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Gender, style diversity, and their effect on fund performance☆

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ABSTRACT

This paper examines the performance of 358 European diversified equity mutual funds controlling for gender diversity. Fund performance is evaluated against funds' designated market indices and representative style portfolios. Consistently with previous studies, proper statistical tests point to the absence of significant differences in performance and risk between female and male managed funds. However, perverse market timing manifests itself mainly in female managed funds and in the left tail of the returns distribution. Interestingly, at fund level there is evidence of significant overperformance that survives even after accounting for funds' exposure to known risk factors. Employing a quantile regression approach reveals that fund performance is highly dependent on the selection of the specific quantile of the returns distribution; also, style consistency for male and female managers manifests itself across different quantiles. These results have important implications for fund management companies and for retail investors' asset allocation strategies.

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1. Introduction

Since their launch towards the end of the 19th century mutual funds have been acting as financial intermediaries channelling savings to the most profitable investments, thereby promoting financial stability and social welfare. Designed to provide liquidity, they are the preferred investment vehicle for retail investors mainly because of the benefits of risk diversification and professional management that are not otherwise easily accessible. However, it is not so rare for fund managers to act in a self-interested manner seeking to maximize their compensation through the adoption of gambling strategies (Chevalier and Ellison, 1997).

Following the seminal works of Treynor (1965), Sharpe (1966), and Jensen (1968) most papers have been striving to determine whether actively managed funds are able to deliver superior risk-adjusted returns with respect to a benchmark portfolio. To this end traditional performance measures compare the return of the portfolio of interest with that of a properly defined unmanaged portfolio (benchmark return) after accounting for all aspects of assumed investment risk. The evolution of financial theory has contributed substantially to the proper definition of investment risk that should be accounted for when evaluating the performance of active fund managers. In this context, the single factor evaluation model introduced by Jensen (1968) has been gradually replaced by multi-factor models (Fama and French, 1993; Carhart, 1997). On the other hand, conditional performance evaluation models have been developed on the assumption that fund managers might shift their investment strategy responding to market-wide information (Ferson and Schadt, 1996; Kosowski, 2006; Jha et al., 2009). In view of the growing popularity of mutual funds academic research has attempted to shed light on various aspects of their behaviour. Sirri and Tufano (1998) in their influential study pointed out the importance of mutual funds as a laboratory where one can study the actions of retail investors who buy fund shares. Investors usually base their selection on past performance information but invest asymmetrically, i.e., more in funds that performed very well in the near past. Although it has been recognized that actively managed mutual funds, on average, fail to outperform the market or any combination of passively managed portfolios (Fama and French, 2010), there is evidence that some predetermined variables such as past performance might have predictive power for future investment performance. Performance either measured in an absolute way or on a risk-adjusted basis is related to past performance, managerial characteristics including manager age, education etc. (Chevallier and Ellison, 1999) and fund characteristics such as expenses, turnover and size (Prather et al., 2004); investors seem to recognize this to a certain extent and chase past winners (Gruber, 1996). Another fund characteristic highlighted in some studies is manager style. There is mixed evidence whether fund managers of a certain style tend to outperform or underperform passive benchmarks (see inter alia Daniel et al., 1997; Davis, 2001).

However, there is limited research on the role of the manager gender on fund performance. Well documented differences between men and women in terms of investment behaviour and/or risk-taking have attracted the research interest of other social sciences and economics literature. For example, previous studies have shown that men are more confident (Barber and Odean, 2001) and/or less risk averse than women (Sunden and Surette, 1998). However, the latter was disputed by Schubert et al. (1999), who attributed women's higher levels of risk aversion to the use of survey data and their inability to capture adequately differences in other relevant factors such as the investment opportunity set. Professional money management provides the perfect setting to explore stereotyped behavioural issues mainly because it includes a homogeneous group of individuals with comparable levels of financial expertise. It allows to capture differences in wealth and knowledge in a more effective manner than in an experimental setting. Both Atkinson et al. (2003) and Niessen and Ruenzi (2013), using a sample of US bond and equity funds, respectively, reached the conclusion that there are no significant differences in the risk-adjusted performance of male and female managers. In a related study Beckmann and Menkhoff (2008) analyzed the survey responses of 649 fund managers in the US, Germany, Italy and Thailand and confirmed that female fund managers are more risk averse and less overconfident than men.

Our paper makes a number of important contributions to the literature. First, we compare the performance of male and female managed equity funds employing a novel and comprehensive sample of European diversified equity funds which includes one of the largest proportions of female

professionals in studies in this field. Second, for the first time in the literature we compare the ability of managers to predict not only market portfolio returns but also the size and growth of portfolios. To this end, we apply the approach of Treynor and Mazuy (1966) to the multi-factor Fama and French model (1996) in the spirit of Lu (2005). Third, we control for differences in style since funds are classified into fourteen investment categories and their performance is measured against a proper benchmark for each category. This ensures that we alleviate any of the biases related to inappropriate benchmarking that have been thoroughly examined by Lehmann and Modest (1987), Elton et al. (1993), and Sensoy (2009) inter alia. Fourth, owing to the considerable heterogeneity in returns both at fund and portfolio level we employ a quantile approach to explore fund performance and style consistency across various pre-specified regions of the returns distribution. Finally, we address the need highlighted by Banegas et al. (2013) for a more comprehensive research on European funds and especially for funds that invest across Europe.[1]

Previewing our results, we find that gender does not influence fund performance and more interestingly women are not more risk averse than men. However, at fund level we detect statistically and economically significant alphas, mainly in the Eurozone Large Cap investment category. The documented over-performance of many individual funds gains importance in the light of the turbulence experienced by financial markets as a result of the global financial crisis and the ensuing Eurozone debt crisis. In terms of market timing we document that women exhibit a worse record than men. In particular, half of women in our sample exhibit perverse market timing. Although female managers are in charge of larger funds and shareholders in female managed funds pay on average lower management fees, these differences are not significant. With respect to portfolio quality, both female and male managed funds appear to be sufficiently diversified. As for investment strategies, male managers seem to favour small size stocks whereas female managers prefer more growth-oriented strategies. Measuring fund performance by means of the quantile regression method provides more insights into the fund management process as we move from the left to the right of the conditional returns distribution. Performance appears to be highly dependent on the selection of a specific quantile of the returns distribution. Perverse market timing is still present and more intense in the left tail of the distribution. Finally, there is decreasing market exposure as one moves to the right of the returns distribution irrespective of the gender.

The remainder of the paper is organized as follows. The next section outlines the data selection process and some preliminary results while Section 3 describes the employed performance models and the robust quantile regression approach. The empirical results are presented in Sections 4 and 5 concludes the paper.

2. Mutual funds data and preliminary analysis

We collect monthly returns of European diversified equity mutual funds with a European equity investment focus that are domiciled in one of the four largest European fund markets, namely France, Germany, Italy, and Spain.[2] The data source is the Morningstar Direct comprehensive database covering the period from January 2006 to December 2011. Mutual fund returns are calculated by computing the change in monthly net asset value (NAV), reinvesting all income and capital gains during the month, and dividing by the NAV at the beginning of the month. Returns are not adjusted for sales charges (such as front-end or deferred loads and redemption fees), since we are only concerned with fund manager's skills and investment strategy. Excess returns have been calculated with respect to the 3-month Euribor rate. Monthly prices of the relevant benchmark indices and the Euribor rate were obtained from Datastream Thomson Reuters.

