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Investment and profitability factors in mutual fund performance evaluation: A conditional approach

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ABSTRACT

This paper provides new evidence on the appropriateness of the Fama-French (2015) five-factor model to evaluate international equity funds' performance. After extending this model to a conditional framework by allowing for time-varying risk and performance, the results show that funds underperformed during the 2000-2017 period. Funds investing globally and in Europe tend to invest in aggressive firms, but only the latter are exposed to firms with weak profitability. We thus conclude that although both investment and profitability factors are significant in explaining fund returns, the investment factor plays a more relevant role irrespective of the funds' geographical area of investment.

1. Introduction

Portfolio performance evaluation measures have evolved considerably over the last decades. Given the wide diversity of funds' investment styles, and the development of research on the cross-sectional variation of stock returns, multi-factor models are one of the most significant improvements in this area and are recognized to provide a better explanation of mutual fund behavior than single-index models. In line with this argument, the Fama and French (1993) (FF hereafter) three-factor model, which controls for size and book-to-market effects, and the Carhart (1997) four-factor model, which adds a momentum factor, have been extensively used to evaluate the performance of equity funds.

More recent developments in the asset pricing literature have led to the emergence of new multi-factor models that perform better in capturing stock market anomalies such as the FF (2015) five-factor model, which demonstrates the relevance of incorporating two additional risk factors: profitability and investment. This study recognizes that stocks of companies with higher operating profitability and lower total asset growth perform better. For this reason, it is likely to become the new standard in asset pricing studies. Considering that alpha – abnormal performance – is dependent on the underlying asset pricing model, we aim to extend the tests of this new asset pricing model to the fund performance evaluation area.

Another important development in the portfolio performance literature demonstrates that conditional models are theoretically more robust than unconditional ones, as they are better able to explain the variability of fund returns and provide more reliable performance estimates (Ferson and Schadt, 1996). So, although the FF (2015) model is considered state-of-the-art in multi-factor models, it still bears the limitations of unconditional models, as factor exposures are constant over time. Thus, we extend this model to a conditional framework by allowing

performance and risk estimates to be time-varying. As far as we are aware of, this is the first paper to use a conditional version of the FF (2015) five-factor model to evaluate mutual fund performance and explore the role of investment and profitability factors in explaining fund returns in a time-varying risk setting.[1] To demonstrate this role, an empirical application is performed using Portuguese mutual funds investing internationally.

The rest of the paper is organized as follows. Section 2 presents the performance evaluation model used. Section 3 describes the data. The empirical results are presented and discussed in section 4 and section 5 concludes the paper.

2. Methodology

To evaluate fund performance, we apply a conditional version of the FF (2015) five-factor model, which allows both alphas and betas to vary over time as linear functions of a set of predetermined lagged information variables (Z_{t-1}), in line with Ferson and Schadt (1996) and Christopherson et al. (1998). The model writes as:

$$r_{p,t} = \alpha_{0p} + A'_p \, z_{t-1} + \beta_{1p} \, r_{m,t} + \beta'_{1p}\left(z_{t-1} \, r_{m,t}\right) + \beta_{2p} SMB_t + \beta'_{2p}(z_{t-1} \, SMB_t) +$$

$$\beta_{3p} HML_t + \beta'_{3p}(z_{t-1} \, HML_t) + \beta_{4p} RMW_t + \beta'_{4p}(z_{t-1} \, RMW_t) + \beta_{5p} CMA_t +$$

$$\beta'_{5p}(z_{t-1} \, CMA_t) + \varepsilon_{p,t} \tag{1}$$

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[1] Gregoriou et al. (2016) test an unconditional version of the FF (2015) five-factor model in a hedge fund setting and find that this type of funds seems to prefer stocks of firms with lower exposures to the investment and profitability factors.

where $r_{p,t}$ ($r_{m,t}$) represents fund (market) excess returns, SMB_t is the return spread between small and large stocks, HML_t is the return spread of high and low book-to-market stocks, RMW_t is the return spread between stocks with robust (higher) and weak (lower) profitability and CMA_t is the return spread between low (conservative) and high (aggressive) investment firms. In regression [1], α_{0p} is the average conditional alpha, β_{1p}, β_{2p}, β_{3p}, β_{4p}, and β_{5p} are the average conditional betas, z_{t-1} represents a vector of lagged information variables, measured as deviations from their unconditional average values ($z_{t-1} = Z_{t-1} - E(Z)$), and vectors A'_p, β'_{1p}, β'_{2p}, β'_{3p}, β'_{4p} and β'_{5p} capture the response of the conditional alphas/betas to the information variables.[2]

3. Data

We use a survivorship bias-free dataset of all actively-managed open-end equity funds domiciled in Portugal but investing internationally, with at least 24 monthly observations across the January 2000–December 2017 period. The dataset consists of 53 funds, 24 of which invest in European equities (European funds) and 29 worldwide (Global funds). Monthly data required to compute fund returns was collected from the Portuguese Securities Market Commission (CMVM).[3] All returns are in Euros, net of operating expenses but do not include load charges. The risk-free rate is the 1-month Euribor.[4]

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[2] As an additional robustness test, since the model remains unable to explain the momentum premium, we have also estimated a conditional 6-factor variant by adding the momentum factor to the model. However, the results obtained were very similar and are not reported here for the sake of brevity. Nevertheless, they are available upon request from the authors.

