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Articles

Market crises and benchmark-adjusted fund alphas in a small market context

As crises de mercado e os alfas dos fondos axustados ao índice de referencia nun contexto de mercados pequenos

Fernando Lopes[1,a], Paulo Leite[2,b], Maria Carmo Correia[1,c], Pablo Durán-Santomil[3,d]

[1] School of Management, Polytechnic Institute of Cávado and Ave, Campus do IPCA, 4750-180 Barcelos, Ave, Campus do IPCA, 4750-180 Barcelos, Portugal

[2] Applied Management Research Unit (UNIAG), School of Management, Polytechnic Institute of Cávado and Ave, Campus do IPCA, 4750-180 Barcelos, Portugal, Ave, Campus do IPCA, 4750-180 Barcelos, Portugal

[3] Department of Finance and Accounting, Economics Faculty, Universidade de Santiago de Compostela, Avda. Burgo das Nacións s/n, 15704 Santiago de Compostela, Avda. Burgo das Nacións s/n, 15704 Santiago de Compostela, Spain

[a]fernandojmlopes@gmail.com

[b]pleite@ipca.pt

[c]mcorreia@ipca.pt

[d]pablo.duran@usc.es

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Abstract

Most mutual fund performance evaluation studies interpret fund alphas as the incremental performance of managers in relation to passive benchmark indices, which should exhibit statistically insignificant alphas. However, if these indices present significant non-zero alphas, standard (non-adjusted) fund alphas are biased. This paper investigates the impact of using benchmark-adjusted alphas to assess the performance of Portuguese-based mutual funds, investing in domestic and European equities. For the period 2000-2020, our results show that fund benchmarks exhibit significantly negative alphas, which lead to an underestimation of mutual fund performance when employing standard models. As a result, benchmark-adjusted alphas are significantly higher than unadjusted alphas for both fund categories, though the differences are larger for domestic than for European funds. We have also found that the impact of the benchmark-adjustment procedure depends on the state of markets. The domestic (European) benchmark exhibits considerably lower (higher) alphas during crisis than during non-crisis periods. During market crises, the differences between pre- and post-adjustment alphas are statistically significant only for domestic funds, whereas during non-crisis periods, both fund categories exhibit significant performance improvements. Our findings suggest that the benchmark-adjustment procedure has a higher impact when benchmark indices exhibit higher concentration.

Keywords: Mutual fund performance; Benchmark-adjusted alphas; Market crises; Multifactor models.

Resumo

Este traballo investiga o impacto da utilización de alfas axustados aos índices de referencia para avaliar o rendemento dos fondos de investimento de mercados pequenos, que invisten en renda variable nacional e europea. Para o período 2000-2020, os nosos resultados mostran que os índices de referencia dos fondos presentan alfas significativamente negativos, o que conduce a unha subestimación do rendemento dos fondos de investimento cando se empregan modelos estándar. Como resultado, os alfas axustados aos índices de referencia son significativamente superiores aos non axustados para ambas as categorías de fondos, aínda que as diferenzas son maiores para os fondos nacionais que para os europeos. Tamén observamos que o impacto do procedemento de axuste do índice de referencia depende dos estados do mercado. O índice de referencia nacional (europeo) exhibe uns alfas considerablemente menores (maiores) durante períodos de crises que durante os períodos sen crises. Durante as crises de mercado, as diferenzas entre os alfas anteriores e posteriores ao axuste só son estatisticamente significativas no caso dos fondos nacionais, mentres que durante os períodos sen crises ambas as categorías de fondos mostran melloras significativas de rendibilidade. Os nosos resultados suxiren que o procedemento de axuste do índice de referencia ten un maior impacto cando os índices de referencia presentan unha maior concentración.

Palabras chave: Rendibilidade dos fondos de investimento; Alfas axustados ao índice de referencia; Crise de mercado; Modelos multifactoriais.

JEL Codes: G01; G11.

1. INTRODUCTION

The growth of the mutual fund industry has highlighted the importance of correctly evaluating the performance of these financial products. However, the predominance of neutral or below-market performance, which contrasts with the continuous demand for actively managed funds, has triggered a wide debate on the effectiveness of the measures used.

Following the limitations identified regarding classical performance evaluation measures (Treynor, 1965; Sharpe, 1966; Jensen, 1968), the literature has produced several developments in terms of evaluation models, namely multifactor specifications that incorporate additional risk factors, such as size and book-to-market (Fama & French, 1993), momentum (Carhart, 1997), and profitability and investment (Fama & French, 2015). Since they are theoretically more robust than single factor models, multifactor ones allow for a better characterization of managers' investment styles and, consequently, a more accurate assessment of performance. Yet, most studies based on these models still indicate a predominance of negative or neutral performance from fund managers in several international mutual fund markets (e.g., Carhart, 1997; Bauer et al., 2006; Leite & Cortez, 2020). A potential reason for these findings may be that they interpret fund alphas as a manager's incremental performance in relation to passive benchmark indices, which should present statistically insignificant alphas. However, if this assumption is violated, mutual fund performance estimates are biased.

Cremers et al. (2013) argue that, even in the context of the Fama and French (1993) or Carhart (1997) models, passive benchmark indices may exhibit statistically significant non-zero alphas, along with significant systematic risk factor coefficients. In line with this argument, Angelidis et al. (2013) suggest using benchmark-adjusted alphas to measure equity fund performance. Through an empirical study of 5,738 US funds, between September 1998 and June 2012, the authors report an average Carhart (1997) 4-factor alpha of -2.11% per year, while the adjusted alpha is only -1.25% per year, on average. This result suggests that benchmark-adjusted alphas may lead to an improvement in fund performance estimates.

Chinthalapati et al. (2017) also find that the methodology of Angelidis et al. (2013) brings the fund alphas closer to zero. They propose an optimization algorithm that adjusts the four Carhart (1997) factors in order to achieve an alpha of zero for any benchmark index. For a total sample of 1,383 equity funds from the US market, the adjustment leads to higher (lower) fund alphas when benchmark (S&P500) alphas are negative (positive).

