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Predictability of Korean mutual fund performance

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Abstract

In this article, we examine the persistence in the performance of South Korean equity mutual funds between 1990 and 2023. South Korea has the second largest number of mutual funds registered globally after the US; it has more funds domiciled than the UK or Japan. The country is the world's 12th-biggest economy, in the following five years; it is set to make the 10th-biggest contribution to global growth, more than France or Italy and approximately the same as the UK. Using a daily return sample, we show a strong existence of performance persistence in the South Korean mutual fund market during the 33-year sample period included in our study. We find this result using a non-parametric methodology based on contingency tables checked by statistical tests, which show statistical significance at 1%.

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1. Introduction

The main objective of this article is to examine the evolution of the mutual fund industry in South Korea and the level of persistence of equity mutual funds profitability. We use the non-parametric technique of contingency tables and contrast statistics. Although these studies have been widely disseminated in more developed financial markets, there are no similar studies in South Korea.

The studies on this matter have been mainly carried out on the mutual fund market in the US, Malkiel (1995), Brown and Goetzman (1995), Carhart (1997) and Teo and Woo (2001) evaluated the persistence of performance using contingency tables. Classical studies on persistence include Sharpe (1966), Jensen (1968), Carlson (1970), McDonald (1974), Shawky (1982), Chang and Lewellen (1984), Henriksson (1984), Lehmann and Modest (1987), and Kahn and Rudd (1995). Among the more recent studies of persistence, we can point out those of Agarwal and Naik (2000), Jain and Wu (2000), Droms and Walter (2001), Davis (2001), Ibbotson and Patel (2002), Wermers (2003), Capocci and Hübner (2004), Capocci, Corhay and Hübner (2004), Keswani and Stolin (2006), and Boyson (2008). In Europe, Otten and Bams (2002) and Vidal-García (2013) examine persistence in performance, while Vidal-García et al. (2016) and Vidal and Vidal-García (2024) test for persistence globally and in Indonesia, respectively, also employing contingency tables. Evidence about performance persistence is mixed both in the U.S. and in Europe with some studies stating that there is performance in the U.S. while others explain that is only partial and due to some periods or the worst performing funds. In Europe, the UK seems to present evidence of persistence in most studies while other countries present mixed evidence.

Carhart (1997) explains that frequent factors in stock returns and investment expenses almost completely explain the persistence in equity mutual funds´ risk-adjusted returns. He shows that the only significant persistence not explained is focused on underperformance by the worst-return mutual funds. Otten and Bams (2002) show that most European funds provide only weak evidence of persistence in performance, except for UK funds. They find strong persistence in mean returns for funds investing in the United Kingdom. France

Germany and Italy still exhibit weak or no persistence. Vidal-García et al. (2016) examine the short-term persistence of equity mutual funds around the world; they find robust evidence of persistence using daily mutual fund returns during quarterly measurement intervals, although persistence is much more pronounced for the top and bottom countries. However, the post-ranking abnormal return disappears when performance is examined over longer periods. Vidal and Vidal-García (2024) show strong evidence of persistence in Indonesian mutual fund performance across all investment style portfolios.

South Korea is the country with the second largest number of mutual funds registered globally after the US; it has more funds domiciled than the UK or Japan (see Table I for statistics). South Korea is the world's 12th-biggest economy, in the following five years; it is set to make the 10th-biggest contribution to global growth, more than France or Italy and approximately the same as the UK.

The rest of this article is structured as follows. Section II introduces the data and the variables used in the study. Section III presents the methodology. Section IV shows the main empirical results. Finally, Section V offers concluding comments. Tables and figures are included in the appendix.

2. Data and Summary Statistics

2.1 Data

Our sample consists of daily returns of 1,385 actively managed equity mutual funds. All returns include any dividend paid. The returns are net of fund performing fees, which imply that management and distribution fees are incorporated, but not sales loads. Our time interval is a 33 years starting on January 1st, 1990, and ending on December 31, 2023. We obtain return data from the Morningstar Direct database. Our sample of equity funds covers above 95% of the total net assets of equity funds. See Hammouda et al. (2023) and El

Ammari, Vidal, and Vidal-García (2023) for daily equity mutual fund performance in Europe, or Vidal-García et al. (2016) for a global sample.

