	-0.09	-0.15
	(0.82)	(0.96)	(0.95)	(0.63)	(2.27)	(1.31)	(1.66)	(2.72)
Adjusted R^2	17.55	16.72	13.40	12.69	15.38	14.67	12.21	11.59

Table VI
Fund Size and Performance across Size Partitions

This table reports instrument variable 2SLS regression output relating fund size to performance, which replicate the regression models in Table IV, with the sample partitioned by fund size in month *t*-1. The full sample and two subsamples are considered, including and excluding funds with overlapping management objectives in the same fund family. For example, if two or more funds in the same management objective are offered in the same fund family, these funds have overlapping management objectives. The variables are as previously defined. Net fund returns are fund returns net of management and marketing fees adjusted using the 4-factor model. The table reports standardized regression coefficients with t-statistics reported in brackets. The regressions include year fixed effects and standard errors are clustered by fund. In Panel B, coefficient values for the control variables are suppressed in the interest of brevity.

Panel A: Full Sample

	Dependent variable: Net fund return$_t$					
Fund Size Quintile	Small	2	3	4	Large	Full
Mean log fund size	1.64	4.10	5.52	6.22	9.22	Sample
Fund size from 1st stage $_{t\text{-}1}$	-0.03	-0.03	-0.07	-0.06	-0.11	-0.05
	(0.79)	(0.84)	(1.50)	(1.44)	(2.16)	(1.38)
Fund size from 1st stage^2 $_{t\text{-}1}$						-0.13
						(2.38)
Expense ratio $_{t\text{-}1}$	-0.03	-0.03	-0.03	-0.02	-0.02	-0.03
	(0.45)	(0.95)	(0.82)	(0.32)	(0.35)	(0.63)
Turnover $_{t\text{-}1}$	0.06	0.04	0.06	0.04	0.05	0.05
	(1.04)	(0.34)	(1.03)	(0.38)	(0.39)	(0.79)
Total load $_{t\text{-}1}$	0.10	0.09	0.07	0.07	0.08	0.08
	(1.40)	(0.83)	(0.62)	(0.50)	(0.50)	(0.77)
Gross fund return $_{t\text{-}1}$	0.38	0.49	0.33	0.38	0.43	0.37
	(4.87)	(9.73)	(6.49)	(6.04)	(9.18)	(4.68)
Log age $_{t\text{-}1}$	0.01	0.01	0.01	0.01	0.01	0.01
	(0.29)	(0.22)	(0.19)	(0.24)	(0.77)	(0.35)
Fund flow $_{t\text{-}1}$	0.06	0.05	0.05	0.04	0.04	0.04
	(1.03)	(0.99)	(0.42)	(0.36)	(0.33)	(0.87)
Log family size $_{t\text{-}1}$	-0.09	-0.10	-0.08	-0.10	-0.09	-0.09
	(1.61)	(2.20)	(1.42)	(2.26)	(1.57)	(1.54)
Family flow $_{t\text{-}1}$	0.05	0.05	0.05	0.04	0.05	0.04
	(1.03)	(1.47)	(1.22)	(0.51)	(1.35)	(1.02)
Number of funds in family $_{t\text{-}1}$	-0.11	-0.10	-0.14	-0.15	-0.15	-0.12
	(1.45)	(1.38)	(1.95)	(2.62)	(2.19)	(2.09)
Adjusted R^2	9.12	9.35	9.16	9.04	9.50	10.27

