Do asymmetric risk metrics influence performance persistence?

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Practical applications

This paper is useful for investors and managers of money market funds since it tries to identify the true performance of these portfolios. The empirical results indicate incorrect performance valuations of Spanish funds when classical measures are considered. Two problems are detected: (1) asymmetric fund return distributions; (2) negative return premia. This latter feature is observed as the main reason that leads to the incoherent performance valuations. Hence, this paper provides the application of alternative performance measures to reach coherent performance rankings, very useful information for investors to evaluate the management of each fund and for fund managers to know their relative position in the market. Moreover, higher levels of performance persistence are found when alternative performance measures are applied, an interesting added value to investors when choosing a money market fund.

Abstract

This paper examines the influence of downside risk metrics when it comes to evaluating the performance persistence of Spanish money market funds. We present findings of important subsets of funds that show significant asymmetric return distributions; thus by taking alternative risk measures into account, such as semi-standard deviation and absolute deviation, we try to provide more appropriate performance rankings than those obtained with classic indices. We then adjust the performance indices used, given that significant subsets of funds with negative return premiums are found. The results provide strong evidence of markedly different rankings when considering adjusted

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performance measurements to avoid the effect of negative return premiums. Similar rankings, however, are achieved once the aforementioned effect is corrected, regardless of applying symmetric or asymmetric measures. Finally, a more accused empirical evidence of performance persistence using Cochran's test is observed in asymmetric measures, despite the similar classifications.
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INTRODUCTION AND AIMS

The aim of this paper is to infer which measures are relevant in order to capture the performance of Spanish money market funds, given the presence of asymmetric return distributions and negative return premiums. It is also our aim to determine the influence of these measures on performance persistence.

The traditional risk measures used in finance are variance and standard deviation. However, it is a well-known fact in literature that these measures are not the most appropriate for evaluating the risk when returns are asymmetric. In these circumstances, authors like Sortino and Price,[1] Eftekhari *et al.*,[2] Damant *et al.*,[3] Pedersen,[4] Pedersen and Satchell,[5,6] Hwang and Pedersen,[7] defend the use of other indicators such as absolute deviation, semi-standard deviation and semi-variance, among others.

Eftekhari *et al.*[2] conclude that the standard deviation may be the appropriate risk measure for high volume markets like Germany, the UK and France, but it is not the most reliable risk measure when considering lower volume markets like Italy, Holland and Belgium.

Recent studies that focus on the application of asymmetric risk measures are those conducted by Hyung and De Vries,[8] who compare the benefits of portfolio diversification for downside risk in case returns that are normally distributed with the case fat-tailed distributed returns, and Campbell and Kraeussl,[9] who observe the international equity allocation for the downside risk investor.

Other recent studies have been carried out by Cheng[10] and Morton *et al.*[11] Cheng[10] presents us six asymmetric risk metrics to test their ability to explain the cross-sectional variations in real estate returns, and Morton *et al.*[11] state that skewness and larger kurtosis are observed in monthly return series of hedge funds, which leads to underestimation of volatility and, as a result, overestimation of Sharpe's ratio if it is used as a performance measure.

Owing to the asymmetric return distributions, this paper examines the annual performance rankings, obtained by applying Sharpe's ratio,[12] by considering a traditional risk measure such as standard deviation, and some downside risk measures (absolutedeviation and semi-standard deviation) to detect whether important differences exist in the rankings and to assess the influence of applying the different metrics on the persistence phenomenon.

Negative return premiums, by comparing portfolio return with risk-free assets (Treasury Repos with overnight securities), are also detected in the vast majority of the money market funds analysed. This problem is also shown in Ferruz *et al.*[13] when analysing the Spanish equity fund industry; so, we follow the same complementary approach in this study, previously proposed by Ferruz *et al.*[14] and Ferruz and Sarto.[15,16]

The two aims tackled in this paper are original, and little research has been carried out

on them in relation to Spanish money market funds. Above all, the influence of asymmetric risk measures on performance persistence is an issue that has not been closely looked at in financial literature, as far as we know.

Some interesting results are found when the correlation between all the applied performance indices is analysed. Significantly different rankings are obtained when metrics that correct the effect of negative return premium, and likewise when those that do not correct this effect, are applied. Similar rankings, however, are found when downside risk metrics and standard deviation are applied, showing that the important issue is the consideration of relative premiums.