We remove the following categories of funds from our dataset: sector funds (e.g. real estate or industry funds), index tracking funds, fixed income and money market funds, international equity funds, funds that buy non-equity instruments such as convertible fixed income, or funds that transform to one of these categories over the time horizon of the study. Although, we incorporate merged and liquidated funds in the dataset. Additionally, we employ several filters to the fund dataset. First, we limit the study to equity funds with at least 24 months of observations, as we need a sufficient return history to successfully run a factor model regression. Second, we limit the sample to open-end national equity funds as we are only interested in mutual funds that operate within the country.

Survivorship bias is an important concern in mutual fund literature as explained broadly in earlier papers (see Elton et al. (1996), Elton, Gruber, and Blake (1996), and Carhart (1997)). The survivorship bias is a characteristic of the sample selection technique and is the result of incorporating in a dataset exclusively surviving funds. To solve this issue, we incorporate dead funds in our dataset until they stop operations, afterwards, the portfolios are re-weighted with the remaining funds. Another important characteristic to consider in our study to test persistence is the look-ahead bias. This is the consequence of disappearing funds from the dataset that do not continue operations after the ranking period. We employ a full look-ahead bias approach in our dataset construction, this means that we exclude disappearing funds previous to the ranking process commences, excluding returns with less than 20 months´ worth of observations.

2.2 Descriptive Statistics

Table I shows the summary statistics of the sample for South Korea and other countries around the world for comparison purposes; we include other countries according to the

mutual funds´ market capitalization. Our dataset is, to the best knowledge, the biggest and most comprehensive sample for daily mutual fund returns in existence for South Korea.

The second column of Table I shows the number of mutual funds per country, the third column presents the mean raw returns, the fourth column reports the mean market value of assets, and the fifth column shows the mean number of years since a fund starts operations. The US (8,552) has the largest number of mutual funds investing in domestic equity, while Hong Kong (20) has the smallest number.

Table II presents descriptive statistics of the fund return distributions; we show the mean (μ), standard deviation (σ), Skewness (S), and excess kurtosis (K) using daily and monthly data. Returns are negative in both situations. Standards deviations are sufficiently large, suggesting that stocks are volatile and prices go up and down frequently. The negative skewness of the distribution implies that an investor may expect frequent small gains and a few large losses. Kurtosis is positive, in this sense greater positive kurtosis and more negative skewness mean an increased risk due to a fatter left tail, suggesting a higher probability of extremely large, negative outcomes.

3. Methodology

To determine the possible existence of performance persistence in portfolio management we compare the level of performance achieved by mutual funds in consecutive periods using a non-parametric technique consisting on contingency tables and contrast statistics. This methodology compares the performance rankings in two consecutive periods, distinguishing in both periods' two portfolio subsets, winners and losers, and comparing each fund return with the average. A fund is a winner if the performance is above the average and it is a loser if it is below this average. Thus, funds are classified as WW if they are winners in two consecutive periods, LL if they are losers in two consecutive periods, WL if they are winners in one period and losers in the following and LW if they are losers in one period and winners in the next.

We apply Malkiel's (1995), Brown and Goetzmann´s (1995), and Kahn and Rudd´s (1995) statistical tests to determine the significance level of the persistence phenomenon. The expression of the Z-statistic of Malkiel (1995) is as follows:

$$Z = (y - np) / \sqrt{np(1-p)} \quad (1)$$

where Z represents the statistic that follows a normal distribution (0,1), y is the number of winning portfolios in two consecutive periods, n is WW + WL and p has a value of 0.5. With this statistical contrast, we intend to analyze whether this probability is true. Thus, it is assuming a hypothesis of neutrality regarding performance persistence, since the fact that p is 0.5 means that a winning portfolio in a certain period presents the same probability of being either a winner or a loser in the following period.

If Z is a positive value then there is persistence in efficiency, while if Z takes a negative value there is no persistence. Furthermore, to have evidence of persistence, p should be a value as small as possible. In general, the relevant values of statistical significance are the levels of 1% and 5%, so if the probability value, obtained from the table of N (0,1), is less than 5% the contrast is robust, and if it is less than 1% this contrast will be even more statistically significant.