Panel B: Subsamples

	Dependent variable: Net fund return$_t$				
Fund Size Quintile	Small	2	3	4	Large
Partition 1: Funds with overlapping management objectives in the same family					
Number of funds	458	458	458	458	459
Mean log fund size	2.13	5.39	6.22	8.88	9.70
			Model 1		
Fund size from 1st stage $_{t-1}$	-0.03	-0.03	-0.06	-0.07	-0.18
	(0.64)	(0.83)	(1.54)	(1.57)	(2.68)
			Model 2		
Fund size from 1st stage $_{t-1}$	-0.03	-0.04	-0.06	-0.07	-0.20
	(0.73)	(0.91)	(1.51)	(1.62)	(2.95)
Active share $_{t-1}$	0.19	0.06	0.09	0.08	0.05
	(3.14)	(1.58)	(2.05)	(1.67)	(1.44)
Partition 2: Funds without overlapping management objectives in the same family					
Number of funds	208	209	209	209	209
Mean log fund size	1.85	4.68	6.19	7.67	8.51
Fund size from 1st stage $_{t-1}$	-0.03	-0.02	-0.05	-0.07	-0.06
	(0.79)	(0.68)	(1.01)	(1.61)	(1.32)

Table VII
Large Relative to Small Fund Holdings and Return Comparison

This table summarizes holdings in common and performance for small – large fund pairs. Fund pairs are formed between funds which share a common family and detailed Lipper investment objective, matching funds in the large fund size quintile in Table VI with the smallest fund in either of the bottom two quintiles. The holdings comparisons considers the proportion of asset held in common between the fund pairs based on the holdings declaration most proximal to calendar year-end from 2004 - 2012. Returns are calculated over the subsequent year (T). Average returns are reported for the small and large fund as well as the subset of the large fund portfolio not held by the small fund. T-test statistics are reported (H_0: average return = 0), calculated with standard errors clustered by fund pair.

Holdings		Average return $_{T+1}$				
Ave.% of small fund holdings held by large fund	Ave.% of large fund holdings held by small fund	Small fund	Large fund	Small - Large	Unique holdings of large fund	Actual – unique holdings for large fund
73.10%	33.89%	5.48%	3.92%	2.07%	-2.37%	5.98%
				(2.51)	(2.78)	(4.04)

Table VIII
Family Size and Fund Performance

This table reports coefficients for instrument variable 2SLS regressions relating fund performance to family size. $\beta_{13,}$ β_{37}, and β_{61} are obtained from the regression: $Flow_{j,t} = \alpha_i + \beta_{j,1}R_{j,t-1} + \beta_n R_{j,t-n} + \varepsilon_{i,t}$ where $Flow_{j,t}$ is net asset flow to family j in month t, calculated as $(TNA_{j,t} - TNA_{j,t-1} \times (1+R_{j,t}))/TNA_{j,t-1})$, TNA is total net assets and R is family return calculated as the TNA-weighted average return to all funds in the family. The regression is estimated by year utilizing monthly frequency family flow and returns. For each fund-year, an indicator variable is set to 1, 0, -1 corresponding with an increase, no change or decrease in Morningstar Rating. The Morningstar threshold variable is the TNA-weighted indicator average for all funds in the family. All other variables are as defined in Table IV. The second stage estimates in Panel B are partitioned before (1992-1999) and after (2001-2010) introduction of the Fair Disclosure (FD) regulation. The table reports standardized regression coefficients with t-statistics reported in brackets. The regressions include year fixed effects and standard errors are clustered by family.

Panel A: First Stage

Dependent variable: Family size$_t$	
Family $\beta_{13,\,t-1}$	-0.12
	(2.18)
Family $\beta_{37,\,t-1}$	-0.47
	(5.29)
Family $\beta_{61,\,t-1}$	-0.37
	(4.55)
Family Morningstar threshold $_{t-1}$	0.20
	(3.25)
Expense ratio $_{t-1}$	-0.18
	(2.53)
Turnover $_{t-1}$	0.02
	(1.15)
Total load $_{t-1}$	0.03
	(1.35)
Gross fund return $_{t-1}$	0.25
	(3.14)
Log age $_{t-1}$	0.06
	(1.60)
Family flow $_{t-1}$	0.20
	(3.14)
Number of funds in family $_{t-1}$	0.19
	(2.72)
Adjusted R^2	16.68