Using a sample of 887 UK funds from the period 1992-2013, Mateus et al. (2016) show that benchmark-adjusted alphas are significantly higher than traditional ones for both 3-factor (Fama and French, 1993) and 4-factor (Carhart, 1997) models, with differences reaching 127 basis points per year. More importantly, contrary to the majority of past bodies of research, which have reported that UK funds significantly underperformed, the adjusted alphas support evidence of significant outperformance. These results were attributed to the negative benchmark alphas (FTSE 100), which were more noticeable during bear- than during bull-market periods, resulting in fund performance being more (less) undervalued in bear (bull) markets.

In a subsequent study, Mateus et al. (2019a) evaluate the impact of the mismatch between fund objectives and the prospectus benchmark for 1,281 US funds, using the S&P500 as the benchmark. Based on the adjusted-alpha methodology, their results show that, contrary to the traditional Carhart (1997) model where positive (negative) fund performance is related to a positive (negative) benchmark performance, when the Angelidis et al. (2013) methodology is applied, the relationship is reversed, with a prevalence of negative adjusted alphas in the periods when the benchmark exhibits positive performance, thus changing the perception that investors have of the actual performance of mutual funds.

As a consequence, the literature confirms the importance of considering benchmarks of funds to adequately measure their performance. As mentioned by Mateus et al. (2019b), larger negative benchmark alphas increase the possibility of mutual fund alphas changing from negative and statistically significant when using traditional models to positive when employing benchmark-adjusted specifications.

Although there are already some practical applications of the Angelidis et al. (2013) methodology (e.g., Mateus et al., 2016, 2019a; Chinthalapati et al., 2017; Cuthbertson et al., 2022), these are restricted to large mutual fund markets, like the US and UK ones. Therefore, one of the main contributions of this paper is that, to the best of our knowledge, it is the first to compute and analyze benchmark-adjusted alphas for funds domiciled in a small market, namely Portugal[1] . This is an interesting research topic because, besides avoiding data mining, benchmark indices in small markets include a considerably lower number of stocks and exhibit higher concentration levels[2] . A more restricted investment universe, combined with lower information costs (Alves & Mendes, 2007), may help fund managers to be better stock pickers and, consequently, to outperform their benchmarks. However, most previous bodies of work that analyze the performance of Portuguese-based equity funds, using distinct sample periods and employing several different performance evaluation methodologies, show that they tend to underperform the market (e.g., Romacho & Cortez, 2006; Leite & Cortez, 2009, 2020; Neto et

[1] By the end of 2020, the Portuguese investment fund market had €17 billion of assets under management (EFAMA, 2021).

[2] The main Portuguese Stock Index, the PSI, had only 18 stocks at the end of 2020. The weight of the top 5 constituents is usually close to 60%, which is considerably higher than that of indices such as the S&P 500 and the FTSE 100.

al., 2017). A potential justification for these findings may be that all these studies are based on standard, non-benchmark-adjusted, performance evaluation models, which may not recognize a manager's superior performance if the benchmark itself presents a consistently negative alpha. Therefore, the performance of Portuguese mutual funds should be re-evaluated using benchmark-adjusted alphas.

Furthermore, unlike the studies of Mateus et al. (2016, 2019a) and Chinthalapati et al. (2017), which focus on investing in domestic mutual funds, our work is one of the first to extend this research topic to making investments in international funds (more precisely, at a European level), for which benchmarks are less concentrated and comprise a considerably higher number of stocks. Angelidis et al. (2013) have also evaluated the benchmark-adjusted performance of US funds that invest in European stocks and find the results to be consistent with those obtained for domestic US funds. However, their work is based only on the 4-factor model of Carhart (1997) and does not incorporate the more recent investment and profitability factors of Fama and French (2015).

Another contribution that this piece of work makes is that it divides and compares both benchmark and mutual fund performance across different market conditions. Unlike previous studies that assume a certain calendar year as a bull- or bear- market period (e.g., Mateus et al., 2016), market states are identified using a more robust approach, based on the econometric algorithm of Pagan and Sossounov (2003), which is also used by Wang et al. (2022) and Xu et al. (2023), among others. Therefore, we aim to evaluate whether the impact of using benchmark-adjusted alphas is higher during bear / crisis or bull / non-crisis phases, for both fund categories in our dataset (domestic and European). To accomplish this, we have used a broad 21-year (2000-2020) evaluation period that covers several different bull- and bear-market phases.

The rest of the paper is structured as follows: section 2 details the methodology; section 3 provides a description of the data; section 4 presents and discusses the results; section 5 presents the conclusions and some suggestions for further research.

2. METHODOLOGY

2.1 Benchmark alphas

We have estimated the alphas of each benchmark using 4-, 5- and 6-factor models, in line with Carhart (1997) and Fama and French (2015, 2018). The 6-factor specification is written as:

$$R_{b,t} - R_{f,t} = \alpha_b + \beta_{1b}(Rm_t - Rf_t) + \beta_{2b}SMB_t + \beta_{3b}HML_t + \beta_{4b}RMW_t + \beta_{5b}CMA_t + \beta_{6b}WML_t + \varepsilon_{b,t} \quad [1]$$

where $Rb_t - Rf_t$ is the excess return (over the risk-free rate) of the benchmark in period t and $Rm_t - Rf_t$ is the excess return of a broader market index during the same period. SMB_t, HML_t, RMW_t and CMA_t are the Fama and French (2015) size, book-to-market, profitability, and investment factors, respectively, and WML_t is the Carhart (1997) momentum factor. The 5-factor alpha is estimated excluding the momentum factor (WML_t) from equation [1], while the

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4-factor alpha is estimated excluding the investment (RMW_t) and profitability (CMA_t) factors from the same equation[3] .