We apply a preliminary filter on all available funds offered in the four markets excluding funds that are team managed. Next, the gender of each fund manager is identified from the manager profile data. In this way we are able to gather data on 59 female-managed mutual funds and 299 male-managed funds as reported in the last row of Table 1. It should be noted that the proportion of females to

[1] A widely known study that examines more than one European fund market is that by Otten and Bams (2002).
[2] Except for the fund markets of Luxembourg, Ireland, and the United Kingdom.

Table 1
Female fund managers.

Category	Male	Female	Number of funds	Percentage of female (%)
Eurozone Small-Cap	8	1	9	11.11
Eurozone Mid-Cap	9	–	9	0.00
Eurozone Large-Cap	78	18	96	18.75
Europe Small-Cap	2	–	2	0.00
Europe Mid-Cap	10	2	12	16.67
Europe Large-Cap Value	30	7	37	18.92
Europe Large-Cap Growth	2	4	6	66.67
Europe Large-Cap Blend	52	10	62	16.13
France Large-Cap	49	5	54	9.26
France Small/Mid-Cap	33	8	41	19.51
Germany Large-Cap	7	–	7	0.00
Germany Small/Mid-Cap	1	–	1	0.00
Italy Equity	4	1	5	20.00
Spain Equity	14	3	17	17.65
Total	299	59	358	16.48

Note: This table shows the allocation of funds that are managed by female managers as a percentage of the total funds by Morningstar investment category. Funds are classified by Morningstar into investment categories on the basis of the underlying portfolio holdings.

Table 2
Funds' operational and cost variables.

	Assets under management (millions €)	Age (in years)	Expense ratio (%)	Turnover ratio (%)	Management fee (%)	Max front load (%)	Morningstar 5-star ratings
Male	93.80	12.91	2.10	120.57	1.42	2.95	26 out of 288 (9.03%)
Female	136.94	12.97	1.84	67.12	1.31	2.51	5 out of 57 (8.77%)
p-Value	0.15	0.95	0.18	0.11	0.26	0.06	–

Note: This table shows the average assets under management, age, expense ratio, turnover ratio, management fee, max front load, and Morningstar 5-star ratings for male and female managed equity funds. Assets are expressed in millions of euros while fund age is measured in years. The expense ratio is the percentage of fund assets paid for operating expenses and management fees, including 12b-1 fees, administrative fees, and all other asset-based costs incurred by the fund. Management fee is also reported in a separate column. Turnover ratio measures trading activity of the portfolio manager and is computed as the lesser of purchases or sales divided by average monthly assets. Max front load denotes the max of the purchase fees deducted from the amount of the investment. The Morningstar 5-star rating denotes funds that receive the highest ranking among their peer group according to Morningstar risk-return analysis. The *p*-value indicates the significance of the difference between the sample means. Data are from Morningstar as of December 2011.

total population in our study is larger than in most previous studies in this area of the literature. For example, Chevalier and Ellison (1997) reported a 7% share of women in their sample, in Atkinson et al. (2003) females constituted 5.6% of the total sample, while Niessen and Ruenzi (2013) performed their analysis with a share of female professionals of approximately 10%. Only the survey response study of Beckmann and Menkhoff (2008) has a 19% share of female managers which is larger than ours. Sample funds are then classified into fourteen different categories on the basis of their investment objective. Following Golec (1996), who concluded that manager tenure is associated with future fund performance, we match tenure to fund performance in order to ensure comparability of funds' realized performance. Index funds and exchange traded funds are both excluded since we are interested in active management.

Table 2 reports some useful statistics for male and female managed equity funds. Average values for both groups as well as the statistical significance of the difference between the female and male managed equity funds are presented. It appears that there are only minor differences. The only significant one is observed in the column max front load. Investors preferring a male managed fund are faced with a substantially higher sales fee than if they had invested in a female managed fund. Moreover, the turnover ratio is substantially different in the two samples, although the difference is only

marginally insignificant. This finding could be explained by the argument of Barber and Odean (2001), who claimed that overconfident investors such as male investors might engage into more frequent trading, which is reflected in our case by the substantially higher turnover ratio for male managers. Finally, female managers are in charge of larger funds while shareholders in female managed funds pay lower management fees. The latter might be due to behavioural factors in professional money management. As stated previously, male managers might have more confidence in their management skills, which leads them to claim higher compensation than female managers.

Table 3 presents some descriptive statistics for the employed series. The last column implies non-normality of the returns of male and female managed portfolios across the majority of investment styles. This is an important finding that motivates the use of the more robust quantile regression method as a tool for exploring the behaviour of the conditional returns distribution. A comparison of the two portfolios in terms of the median return and variability of returns provides some preliminary evidence on the performance of male and female managers. In particular, in general there are no statistically significant[3] differences either in the average return or in the total riskiness of the two portfolios. The latter sheds light on managers' attitude towards risk, allowing us to conclude that male and female managers exhibit similar risk appetite as in Atkinson et al. (2003). For better comparisons a synthetic portfolio that goes long in male managers and simultaneously short in female managers has been constructed and monitored across the various investment categories. Return statistics of the synthetic portfolio are reported in the row labelled Male vs. Female. Interestingly, we do not detect any evidence of significant over- or under-portfolio performance, which reinforces the evidence that male and female managers perform similarly. As a robustness test we have regressed the return difference between male and female managed funds for each investment style on an intercept. Results of the estimated OLS regressions which are available from authors upon request confirm the absence of a statistically significant difference between the performance of male and female managed funds.

3. Methodology

Accurate performance evaluation is crucial in the fund management industry. There is an ongoing debate in the literature on whether mutual fund managers should be evaluated against the benchmark reported in their prospectus or with respect to a broad market-based passive portfolio of comparable risk (see, inter alia, Cremers and Petajisto, 2009; Sensoy, 2009; Hsu et al., 2010; Cremers et al., 2010; Angelidis et al., 2013). Babalos et al. (2013) employing an augmented Carhart's multi-benchmark model (1997) with a stock-level liquidity factor documented the absence of skills among Greek domestic equity fund managers. Vidal-García (2013) provided evidence of short- and long-term performance persistence employing a sample of style-consistent European equity mutual funds between 1988 and 2010, whereas Foran and O'Sullivan (2014) examined the role of micro and macro liquidity risk in UK mutual fund performance revealing liquidity's crucial role in mutual fund evaluation models. All the above studies highlight that benchmark mismatches may result in severe misconceptions regarding funds' risk exposures or funds' superior skills at generating abnormal returns. In the context of the present study, we address this issue by relying on the benchmarks officially assigned by Morningstar to each fund category, which are presented in Table 4.