Panel B: Gross Fund Return 2nd Stage

Dependent variable: Gross fund return$_t$								
	Before FD 1992-1999				After FD 2001-2010			
	Market -adj	Beta-adj	3-factor	4-factor	Market-adj	Beta adj	3-factor	4-factor
Family size from 1st stage $_{t-1}$	0.06	0.09	0.07	0.09	-0.03	-0.02	-0.03	-0.04
	(1.23)	(1.91)	(1.82)	(1.66)	(1.08)	(0.90)	(1.17)	(1.30)
Log fund size $_{t-1}$	-0.18	-0.22	-0.21	-0.12	-0.19	-0.18	-0.14	-0.12
	(2.37)	(3.96)	(3.67)	(2.16)	(2.93)	(3.13)	(3.30)	(1.64)
Expense ratio $_{t-1}$	-0.06	-0.05	-0.09	-0.10	-0.04	-0.03	-0.05	-0.07
	(0.17)	(0.09)	(0.19)	(0.11)	(0.15)	(0.12)	(0.09)	(0.09)
Turnover $_{t-1}$	0.03	0.06	0.04	0.02	0.02	0.06	0.03	0.02
	(0.67)	(2.07)	(1.20)	(1.12)	(0.40)	(2.10)	(0.75)	(1.85)
Total load $_{t-1}$	0.13	0.14	0.13	0.15	0.18	0.13	0.15	0.11
	(1.50)	(1.05)	(0.70)	(1.08)	(1.28)	(1.23)	(0.86)	(1.59)
Fund return $_{t-1}$	0.52	0.34	0.41	0.36	0.45	0.33	0.18	0.20
	(4.02)	(5.21)	(3.20)	(5.12)	(5.23)	(2.17)	(4.13)	(2.76)
Log age $_{t-1}$	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.30)	(0.41)	(0.31)	(0.97)	(0.47)	(0.68)	(0.60)	(0.57)
Fund flow $_{t-1}$	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01
	(0.65)	(0.62)	(0.28)	(0.52)	(0.93)	(0.73)	(0.31)	(0.76)
Family flow $_{t-1}$	0.10	0.11	0.05	0.03	0.08	0.14	0.07	0.03
	(2.71)	(1.37)	(1.77)	(1.23)	(1.56)	(3.08)	(2.16)	(0.62)
Funds in family $_{t-1}$	0.07	0.02	0.04	-0.08	0.08	0.03	0.04	-0.11
	(1.10)	(0.49)	(0.57)	(1.21)	(2.30)	(0.49)	(1.27)	(1.94)
Adjusted R^2	11.04	12.12	13.99	14.32	14.74	11.26	10.73	12.31