2.2 Unadjusted and benchmark-adjusted fund alphas

Unadjusted and benchmark-adjusted mutual fund alphas are also estimated with 4-, 5- and 6-factor models. The unadjusted (α_p) 6-factor alphas are based on the following equation:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{1p}(Rm_t - Rf_t) + \beta_{2p}SMB_t + \beta_{3p}HML_t + \beta_{4p}RMW_t + \beta_{5p}CMA_t + \beta_{6p}WML_t + \varepsilon_{p,t} \quad [2]$$

where $Rp_t - Rf_t$ is the excess return of fund p in period t and the remaining variables are as described previously. After this, we estimated the 6-factor benchmark-adjusted alphas (α_p^*) using the following formula:

$$R_{p,t} - R_{b,t} = \alpha_p^* + \beta_1^*(R_{m,t} - R_{f,t}) + \beta_2^*SMB_t + \beta_3^*HML_t + \beta_4^*RMW_t + \beta_5^*CMA_t + \beta_6^*WML_t + \varepsilon_{p,t}^* \quad [3]$$

where $R_{p,t} - R_{b,t}$ is the excess return of fund p over its benchmark in period t. In equation [3], α_p^* is the difference between the alpha of the fund (α_p) and the alpha of the benchmark (α_b) and is the difference between the market beta of the fund (β_1^*) and the market beta of the benchmark (β_{1b}). Similar interpretations apply to the following parameters[4] .

2.3 Crisis and non-crisis phases

To investigate whether benchmark and mutual fund performance differ across different market conditions, we began by detecting the crisis / bear-market periods based on the econometric algorithm of Pagan and Sossounov (2003). The peaks / troughs of each benchmark index occur when they are the highest / lowest values in an eight-month window of surrounding values. Hence, with Pt representing the value of the index, a trough occurs at time t if $ln(P_{t-8}, \dots, P_{t-1}) > ln(P_t) < ln(P_{t+1}, \dots, P_{t+8})$ and a peak occurs at time t if $ln(P_{t-8}, \dots, P_{t-1}) < ln(P_t) > ln(P_{t+1}, \dots, P_{t+8})$. After this, all falls of at least 20% from peak to trough are classified as crisis / bear-market phases, whereas the remaining periods are considered non-crisis / bull-market phases.

We have used the PSI and the FTSE Eurofirst 100 as they are suitable stock market indices for our study. Over the period 2000-2020, we have identified six crisis periods for the PSI index and four for the FTSE Eurofirst 100 index, which are detailed in Table 1 below.

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[3] Due to the unavailability of the investment and profitability factors for the Portuguese market, 5- and 6-factor versions can only be applied to the European funds category. For domestic funds, we have used the 4-factor specification.

[4] To estimate 5-factor (unadjusted and benchmark-adjusted) alphas we have omitted the factor from equations [2] and [3], respectively. 4-factor alphas are obtained by excluding and factors.

Table 1. Crisis Periods

Panel A: PSI index			
Start	**End**	**Change in market index**	**Length of period (months)**
02/2000	09/2002	-65.13%	32
07/2007	02/2009	-55.31%	20
10/2010	05/2012	-44.16%	20
03/2014	12/2014	-36.92%	10
04/2015	06/2016	-26.93%	15
01/2020	03/2020	-22.51%	3
Panel B: FTSE Eurofirst 100 index			
Start	**End**	**Change in market index**	**Length of period (months)**
10/2000	03/2003	-56.23%	30
06/2007	02/2009	-55.15%	21
02/2011	09/2011	-21.93%	8
12/2019	03/2020	-25.97%	4

For both indices we can observe crisis periods in the early 2000s, related to the dot-com bubble crash, from the second half of 2007 to the beginning of 2009, associated with the global financial crisis, and during the first quarter of 2020, following the Covid-19 pandemic. The remaining periods (1 for the European index, in 2011, and 3 for the Portuguese index, covering from the last quarter of 2010 to the first half of 2016) are mostly linked to the Euro-area debt crisis, which also impacted the equity sector. As Portugal was one of the most affected countries, requiring an official bailout programme financed by the European Central Bank, the European Commission, and the International Monetary Fund, it may justify why the total length of the crisis period is considerably higher for the Portuguese index (100 months) than for the European index (63 months).

Following Leite and Cortez (2015), we have obtained alpha and beta estimates in the crisis and non-crisis phases separately by adding two dummy variables to all the previous equations. Based on the 6-factor model, we have obtained the benchmark alphas, the unadjusted fund alphas, and the benchmark-adjusted fund alphas through equations [4], [5] and [6], respectively:

$$R_{b,t} - R_{f,t} = \alpha_{b,NC} D_{NC} + \alpha_{b,C} D_C + \sum_{i=1}^{6} \beta_{ib,NC} F_{i,t} D_{NC} + \sum_{i=1}^{6} \beta_{ib,C} F_{i,t} D_C + \varepsilon_{b,t} \quad [4]$$

$$R_{p,t} - R_{f,t} = \alpha_{p,NC} D_{NC} + \alpha_{p,C} D_C + \sum_{i=1}^{6} \beta_{ip,NC} F_{i,t} D_{NC} + \sum_{i=1}^{6} \beta_{ip,C} F_{i,t} D_C + \varepsilon_{p,t} \quad [5]$$

$$R_{p,t} - R_{b,t} = \alpha^*_{p,NC} D_{NC} + \alpha^*_{p,C} D_C + \sum_{i=1}^{6} \beta^*_{i,NC} F_{i,t} D_{NC} + \sum_{i=1}^{6} \beta^*_{i,C} F_{i,t} D_C + \varepsilon^*_{p,t} \quad [6]$$

where $F_{i,t}$ represents each of the six risk factors described earlier, D_{NC} (D_C) equals 1 for the non-crisis (crisis) phases and 0 otherwise. In equation [4], $\alpha_{b,NC}$ and $\alpha_{b,C}$ are the non-crisis and crisis period benchmark alphas, respectively. In equations [5] and [6], $\alpha_{p,NC}$ $(\alpha_{p,C})$ and

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$\alpha^*_{p,NC}$ $(\alpha^*_{p,C})$ are the non-adjusted and benchmark-adjusted fund alphas for the non-crisis (crisis) phases, respectively. The remaining parameters are straightforward to interpret[5] .

3. DATA

Our dataset includes all (36) active open-end funds based in Portugal, investing in domestic (10 funds) and European (26 funds) equities[6] , with a minimum of 24 monthly observations from January 2000 to December 2020. Given that non-surviving funds are also included, there is no survivorship bias. By the end of the evaluation period, fund age had reached an average of 15.73 years, fund size was €14.34 million, and the average total expense ratio was 1.85% per year[7] .