3.1. Security selection models

3.1.1. Single factor model

The first performance measure employed here is the well-known Jensen's alpha (1968), that is, rooted in the CAPM theory. It measures the additional return generated by a fund over and above that justified by market risk, thereby conveying information on security selection or selectivity skills of a

[3] For the comparison of the portfolio medians we have employed the Wilcoxon/Mann–Whitney non-parametric test while an *F*-test has been carried out for the variance comparison.

Table 3
Summary statistics for European equity funds and their benchmarks.

Category	Median (%)	SD (%)	Jarque–Bera	Category	Median (%)	SD (%)	Jarque–Bera
Eurozone Small-Cap				Europe Large-Cap Value			
Male	0.69	5.61	0.00	Male	0.03	4.95	0.03
Female	0.62	5.58	0.00	Female	0.06	4.78	0.03
Male vs. female	−0.45	1.42	0.59	Male vs. female	−0.10	0.64	0.00
R_m	0.73	8.47	0.05	R_m	−0.71	5.75	0.10
SMB	0.25	2.42	0.71	SMB	0.50	2.72	0.06
HML	−0.35	2.66	0.00	HML	−0.35	2.16	0.00
R_B	0.06	1.05	0.35	R_B	0.06	1.05	0.35
France Large-Cap				Europe Large-Cap Growth			
Male	0.02	5.12	0.27	Male	0.09	5.01	0.00
Female	0.24	5.50	0.44	Female	0.03	4.98	0.00
Male vs. female	0.08	0.61	0.76	Male vs. female	−0.23	1.63	0.77
R_m	−0.37	5.55	0.49	R_m	0.68	4.38	0.03
SMB	0.25	2.42	0.71	SMB	0.50	2.72	0.06
HML	−0.35	2.66	0.00	HML	−0.35	2.16	0.00
R_B	0.06	1.05	0.35	R_B	0.06	1.05	0.35
Eurozone Large-Cap				Europe Large-Cap Blend			
Male	0.24	5.27	0.05	Male	0.19	4.81	0.02
Female	0.09	5.14	0.05	Female	0.57	4.77	0.00
Male vs. female	−0.03	0.47	0.00	Male vs. female	−0.15	0.66	0.51
R_m	−0.29	5.65	0.18	R_m	−0.10	4.91	0.19
SMB	0.25	2.42	0.71	SMB	0.50	2.72	0.06
HML	−0.35	2.66	0.00	HML	−0.35	2.16	0.00
R_B	0.06	1.05	0.35	R_B	0.06	1.05	0.35
Europe Small-Cap				Eurozone Mid-Cap			
Male	0.18	5.26	0.00	Male	0.17	5.46	0.05
R_m	0.22	6.31	0.00	R_m	0.24	6.13	0.04
SMB	0.50	2.72	0.06	SMB	0.25	2.42	0.71
HML	−0.35	2.16	0.00	HML	−0.35	2.66	0.00
R_B	0.06	1.05	0.35	R_B	0.06	1.05	0.35
Male	0.15	5.60	0.01	Male	0.53	5.10	0.00
Female	0.53	5.54	0.01	Female	0.66	5.31	0.01
Male vs. female	−0.37	1.27	0.76	Male vs. female	−0.07	0.97	0.65
R_m	0.52	5.62	0.01	R_m	0.64	6.04	0.03
SMB	0.50	2.72	0.06	SMB	0.25	2.42	0.71
HML	−0.35	2.16	0.00	HML	−0.35	2.66	0.00
R_B	0.06	1.05	0.35	R_B	0.06	1.05	0.35
Germany Small/Mid-Cap				Germany Large-Cap			
Male	1.25	6.76	0.00	Male	0.99	6.43	0.00
R_m	0.56	6.95	0.00	R_m	1.12	6.12	0.01
SMB	0.25	2.42	0.71	SMB	0.25	2.42	0.71
HML	−0.35	2.66	0.00	HML	−0.35	2.66	0.00
R_B	0.06	1.05	0.35	R_B	0.06	1.05	0.35
Italy Equity				Spain Equity			
Male	−0.79	5.74	0.41	Male	0.18	5.58	0.31
Female	−0.64	5.94	0.55	Female	−0.20	5.70	0.29
Male vs. female	0.04	0.51	0.72	Male vs. female	0.16	1.21	0.48
R_m	−1.04	6.25	0.60	R_m	0.03	6.36	0.31
SMB	0.25	2.42	0.71	SMB	0.25	2.42	0.71
HML	−0.35	2.66	0.00	HML	−0.35	2.66	0.00
R_B	0.06	1.05	0.35	R_B	0.06	1.05	0.35

Note: This table reports summary statistics for the two equally-weighted portfolios of male and female managers, respectively. Table also reports returns statistics for a strategy that is long in male managers and short in female managers (male vs. female) along with the statistics of the employed benchmark portfolios. R_m is the market portfolio return defined for each category, SMB is the small vs. large strategy portfolio returns whereas HML is the value vs. growth strategy portfolio returns properly constructed for each investment category. R_B is the returns of the Barclays Corporate and Government Total Return fixed income index. The p-value of the Jarque–Bera test statistic reported in the last column measures the degree of normality for the returns distribution.

Table 4
Designated benchmarks per investment style.

investment category	Benchmark index
Eurozone Small-Cap Equity	MSCI EMU Small Cap
Eurozone Mid-Cap Equity	MSCI EMU Mid
Eurozone Large-Cap Equity	MSCI EMU
Europe Small-Cap Equity	MSCI Europe Small Cap
Europe Mid-Cap Equity	Stoxx Europe Mid 200
Europe Large-Cap Value Equity	MSCI Europe Value
Europe Large-Cap Growth Equity	MSCI Europe Growth
Europe large-Cap Blend Equity	MSCI Europe
France Large-Cap Equity	Euronext Paris CAC 40
France Small/Mid-Cap Equity	Euronext Paris CAC Mid 100
Germany Large-Cap Equity	DAX
Germany Small/Mid-Cap Equity	MSCI Germany Small Cap
Italy Equity	MSCI Italy
Spain Equity	MSCI Spain

Note: This table reports the most suitable market benchmarks across investment categories defined by Morningstar.

fund manager. Formally, the single factor performance measure is the intercept (α_p) in the regression of the fund excess returns on the excess returns of a representative market index:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,1}(R_{m,t} - R_{f,t}) + \varepsilon_{p,t} \quad (1)$$

where $R_{p,t}$ is the return of fund p in period t; $R_{f,t}$ is the risk-free rate in period t; $R_{m,t}$ is the return of the proper market portfolio of each fund in period t.