Panel C: Net Fund Return 2nd Stage

Dependent variable: Net fund return$_t$								
	Before FD: 1992-1999				After FD: 2001-2010			
	Market -adj	Beta-adj	3-factor	4-factor	Market-adj	Beta adj	3-factor	4-factor
Family size from 1st stage $_{t-1}$	0.04	0.08	0.01	0.08	-0.02	-0.02	-0.02	-0.07
	(1.26)	(1.78)	(0.80)	(1.61)	(0.94)	(0.86)	(0.77)	(1.50)
Log fund size $_{t-1}$	-0.16	-0.17	-0.18	-0.14	-0.15	-0.13	-0.14	-0.09
	(3.51)	(2.21)	(2.73)	(1.71)	(3.99)	(1.92)	(2.66)	(1.49)
Expense ratio $_{t-1}$	-0.08	-0.06	-0.07	-0.04	-0.04	-0.03	-0.06	-0.02
	(1.47)	(1.03)	(1.37)	(1.13)	(1.06)	(2.32)	(1.66)	(1.19)
Turnover $_{t-1}$	0.03	0.03	0.04	0.05	0.02	0.03	0.04	0.06
	(0.55)	(0.38)	(0.58)	(1.38)	(0.93)	(1.04)	(1.08)	(1.16)
Total load $_{t-1}$	0.06	0.16	0.07	0.10	0.10	0.13	0.11	0.08
	(1.33)	(1.49)	(0.69)	(0.69)	(1.24)	(0.90)	(1.11)	(0.93)
Fund return $_{t-1}$	0.35	0.37	0.25	0.27	0.39	0.32	0.25	0.29
	(4.46)	(8.09)	(6.39)	(2.43)	(8.52)	(4.46)	(2.50)	(2.83)
Log age $_{t-1}$	-0.01	-0.01	0.01	0.01	-0.01	-0.01	0.01	0.01
	(0.51)	(0.70)	(0.51)	(0.36)	(0.83)	(0.43)	(0.26)	(0.32)
Fund flow $_{t-1}$	0.02	0.05	0.05	0.03	0.02	0.04	0.07	0.03
	(0.46)	(0.68)	(1.25)	(0.52)	(0.47)	(0.45)	(1.32)	(0.47)
Family flow $_{t-1}$	0.07	0.14	0.07	0.03	0.10	0.08	0.05	0.04
	(2.24)	(2.40)	(1.42)	(1.41)	(2.49)	(2.32)	(1.28)	(1.09)
Funds in family $_{t-1}$	0.08	0.03	0.03	-0.12	0.07	0.03	0.04	-0.14
	(2.25)	(0.48)	(0.72)	(1.35)	(1.75)	(0.59)	(0.69)	(2.30)
Adjusted R^2	13.18	14.62	15.81	15.85	11.22	11.38	13.17	15.48

Table IX
Fund Family Size and Performance across Size Partitions

This table reports coefficients for instrument variable 2SLS regressions relating fund performance to family size, which replicate the regression models in Table VIII, with the sample partitioned by fund family size in month *t*-1. The full sample and two subsamples are considered, including and excluding funds with overlapping management objectives in the same fund family. The variables are as previously defined. Net fund returns are fund returns net of management and marketing fees adjusted using the 4-factor model. The table reports standardized regression coefficients with t-statistics reported in brackets. The regressions include year fixed effects and standard errors are clustered by fund. In Panel B, coefficient values for the control variables are suppressed in the interest of brevity.

Panel A: Full Sample

	Dependent variable: Net fund return$_t$									
	Before FD					After FD				
Family size quintile	Small	2	3	4	Large	Small	2	3	4	Large
Mean log family size	3.09	6.30	8.85	10.63	13.79	3.07	6.47	7.06	9.65	14.45
Number of families	74	74	74	74	75	101	101	101	102	102
Number of funds	102	156	251	369	492	151	214	322	581	696
Family size 1st stage $_{t-1}$	0.06	0.09	0.07	0.07	0.09	-0.06	-0.07	-0.05	-0.06	-0.09
	(1.21)	(1.69)	(1.32)	(1.54)	(1.71)	(1.37)	(1.71)	(1.36)	(1.65)	(1.82)
Log fund size $_{t-1}$	-0.17	-0.10	-0.20	-0.14	-0.13	-0.16	-0.16	-0.13	-0.10	-0.22
	(2.12)	(1.05)	(2.37)	(1.89)	(1.51)	(1.89)	(1.92)	(1.20)	(1.13)	(2.41)
Expense ratio $_{t-1}$	-0.05	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.01
	(1.88)	(1.70)	(1.37)	(1.69)	(1.72)	(1.00)	(1.32)	(1.66)	(1.68)	(0.50)
Turnover $_{t-1}$	0.06	0.03	0.05	0.05	0.06	0.08	0.04	0.06	0.05	0.06
	(1.73)	(1.28)	(1.51)	(1.71)	(1.80)	(1.20)	(1.46)	(1.64)	(1.52)	(1.46)
Total load $_{t-1}$	0.12	0.13	0.10	0.08	0.10	0.11	0.07	0.05	0.05	0.09
	(1.40)	(1.17)	(1.25)	(0.52)	(0.85)	(0.93)	(1.10)	(0.91)	(0.62)	(0.80)
Fund return $_{t-1}$	0.39	0.35	0.36	0.29	0.27	0.40	0.33	0.26	0.27	0.28
	(5.63)	(3.08)	(4.69)	(2.40)	(2.86)	(5.25)	(5.72)	(3.37)	(3.93)	(2.78)
Log age $_{t-1}$	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	(0.35)	(0.21)	(0.16)	(0.29)	(0.93)	(0.27)	(0.18)	(0.17)	(0.20)	(0.63)
Fund flow $_{t-1}$	0.04	0.03	0.04	0.03	0.03	0.05	0.03	0.04	0.03	0.03
	(0.50)	(0.55)	(0.22)	(0.21)	(0.20)	(0.58)	(0.53)	(0.26)	(0.23)	(0.18)
Family flow $_{t-1}$	0.04	0.04	0.03	0.03	0.04	0.06	0.05	0.06	0.04	0.04
	(1.52)	(2.41)	(1.45)	(0.76)	(1.89)	(1.29)	(1.45)	(1.52)	(0.54)	(1.46)
Funds in family $_{t-1}$	-0.13	-0.11	-0.12	-0.13	-0.14	-0.11	-0.14	-0.15	-0.14	-0.21
	(1.05)	(0.68)	(1.12)	(1.79)	(1.11)	(1.64)	(1.70)	(2.00)	(2.22)	(2.63)
Adjusted R^2	16.11	13.74	15.71	12.45	13.56	16.22	16.48	12.80	13.13	11.60