[3] Available at http://web3.cmvm.pt/english/sdi/fundos/app/index.cfm.

[4] We note that the time series excess returns of both portfolios exhibit statistically significant (at 5% level) negative skewness and positive excess kurtosis, which leads to the rejection of the normality hypothesis. As pointed out by Adcock et al. (2012), the non-normality of fund excess returns further supports the use of conditional rather than unconditional performance evaluation models.

Market returns for European and Global funds were proxied by the FTSE Europe/World Total Return indexes, respectively, collected from Datastream. The additional size, book-to-market, investment and profitability factors for each fund category were obtained from Kenneth French's website and converted into Euros.

The conditional model uses two 1-month lagged instruments that several studies have shown useful to predict stock returns (e.g., FF, 1989; Pesaran and Timmermann, 1995; Avramov and Chordia, 2006): (1) the dividend yield of a market index (FTSE Europe/World) and (2) the slope of the term structure, measured by the annualized yield spread between 10-year German/US government bonds and the 3-month Euribor/US Treasury bills. To avoid spurious regressions, both variables were stochastically detrended by subtracting a 12-month trailing moving average.

4. Results and Discussion

Table 1 presents performance and risk estimates for two equally-weighted portfolios (European and Global funds), and for individual funds.

Table 1 – Conditional fund performance and risk estimates

	α_{0p}		β_{1p}		β_{2p}		β_{3p}		β_{4p}		β_{5p}		W1	W2	W3	R^2 adj.
European funds	-0.5194	***	0.9552	***	0.0582		0.2150	***	-0.1497	**	-0.3532	***	0.0877	0.0000	0.0000	93.67%
N+	2 [0]		24 [23]		11 [3]		16 [11]		8 [2]		5 [1]					
N-	22 [19]		0 [0]		13 [4]		8 [1]		16 [4]		19 [12]					
Global funds	-0.4972	***	0.9502	***	0.3346	***	0.0587		0.0643		-0.3436	***	0.5200	0.0000	0.0000	93.80%
N+	2 [0]		29 [29]		21 [10]		15 [6]		16 [7]		9 [1]					
N-	27 [15]		0 [0]		8 [3]		14 [4]		13 [5]		20 [10]					

This table presents average conditional alphas (in percentage) and average conditional betas, based on equation [1]. W_1, W_2 and W_3 correspond to the probability values of the χ-square statistic of the Wald test on the existence of time-varying alphas, time-varying betas and the joint time-variation in alphas and betas, respectively. R^2 adj. is the adjusted coefficient of determination. The asterisks are used to represent statistically significant coefficients at the 1% (***), 5% (**) and 10% (*) significance levels, based on Newey-West heteroskedasticity and autocorrelation-adjusted errors. N+ and N- represent the number of individual funds presenting positive or negative coefficients; the number of statistically significant coefficients at the 5% level are reported in brackets.

The results of the Wald tests clearly support the use of the conditional model, since both fund portfolios exhibit time-varying betas. Also, although we have only a slight evidence of time-varying alphas for the European fund portfolio, none of the portfolios rejects the joint time-variation of alphas and betas.[5]

Alphas are negative and statistically significant at the 1% level for both portfolios, with European funds presenting lower performance than Global funds. The results obtained at the individual fund level reinforce this evidence, with 79% of the European funds presenting significantly negative conditional alphas at the 5% level, against only 52% of the Global funds. These results are in line with most studies in the literature, which typically find that mutual funds are unable to outperform the market.

Regarding investment styles, European funds have a positive and significant exposure to the HML factor and a negative and significant exposure to the RMW and CMA factors. With respect to Global funds, they exhibit a significant positive exposure to the SMB factor and a significant negative exposure to the CMA factor. Results at the individual fund level confirm this inference, although to a lesser extent, with 45% (34%) of funds presenting statistically significant exposures to the investment (profitability) factors at the 5% level. Nevertheless, at the same significance level, the vast majority of funds (75% of the European funds and 83% of the Global funds) reject the null hypothesis of the Wald test that the coefficients associated with the investment and profitability factors are jointly equal to zero.