Finally, greater annual performance persistence is found when asymmetric risk measurements are applied, as Cochran's test suggests.

The remainder of the paper is organised as follows: the next section describes the Spanish fund industry and data used; the subsequent section contains the description of the different performance measures analysed; the penultimate section focuses on the persistence phenomenon when different risk metrics are applied; finally, the last section contains concluding remarks.

INDUSTRY AND DATA

The Spanish fund industry has caught up with the US development of investment funds as a vehicle of investment from the 1990s. The recent growth of the asset under management by Spanish funds has been one of the biggest in Europe over the past 15 years, with a compounded annual growth rate of more than 25 per cent.

In 2004 almost €220 billion have been managed by approximately 2,600 Spanish investment funds, which is 26.1 per cent of the GDP. In terms of asset under management, Spain is ranked in sixth place in the European Union (EU), just behind Luxembourg, France, United Kingdom, Ireland and Italy, respectively. The average assets managed by each fund, however, are still among the lowest in the EU, thereby pointing out an industry where a small number of large funds coexist with mainly small funds.

As part of the investment fund industry, money market funds are an important category, managing more than €56 billion and representing more than 25 per cent of total assets in the fund industry, a significantly higher percentage than those obtained in other developed fund industries such as the US (approximately 5 per cent), which affirms the interest in conducting research into Spanish money market funds.

The data set includes the daily return of all Spanish money market funds and of Treasury Repos with overnight securities (risk-free asset) from January 1995 to December 2004. This ten-year period is of paramount importance because it is the period in which the industry really developed.

The information provided by the *Spanish Securities and Exchange Commission (CNMV)* allows us to create a survivor bias-free data set. Therefore, the existing asymmetry is not understated. The skewness coefficient of Fisher is used to assess the existence of this phenomenon in the data.

$$a_3 = \frac{\left(\sum_{t=1}^{n} R_t - E(R)\right)^3 / n}{\sigma^3} \qquad (1)$$

On the other hand, the vast majority of the funds show negative return premiums compared to the risk-free assets for all time periods except the first. In this situation, Ferruz *et al.*[14] and Ferruz and Sarto[15,16] demonstrate that Sharpe's ratio does not function properly because the partial derivative for the level of risk in the portfolio is positive.

Table 1: Summary of statistics of the money market fund sample

	Number of funds	*Funds with negative return premium*	*Funds with asymmetric returns*[a]
1995	135	1	131
1996	152	149	146
1997	179	175	163
1998	201	198	192
1999	199	197	156
2000	197	191	170
2001	170	167	139
2002	159	157	106
2003	157	152	136
2004	163	159	141

[a]These returns are asymmetric at 5 per cent.
The first two columns of the table show the different annual periods analysed and the total number of funds examined, whereas the following two columns contain the number of funds with negative return premium and asymmetry problems, respectively.

Therefore, the aforementioned authors suggest an alternative performance measure to Sharpe's ratio, which, while maintaining the nature of the original index, considers the return premium in relative terms.

$$S_p(1) = \frac{E_p/R_f}{\sigma_p} \qquad (2)$$

where E_p represents the average return on portfolio p; R_f indicates the average return on the risk-free asset; σ_p is the standard deviation of the return on portfolio p.

This alternative measure provides consistent rankings for any set of funds with the only requirement that $E_p>0$ for all portfolios. This metric overcomes the inconsistencies observed in the original ratio proposed by Sharpe[17]; however, it does not show significantly different rankings when portfolios display similar levels of risk. Consequently, the $S_p(1)$ ratio is considered an appropriate performance measurement in this case.

Table 1 gathers a summary of the statistics of the investment funds analysed. As can be seen, a larger number of Spanish money market funds show both problems: asymmetry in the return distributions and negative return premiums.

This asymmetry problem in the Spanish market, as Ferruz *et al.*[13] point out, could be due to the youth of the market because the investment funds have only experienced high growth in the last 15 years, which is a short period of time compared to more mature markets like the US or UK.

PERFORMANCE MEASURES

The first performance metric applied is Sharpe's ratio, which considers the standard deviation as measure of risk. Then, due to the negative return premiums, $S_p(1)$ is calculated, which implies a modification from absolute premiums to relative premiums. Finally, two alternative indices are carried out in order to take downside risk metrics into account.