3.1.2. Multi-factor model

We then employ a modified version of the Fama and French (1993) three factor model. In particular, we follow Elton et al. (1996, 1999), who used an overall market index, a size index and a growth versus value index that are readily available to investors via passive investment products such as index funds or exchange traded funds. This allows for direct comparisons of active fund managers with comparable passive strategies. Specifically, we opt for a multi-factor performance evaluation model that includes the STOXX Size and Style Indices tracking equity investments in Europe and the Eurozone, respectively. We also employ the Barclays Corporate and Government Total Return fixed income index in order to account for European funds' non-stock holdings. Fund overperfomance (underperformance) manifests itself as a significantly positive (negative) intercept (α_p) in the four-factor model that compares the realized returns of the fund against the returns of risk-bearing, passive investment strategies as follows:

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,1}(R_{m,t} - R_{f,t}) + \beta_{p,2}\mathrm{SMB}_t + \beta_{p,3}\mathrm{HML}_t + \beta_{p,4}(R_{B,t} - R_{f,t}) + \varepsilon_{p,t} \quad (2)$$

where $\beta_{p,1}$, $\beta_{p,2}$, $\beta_{p,3}$, and $\beta_{p,4}$ are funds' exposures to the relevant risk factors; $R_{p,t}$ is the return of fund p in period t; $R_{f,t}$ is the risk-free rate in period t; $R_{m,t}$ is the return of the proper market portfolio of each fund in period t; SMB (Small minus Big) stands for the returns of a size strategy and is constructed as the difference between the returns of the STOXX Europe Total Market Small Index and those of the STOXX Europe Total Market Large Index; HML (High minus Low) stands for the returns of the STOXX Europe Total Market Value Index minus those of the STOXX Europe Total Market Growth Index, and $R_{B,t}$ is the return of the comprehensive fixed income index.

For funds investing mainly in the Eurozone we modify the benchmark portfolios accordingly, i.e., SMB is computed by taking the difference between the returns of the EURO STOXX Total Market Small Index and those of the EURO STOXX Total Market Large Index, while the HML benchmark factor is calculated as the difference between the returns of the EURO STOXX Total Market Value Index and those of the EURO STOXX Total Market Growth Index.

3.2. Factor timing models

Market timing manifests itself as the ability of a fund manager to shift successfully its portfolio systematic risk in response to market movements. Traditional market timing models hypothesize that a skilled fund manager increases (decreases) its average market exposure when the market experiences positive (negative) returns, and therefore assume that fund returns are a convex function of benchmark returns in an attempt to quantify managers' timing skills. In the present study we employ the well-known Treynor and Mazuy (1966) (TM hereafter) model that assumes a time-varying market beta which in effect depends linearly on the market return. Therefore, market timing ability is captured by the coefficient c_p in the non-linear regression of the TM model. Positive and significant values of c_p indicate managers' successful market timing ability.

$$R_{p,t} - R_{f,t} = \alpha_p + \beta_{p,1}(R_{m,t} - R_{f,t}) + c_p(R_{m,t} - R_{f,t})^2 + \varepsilon_{p,t} \tag{3}$$

Following the introduction of the TM model various exrensions have emerged in the literature including a multivariate GARCH approach (Oueslati et al., 2014). Along the same lines the model can be easily extended to include the benchmark portfolios of Fama and French (1993) as well as two additional regressors that measure potential style timing in the spirit of Lu (2005), Benos et al. (2010), and Chen et al. (2013). In particular, we assume that the coefficients $\beta_{p,2}$ and $\beta_{p,3}$ of Eq. (2) are linearly related to the relevant benchmark returns, which yields the following factor timing model:

$$\begin{aligned} R_{p,t} - R_{f,t} = {} & \alpha_p + \beta_{p,1}(R_{m,t} - R_{f,t}) + \beta_{p,2}\mathrm{SMB}_t + \beta_{p,3}\mathrm{HML}_t + c_{p,1}(R_{m,t} - R_{f,t})^2 + c_{p,2}\mathrm{SMB}_t^2 \\ & + c_{p,3}\mathrm{HML}_t^2 + \varepsilon_{p,t} \end{aligned} \tag{4}$$

where $c_{p,1}$, $c_{p,2}$, $c_{p,3}$ measure the ability of fund managers to time successfully the market, size, and growth style, respectively. Eq (4) enables us to disentangle more accurately the effect of each timing skill on fund performance.

3.3. Quantile regression

In this section we describe the quantile regression method proposed by Koenker and Bassett (1978) and Koenker (2005) employed here to explore the asymmetric behaviour of European fund returns. Quantile regression is a very robust tool in cases of non-symmetric distributions. It can provide extra information on the relationship between returns and the various risk factors, not only in the median return but across different, prespecified areas of the returns distribution. In particular, it overcomes the limitations of the traditional conditional-mean regression models and permits the estimation of various quantile functions, shedding light on the exposure of funds' returns to the various risk factors in the tails of the distribution.[4] Given that quantile analysis does not rely on any assumption with respect to the conditional distribution of funds' performance, it is particularly suited to our data with significant heterogeneity in returns.

The τ-th conditional quantile function of a distribution is defined as:

$$Q_{y_i}(\tau/x) = x_i^T \beta \tag{5}$$

where y_i is the dependent variable, in our case fund returns, x_i is a vector of independent variables including various benchmark portfolio returns, and β is a vector of risk loadings to be estimated. The estimator of $\hat{\beta}(\tau)$ is obtained by solving the following weighted minimization problem:

$$\hat{\beta}(\tau) = \arg\min_{\beta \in R^p} \sum_{i=1}^{n} \rho_\tau(y_i - x_i^T \beta) \tag{6}$$

[4] Generally, each quantile regression defines a particular, centre or tail, point of a conditional distribution. This approach also allows the estimation of the median (0.5th quantile) function as a special case, which can be thought of the mean function of the conditional distribution of funds'returns.

where ρ_τ is a weighting function. For any $\tau \in (0, 1)$ this takes the form:

$$\rho_\tau(u_i) = \begin{cases} \tau u_i & \text{if } u_i \geq 0 \\ (1-\tau)u_i & \text{if } u_i < 0 \end{cases} \quad \text{where } u_i = y_i - x_i^T \beta \tag{7}$$

Combining Eqs. (6) and (7) we get the following expression:

$$\hat{\beta}(\tau) = \arg\min \left\{ \sum_{i=1}^{n} \tau |y_i - x_i^T \beta| + \sum_{i=1}^{n} (1-\tau)|y_i - x_i^T \beta| \right\} \tag{8}$$

Eq. (8) shows that the quantile regression estimator is obtained by minimizing the weighted sum of the absolute errors, where the relative weights depend on the specified quantile.

4. Results

4.1. Fund by fund analysis

We first explore fund managers' skills in terms of selectivity and timing employing the entire fund universe described above. Tables 5–8 report the estimation results of Eqs. (1)–(4) using the OLS method adjusted with the Newey and West (1987) procedure. We divide our dataset into male and female managers and according to the investment strategy adopted in order to capture potentially different skills. The results for the single factor model are reported in Table 5. Panel A reveals significant managerial talent for 120 funds while 9 appear to lack managerial skills. Panel B suggests that female

Table 5
Single factor model regression estimates.