One of the possible explanations for the underperformance of Global funds may be the failure of the model to explain the returns of portfolios of small stocks that invest

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[5] However, estimating the model without the time-varying alpha term could lead to biases in conditional betas, as shown by Ferson et al. (2008). Additionally, compared to the (unreported) unconditional model, the conditional version presents a higher explanatory power.

aggressively, as pointed out by FF (2015). Besides, as these authors show, the book-to-market factor is redundant in the presence of the investment and profitability factors.[6]

European funds show a significant exposure to value stocks with low profitability and high investment, a result that is partially surprising because, traditionally, value stocks are related to less profitable but also more conservative firms. However, in line with our findings, FF (2017) show that average stock returns for Europe are positively related to HML but negatively related to CMA. Additionally, as shown by FF (2016), negative RMW and CMA coefficients can help to explain the low average stock returns associated with high betas and highly volatile returns. In fact, in comparison to Global funds and for the overall period under evaluation, European funds exhibit lower average returns (-0.3968% vs. -0.2706%), higher standard deviation (4.6958% vs. 4.2402%) and higher market betas. Furthermore, in contrast to FF (2015), the book-to-market factor does not become redundant in a European context,[7] meaning that the average European HML return is not captured by its interactions with the other four factors. One possible explanation for this result is that correlations among HML, RMW and CMA are considerably lower for European than for Global factors.[8]

5. Conclusions

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[6] This evidence is further reinforced at the individual fund level, with only 34% of the Global funds presenting a statistically significant exposure, at the 5% level, to the HML factor.

[7] It should be noted that 50% of the European funds present a statistically significant exposure (at the 5% level) to the HML factor.

[8] In fact, for European funds, we find a positive correlation between HML and CMA (0.69) and a negative correlation between HML and RMW (-0.40). For Global funds, correlations are not only higher but both positive (0.81 and 0.44, respectively).

This study investigates the impact of investment and profitability factors in explaining mutual fund returns. Specifically, we evaluate the performance of a dataset of international equity funds over the 2000–2017 period, using a conditional version of the recent FF (2015) five-factor model.

Our results show that average conditional alphas are significantly negative, indicating that funds underperform the market. We find that both investment and profitability factors are statistically significant in explaining fund returns, but the results differ for funds investing in different geographical areas. On the one hand, funds investing in Europe prefer value stocks of firms with lower exposures to the investment and profitability factors. On the other hand, funds investing globally prefer small and more aggressive stocks. So, although the investment factor is relevant for both fund categories, the profitability factor appears to be significant only in a European context. Overall, our findings suggest that the investment factor offers the most potential in explaining international mutual fund returns.

References

Adcock, C.J., Cortez, M.C., Armada, M.R., & Silva, F. (2012). Time varying betas and the unconditional distribution of asset returns. Quant. Finance 12, 951-967.

Avramov, D., & Chordia, T. (2006). Predicting Stock Returns. J. Financ. Econ. 82, 387-415.

Carhart, M. (1997). On persistence in mutual fund performance. J. Finance 52, 57-82.

Christopherson, J., Ferson, W., & Glassman, D. (1998). Conditioning Manager Alphas on Economic Information: Another Look at the Persistence of Performance. Rev. Financ. Stud. 11, 111-142.

Fama, E., & French, K. (1989). Business Conditions and Expected Returns on Stocks and Bonds. J. Financ. Econ. 25, 23-49.

Fama, E., & French, K. (1993). Common risk factors in the returns on stocks and bonds. J. Financ. Econ. 33, 3-53.

Fama, E., & French, K. (2015). A five-factor asset pricing model. J. Financ. Econ. 116, 1-22.

Fama, E., & French, K. (2016). Dissecting Anomalies with a Five-Factor Model. Rev. Financ. Stud. 29, 69-103.

Fama, E., & French, K. (2017). International tests of a five-factor asset pricing model. J. Financ. Econ. 123, 441-463.

Ferson, W., & Schadt, R. (1996). Measuring Fund Strategy and Performance in Changing Economic Conditions. J. Finance 51, 425-461.

Ferson, W., Sarkissian, S., & Simin, T. (2008). Asset Pricing Models with Conditional Betas and Alphas: The Effects of Data Snooping and Spurious Regression. J. Financ. Quant. Anal. 43, 331-354.

Gregoriou, G., Racicot, F., & Théoret, R. (2016). The q-factor and the Fama and French asset pricing models: hedge fund evidence. Managerial Finance 42, 1180-1207.

Pesaran, M.H., & Timmermann, A. (1995). Predictability of Stock Returns: Robustness and Economic Significance. J. Finance 50, 1201-1228.