End-of-month fund net asset values were collected from CMVM – the Portuguese Securities Market Commission[8]. After analyzing the funds' prospectuses, and verifying they were all accumulation funds, their returns (R_p) were calculated using the following expression: $R_p = (NAV_t - NAV_{t-1}) / NAV_{t-1}$, where NAV_t (NAV_{t-1}) is the fund's net asset value at time t ($t-1$). These returns include all operating expenses, such as management and supervision fees, but exclude subscription and redemption fees.

In Table 2, some descriptive statistics are displayed for the monthly excess returns of two equally weighted fund portfolios, one for each category (domestic and European). The risk-free rate corresponds to the 1-month Euribor rate. On average, both fund categories exhibit negative excess returns for the full sample period. However, European funds not only display lower returns but also lower standard deviations than their domestic equivalents. Despite this, the difference in mean excess returns is highly prominent in the two market states. Although during the crisis (non-crisis) phases the two fund types exhibited negative (positive) mean excess returns, in comparison to European funds, the domestic funds show considerably (slightly) higher returns during the non-crisis (crisis) phases. Besides this, as expected, the highest standard deviations for both portfolios occurred during the market downturns.

Table 2. Descriptive Statistics for Fund Portfolios, 2000-2020

		Mean (%)	Median (%)	Max. (%)	Min. (%)	Std. Dev. (%)	Observations
Domestic	Entire period	-0.1919	-0.0395	14.3769	-19.5710	5.4070	251
	Non-crisis	1.8240	1.3673	17.4180	-8.7857	4.3019	151
	Crisis	-2.8558	-2.3981	14.3769	-19.5710	6.0637	100
European	Entire period	-0.3099	0.4155	12.4539	-16.9559	4.5700	251
	Non-crisis	0.9641	1.6822	16.9807	-8.2508	3.7633	188
	Crisis	-3.5327	-2.4385	12.1227	-16.8647	5.6475	63

[5] Again, for robustness purposes, we have estimated 4- and 5-factor versions of these models.

[6] European equity funds are included because, throughout our evaluation period, they were the most representative international fund category in the market.

[7] In comparison to European funds, domestic funds are, on average, larger (€17.34 vs. €13.12 million) and slightly older (17.08 vs. 15.21 years), but expense ratios are very similar for both categories (1.88% vs. 1.83% per year).

The fund benchmarks are the PSI total return index for the domestic funds and the FTSE Eurofirst 100 total return index for the European funds. These indices are frequently used to represent Portuguese and European equity market trends[9] . As broader total return market indices we have used the PSI All-Share and the FTSE Europe.

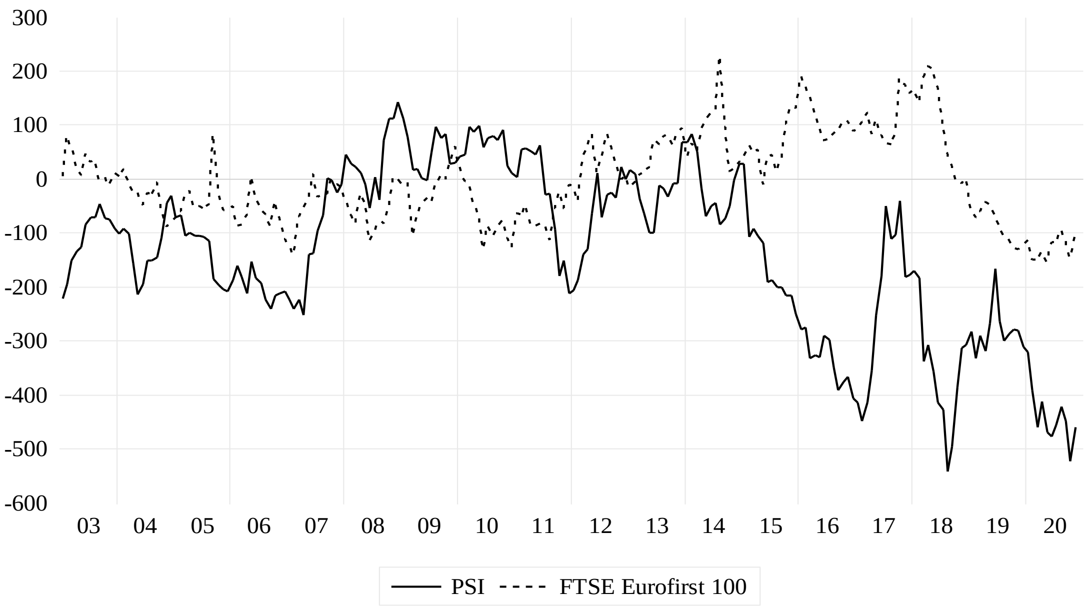
The European (size, book-to-market, investment, profitability, and momentum) factors were obtained from Kenneth French's website[10] , while the domestic factors were collected from Applied Quantitative Research (AQR)[11] . All factors were converted to euros using the USD/EUR exchange rate. Factor correlations, ranging from -0.37 and 0.16 for the domestic market and from -0.51 and 0.70 for the European market, allow us to avoid multicollinearity issues.

4. RESULTS

4.1 Benchmark alphas

Since benchmarks should be broad passive indices, they should not generate abnormal returns. However, if a positive (negative) performance is verified, it must be represented by a positive (negative) alpha. Figure 1 presents the alphas obtained for the domestic and European benchmarks, expressed in basis points per year, using 3-year moving averages and the 4-factor model of Carhart (1997), for the entire evaluation period[12] .

Figure 1. Evolution of Benchmark Alphas



[9] For the period under analysis (2000-2020), correlations between the two indices were reasonably high, reaching 72.29%.

[10] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html

[11] https://www.aqr.com/Insights/Datasets/Betting-Against-Beta-Equity-Factors-Monthly

[12] At this stage, to facilitate comparisons and allow a clearer interpretation of Figure 1, we opted for just one model specification for both benchmarks.

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We have found evidence of consistently negative alphas for both benchmarks for most of the sample period. Comparing the domestic and European benchmarks, we can also see that these negative alphas were not only considerably more frequent, but also of a notably larger magnitude for the PSI than for the FTSE Eurofirst 100.