These two alternative indices are expressed as follows:

$$P(1) = \frac{E_p/R_f}{SSD_p} \qquad (3)$$

where E_p represents the average return on portfolio p; R_f indicates the average return on the risk-free asset; SSD_p is the semi-standard deviation of the return on portfolio p.

$$SSDp = \left[\frac{1}{n}\sum_{t=1}^{n}\left(\min\left[0, R_{pt} - E_p\right]\right)^2\right]^{1/2} \qquad (4)$$

This index is therefore similar to Sortino's index, although the return premium is expressed in

Table 2: Correlation coefficients amongst the performance measures

	Sharpe	$S_p(1)$	*P(1)*	*P(2)*
Sharpe	—	0.0317	0.0270	0.0359
$S_p(1)$	—	—	0.9590	0.9736
$P(1)$	—	—	—	0.9239
$P(2)$	—	—	—	—

relative terms.

$$P(2) = \frac{E_p/R_f}{AD_p} \tag{5}$$

where AD_p indicates the absolute deviation of the returns on portfolio p, which would be calculated as follows:

$$AD_p = E[\,|R_p - E_p|\,] \tag{6}$$

Once the different performance measures are calculated, we analyse the levels of correlation among them in order to detect whether the annual rankings provided are similar or otherwise very different. These results are shown in Table 2.We can observe some important results in Table 2. On the one hand, very little correlation is observed between Sharpe's ratio and the others, indicating that considering relative premiums very different performance rankings are found.On the other hand, the high correlation between $S_p(1)$, $P(1)$ and $P(2)$ indicates that no material changes in performance rankings exist. Thus, there is no reason to change from traditional risk measures to asymmetric measures.

PERFORMANCE PERSISTENCE USING DIFFERENT RISK METRICS

Finally, in order to improve knowledge of the importance of measuring the risk with different metrics, an additional and novel analysis has been carried out.

Little research has been done on the influence of asymmetric risk metrics on performance persistence, in spite of its importance; this paper tries to fill this void.

The persistence study has been carried out by applying a non-parametric methodology in the three measures that provide similar performance rankings.[18]

In this analysis, 2×2 contingency tables are defined by comparing performance rankings in two consecutive investment periods. Thus, two categories are determined in each period: *Winner* and *Loser* funds, depending on whether the funds have higher or lower returns than the median.

So, *WW* (*LL*) denotes the number of funds that are *winners* (or *losers*) in two consecutive periods, whereas *WL* (*LW*) represents the number of funds that are *winners* (or *losers*) in the first period, then *losers* (or *winners*) in the consecutive performance ranking.

Once the different subsets of funds have been determined, the statistical significance of persistence can be obtained using the *Z*-test, the Odds Ratio, the Chi-square test and Cochran's test.

— The *Z*-test for repeat winners applied by Malkiel[19]:

$$Z = \frac{Y - np}{\sqrt{np(1-p)}} \; Z \approx N(0,1) \tag{7}$$

where Y is the number of winner funds in two consecutive periods; n is the total number of winner funds in the first period; p is the probability that a winner fund repeats as a winner in the following period. Using the median

Table 3: Performance persistence results

	WW	*LL*	*LW*	*WL*	*Malkiel Z-test*	*B&G Z-test*	*K&P χ^2-test*	*Cochran Y-test*
Panel A								
1995–1996	54	53	14	14	4.851**	6.315**	46.244**	
1996–1997	54	53	22	22	3.671**	4.962**	26.298**	
1997–1998	63	62	26	26	3.922**	5.315**	30.119**	
1998–1999	68	67	30	30	3.839**	5.226**	28.856**	
1999–2000	77	77	19	19	5.920**	7.726**	70.083**	16.739**
2000–2001	58	57	26	26	3.491**	4.749**	23.778**	
2001–2002	51	51	28	28	2.588**	3.605**	13.392**	
2002–2003	51	50	26	26	2.849**	3.889**	15.706**	
2003–2004	58	58	18	18	4.588**	6.133**	42.105**	
Panel B								
1995–1996	53	52	15	15	4.608**	6.051**	41.681**	
1996–1997	57	56	19	19	4.359**	5.811**	37.265**	
1997–1998	62	61	27	27	3.710**	5.043**	26.910**	
1998–1999	67	66	31	31	3.637**	4.963**	25.862**	
1999–2000	78	78	18	18	6.124**	7.930**	75.000**	17.675**
2000–2001	62	61	22	22	4.364**	5.852**	37.383**	
2001–2002	53	53	26	26	3.038**	4.207**	18.456**	
2002–2003	52	51	25	25	3.077**	4.193**	18.373**	
2003–2004	59	59	17	17	4.818**	6.393**	46.421**	
Panel C								
1995–1996	55	54	13	13	5.093**	6.567**	51.044**	
1996–1997	55	54	21	21	3.900**	5.251**	29.742**	
1997–1998	67	66	22	22	4.770**	6.360**	44.763**	
1998–1999	67	66	31	31	3.637**	4.963**	25.862**	
1999–2000	76	76	20	20	5.715**	7.512**	65.333**	18.819**
2000–2001	66	65	18	18	5.237**	6.864**	54.054**	
2001–2002	54	54	25	25	3.263**	4.502**	21.291**	
2002–2003	57	56	20	20	4.217**	5.644**	34.843**	
2003–2004	57	57	19	19	4.359**	5.865**	38.000**	