In a second test statistic, we estimate the cross-product ratio (CPR), which is also known as the Odds Ratio (see Brown and Goetzmann (1995)). The CPR is determied as:

$$CPR = (WW \times LL) / (LW \times WL) \quad (2)$$

A CPR higher than one suggests persistence performance, and a value lower than one indicates a reversal in performance. A Z-statistic is estimated from this value, which also follows a normal distribution (0,1) so that the same procedure indicated above will be followed to analyze the robustness of persistence.

The final statistical test is the Chi-square statistic, created by Kahn and Rudd (1995). The Chi-square statistic is estimated as:

$$Chi = (WW-D1)^2/D1 + (WL-D2)^2/D2 + (LW-D3)^2/D3 + (LL-D4)^2/D4 \quad (3a)$$

where:

$$D1 = (WW+WL) \times (WW+LW)/N \quad (3b)$$

$$D2 = (WW+WL) \times (WL+LL)/N \quad (3c)$$

$$D3 = (LW+LL) \times (WW+LW)/N \quad (3d)$$

$$D4 = (LW+LL) \times (WL+LL)/N \quad (3e)$$

N represents the number of funds. The null hypothesis of the Chi-Square test is that no relationship exists between the categorical variables in the sample; they are independent. Carpenter and Lynch (1999) point out that the Chi-squared test is well-specified, high-powered, and more robust to the existence of survivorship bias in contrast to other measures of performance.

4. Results

4.1 Main Results

Our analysis has been carried out based on the daily returns for each mutual fund. We have included existing funds to avoid survival biases. We estimate the quarterly returns of mutual funds and then we classify those funds in contingency tables in order to identify WW, WL, LL, and LW funds. The identification of Winning (W) or Losing (L) funds was performed by applying the methodology already explained every quarter.

The results of the non-parametric contingency table are presented in Table III. The table presents the repeat winning and repeat losing proportion of funds as well as its significance, and those that are winning in one period and losers in the other period. We can observe

strong evidence of persistence in mutual fund performance. In this situation, winners will likely repeat as winners, and losers will repeat as losers or will stop operations, as the proportion of funds remaining as winners or losers is greater than the proportion of funds that modify their position, which shows that mutual fund performance during the second period relies on the performance in the earlier period. From the test statistics, we reject the hypothesis of no persistence; all statistical tests show statistical significance at the 1% level. Thus, in comparison to the evidence of earlier articles that show persistence focused mainly on the poor-performing funds, we show that persistence in South Korean funds is present in the top-performing funds and underperforming funds.

Table IV shows our analysis divided into several subperiods. There is no strong evidence of persistence up to the year 2000. South Korean funds still show performance persistence but the evidence is weak, the situation changes from the year 2000 onwards with stronger evidence for both top and underperforming funds. We find evidence of significance for all subperiods.

Table V shows the results of the same analysis using monthly returns instead of daily observations. We also find evidence of persistence employing monthly data. The results of persistence are slightly stronger compared to the contingency table of daily returns and statistical significance is also more pronounced.

Our results indicate that the future behavior of equity mutual fund profitability in the South Korean market is possible to predict based on the returns of funds in the previous year. Thus, if the performance of mutual funds is lower than the average in one year (Losers), it can be predicted that the behavior in the following year will also be lower and vice versa. Consequently, earlier fund performance evidence is beneficial to implement investment strategies to obtain larger returns. An additional issue to consider for potential investors is the expense ratio of each fund as compared to their competitors in South Korea, as Vidal et al. (2015) explain fees are negatively associated with return predictability.

4.2 Comparison of South Korea with the rest of the World

We find significantly positive performance in comparison to other authors who show negative performance for US mutual funds, for instance, Fama and French (2010), similar relevant studies for European funds, Otten and Bams (2002) find positive performance for France, Italy, UK and Netherland and negative performance for Germany. In this sense, Vidal-García et al. (2016) find positive performance for 21 out of 35 countries worldwide. However, the average performance for South Korea is significantly more positive than most countries that also show a positive performance over the same sample period.

We show strong evidence of short-term persistence for South Korean funds, similar to Bollen and Busse (2005) who find short-term persistence for US funds, or Vidal-García et al. (2016) who find short-term persistence for funds around the world. Employing monthly data, Otten and Bams (2002) do not show persistence for France, Germany, and Italy; instead, they find robust evidence of persistence for the UK. Carhart (1997) finds performance persistence for US funds during the period 1963-1993, however, Choi and Zhao (2020) find that significant performance persistence does not exist in the 1994-2018 interval, they point out that the disappearance of significant performance persistence is due to lower returns to favorable styles.