Panel A: Number of significant 1 factor alphas		
No. of significantly positive	120	
No. of significantly negative	9	
Panel B: Analysis by gender		
No. of significantly positive 1 factor alphas		No. of funds in the category
Male	98	299 (33%)
Female	22	59 (37%)
No. of significantly negative 1 factor alphas		
Male	6	299 (2%)
Female	3	59 (5%)
Panel C: Analysis by investment objective		
No. of significantly positive 1 factor alphas	*120*	
Eurozone Mid-Cap	4	9
Eurozone Large-Cap	37	96
Europe Large-Cap Value	15	37
Europe Large-Cap Blend	21	62
France Large-Cap	28	54
France Small/Mid-Cap	3	41
Italy Equity	3	5
Spain Equity	9	17
No. of significantly negative 1 factor alphas	*9*	
Eurozone Small-Cap	1	9
Eurozone Large-Cap	1	96
Europe Small-Cap	1	2
Europe Large-Cap Growth	2	6
France Small/Mid-Cap	4	41

Note: This table reports overall OLS estimation results from the single factor securities selection model in Eq. (1) employing the Newey and West (1987) method for robust standard errors. Panel A of the table reports the number of significant positive and negative single factor alphas at the 10% significance level whereas Panel B presents the results grouped by manager gender. Panel C reports the significant alphas broken down by investment category.

Table 6
Timing model I regression estimates.

Panel A: Number of significant timing coefficients		
No. of significantly positive	13	
No. of significantly negative	123	
Panel B: Analysis by gender		
No. of significantly positive timing coefficients		No. of funds in the category
Male	12	299 (4%)
Female	1	59 (2%)
No. of significantly negative timing coefficients		
Male	94	299 (31%)
Female	29	59 (49%)
Panel C: Analysis by investment objective		
No. of significantly positive timing coefficients		
Eurozone Mid-Cap	3	9
Eurozone Large-Cap	5	96
Europe Mid-Cap	1	12
Europe Large-Cap Value	1	37
Europe Large-Cap Blend	1	62
France Small/Mid-Cap	1	41
Germany Large-Cap	1	7
No. of significantly negative timing coefficients		
Eurozone Small-Cap	2	9
Eurozone Mid-Cap	3	9
Eurozone Large-Cap	22	96
Europe Small-Cap	2	2
Europe Mid-Cap	4	12
Europe Large-Cap Value	30	37
Europe Large-Cap Growth	1	6
Europe Large-Cap Blend	26	62
France Large-Cap	9	54
France Small/Mid-Cap	17	41
Germany Large-Cap	1	7
Germany Small/Mid-Cap	1	1
Italy Equity	3	5
Spain Equity	2	17

Note: This table reports overall OLS estimation results from the estimation of the Treynor and Mazuy (1966) market timing model in Eq. (2) employing the Newey and West (1987) method for robust standard errors. Panel A of the table reports the number of significant positive and negative timing coefficients at the 10% significance level whereas Panel B presents the results grouped by manager gender. Panel C reports the significant timing coefficients broken down by investment category.

managers are slightly superior to male managers in terms of performance. In particular, 37% of female managers have stock picking ability whereas almost 33% of male managers achieve a higher risk-adjusted return. As for the distribution of significant single-factor alphas across investment styles, Panel C highlights over-performance for eight of the fourteen investment categories. The majority of significantly positive single-factor alphas are concentrated in the Eurozone Large-Cap category.

However, the results for the more representative factor model reported in Table 7 provide a different performance picture. Specifically, Panel A shows that the number of funds with statistically significant positive alphas is slightly lower than according to the single factor model estimates (116 instead of 120) while the number of funds that underperform is higher (12 as opposed to 9). This finding is consistent with the vast literature suggesting that the omission of known risk factors that are priced in financial markets (Fama and French, 1993) can severely bias inference during the fund performance evaluation process, as well as with the results of Cuthbertson and Nitzsche (2013) for the German market. Interestingly, Panel A of Table 8, where the estimated parameters of Eq. (2) are presented, indicates that almost half of the male managers have tilted towards small size stocks as revealed by their significant positive exposure to the SMB factor, whereas a substantial portion of female managers (36%) favour a growth-oriented strategy. Again, the best performance is found for the funds belonging to the Eurozone Large-Cap category.

Table 7
Four factor model regression estimates.

Panel A: Number of significant 4F alphas		
No. of significantly positive	116	
No. of significantly negative	12	
Panel B: Analysis by gender		
No. of significantly positive 4F alphas		No. of funds in the category
Male	96	299 (32%)
Female	20	59 (34%)
No. of significantly negative 4F alphas		
Male	9	299 (3%)
Female	3	59 (5%)
Panel C: Analysis by investment objective		
No. of significantly positive 4F alphas		
Eurozone Mid-Cap	4	9
Eurozone Large-Cap	47	96
Europe Large-Cap Value	10	37
Europe Large-Cap Blend	17	62
France Large-Cap	24	54
France Small/Mid-Cap	4	41
Italy Equity	3	5
Spain Equity	7	17
No. of significantly negative 4F alphas		
Eurozone Small-Cap	1	9
Eurozone Large-Cap	2	96
Europe Small-Cap	1	2
Europe Large-Cap Growth	2	6
France Large-Cap	1	54
France Small/Mid-Cap	4	41
Germany Large-Cap	1	7

Note: This table reports overall OLS estimation results from the four factor securities selection model in Eq. (2) employing the Newey and West (1987) method for robust standard errors. Panel A of the table reports the number of significant positive and negative four factor alphas at the 10% significance level whereas Panel B presents the results grouped by manager gender. Panel C reports the significant multi factor alphas at the 10% significance level broken down by investment category.

Table 8
Fund exposures to risk factors.

Panel A: Sensitivity to risk factors	SMB		HML	
Number of significantly positive coefficients	143	% of funds in the category	28	% of funds in the category
Male	125	42%	23	8%
Female	18	31%	5	8%
Number of significantly negative coefficients	45		102	
Male	35	12%	81	27%
Female	10	17%	21	36%
Panel B:Timing of risk factors	SMB^2		HML^2	
Number of significantly positive coefficients	43	% of funds in the category	41	% of funds in the category
Male	39	13%	37	12%
Female	4	7%	4	7%
Number of significantly negative coefficients	27		38	
Male	20	7%	26	9%
Female	7	12%	12	20%

Note: Panel A of the table reports the sum of funds with significant negative or positive loadings to the SMB and HML factors at the 10% significance level derived from the four factor securities selection model in Eq. (2). Model has been estimated under the OLS method and the Newey and West (1987) method for robust standard errors. Panel B of the table reports the number of significant positive and negative factor timing coefficients at the 10% significance level derived from the factor timing model in Eq. (4). Model has been estimated using the OLS method and the Newey and West (1987) method for robust standard errors.

Market timing abilities of fund managers are investigated using the classical market timing model of Treynor and Mazuy (1966). The results of the favourable and unfavourable values for the estimated parameters are reported in Table 6. Panel A shows that only a small number (13) of managers possess significant market timing abilities. Moreover, the gender analysis presented in Panel B shows that half of the female managers are poor market timers. By contrast, male managers dominate as successful market timers with twelve of the thirteen positive market timing coefficients. In terms of investment style, three fund styles, namely Europe Large-Cap Value, Europe Large-Cap Blend, and Eurozone Large Cap, offer the strongest evidence of perverse market timing.

