Exchange-Traded Funds 101 for Economists: Appendix

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Factor Exposure of Active Mutual Funds

In what ways do exchange-traded funds, which are passive by nature, compete with *active* mutual funds? Active mutual funds typically have higher fees than factor ETFs, but of course, the higher fees might be justified if active mutual funds can outperform passive ETFs after fees are taken into account. Moreover, active mutual funds might offer investment strategies that are not spanned by combinations of passive factor ETFs.

A passive mutual fund that tracks a broad market index will move with the market very nearly on a one-to-one basis. An actively managed mutual fund must, by its nature, not invest in the market portfolio. An active mutual fund that has a very high R^2 correlation with the overall market is sometimes called a "closet indexer" since most of its return can be closely replicated by investing in the market; such a fund can also be identified because its holdings rarely depart from market weights, implying a very low active share as defined by Cremers and Petajisto (2008). The top left panel of Figure A1 shows the histogram of the R^2 for the 2,407 funds and the left column of Table A1 reports percentiles. The median active mutual fund has an R^2 of 84 percent and 90 percent of all active mutual funds have an R^2 of at least 72 percent. Thus, the total returns of most active mutual funds can be mimicked to a significant degree by investing only in the market portfolio.

Consistent with a large body of academic literature (for example, Ang 2014), we use Fama-French factors as a proxy for passive long/short portfolios that are constructed to yield exposure to well-known factors, such as value/growth, size, and momentum. It is important to understand that the Fama-French factors – like indexes – are not directly investable (and ignore transaction costs and shorting costs) but there are long-only ETFs and passive mutual funds that attempt to provide exposure to similar factors. The mutual fund data is from the Center for Research in Security Prices. After applying some standard screens, we have data for 2,407 active mutual funds domiciled in the United States. The sample is from January 1980 to December 2014.

Let R_i, R_m and R_f be the returns of mutual fund i, the CRSP value-weighted index (a proxy for the broad market portfolio) and the 30-day Treasury rate, respectively. For each active mutual fund i on CRSP, we run the CAPM regression

$$R_{it} - R_{ft} = \alpha_i + \beta_m(R_{Mt} - R_{ft}) + \epsilon_t.$$

The R^2 of this regression is the part of the variance of the excess return of the mutual fund that is due to exposure to the market return.

Next, we add Fama-French factors to the regression. HML (high minus low) is a long-short portfolio that invests in high book-to-market value stocks and shorts high book-to-market growth stocks. SMB (small minus big) is long in small stocks and short in large stocks and UMD (up minus down) is a momentum factor that is long in stocks that have had high return over the previous year and short in stocks that had low returns. This model is known as the four-factor model and the corresponding regression is

$$R_{it} - R_{ft} = \alpha_i + \beta_m(R_{Mt} - R_{ft}) + \beta_h HML_t + \beta_s SMB_t + \beta_u UMD_t + \epsilon_t.$$

The histogram of the R^2 is in the top right panel of Figure A1 and percentiles are reported in the second column of Table A1. The median R^2 is 90 percent and 90 percent of active mutual funds have an R^2 of at least 83 percent. We can add other passive factor portfolios to further increase the R^2.

Fama and French (2015) construct two additional long-short portfolios: RMW (robust minus weak) is the difference between returns of profitable firms and unprofitable firms and CMA (conservative minus aggressive) is the difference between returns of firms that invest a lot and firms with low investment rates. This six-factor is estimated using the regression

$$R_{it} - R_{ft} = \alpha_i + \beta_m(R_{Mt} - R_{ft}) + \beta_h HML_t + \beta_s SMB_t$$
$$+ \beta_u UMD_t + \beta_r RMW_t + \beta_c CMA_t + \epsilon_t.$$

Finally, we add 12 industry factors to the six-factor model. The corresponding histograms of the R^2s are in the bottom panels of Figure A1. Adding in passive factors further increases the R^2s of most active funds.

In fact, the 94 percent of the return of the median fund can be replicated by exposure to passive factors. These results are very similar to those reported by Kahn and Lemmon (2014) based on their analysis of fund performance data. Given these findings, it is not surprising that

passive factor ETFs have become more popular while active mutual funds have experienced significant asset outflows.

How about the performance of active funds? Figure A2 shows the histogram of mean excess returns across all mutual funds. The average equity mutual fund earned an average annualized return of 5.70 percent over the sample period. For comparison, the mean return of the CRSP-value weighted index was 7.79 percent, although we repeat our caveat that one cannot directly invest in an index. Thus, the average fund underperformed the market by 2.09 percent net of fees and 85 percent of all mutual funds had a lower net return than the market index.

Figure A3 shows the histogram of α_i's for the four-factor model that includes the market excess return, HML, SMB and UMD as regressors. Following Jensen's seminal work, a mutual fund α_i measures the return of the fund after subtracting the part that is due to the exposure to the (passive) market, value/growth (HML) and size (SMB) factors. The mean alpha of active mutual funds is -0.66 percent per year and in the sample about two-thirds of all mutual funds produced a negative alpha.

These results do not necessarily imply that mutual fund managers have no skill (Berk and van Binsbergen 2015). For example, Cremers and Petajisto (2009) show that mutual funds that deviate more from their benchmark have on average better performance than funds that mimic their benchmark more closely. One simple measure of factor mimicking is the R^2 in the factor regressions above (Kahn and Lemmon 2014). Funds with higher R^2s are following static factors more closely than funds with lower R^2s. To see whether mutual funds alphas are related to factor R^2s of the four-factor model, we run the regression

$$\alpha_i = \gamma_0 + \gamma_1 R_i^2 + e_i$$

Figure A4 shows the corresponding scatter plot. The estimated coefficient γ_1 is equal to -1.1 with a t-statistic of -2.53. While the coefficient is statistically significant the effect of the R^2s on fund α_is is economically small. A mutual fund with an R^2 of 0.95 has an estimated α_i of -0.75% compared to an α_i of 0.47% of a mutual fund with an R^2 of 0.7.

To summarize, returns of active mutual funds can, to a significant degree, parallel the returns to theoretical long/short passive factors, but without transaction costs. Further, the majority of mutual funds have not outperformed the overall market or passive index benchmarks.

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Factor ETFs might be useful low cost investment vehicles for equity investors who seek long only exposure to well-known factor risks with lower fees than active mutual fund and hedge fund managers.

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