4.3 Robustness Analysis

Standard measures of performance support several biases, employing unconditional models may lead to unreliable inference regarding mutual fund returns performance. Employing several variables for the time-varying expectations, we account for predetermined information and minimize this origin of bias. The expected returns and risks are conditioned on publicly accessible information. In this context, De Souza and Lynch (2012) explain that the conditional performance of mutual funds fluctuates with the business cycle, and Kosowski et al. (2006) find that unconditional performance models underrate the value generated by actively managed funds in recession intervals. Conditional asset pricing

models can estimate the cross-section of returns better than unconditional ones (see for instance Cochrane (1992), and Jagannathan and Wang (1996)).

To examine our results we estimate a conditional version of the four-factor Carhart model:

Z_t represents a vector of variables for the information available at time t and b_i (Z_t) represents time t conditional betas, as Ferson and Schadt (1996) we estimate their function linearly:

$$b_i(Z_t) = b_0 + B' z_{t-1} \quad (4)$$

where $z_{t-1} = Z_{t-1} - E(Z)$ represents a vector of the deviation of Z from the unconditional means. We presume that market prices incorporate accessible public information, as estimated by the vector of predetermined variables, Z_t. We employ four publicly accessible conditioning state variables in our evaluation: (1) a Treasury bill spread (the difference between long- and short-term government bond yields), (2) dividend yield, (3) a corporate bond yield spread (the difference between low- and high-quality corporate bonds), and (4) the yield on a 3-month Treasury bill.

We examine the persistence of alphas using contingency tables. We find that fund performance persistence does not change when the conditional measures are included. The significance is more robust than the previously found with unconditional models. Similarly to the results found with the unconditional model, evidence is robust for all subperiods (with statistical significance Chi-square at the 5% level). We omit the tables for brevity.

5. Conclusion

In this article, we examine the persistence in the performance of South Korean equity mutual funds between 1990 and 2023. Using a daily return sample, we show a strong existence of performance persistence in the South Korean mutual fund market during the

33-year sample period included in our study. We find this result using a non-parametric technique based on contingency tables verified by statistical tests, which show statistical significance at 1% level.

Our results persist when we analyze different subperiods of our sample and when we employ monthly data in the contingency tables test instead of daily returns. Thus, the information content of the performance history is not affected by the return value employed or by the performance persistence interval considered. Therefore, we can conclude that the South Korean market for equity funds in recent years has been quite predictable. The previous performance of South Korean mutual funds has explanatory power for future performance, winners´ funds in one year will continue to be winners in the following year, and losing funds in a given year will continue in that condition next year. Additionally, we employ conditioning information in performance measurement; our results show that conditional measures present stronger significance about future performance than unconditional measures. Conditional alphas show stronger evidence of performance persistence for all subperiods.

Our findings may have important and profound implications for investor decisions regarding South Korean equity mutual funds. Potential investors can obtain helpful evidence from previous performance data. To know the funds that will be most attractive in terms of performance in the near future, it would only be sufficient to review their previous performance.

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Appendix: Tables

Table I: Summary Statistics

This table shows summary statistics on our mutual fund dataset. The study period is from January 1990 to December 2023. The first column shows the number of actively managed equity mutual funds. Raw Return shows the mean daily fund return for the whole sample period. TNA means the total net assets for the entire dataset and is stated in millions of dollars. Fund age means the number of years since the fund was created.

