PERFORMANCE COMPARISON OF INSTITUTIONAL AND RETAIL MUTUAL FUNDS USING MULTIFACTOR MODELS

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Web Appendix

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Performance Comparison of Institutional and Retail Mutual Funds using Models

Multifactor

APPENDIX A. Tables for measures of fund performance and differences in measures.

The following tables show performance comparison results with each model. The regression equations referenced in the study for the models used are as follows:

$$\text{CAPM} : R_{it}-R_{ft} = \alpha_i + \beta_i(R_{mt}-R_{ft}) + \varepsilon_{it} \quad (4)$$

$$\text{FF3F} : R_{it}-R_{ft} = \alpha_i + \beta_{0i}(R_{mt}-R_{ft}) + \beta_{1i}\text{SMB} + \beta_{2i}\text{HML} + \varepsilon_{it} \quad (5)$$

$$\text{C4F} : R_{it}-R_{ft} = \alpha_i + \beta_{0i}(R_{mt}-R_{ft}) + \beta_{1i}\text{SMB} + \beta_{2i}\text{HML} + \beta_{3i}\text{MOM} + \varepsilon_{it} \quad (6)$$

where

β_i and β_{0i} are fund betas, in the CAPM and the multifactor models, respectively,

R_{it} and R_{ft} are a fund's monthly return¹, the monthly risk-free rate² at time t ,

$R_{it}-R_{ft}$ is fund's risk premium at time t ,

$R_{(mt)}$ is the monthly return on the fund's benchmark at time t ,

$R_{(mt)}-R_{(ft)}$ is the market risk premium at time t ,

SMB_t^3 is the difference in return between a **small cap portfolio** and a **large cap portfolio** at time t ,

HML_t is the difference in return at time t between a portfolio containing '**value**' stocks (with a high book-to-market ratio) and one consisting of '**growth**' stocks with a (low book-to-market ratio).

CAPM, FF3F and C4F are Capital Asset Pricing Model, Fama-French Three-Factor Model and Carhart Four-Factor model, respectively.

In the following tables, "difference" is simply the difference between the slope coefficients of institutional and retail funds for a given category obtained by least squares regression (equations (4), (5) and (6) above). The significance of the difference in regression coefficients in each category was tested by computing the p value for the test statistic for the difference ($=d/se_d$) where d is the difference in slopes ($=b_1 - b_2$), and se_d is the standard error of the difference; without assuming homogeneity of the error variances and with large samples (each $n > 25$), $se_d = \sqrt{(s_{b1})^2 + (s_{b2})^2}$, where s_{b1} , s_{b2} are the standard errors of the slope coefficients b_1 and b_2 , respectively. Statistically significant coefficients or differences are indicated by (***) (** or *) depending on the level of significance specified below each of the following tables.

Table A-1. Overall performance comparisons results with each model.

(a) Results with CAPM

Fund class	Alpha	Market	R²_{adj}
Institutional	0.142	1.070 ***	0.854
Retail	0.074	1.014 ***	0.873
<i>Difference</i>	0.068 *	0.056	-0.020

(b) Results with Fama-French Three Factor Model

Fund class	Alpha	Market	SMB	HML	R²_{adj}
Institutional	0.132	1.029 ***	0.232 ***	0.002	0.859
Retail	0.096	0.964 ***	0.316 ***	-0.028	0.890
<i>Difference</i>	0.036	0.065	-0.084 *	0.031	-0.031

(c) Results with Carhart Four Factor Model

Fund class	Alpha	Market	SMB	HML	Mom	R²_{adj}
Institutional	0.133	1.003 ***	0.236 ***	-0.057 **	-0.090 *	0.864
Retail	0.096	0.942 ***	0.319 *	-0.079	-0.077 *	0.894
<i>Difference</i>	0.037	0.061	-0.083 *	0.022	-0.013	-0.030

***=significant at the 1% level, **=significant at the 5% level, *=significant at the 10% level

Table A-2. Results by size categories with each model.

(a) Results by size categories with CAPM

Fund

category/class	Alpha	Market	R²_{adj}
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Large Cap

Institutional	0.238 *	0.935 ***	0.894
Retail	0.030	0.971 ***	0.896
<i>Difference</i>	0.208 **	-0.036 *	-0.003

Midcap

Institutional	0.134	1.028 ***	0.807
Retail	0.165	1.035 ***	0.714
<i>Difference</i>	-0.030	-0.008	0.093

Small Cap

Institutional	0.171	0.849 ***	0.787
Retail	0.145	0.889 ***	0.895
<i>Difference</i>	0.026	-0.041	-0.108

(b) Results by size categories with the Fama-French Three Factor Model

Fund

category/class	Alpha	Market	SMB	HML	R^2_{adj}
Large Cap					
Institutional	0.223 *	0.949 ***	0.120 *	-0.018 **	0.895
Retail	0.015	0.979 ***	0.026 *	-0.059	0.882
<i>Difference</i>	0.208 **	-0.029 *	0.094	0.041	0.896

Midcap

Institutional	0.090	1.009 ***	0.120 **	-0.018 *	0.819
Retail	0.110 *	1.009 ***	0.335 *	-0.155	0.882
<i>Difference</i>	-0.020	0.000	-0.215 *	0.137	0.725

Small Cap

Institutional	0.166 *	0.871 ***	0.120 ***	-0.018	0.784
Retail	0.114 *	0.924 ***	-0.076 ***	-0.083	0.882
<i>Difference</i>	0.053	-0.053	0.196	0.065	0.895

(c) Results by size categories with Carhart Four Factor Model

Fund/category	Alpha	Market	SMB	HML	MOM	R²_{adj}
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Large Cap