To explore this topic in greater detail, Table 3 shows performance (monthly and yearly alphas) and risk estimates for the domestic (PSI) and European (FTSE Eurofirst 100) benchmarks in the period 2000-2020. We used three alternative models: the 6-factor model (FF6) of equation [1]; a 5-factor variant (FF5) that omits the momentum factor; a 4-factor version (CH4) that excludes investment and profitability factors. Besides the total sample period, results are also presented for the crisis and non-crisis phases separately, following equation [4][13] .

Table 3. Benchmark Alphas

			Alpha per month (%)	Alpha per year (bps)	Market beta	SMB	HML	RMW	CMA	WML	Adj. R^2
PSI	CH4	Total sample	-0.1204*	-143.53	1.0399***	0.0080	-0.0087			-0.0639**	0.9708
			(0.0548)		(0.0000)	(0.6357)	(0.6504)			(0.0166)	
		Non-crisis	-0.1071	-127.77	1.0587***	0.0172	-0.0360			-0.0617	0.9711
			(0.1635)		(0.0000)	(0.4026)	(0.1959)			(0.1363)	
		Crisis	-0.2495**	-295.33	1.0175***	-0.0144	0.0207			-0.0678***	0.9711
			(0.0276)		(0.0000)	(0.5249)	(0.1706)			(0.0055)	
FTSE Eurofirst 100	CH4	Total sample	-0.0930**	-111.03	1.0006***	-0.2157***	0.0568*			-0.0020	0.9849
			(0.0199)		(0.0000)	(0.0000)	(0.0674)			(0.8862)	
		Non-crisis	-0.1192***	-142.11	1.0027***	-0.2020***	0.0751**			0.0001	0.9848
			(0.0031)		(0.0000)	(0.0000)	(0.0383)			(0.9946)	
		Crisis	-0.0150	-17.99	1.0120***	-0.2187***	0.0324			0.0119	0.9848
			(0.7697)		(0.0000)	(0.0000)	(0.3733)			(0.5740)	
	FF5	Total sample	-0.1042**	-124.33	1.0046***	-0.2157***	0.0607	0.0245	0.0050		0.9849
			(0.0122)		(0.0000)	(0.0000)	(0.1903)	(0.4245)	(0.9228)		
		Non-crisis	-0.1407***	-167.54	1.0114***	-0.1860***	0.0749	0.0515	0.0519		0.9849
			(0.0007)		(0.0000)	(0.0000)	(0.2038)	(0.3248)	(0.3575)		
		Crisis	-0.0284	-34.03	1.0086***	-0.2282***	0.0561	0.0567	-0.0258		0.9849
			(0.6570)		(0.0000)	(0.0000)	(0.3215)	(0.2270)	(0.7213)		
	FF6	Total sample	-0.1012**	-120.77	1.0031***	-0.2129***	0.0573	0.0301	0.0099	-0.0070	0.9849
			(0.0140)		(0.0000)	(0.0000)	(0.2031)	(0.3726)	(0.8511)	(0.6614)	
		Non-crisis	-0.1389***	-165.41	1.0108***	-0.1854***	0.0718	0.0519	0.0534	-0.0031	0.9848
			(0.0007)		(0.0000)	(0.0000)	(0.2234)	(0.3221)	(0.3492)	(0.8670)	
		Crisis	-0.0281	-33.67	1.0099***	-0.2291***	0.0559	0.0529	-0.0273	0.0040	0.9848
			(0.6650)		(0.0000)	(0.0000)	(0.3264)	(0.3337)	(0.7258)	(0.8901)	

Note: Standard errors were adjusted for autocorrelation and heteroskedasticity (Newey & West, 1987). P-values are in parentheses. ***, **, and * indicate the statistically significant coefficients at the 1%, 5%, and 10% levels, respectively

For the total sample period, the results show the existence of negative and statistically significant alphas for both benchmarks, reaching -143.53 basis points per year for the PSI index and between -111.03 and -124.33 basis points per year for the FTSE Eurofirst 100 index, in accordance with Cremers et al. (2013) and Mateus et al. (2016). Therefore, if mutual fund performance is evaluated against these benchmarks, fund alphas will have a downward bias. What is more, in comparison to the broader market index, the European (but not the domestic) benchmark exhibited clear large cap biases, as expected.

[13] In line with Mateus et al. (2016), the alphas per month and per year (in basis points) are shown.

The results obtained separately for the market crisis and non-crisis phases show a substantial contrast between both benchmarks. Indeed, for the domestic benchmark, the alphas were significantly negative during the crisis periods, reaching -295.33 basis points per year, but became neutral during the non-crisis periods. For the European benchmark, the alphas were significantly negative during the non-crisis periods, varying between -142.11 and -167.54 basis points per year, but were neutral during the market crises in all the multifactor models used.

This prevalence of significantly negative benchmark alphas in the sampled period aligns with the results of Mateus et al. (2016). However, while these authors found that the performance of the domestic benchmark decreases during non-crisis periods, we have only observed the pattern occurring for the European (as opposed to the domestic) index. Hence, the evidence of fund underperformance may lie in model specification errors, which lead to negative reference alphas.

4.2 Unadjusted fund alphas

Table 4 shows the performance (monthly and yearly unadjusted alphas) and risk estimates for equally weighted portfolios of the domestic and European funds in the period 2000-2020 using standard / unadjusted performance evaluation models. We used three alternative models: the 6-factor model (FF6) of equation [2]; a 5-factor variant (FF5) that omits the momentum factor; a four-factor version (CH4) that excludes investment and profitability factors. Besides the total sample period, the results are also shown for the crisis and non-crisis phases separately, following equation [5].