Next, we opt for an augmented Treynor and Mazuy (1966) model to test for size and growth timing skills of fund managers in the spirit of Lu (2005). Three main points arise from Panel B of Table 8. First, we document substantial size and growth timing skills for European fund managers, which is consistent with the findings of Lu (2005). Second, male managers appear slightly superior to their female counterparts in terms of factor timing. Third, the results confirm that, as in the case of the simple TM model, female managers exhibit poor size and growth timing abilities: one out of five failed to adjust successfully her portfolio exposure to the growth factor.

4.2. Analysis at portfolio level

In this section we repeat the analysis conducted above on two equally-weighted portfolios composed of male and female managers, respectively. The results of the estimated single-factor model[5] highlight the existence of a statistically significant positive alphas in 6[6] out of the 14 investment styles, the strongest performance being observed for the Italy Equity style. The aggregate results reinforce the earlier finding that female managers have an insignificant advantage over male managers: they are found to outperform their male counterparts in four (Europe Large-Cap Blend, Eurozone Large-Cap, France Large-Cap, Europe Large-Cap Value) out of the six investment styles that exhibit significant positive performance. With a few exceptions, male and female portfolios exhibit comparable exposures to market movements and sufficient levels of diversification as revealed by the values of the Adjusted R^2s.

The results of the estimated four factor model are presented in Table 9. A few findings are noteworthy. First, this model explains the variability of fund returns better than the single factor one: the average adjusted R^2 for the former across all investment categories is 0.94 compared to 0.92 for the latter. Although there are no significant differences across genders and models we document some substantial deviations for two styles (Europe Large Cap Growth, Spain Equity). Second, the estimated positive alphas are significantly lower. Examples include the France Large Cap category where the statistically significant coefficient for abnormal performance for male managers falls from 0.20% to 0.14%. For female managers the adjustment in the documented performance resulting from the use of the multi factor model is not negligible and amounts to five basis points (0.05%). Interestingly, German fund managers have adopted a positive and significant exposure to the corporate and sovereign bond market, in contrast to their fellow managers in the South (Italy Equity and Spain Equity). This finding may be related to the recent Eurozone debt crisis and the subsequent response of fixed income markets.

Estimation results of Eqs. (3) and (4) for the two equally-weighted portfolios that are available from the authors upon request confirm the poor market timing abilities documented earlier at fund level. In particular, perverse market timing characterizes both female and male managers for 6 of the 14 investment styles, especially in the case of the former. For example, in the Europe Large-Cap Blend category the estimated negative value of the timing coefficient for female managers is twice as big as that for male managers and strongly significant (at the 1% significance level). As for the augmented timing model results indicate differences in timing behaviour for the two genders: there is weak evidence of size and growth timing ability of male managers for four investment categories (Eurozone

[5] Results are available from the authors upon request

[6] The Eurozone Mid-Cap investment style is not included in the calculations owing to the absence of female managers in that category.

Table 9
Securities selection model II.

Category	Intercept	$\beta_{p,1}$	$\beta_{p,2}$	$\beta_{p,3}$	$\beta_{p,4}$	Adj. R^2	Category	Intercept	$\beta_{p,1}$	$\beta_{p,2}$	$\beta_{p,3}$	$\beta_{p,4}$	Adj. R^2
Eurozone Small-Cap							Europe Large-Cap Blend						
Male	−0.37%	0.57***	0.19	0.02	−0.28	0.80	Male	0.11%*	0.95***	0.10***	−0.02	−0.06	0.98
Female	−0.13%	0.59***	0.10	−0.13	−0.37	0.77	Female	0.17%*	0.93***	0.14***	−0.08	−0.11	0.95
Eurozone Mid-Cap							France Large-Cap						
Male	0.21%*	0.87***	0.11**	−0.09**	−0.17	0.96	Male	0.14%**	0.92***	0.15	−0.07**	0.07	0.98
Female	–	–	–	–	–	–	Female	0.17%**	0.99***	0.10*	−0.06	0.11	0.98
Eurozone Large-Cap							France Small/Mid-Cap						
Male	0.13%**	0.93***	0.05*	−0.04*	0.03	0.99	Male	−0.05%	0.83***	−0.13	0.04	−0.11	0.95
Female	0.19%***	0.92***	−0.05	−0.08***	−0.08	0.98	Female	0.01%	0.88***	−0.10	−0.02	−0.15	0.97
Europe Small-Cap							Germany Large-Cap						
Male	−0.31%	0.90***	−0.38***	−0.12	0.11	0.85	Male	−0.18%	1.04***	0.33***	−0.03	0.46*	0.96
Female	–	–	–	–	–	–	Female	–	–	–	–	–	–
Europe Mid-Cap							Germany Small/Mid-Cap						
Male	0.05%	0.91***	0.15*	0.10	−0.28*	0.95	Male	0.22%	0.94***	−0.27*	0.09	0.18	0.88
Female	0.19%	0.94***	0.08	−0.01	−0.40***	0.96	Female	–	–	–	–	–	–
Male	0.12%	0.92***	0.04	−0.34***	−0.07	0.97	Male	0.27%**	0.92***	0.16***	−0.08**	−0.25**	0.97
Female	0.10%	0.89***	0.09	−0.42***	−0.19*	0.96	Female	0.22%*	0.95***	0.22***	−0.09**	−0.25**	0.97
Europe Large-Cap Growth							Spain Equity						
Male	−0.31%	0.92***	0.38***	0.22***	0.12	0.87	Male	0.18%	0.85***	0.27***	0.01	−0.24	0.96
Female	−0.29%**	0.96***	0.37***	0.21***	−0.11	0.95	Female	−0.10%	0.86***	0.50***	−0.14*	−0.44**	0.91

Note: This table reports the OLS estimation results from the four factor securities selection model in Eq. (2) employing the Newey and West (1987) method for robust standard errors for the two equally-weighted portfolios of male and female managed equity funds. *, **, and ***, respectively denote statistical significance at the 10%, 5%, and 1% levels.

Table 10
Multi factor securities selection model: quantile regression.