Country	Number of Funds	Raw Return (%)	TNA ($ million)	Fund Age (years)
Australia	1,268	0.821	313	13
Austria	25	-0.031	220	12
Belgium	40	0.020	129	19
Brazil	127	1.050	154	9
Canada	1,302	0.153	534	10
Chile	74	-0.221	67	9
China	760	-0.595	456	4
Denmark	83	0.411	150	13
Finland	64	0.058	207	12
France	1,283	0.138	114	10
Germany	106	-0.094	828	17
Hong Kong	20	-0.770	738	13
India	630	0.904	13	7
Indonesia	143	0.289	147	6
Ireland	43	0.274	133	3
Israel	215	0.058	17	12
Italy	87	0.152	190	16
Japan	1,316	-1.080	124	12
Korea (South)	**1,385**	**-0.132**	**112**	**6**
Luxembourg	22	-0.365	655	12
Malaysia	267	0.112	112	13
Netherlands	36	-0.483	360	16
New Zealand	25	0.511	203	9
Norway	143	0.031	300	15
Poland	102	-0.963	150	7
Portugal	30	-0.131	24	16
Singapore	24	-0.460	192	14
South Africa	354	-0.480	195	9
Spain	189	-0.441	57	15
Sweden	251	-1.070	600	12
Switzerland	259	-0.780	395	8
Taiwan	325	0.646	74	13
Thailand	311	0.362	87	10
U.K.	1,290	-0.300	1,048	13
U.S.	8,552	0.140	3,061	12
All countries	21,150	-0.065	12,277	11

Table II: Descriptive Statistics

This table presents descriptive statistics of the fund return distributions. The mean (μ) and standard deviation (σ) represent sample estimates. Skewness (*S)* is calculated as:

$$S = \frac{1}{\sigma^3 \ T} \sum_{t=1}^{T} (R_t - \mu)^3$$

and excess kurtosis (*K)* is calculated as:

$$K = \frac{1}{\sigma^4 \ T} \sum_{t=1}^{T} (R_t - \mu)^4 - 3$$

	μ		σ		*S*		*K*	
	Daily	Monthly	Daily	Monthly	Daily	Monthly	Daily	Monthly
Korea (South)	-0.132%	-0.074%	0.609%	5.021%	-2.305	-1.921	47.142	6.324

Table III: Performance Persistence Based on Contingency Table

This table presents the proportion of funds that were winners in the two-time intervals (WW), winners then losers (WL), and losers then winners (LW) and losers in both intervals (LL). We sort mutual funds as winners or losers for each of the following quarterly intervals. We employ the statistical tests of Malkiel, Brown, and Goetzmann, and Kahn and Rudd. The last column shows the Chi-square statistic and the corresponding p-value. *** and ** indicate statistical significance at a level of 1% and 5% respectively.

				RW			
WW	WL	LW	LL	Z-score	CPR	Z-score	chi-sq.
63.5%	36.5%	27.8%	72.2%	3.23	2.39	3.49	60.67***

Table IV: Performance Persistence by Subperiods

This table presents the proportion of funds that were WW, WL, LW, and LL in different subperiods of the sample interval. We employ the statistical tests of Malkiel, Brown, and Goetzmann, and Kahn and Rudd. The last row shows the Chi-square statistic and the corresponding p-value. *** and ** indicate statistical significance at a level of 1% and 5% respectively.

	90/93	94/96	97/99	00/02	03/05	06/08	09/11	12/14	15/17	18/20
WW	52.5%	54.1%	51.9%	59.4%	61.8%	65.8%	65.0%	64.8%	69.5%	63.1%
WL	47.5%	45.9%	48.1%	40.6%	38.2%	34.2%	35%	35.2%	30.5%	36.9%
LW	46.5%	46.2%	40.7%	45.9%	37.5%	30.7%	26.3%	26.0%	23.8%	28.9%
LL	53.5%	53.8%	59.3%	54.1%	62.5%	69.3%	73.7%	74.0%	76.2%	71.1%
RW Z-score	3.43	6.34	4.34	3.45	2.67	3.34	4.13	3.56	6.34	3.84
CPR	11.08	5.68	2.39	3.04	2.07	2.94	3.45	2.78	4.53	5.56
Z-score	3.24	2.98	3.49	2.93	3.62	3.89	2.45	3.87	4.05	3.23
chi-sq.	56.78***	75.56***	35.67***	62.45***	78.00***	34.89***	78.45***	56.45***	82.12***	56.45***

Table V: Performance Persistence with Monthly Return Data

This table presents the proportion of funds that were WW, WL, LW, and LL. We use monthly observations for our analysis. We employ the statistical tests of Malkiel, Brown, and Goetzmann, and Kahn and Rudd. The last column shows the Chi-square statistic and the corresponding p-value. *** and ** indicate statistical significance at a level of 1% and 5% respectively.

				RW			
WW	WL	LW	LL	Z-score	CPR	Z-score	chi-sq.
64.9%	35.1%	26.9%	73.1%	4.34	3.18	4.10	68.15***