Table 4. Unadjusted Fund Performance and Risk Estimates

			Alpha per month (%)	Alpha per year (bps)	Market beta	SMB	HML	RMW	CMA	WML	Adj. R^2
Domestic funds	CH4	Total sample	-0.0466	-55.78	0.9952***	0.1834***	-0.0115			-0.1281***	0.9174
			(0.6595)		(0.0000)	(0.0000)	(0.7230)			(0.0006)	
		Non-crisis	-0.0436	-52.19	0.9946***	0.1811***	-0.00071			-0.0761	0.9182
			(0.7449)		(0.0000)	(0.0001)	(0.8956)			(0.2301)	
		Crisis	0.0586	70.55	0.9892***	0.1885***	-0.0071			-0.1837***	0.9182
			(0.7563)		(0.0000)	(0.0000)	(0.8505)			(0.0000)	
European funds	CH4	Total sample	-0.4721***	-552.04	0.9976***	0.1476**	0.0640			-0.0137	0.9113
			(0.0000)		(0.0000)	(0.0437)	(0.2119)			(0.7565)	
		Non-crisis	-0.6095***	-707.37	1.0446***	0.2150**	0.1191*			0.0458	0.9131
			(0.0000)		(0.0000)	(0.0162)	(0.0915)			(0.3479)	
		Crisis	-0.4292	-503.05	0.9264***	0.0829	0.0832			-0.1040*	0.9131
			(0.2060)		(0.0000)	(0.4833)	(0.1840)			(0.0766)	
	FF5	Total sample	-0.3947***	-463.49	0.9621***	0.1241**	0.0928	-0.1967**	-0.1361		0.9152
			(0.0000)		(0.0000)	(0.0480)	(0.1800)	(0.0134)	(0.2239)		
		Non-crisis	-0.4679***	-547.25	0.9888***	0.1377*	0.0833	-0.2612***	-0.2652*		0.9157
			(0.0000)		(0.0000)	(0.0646)	(0.3903)	(0.0059)	(0.0761)		
		Crisis	-0.3816	-448.43	0.9420***	0.0783	0.0669	-0.2436*	-0.0404		0.9157
			(0.2449)		(0.0000)	(0.5229)	(0.5647)	(0.0765)	(0.8131)		
	FF6	Total sample	-0.4078***	-478.53	0.9688***	0.1120*	0.1076*	-0.2210***	-0.1572	0.0304	0.9152
			(0.0000)		(0.0000)	(0.0646)	(0.0967)	(0.0044)	(0.1907)	(0.5029)	
		Non-crisis	-0.5060***	-590.58	0.9998***	0.1254*	0.1454	-0.2691**	-0.2966**	0.0634	0.9165
			(0.0000)		(0.0000)	(0.0921)	(0.1114)	(0.0175)	(0.0343)	(0.2178)	
		Crisis	-0.3868	-454.41	0.9202***	0.0913	0.0708	-0.1796	-0.0154	-0.0664	0.9165
			(0.3162)		(0.0000)	(0.4702)	(0.4988)	(0.2710)	(0.9309)	(0.3749)	

Note: Standard errors were adjusted for autocorrelation and heteroskedasticity (Newey & West, 1987). The P-values are in parentheses. ***, **, and * indicate the statistically significant coefficients at the 1%, 5%, and 10% levels, respectively.

The results show that the model has high explanatory power, with values of approximately 92% in both portfolios, which indicates that the right choice was made for the benchmarks. For the total period under evaluation, the unadjusted alpha of the domestic portfolio was negative (-55.78 basis points per year) but not statistically significant, indicating a neutral performance, in line with Leite and Cortez (2009), but unlike both Angelidis et al. (2013) and Mateus et al. (2016), who found negative and statistically significant unadjusted alphas for domestic funds domiciled in the US and UK markets. In contrast, the European funds exhibited significantly negative alphas in all cases, consistent with Leite and Cortez (2020), with values ranging between -463.49 basis points and -552.04 basis points per year. Additionally, in terms of investment styles, both fund portfolios exhibited significant exposure to small caps, but no clear value or growth tilts. The coefficient of the momentum factor was negative and statistically significant only for the domestic funds, suggesting contrarian strategies. For the European funds, there was also significant exposure to firms with low profitability.

Upon reviewing the alphas obtained for the crisis and non-crisis phases separately, we can see that, for both fund categories, unadjusted alphas were higher for the market crisis phases than for the market non-crisis phases, contrary to Mateus et al. (2016). However, while the domestic funds exhibited neutral performance during the two market phases, the European funds showed neutral performance for market crises and significant underperformance for the non-crisis phases. Consequently, the results for the European funds may be due to the lower benchmark alphas during the non-crisis phases, which underestimated fund alphas in the standard models. For the domestic funds, benchmark alphas were significantly lower during the crises, meaning that fund performance may be undervalued, especially during more turbulent times.

The factor coefficients of the domestic funds are similar for the market crisis and non-crisis phases, except for the significantly negative coefficient of the momentum factor, which was only found during the crises. For the European funds, we noted higher market betas, as well as higher exposure to small caps, weaker profitability and higher investment firms, for non-crisis phases than for crisis phases.

4.3 Benchmark-adjusted fund alphas

Table 5 shows performance estimates (yearly alphas, in basis points) before and after the benchmark adjustment procedure for equally weighted portfolios of domestic and European funds for the period 2000-2020. The benchmark-adjusted alphas were based on three model specifications: the 6-factor model (FF6) of equation [3]; a 5-factor variant (FF5) that omits the momentum factor; a four-factor version (CH4) that excludes the investment and profitability factors. The excess betas for each factor can also be seen. The unadjusted alphas were based on equation [2] and its variants. Besides the total sample period, the results are also shown for the crisis and non-crisis phases separately, following equation [6].