		Intercept	$\beta_{p,1}$	$\beta_{p,2}$	$\beta_{p,3}$	$\beta_{p,4}$			Intercept	$\beta_{p,1}$	$\beta_{p,2}$	$\beta_{p,3}$	$\beta_{p,4}$
Eurozone Small-Cap							Europe Small-Cap						
Male	q05	−5.13%***	0.66***	−0.24	0.46	−1.43*	Male	q05	−3.30%***	0.93***	−0.54***	−0.06	0.28
	q25	−1.58%**	0.57***	0.20	0.20	−0.35		q25	−1.75%***	0.98***	−0.52***	−0.18	0.16
	q50	−0.49%	0.53***	0.29*	0.10	−0.04		q50	−0.27%	0.83***	−0.24	0.06	−0.18
	q75	1.19%***	0.52***	0.33***	−0.02	−0.10		q75	0.75%**	0.82***	−0.26	−0.10	0.21
	q95	2.71%***	0.52***	0.28	0.04	0.06		q95	3.35%***	0.95***	−0.67	0.23	0.61
Female	q05	−5.28%***	0.68***	−0.09	−0.35	−1.23	Female	q05	–	–	–	–	–
	q25	−1.52%**	0.61***	−0.12	−0.08	−0.76		q25	–	–	–	–	–
	q50	0.26%	0.58***	0.07	−0.04	−0.53		q50	–	–	–	–	–
	q75	1.45%***	0.55***	0.16	−0.09	0.15		q75	–	–	–	–	–
	q95	3.79%***	0.46***	0.38*	0.36	0.11		q95	–	–	–	–	–
Eurozone Mid-Cap							Europe Mid-Cap						
Male	q05	−1.56%***	0.95***	0.16	−0.18	−0.25	Male	q05	−2.36%***	1.02***	0.16	0.03	0.04
	q25	−0.48%***	0.89***	0.10	−0.10*	−0.11		q25	−0.68%***	0.88***	0.14	0.01	−0.05
	q50	0.27%	0.86***	0.10	−0.09*	−0.16		q50	0.08%	0.87***	0.14	0.11	−0.20
	q75	0.85%***	0.81***	0.16	0.02	−0.20*		q75	0.93%***	0.92***	0.15	0.09	−0.44***
	q95	1.92%***	0.76***	0.41***	−0.22**	−0.15		q95	2.65%***	0.89***	−0.09	0.46**	−0.55**
Female	q05	–	–	–	–	–	Female	q05	−1.52%***	0.98***	0.07	−0.04	−0.88***
	q25	–	–	–	–	–		q25	−0.48%***	0.95***	0.04	−0.08	−0.41***
	q50	–	–	–	–	–		q50	0.21%*	0.90***	0.12	0.05	−0.37***
	q75	–	–	–	–	–		q75	0.71%***	0.92***	0.09	0.07	−0.21
	q95	–	–	–	–	–		q95	2.10%***	0.85***	0.09	0.33	−0.70
Eurozone Large-Cap							Europe Large-Cap Value						
Male	q05	−0.91%***	0.94***	0.06	0.02	0.04	Male	q05	−1.50%***	0.93***	0.06	−0.37***	−0.17
	q25	−0.20%***	0.95***	0.05**	−0.06**	−0.08		q25	−0.38%**	0.96***	0.03	−0.35***	−0.16
	q50	0.12%	0.94***	0.03	−0.04	−0.04		q50	0.14%	0.91***	0.06	−0.37***	−0.07
	q75	0.42%***	0.93***	0.00	−0.03	0.10		q75	0.58%***	0.88***	0.02	−0.29***	−0.10
	q95	1.23%***	0.96***	0.13*	0.01	0.39		q95	1.82%***	0.77***	0.01	0.11	−0.33
Female	q05	−0.85%***	0.93***	0.05	−0.09*	−0.33**	Female	q05	−1.96%***	1.08***	−0.05	−0.89***	−0.04
	q25	−0.24%**	0.96***	−0.08*	−0.13***	−0.13		q25	−0.42%***	0.95***	0.12	−0.47***	−0.28*
	q50	0.12%	0.94***	−0.05	−0.07	−0.12		q50	0.16%	0.90***	0.08	−0.39***	−0.21
	q75	0.59%***	0.91***	−0.08***	−0.04	−0.05		q75	0.73%***	0.84***	0.10	−0.28**	−0.20
	q95	1.59%***	0.94***	0.19	−0.04	0.29		q95	1.74%***	0.78***	0.10	−0.03	−0.53***
Europe Large-Cap Growth							France Small/Mid-Cap						
Male	q05	−2.92%***	0.96***	0.43	0.12	−0.59	Male	q05	−1.88%***	0.92***	−0.09	0.01	−0.44*
	q25	−1.33%***	0.96***	0.35***	0.23	0.07		q25	−0.73%**	0.81***	−0.14	0.00	−0.17
	q50	−0.16%	0.85***	0.35***	0.37***	−0.06		q50	0.00%	0.82***	−0.11	−0.03	−0.05
	q75	1.14%***	0.97***	0.29***	0.18	0.44		q75	0.71%***	0.81***	−0.11	0.04	0.06
	q95	2.66%***	1.07***	0.17	0.08	0.78***		q95	1.50%***	0.73***	−0.16	0.14	−0.20
Female	q05	−2.62%***	1.04***	0.56***	0.25**	−0.63**	Female	q05	−1.64%***	0.87***	−0.06	0.12	−0.12
	q25	−0.97%***	1.01***	0.33***	0.17*	0.04		q25	−0.64%***	0.91***	−0.12	0.00	−0.24
	q50	−0.14%	0.92***	0.37***	0.27***	−0.05		q50	0.04%	0.86***	−0.03	−0.04	−0.26

	q75	0.50%***	0.92***	0.38***	0.23	0.04
	q95	1.48%***	0.90***	0.41***	0.19	−0.25
Europe Large-Cap Blend						
Male	q05	−0.83%***	0.99***	0.09	−0.02	−0.29
	q25	−0.26%***	0.96***	0.07*	−0.04	−0.13
	q50	0.03%	0.98***	0.04	−0.08	−0.13
	q75	0.54%***	0.94***	0.11***	−0.03	−0.06
	q95	1.09%***	0.96***	0.14*	−0.04	0.44
Female	q05	−1.87%***	1.15***	0.11	−0.47**	−0.04
	q25	−0.47%***	0.95***	0.16**	−0.09	−0.34*
	q50	0.14%	0.91***	0.10*	−0.16*	−0.09
	q75	0.73%***	0.89***	0.09	−0.14	−0.16
	q95	1.56%***	0.83***	0.01	−0.20*	−0.08
France Large-Cap Blend						
Male	q05	−0.91%***	0.99***	0.19***	−0.04	0.03
	q25	−0.19%**	0.91***	0.19***	−0.04	−0.03
	q50	0.07%	0.90***	0.16***	−0.07	−0.04
	q75	0.55%***	0.88***	0.17***	−0.04	0.13
	q95	1.14%***	0.85***	0.27***	−0.05	−0.07
Female	q05	−1.10%***	1.03***	0.07	0.01	0.21
	q25	−0.35%**	1.02***	0.07**	−0.11**	−0.01
	q50	0.09%	0.98***	0.07	−0.07	−0.07
	q75	0.68%***	0.94***	0.10	0.01	−0.02
	q95	1.50%***	0.96***	0.21*	−0.07	0.26
Italy Equity						
Male	q05	−1.13%***	0.98***	0.16	−0.12	−0.17
	q25	−0.33%***	0.92***	0.20**	−0.10	−0.11
	q50	0.25%*	0.90***	0.20***	−0.06	−0.24*
	q75	0.84%***	0.89***	0.13*	−0.04	−0.39**
	q95	1.55%**	0.96***	0.12	−0.24	−0.47
Female	q05	−1.20%***	0.96***	0.33***	−0.09	−0.38**
	q25	−0.46%***	0.97***	0.23***	−0.15***	−0.08
	q50	0.15%	0.93***	0.19**	−0.10	−0.20
	q75	0.88%***	0.94***	0.17**	−0.10	−0.32
	q95	2.20%***	1.05***	0.15***	−0.45**	−0.73**
	q75	0.65%***	0.89***	−0.14**	−0.06	−0.10
	q95	1.61%***	0.96***	−0.15	0.01	0.04
Germany Large-Cap						
Male	q05	−2.38%***	1.04***	0.63***	−0.04	0.20
	q25	−0.93%***	1.05***	0.32***	−0.01	0.40
	q50	−0.11%	0.98***	0.29***	0.03	0.37
	q75	0.57%***	1.03***	0.26***	−0.06	0.32
	q95	1.82%***	1.05***	0.15	−0.17	1.29***
Female	q05	–	–	–	–	–
	q25	–	–	–	–	–
	q50	–	–	–	–	–
	q75	–	–	–	–	–
	q95	–	–	–	–	–
Germany Small/Mid-Cap						
Male	q05	−3.46%***	0.93***	−0.25*	0.24	0.03
	q25	−1.16%***	0.97***	−0.43**	0.14	−0.32
	q50	0.10%	0.98***	−0.30	−0.05	0.11
	q75	1.57%***	0.96***	−0.23	0.07	0.35
	q95	4.10%***	0.77***	0.01	0.32	0.57
Female	q05	–	–	–	–	–
	q25	–	–	–	–	–
	q50	–	–	–	–	–
	q75	–	–	–	–	–
	q95	–	–	–	–	–
Spain Equity						
Male	q05	−1.29%**	0.84***	0.24	0.10	−0.31
	q25	−0.25%	0.84***	0.25***	−0.02	−0.16
	q50	0.22%**	0.82***	0.29***	0.03	−0.18
	q75	0.91%***	0.88***	0.29***	−0.02	−0.42***
	q95	1.99%***	0.84***	0.03	0.11	−0.20
Female	q05	−2.62%***	0.93***	0.30*	−0.19	−0.68
	q25	−1.12%***	0.82***	0.52***	−0.19	−0.49*
	q50	0.02%	0.85***	0.49***	−0.11	−0.40**
	q75	0.95%***	0.85***	0.56***	−0.10	−0.30
	q95	2.22%***	0.92***	0.62***	−0.19	−0.55***