Institutional	0.223 *	0.939 ***	-0.052 *	-0.131 ***	-0.074 **	0.900
Retail	0.016	0.958 ***	0.028	-0.105	-0.069	0.899
<i>Difference</i>	0.207 **	-0.019 **	-0.080 **	-0.027 **	-0.005 **	0.001

Midcap

Institutional	0.091	0.983 ***	0.264 ***	-0.198 **	-0.090 *	0.824
Retail	0.108	0.996 ***	0.336 *	-0.197	-0.060 *	0.724
<i>Difference</i>	-0.017	-0.013	-0.071	-0.001	-0.030	0.099

Small Cap

Institutional	0.167 *	0.836 ***	-0.046 ***	-0.095	-0.134 **	0.794
Retail	0.114 *	0.899 ***	-0.051 ***	-0.144	-0.096 **	0.901

<i>Difference</i>	0.053	-0.063	0.006	0.049	-0.038	-0.107
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***=significant at the 1% level, **=significant at the 5% level, * =significant at the 10% level

Table A-3. Results by book-to-market ratio (BM) categories.

(a) Results by BM categories with CAPM

Fund

category/class	Alpha	Market	R^2_{adj}
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Value

Institutional	0.179 *	0.969 ***	0.893
Retail	0.243 *	1.009 ***	0.874
<i>Difference</i>	-0.064	-0.039	0.019

Blend

Institutional	0.173 *	0.988 ***	0.922
Retail	0.095	1.003 ***	0.867
<i>Difference</i>	0.078	-0.015	0.054

Growth

Institutional	0.029	1.071 ***	0.803
Retail	0.058	1.013 ***	0.831
<i>Difference</i>	-0.029	0.058	-0.028

(b) Results by BM categories with the Fama-French Three Factor Model

Fund

category/class	Alpha	Market	SMB	HML	R^2_{adj}
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Value

Institutional	0.178 *	0.941 ***	0.120 ***	-0.018 ***	0.894
Retail	0.202 *	0.967 ***	0.352 ***	-0.062 **	0.882
<i>Difference</i>	-0.024	-0.025	-0.232	0.043	0.895

Blend

Institutional	0.163 *	0.970 ***	0.120 **	-0.018	0.923
Retail	0.084	0.949 ***	0.293 ***	0.013	0.882
<i>Difference</i>	0.079	0.022	-0.173 **	-0.032	0.882

Growth

Institutional	0.005	1.021 ***	0.120 ***	-0.018 ***	0.820
Retail	0.046	0.958 ***	0.329 ***	-0.013 ***	0.882
<i>Difference</i>	-0.041	0.063	-0.208	-0.005	0.848

(c) Results by BM categories with the Carhart Four Factor Model

Fund/category	Alpha	Market	SMB	HML	MOM	R²_{adj}
Value						
Institutional	0.178 *	0.906 ***	0.133 ***	-0.067 *	-0.136 **	0.907
Retail	0.200 *	0.933 ***	0.356 ***	-0.125	-0.111 ***	0.903
<i>Difference</i>	-0.022	-0.027 **	-0.223	0.059	-0.025	0.003
Blend						
Institutional	0.164 *	0.954 ***	0.123 *	-0.055	-0.056 **	0.925

Retail	0.085	0.929 **	0.296 ***	-0.031	-0.067 **	0.885
<i>Difference</i>	0.079	0.025	-0.174	-0.024	0.011	0.041

Growth

Institutional	0.008	1.003 ***	0.326 ***	-0.134 ***	-0.057	0.821
Retail	0.048	0.941 ***	0.332 ***	-0.057 ***	-0.060	0.849
<i>Difference</i>	-0.041	0.062	-0.005	-0.077	0.003 **	-0.029

***=significant at the 1% level, ** =significant at the 5% level, * =significant at the 10% level

APPENDIX B. Fund Categories and benchmarks

Morningstar's style classification allocates funds into different categories based on fund's investment methodology and the market capitalization of the companies in which it invests. It places the funds in large-cap, medium-cap or small-cap based on the market capitalization of the equities they hold. Funds are characterized as growth oriented, value oriented and blend. The combination of orientation and market capitalization yields nine categories: Large-Cap Growth, Mid-Cap Growth and Small-Cap Growth; Large-Cap value, Mid-Cap Value and Small-Cap Value; Large-Cap Blend, Mid-Cap Blend and Small-Cap Blend. To make classification consistent with the multifactor models used in the study, Morningstar style box is used with modification: funds are evaluated in three size categories and in three book-to-market (BM) categories instead of in each of the nine categories the Morningstar style box produces.

Table B-1a. Morningstar Style Box

	Market Cap (size)
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			Large
			Midcap
			Small
BM:	Value	Blend	Growth

Table B-1b. Classification of funds for this study (based on Morningstar style box)

(i)				(ii)			
			Large				
			Midcap				
			Small				
				Value	Blend	Growth	

Table B-2. Appropriate benchmarks⁴ for each fund category.

Fund Category

Relevant benchmark

By market capitalization (size)

Large Cap

Russell 1000 index

Mid-Cap	Russell Midcap index
Small Cap	Russell 2000 index
<u>By Book-to-Market ratio (BM)</u>	
Value	Russell 3000 Value index
Blend	Russell 3000 index
Growth	Russell 3000 Growth index

¹ Computed using Mutual Fund Historical Data. Retrieved from <https://finance.yahoo.com/>

² Monthly yield on Three-month Treasury Bill-Secondary Market rate. Retrieved from <https://fred.stlouisfed.org/series/TB3MS>

³ SMB, HML and MOM factors for the U.S. equity markets are obtained from Kenneth R. French Data Library. Retrieved from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

⁴ The FTSE Russell. Russell US Style Indexes. Retrieved from <http://www.ftse.com/products/indices/russell-us-style>