**Persistence statistically significant at 1 per cent.

This table is divided into three panels: the information provided in panel A relates to $S_p(1)$, the information in panel B refers to $P(1)$ and the information in panel C relates to $P(2)$. The first column of the table shows the consecutive annual periods analysed. The next four columns show the 2×2 contingency tables obtained, and the last four columns present the results of the statistical tests explained above.

criterion and supposing there is no relationship between the two periods, p would be 0.5.

— The Odds Ratio (OR) applied by Brown and Goetzmann[20]:

$$OR = \frac{WW * LL}{WL * LW} \tag{8}$$

This equation is the ratio of funds that display persistence to those that do not. Using the median criterion, if the ratio is equal to one, it implies that each category has a quarter of the total number of funds and there is no persistence.

Based on this ratio a Z-test is calculated.

$$Z = \frac{\ln(OR)}{\sigma_{\log(OR)}} \quad Z \approx N(0,1) \tag{9}$$

— The $\chi 2$-statistic applied by Kahn and Rudd[21,22]:

$$\chi^2 = \sum_{i=1}^{n}\sum_{j=1}^{n}\frac{\left(O_{ij} - E_{ij}\right)^2}{E_{ij}} \; \chi^2 \approx \chi^2(r-1)(c-1) \tag{10}$$

where O_{ij} (E_{ij}) is the actual (expected) frequency in the ith row and the jth column in the table; r (c) is the number of rows (columns) in the contingency table.

The above equations determine performance persistence by considering consecutive periods. To confirm whether this fact exists for the whole period analysed, Cochran's test (1954) has been applied. As far as we know, this is one of the first studies to apply this approach.

— Cochran's test [23]:

$$Y = \frac{\sum_{i=1}^{g} w_i d_i}{\left(\sum_{i=1}^{g} w_i P_i Q_i\right)^{1/2}} \; Y \approx N(0,1) \tag{11}$$

where

$$P_i = \frac{n_{i1}p_{i1} + n_{i2}p_{i2}}{(n_{i1} + n_{i2})} \tag{12}$$

$$Q_i = (1 - P_i) \tag{13}$$

$$d_i = (p_{i1} - p_{i2}) \tag{14}$$

$$w_i = \frac{n_{i1}n_{i2}}{(n_{i1} + n_{i2})} \tag{15}$$

n_{i1} (n_{i2}) is $WW + WL$ ($LL + LW$) in each contingency table, p_{i1} (p_{i2}) is the relationship between WW (LW) and n_{i1} (n_{i2}) *and* g is the number of 2×2 tables analysed.

The results of this analysis are shown in Table 3, in which a significant persistence in the three performance measures can be observed. No considerable difference is observed when paying attention to one-period tests; however, when we focus on Cochran's test, we can see that asymmetric risk measures tend to magnify the persistence phenomenon, although this effect is not exacerbated.

CONCLUDING REMARKS

This section presents the conclusions of analysing the best way to capture the performance of Spanish money market funds and persistence phenomenon by applying different measures over a ten-year period: 1995–2004.

The negative return premiums (the average return corresponding to risk-free assets is not attained by an important subset of funds) and the asymmetric return distributions lead us to

question which performance metrics are the most appropriate.

The results show that the key issue is to correct the negative return premiums and consider them in relative terms. Once this has been done, the application of traditional or downside risk measures do not provoke very different performance rankings.

Finally, a stronger persistence phenomenon is observed in Cochran's test for the whole time period when asymmetric measures are applied, although the differences are confined.

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