Table 5. Benchmark-Adjusted Fund Alphas

			Alpha before adj. (bps per year)	Alpha after adj. (bps per year)	Difference (bps per year)	Excess market beta	Excess SMB	Excess HML	Excess RMW	Excess CMA	Excess WML	Adj. R² (within)
Domestic funds	CH4	Total sample	-55.78 (0.6595)	88.92 (0.4993)	144.70***	-0.0447 (0.1250)	0.1755*** (0.0000)	-0.0028 (0.9279)			-0.0642** (0.0202)	0.2035
		Non-crisis	-52.19 (0.7449)	76.59 (0.5843)	128.78***	-0.0641** (0.0402)	0.1640*** (0.0000)	0.0289 (0.4566)			-0.0144 (0.6569)	0.2332
		Crisis	70.55 (0.7563)	376.05 (0.1505)	305.50***	-0.0283 (0.5159)	0.2029*** (0.0000)	-0.0278 (0.5123)			-0.1159*** (0.0044)	0.2332
European funds	CH4	Total sample	-552.04*** (0.0000)	-445.55*** (0.0000)	106.49***	-0.0030 (0.9048)	0.3632*** (0.0000)	0.0072 (0.8740)			-0.0116 (0.7522)	0.1758
		Non-crisis	-707.37*** (0.0000)	-572.75*** (0.0000)	134.62***	0.0419 (0.1510)	0.4170*** (0.0000)	0.0441 (0.4438)			0.0454 (0.2498)	0.1970
		Crisis	-503.05 (0.2060)	-485.76 (0.2865)	17.30	-0.0856* (0.0821)	0.3017** (0.0171)	0.0508 (0.5103)			-0.1158* (0.0961)	0.1970
	FF5	Total sample	-463.49*** (0.0000)	-343.08*** (0.0002)	120.41***	-0.0426** (0.0358)	0.3398*** (0.0000)	0.0322 (0.5509)	-0.2213*** (0.0002)	-0.1411 (0.1610)		0.2257
		Non-crisis	-547.25*** (0.0000)	-385.65*** (0.0001)	161.60***	-0.0225 (0.3949)	0.3236*** (0.0000)	0.0084 (0.8942)	-0.3127*** (0.0000)	-0.3171*** 0.0169		0.2442
		Crisis	-448.43 (0.2449)	-415.70 (0.1983)	32.73	-0.0665 (0.1215)	0.3066** (0.0163)	0.0108 (0.9248)	-0.3003*** (0.0037)	-0.0145 (0.9074)		0.2442
	FF6	Total sample	-478.53*** (0.0000)	-361.78*** (0.0001)	116.75***	-0.0343 (0.1156)	0.3249*** (0.0000)	0.0503 (0.3585)	-0.2511*** (0.0000)	-0.1671 (0.1278)	0.0374 (0.3398)	0.2284
		Non-crisis	-590.58*** (0.0000)	-431.85*** (0.0000)	158.73***	-0.0110 (0.6387)	0.3108*** (0.0000)	0.0736 (0.2108)	-0.3210*** (0.0000)	-0.3500*** (0.0047)	0.0665* (0.0988)	0.2554
		Crisis	-454.41 (0.3162)	-421.93 (0.2143)	32.48	-0.0896** (0.0495)	0.3203*** (0.0056)	0.0149 (0.8930)	-0.2325* (0.0648)	0.0119 (0.9277)	-0.0703 (0.2753)	0.2554

Note: Standard errors were adjusted for autocorrelation and heteroskedasticity (Newey & West, 1987). The P-values are in parentheses. ***, **, and * indicate the statistically significant coefficients at the 1%, 5%, and 10% levels, respectively. The significance of the difference between the unadjusted and adjusted alphas was determined by a Z-Test =

$$\frac{\alpha_{before} - \alpha_{after}}{\sqrt{\left(SE\ \alpha_{before}\right)^2 + \left(SE\ \alpha_{after}\right)^2}}$$

For the full sample period, we found a statistically significant increase in the alpha estimates (at the 1% level) when switching from unadjusted to benchmark-adjusted alphas, for both fund categories and regardless of the performance evaluation model applied. Although we have evidence of neutral performance for the domestic funds, the alphas increased by 144.70

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basis points, soaring from -55.78 to 88.92 basis points per year. This increase of, approximately, 145 basis points per year was considerably higher than the 86 basis points registered by Angelidis et al. (2013) for US funds and the 127 basis points reported by Mateus et al. (2016) for UK funds. Therefore, the difference between pre- and post-adjustment alphas seems to be higher for funds domiciled in smaller markets. The European funds still exhibited significantly negative alphas, but these increased by between 106.49 and 120.41 basis points per year. This means that the differences between unadjusted and benchmark-adjusted alphas were higher for the funds investing in local stocks than for the ones investing abroad[14] .

With reference to the excess betas, we can see that both the domestic and European funds were significantly more exposed to small caps than the PSI or the FTSE Eurofirst indices, in line with Table 4. Additionally, compared to their benchmarks, the domestic funds show significantly lower loadings on the momentum factor, while the European ones exhibited significantly lower exposure to the profitability factor.

When comparing the results between the crisis and non-crisis phases, we uncovered some interesting results, especially concerning the contrast between fund categories. For the non-crisis periods, for both the domestic and the European funds, we can observe significant differences at the 1% level between pre- and post-adjustment alphas. In this case, the benchmark-adjusted alphas were significantly higher than the unadjusted alphas by 128.78 basis points per year for the domestic portfolio and between 134.62 and 161.60 basis points per year for the European portfolio. The higher differences for the European funds may be because only the European benchmark displayed a significantly negative alpha during the non-crisis phases, while the domestic benchmark exhibited a neutral alpha, thereby underestimating the unadjusted alphas by a greater margin. As a result, while the European funds exhibited higher differences in the alphas for the non-crisis phases than for the overall period, for the domestic funds, we found the opposite to be true.

During the crises, the benchmark-adjusted alpha of the domestic fund portfolio was significantly higher than the unadjusted alpha, at the 1% level, with the difference reaching a noteworthy 305.50 basis points per year. This result is undeniably related to the considerably lower (and statistically significant) benchmark alphas obtained for the domestic benchmark during the crisis periods. Conversely, for the European funds, there were no significant differences between unadjusted or adjusted alphas during the market crises in any of the model specifications used, in line with the neutral benchmark alphas obtained during these periods[15].

5. CONCLUSIONS

This work analyzes whether the use of benchmark-adjusted alphas, as opposed to standard (non-adjusted) alphas, leads to different inferences in terms of mutual fund performance. Since

[14] As an additional robustness test, we evaluated the impact of fees on performance by computing benchmark-adjusted alphas using gross returns. As we can see in Appendix 1, on a before-fee basis, the domestic funds significantly outperformed the market at the 5% level, reaching an adjusted alpha of 280.13 basis points per year. Accordingly, the neutral performance of domestic funds was justified by the fees charged. In contrast, the European funds significantly underperformed, scoring between -164.35 and -268.56 basis points per year, even before management fees were deducted from fund returns. We thank an anonymous referee for suggesting these tests to us.

