# Replicating Hedge Fund Return Components

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Hedge funds, even despite recent bad press, continue to charm investors. Fund managers have a reputation for assembling the smartest teams and developing the most effective trading strategies. They can access unusual markets, be agile in the marketplace and produce "hedged" return streams not correlated with other traditional investments. However, hedge fund managers typically lock up investor funds for long periods of time, offer little or no explanation of how funds are being invested and charge steep fees.

Recent academic research suggests that standard exchange-traded index securities like ETFs can be used to replicate hedge fund returns. Such a model could produce a portfolio with nearly all the benefits of hedge funds, but almost none of the drawbacks. This paper explores three sources of hedge fund return and whether attempts to simulate them can be successful.

## Three Sources of Hedge Fund Returns

Hedge fund returns, positive or negative, can be attributed to three main components; security selection, market timing and persistent market exposures. Security selection includes selecting long and short positions in equity, debt and other various instruments that outperform (long) or underperform (short) their given universe. Market-timing refers to a manager's ability to generate profits being long or short different markets at the appropriate times. The remainder of a fund's return is generated through persistent (or at least semi-persistent) exposure to various markets, or longer term exposures to a particular market segment.

## Replicating Security Selection

Hedge funds tend to focus their efforts on security selection, attempting to pick the best securities to be long and the worst to be short.

Table 1 shows the results of multi-factor regressions across various Hedge Fund Research Indexes (HFRI) using monthly data from January 1998 thru June 2009. The purpose of the regressions is to see what exposures each index has to various factors and if there is any "alpha" or return from skill rather than return from market movement left over after accounting for the exposures.

The HFRI Fund Weighted Composite, HFRI Equity Hedged, HFRI Distressed Securities and HFRI Macro Indexes all showed positive statistically significant alpha ranging from 0.33% to 0.41% per month. The relatively high adjusted R-squared of 0.77 for the HFRI Fund Weighted Composite Index and the HFRI Equity Hedged Index suggests that the model is capturing the majority of the return sources for the indices. While there are differing opinions about whether hedge funds have an abnormal ability to pick the best (worst) securities, given the relative strength of the regressions it would be fair to interpret the model alpha as "skill". The HFRI Distressed Securities Index and the HFRI Macro Index have somewhat lower adjusted R-squared values of 0.55 and 0.34 respectively, thereby decreasing confidence that the apparent "alpha" is correctly captured with the model factors.

By definition, any return that can be attributed to security selection skill cannot be replicated using exchange traded index vehicles. Transparency to the underlying holdings of a large group of hedge funds would be necessary and, practically speaking, no large group of hedge funds is likely to share this information.

### What is a Factor Regression Model?

The success of any process is usually attributable to a combination of forces. For example, elite championship winning athletes might owe their success to a mixture of factors like excellent physical health, years of professional training and general natural ability. If we could measure these factors for a collection of athletes, we might be able to fit a model to our observations which could predict how successful athletes are given their health, training and talent. For example, maybe success is 40% training, 30% talent and 30% health.

This same approach can be used to model hedge fund returns. Suppose a manager's portfolio return for a given month is due to a combination of factors like changes in stock prices, bond yields, exchange rates, and the price of oil. We can measure the impact of these factors and propose a model which explains the manager's exposures. For example, maybe the hedge fund derived +40% of their return from small cap stocks, -30% from short exposure to US Treasuries, +50% from increasing oil prices and +40% from the weakening US Dollar.

When a factor model is developed with good predictive power it can be used to emulate its subject. In the case of the hedge fund manager, owning 40% stocks, -30% bonds, +50% oil and +40% USD would have produced a return similar to owning the hedge fund itself for that month.

**Table 1: Multi-Factor Regression Results** [Jan-1998 thru Jun-2009]

| | HFRI Fund Weighted Composite Index | HFRI Fund of Funds Composite Index | HFRI Equity Hedged Index | HFRI Equity Market Neutral Index | HFRI Convertible Arbitrage Index | HFRI Distressed Securities Index | HFRI Macro Index | HFRI Short Bias |
|---|---|---|---|---|---|---|---|---|
| **S&P 500 Index** | -0.01 | -0.12 | 0.01 | -0.06 | -0.01 | -0.07 | -0.22 | -0.27 |
| *T-Statistic* | -0.21 | -2.36 | 0.09 | -1.77 | -0.20 | -1.24 | -3.81 | -2.07 |
| **Russell 2000 Index** | 0.18 | 0.12 | 0.26 | 0.05 | -0.06 | 0.08 | 0.16 | -0.67 |
| *T-Statistic* | 6.88 | 3.96 | 7.37 | 2.24 | -1.59 | 2.31 | 4.57 | -8.36 |
| **MSCI EAFE (USD)** | 0.13 | 0.17 | 0.17 | 0.05 | 0.09 | 0.09 | 0.16 | -0.03 |
| *T-Statistic* | 3.25 | 3.57 | 3.28 | 1.73 | 1.53 | 1.88 | 3.15 | -0.28 |
| **Barclays Intermdediate Govt Credit** | -0.10 | -0.19 | -0.05 | 0.01 | 0.08 | -0.31 | 0.22 | -0.07 |
| *T-Statistic* | -1.00 | -1.58 | -0.39 | 0.08 | 0.57 | -2.46 | 1.62 | -0.22 |
| **Barclays High Yield** | 0.05 | 0.07 | 0.00 | -0.06 | 0.48 | 0.27 | -0.12 | 0.28 |
| *T-Statistic* | 1.31 | 1.46 | 0.03 | -1.92 | 8.20 | 5.29 | -2.25 | 2.23 |
| **Dow Jones UBS Commodities Index** | 0.08 | 0.08 | 0.09 | 0.05 | 0.09 | 0.06 | 0.09 | 0.06 |
| *T-Statistic* | 3.80 | 3.52 | 3.43 | 3.10 | 2.97 | 2.48 | 3.36 | 0.97 |
| **Monthly Alpha** | 0.33% | 0.11% | 0.41% | 0.13% | 0.15% | 0.35% | 0.35% | 0.18% |
| *T-Statistic* | 3.49 | 0.97 | 3.33 | 1.68 | 1.15 | 2.95 | 2.80 | 0.62 |
| **Observations** | 138 | 138 | 138 | 138 | 138 | 138 | 138 | 138 |
| **Adjusted R-Squared** | 0.77 | 0.56 | 0.77 | 0.15 | 0.55 | 0.55 | 0.34 | 0.69 |