Panel B: Subsamples before FD

	Dependent variable: Net fund return$_t$				
Family size quintile	Small	2	3	4	Large
Partition 1: Funds with overlapping management objectives in the same family					
Mean log family size	3.33	6.00	8.87	8.91	11.71
Number of families	53	53	53	53	54
Number of funds	77	97	183	250	351
Family size from 1st stage $_{t-1}$	0.07	0.06	0.05	0.04	-0.10
	(1.69)	(1.68)	(1.35)	(1.35)	(2.17)
Active share $_{t-1}$	0.20	0.06	0.08	0.07	0.15
	(3.31)	(1.63)	(1.92)	(1.86)	(2.42)
Partition 2: Funds without overlapping management objectives in the same family					
Mean log family size	2.98	5.57	8.84	10.87	14.09
Number of families	21	21	21	21	21
Number of funds	25	59	68	119	141
Family size from 1st stage $_{t-1}$	0.03	-0.03	0.04	-0.07	0.05
	(1.11)	(1.15)	(1.25)	(1.67)	(1.26)
Active share $_{t-1}$	0.19	0.09	0.07	0.09	0.15
	(2.88)	(1.93)	(1.81)	(2.07)	(2.43)

Panel C: Subsamples after FD

Dependent variable: Net fund return$_t$					
Family size quintile	Small	2	3	4	Large
Partition 1: Funds with overlapping management objectives in the same family					
Mean log family size	2.92	6.09	7.80	10.73	12.99
Number of families	69	69	69	69	70
Number of funds	112	153	253	499	566
Family size from 1st stage $_{t-1}$	0.03	0.05	0.04	-0.09	-0.28
	(0.50)	(1.31)	(1.66)	(1.81)	(3.71)
Active share $_{t-1}$	0.27	0.07	0.10	0.09	0.13
	(3.41)	(1.84)	(2.15)	(1.91)	(2.42)
Partition 2: Funds without overlapping management objectives in the same family					
Mean log family size	3.07	6.42	7.80	10.55	13.85
Number of families	32	32	32	33	32
Number of funds	39	60	69	82	130
Family size from 1st stage $_{t-1}$	-0.02	-0.02	-0.04	-0.06	-0.07
	(0.85)	(1.06)	(1.17)	(1.53)	(1.73)
Active share $_{t-1}$	0.22	0.06	0.08	0.11	0.14
	(3.30)	(1.46)	(1.97)	(2.10)	(2.47)