[15] In Appendix 1, we can see that, using gross returns, the benchmark-adjusted alpha of the domestic funds was 572.24 basis points per year. This value is not only statistically significant (5% level) but economically relevant. In contrast, the European funds exhibited significantly negative gross alphas during the non-crisis periods and neutral gross alphas during the crises.

previous evidence on this research topic has been restricted to large mutual fund markets, such as those of the USA and the UK, and to funds investing mostly in local securities, we have focused our analysis on a dataset of mutual funds based in a small market (Portugal), investing both in domestic and in European equities, over a 21-year evaluation period, between January 2000 and December 2020. Besides this, we have split and compared both benchmark and mutual fund performance in market crisis and non-crisis phases.

For the entire duration of the sample, our results show that both benchmark indices exhibited negative and statistically significant alphas, meaning that mutual fund alphas have a downward bias if performance is evaluated using standard models. The unadjusted alphas were neutral for the funds investing in their domestic market and significantly negative for the ones investing in the European market. Therefore, fund managers were unable to beat the market, consistent with the majority of prior research on mutual fund performance. However, the benchmark adjustment procedure increased fund alphas significantly. Indeed, although the domestic funds remained neutral performers and the European funds still significantly underperformed, the benchmark-adjusted alphas were significantly higher than the standard alphas for both fund categories, at the 1% level. The differences between the pre- and post-adjustment alphas reached 145 basis points per year and were considerably higher than the ones reported for larger fund markets, with less concentrated benchmarks, such as those of the USA and the UK. Furthermore, they were also higher for the funds investing in local stocks than for the ones investing abroad.

The results obtained separately in the market crisis and non-crisis phases, highlight several interesting differences between both benchmarks and fund categories. While the domestic benchmark exhibited neutral alphas in the non-crisis phases and significantly negative alphas in the market crises, for the European benchmark we found the opposite to be the case. However, the unadjusted alphas were higher for the market crises than for the non-crisis phases, for both fund categories, in clear contrast to Mateus et al. (2016). Likewise, the domestic funds displayed an identical (neutral) performance for both market phases, while the European funds showed neutral performance for the market crises and significant underperformance for the non-crisis periods.

During the non-crisis phases, the difference between the pre- and post-adjustment alphas were statistically significant for both the domestic and European funds but were higher for the latter (reaching 162 basis points per year) than for the former (129 basis points per year). This result may be related to the lower (and significantly negative) alpha of the European benchmark in those periods, which would have led to a higher underestimation of the standard alphas. On the other hand, during market crises, benchmark-adjusted alphas were significantly (at the 1% level) higher than the unadjusted alphas for the domestic funds only, with the differences reaching 306 basis points per year. A probable justification for this finding is the considerably lower (and statistically significant) benchmark alpha of the domestic benchmark in the crisis periods.

Thus, our results show that the generalized mutual fund underperformance may, at least partially, have been caused by negative benchmark alphas; additionally, the benchmark-adjustment procedure may have had a higher impact when the benchmark indices exhibited higher concentration. Therefore, the use of benchmark-adjusted alphas is crucial for an accurate assessment of mutual fund performance and should contribute to a more optimistic view of the value of active fund management.

This study has several practical implications for evaluating and understanding mutual fund performance in small markets. Firstly, fund managers and investors should consider using benchmark-adjusted alphas to obtain a more reliable assessment of fund performance, particularly during periods of market instability and in small markets with concentrated

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benchmarks. Secondly, it is important to carefully select benchmarks that accurately reflect the characteristics and investment strategies of the funds studied. By recognizing the impact of benchmarks and employing suitable adjustment procedures, fund managers and investors should be able to make more informed decisions, potentially enhancing investment outcomes. Extending this work to other mutual fund markets, especially small or emerging markets, would be appealing for future research. Studying the effects of persistence, market timing, and selectivity that arise from accepting or rejecting benchmark-adjusted alphas would be another recommended future line of research.

Author contribution

Conceptualization: FL, PL; Data curation: FL; Formal analysis: FL, PL, MCC; Methodology: FL, PL; Software: FL, PL, MCC; Validation: FL, PL, MCC, PDS; Visualization: FL, MCC, PDS; Writing – original draft: FL, PL, MCC; Writing – review & editing: PL, MCC, PDS.

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Appendix 1. Fund Fees and Benchmark-Adjusted Alphas

This appendix presents the benchmark-adjusted net (after-fee) and gross (before-fee) alphas, expressed in basis points per year, for equally weighted portfolios of domestic and European funds, over the 2000-2020 period. Benchmark-adjusted alphas are based on three model specifications: the 6-factor model (FF6) of equation [3]; a 5-factor variant (FF5) that omits the momentum factor; a four-factor version (CH4) that excludes the investment and profitability factors. Besides the total sample period, results are also presented for crisis and non-crisis phases separately, following equation [6].

			Net alpha (bps per year)	Gross alpha (bps per year)
Domestic funds	**CH4**	Total sample	88.92	280.13**
			(0.4993)	(0.0356)
		Non-crisis	76.59	267.59*
			(0.5843)	(0.0588)
		Crisis	376.05	572.24**
			(0.1505)	(0.0305)
European funds	**CH4**	Total sample	-445.55***	-268.56**
			(0.0000)	(0.0112)
		Non-crisis	-572.75***	-397.91***
			(0.0000)	(0.0002)
		Crisis	-485.76	-309.44
			(0.2865)	(0.5004)
	FF5	Total sample	-343.08***	-164.35*
			(0.0002)	(0.0689)
		Non-crisis	-385.65***	-207.64**
			(0.0001)	(0.0355)
		Crisis	-415.70	-238.20
			(0.1983)	(0.4643)
	FF6	Total sample	-361.78***	-183.36**
			(0.0001)	(0.0474)
		Non-crisis	-431.85***	-254.62***
			(0.0000)	(0.0058)
		Crisis	-421.93	-244.54
			(0.2143)	(0.4749)

Note: Standard errors were adjusted for autocorrelation and heteroskedasticity (Newey & West, 1987). The P-values are in parentheses

***,**,* indicate the statistically significant coefficients at the 1%, 5%, and 10% levels, respectively