Note: This table reports the estimations of the multi factor performance evaluation model in Eq. (2) under the quantile regression method for the two equally-weighted portfolios of male and female managed funds. Results are presented for five different quantiles namely q05, q25, q50, q75, and q95. *, **, and ***, respectively denote statistical significance at the 10%, 5%, and 1% levels.

Small Cap, Europe Mid-Cap, Europe Small Cap, France Small/Mid Cap), whilst female managers appear to have adopted a perverse growth timing strategy in the case of two investment styles (Europe Mid Cap, Europe Large-Cap Value).

4.3. Quantile regression results

Given the non-Gaussian nature of portfolio returns for male and female managers documented earlier we also investigate how the conditional dependence between fund returns and benchmark returns may vary across the entire range of their conditional distributions. Moreover decomposing the analysis of funds into different performance classes reflects a more complete picture of fund performance. The estimation results for model (2) employing the quantile regression approach are reported in Table 10. The multi-factor estimates of the alphas are negative and statistically significant in the lower part of the conditional return distribution, i.e., for quantiles 0.05 and 0.25, for all investment categories. On the other hand, they are positive and statistically significant in the right tail of the distribution. Interestingly fund alpha increases as the quantile increases. Moreover, many investment styles (e.g., Eurozone Small Cap and Europe Large Cap-Value) are characterized by decreasing market exposure as one moves to the right of the returns distribution irrespective of the gender. This finding is consistent with those of Högholm et al. (2011) for 65 European large-cap mutual equity funds and McCumber (2014) for a large set of US equity funds and hedge funds. Finally, the estimated exposures to the style benchmark indices across various quantiles allows us to draw conclusions regarding the style consistency of European fund managers. In particular, they suggest that they maintain the same exposure to known risk factors regardless of the return distribution area.

The quantile regression results of the TM model that are available from the authors upon request confirm that market timing skills do not vary substantially compared to the OLS results. Both male and female managers exhibit negative timing skills concentrated mainly in the left tail of the returns distribution. Therefore, this approach provides the extra information that European fund managers lack market timing skills mostly in situations with low returns. Moreover, as in the OLS case, the majority of statistically significant negative coefficients is comparatively higher for female managers.

Following the relevant literature perverse timing ability might be explained by the following three hypotheses: the cash flow hypothesis, the managerial incentive hypothesis, and the mismatch hypothesis. The first hypothesis attributes negative market timing to large cash inflows that a fund might experience during high market returns. This cash inflow will naturally result in a decrease of the fund's beta. Another possible explanation for perverse market timing abilities is offered by the managerial incentive hypothesis, according to which fund managers shift their risk exposure depending on their performance (see inter alia Chevalier and Ellison, 1997). Under these circumstances, variations of risk exposure will not be related to market movements. Finally there is the mismatch hypothesis that highlights the bias that might arise from the measurement of timing skills based on specific returns frequency (see inter alia Bollen and Busse, 2001). Simply put, researchers measure timing ability using monthly returns but the managers might shift their portfolio's riskiness more than once a month.

5. Conclusions

Fund managers' skills have been extensively investigated in the mutual funds literature for almost five decades. In this study, using a large sample of European equity funds we have examined the possible effect of gender on the security selection and timing skills of active fund managers. Specifically, we have carried out a peer-group analysis based on fourteen investment categories in order to address some key issues in the active management evaluation process. Funds within each category have been evaluated against the relevant market benchmark index, thus ensuring more informative comparisons. In particular, we have employed the Fama and French (1996) three-factor model augmented with a fixed-income securities index to account for funds' non-stock holdings. Further, in the spirit of Lu (2005) we have followed the Treynor and Mazuy (1966) timing approach to capture the potential size and growth timing skills of European fund managers. Our analysis has been conducted on a fund-by-fund basis and at the aggregate level.

Some preliminary evidence on funds' portfolio characteristics indicates that, although female managers are in charge of larger funds and shareholders in female managed funds pay on average lower management fees, these differences are insignificant. This also applies to the trading behaviour of the managers in our sample, a finding that can be interpreted in terms of the overconfidence hypothesis (Barber and Odean, 2001).

As for gender analysis, we have documented the absence of significant differences in the performance of male and female fund managers. The multi-factor model estimates shed light on the security selection skills of fund managers. In particular, at fund level we detect statistically and economically significant alphas mainly in the Eurozone Large-Cap investment category. Female managers appear to be only slightly superior to their male counterparts in terms of their alphas but to possess perverse market timing skills. As for investment strategies, male managers seem to favour small size stocks whereas female managers prefer more growth-oriented strategies. Related to the above, there is weak evidence of positive size and growth timing for male managers whereas female managers generally fail to predict the movements of the growth factor.

Finally, given the skewness of the fund returns distributions we take a quantile regression approach to deal with the possible bias resulting from heterogeneity in funds returns. Fund performance indeed appears heavily sensitive to the choice of the distribution quantile, with the results being qualitatively the same for male and female managers, both categories displaying a persistent lack of market timing skills, especially for lower returns.

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