### Factor Regression Model: Glossary of Terms

**R-squared**: A measure of how good the model is. An R-squared of 1 means a perfect model, 0 means no fit was found.

**Factor coefficient**: How much impact this factor has on the model. In the case of the elite athlete, the talent coefficient was 30% compared to a training coefficient of 40%. For example, in the case of the hedge fund manager, the stock coefficient was a positive 40% and the bond coefficient was a negative (indicating a short position) 30%.

**T-statistic**: A measure of how significant each factor is in the model. These typically fall in a range of -2 to 2 with 0 meaning no significance. For example, given a hedge fund manager that never trades commodities we would expect the t-stat for crude oil to be very close to zero, but a manager that is heavily short oil should have a very negative t-stat for this factor.

**Alpha**: The portion of the subject measured that cannot be explained by the factors in the model. In the case of a hedge fund manager, this is a gauge of the "secret sauce" complexity that cannot be easily replicated.

## Replicating Market Timing

Many hedge funds, either by design or as a byproduct of their process, attempt to gain exposure to specific markets when they have evidence it will go up and attempt to decrease or have short exposure when they believe it is going down. There is conflicting evidence as to whether hedge funds are able to consistently do this. French and Ko (2006) come to the conclusion that there is strong evidence of security selection skill and limited evidence of market-timing skill. However, Chen (2007) found there is evidence of market-timing ability at both the aggregate and the fund level. This was especially true in focused funds such as convertible arbitrage timing high yield bonds, global macro timing non-U.S. bond markets and currency markets and market-timing funds showing strong timing ability in the U.S. stock market. A follow-up paper by Chen and Liang (2007) used more robust methodologies to conclude that funds self-described as market timing hedge funds did indeed have market timing abilities.

Assuming that market-timing ability does exist, the real question is whether or not it can be replicated. Unfortunately this is viewed as a nearly intractable modeling problem unless inside information regarding hedge fund positions is available, again an unlikely circumstance.

## Replicating Persistent Exposures

The final contributor to fund performance is persistent or semi-persistent market exposure, meaning allocations to a given market segment that are held for a significant period of time. Exposures may include equity, interest rate, credit, commodity, volatility or any other market risk. Lo and Hasanhodzic (2007) outlined a very basic methodology for measuring and replicating market factor exposures using returns based style analysis as described by Sharpe (1992). Li, Markov and Wermers (2009) showed that daily hedge fund performance could be replicated using only monthly data via fairly simple regression models. Even using rudimentary methodologies, the results were surprisingly robust.

Results very similar to the referenced academic studies were obtained using a simple replication model utilizing higher frequency (weekly[1]) data to attempt replication of the HFRX Global Hedge Fund Index. Four different models were tested; a 5 factor model with and without shorting, and a 7 factor model with and without shorting. The 5 factor model was made up of domestic equity,

foreign equity, fixed income, commodities and Treasury Bills. The 7 factor model added emerging market equity and high yield bonds. Portfolio allocations were determined by running a constrained regression that forced all of the allocations to sum to 100% (see Lo and Sharpe above). For the no-shorting portfolios each allocation was constrained to be between 0% and 100% while shorting portfolios allowed allocations to be between -100% and +100%. The resulting portfolios and subsequent returns were calculated with a one week lag to account for any delay in obtaining HFRX Global Hedge Fund Index data. The results are summarized in Table 2 which shows return, volatility and correlation information for each replicating portfolio as well as the target portfolio. Replicator returns[2] over the whole time period outperform the target portfolio by about what you would expect to pay in hedge fund fees. Year over year the replicating portfolios produce similar results to the target portfolio. Correlations are between 0.85 and 0.88, not perfect replication, but respectable for such a simple model. These findings are in agreement with the cited studies; hedge funds exhibit persistent market exposures that can be principally replicated with simple securities.

**Table 2: Multi-Factor Regression Results** [Jan-1998 thru Jun-2009]

| Statistics | No Shorting 5 Factor | Shorting 5 Factor | No Shorting 7 Factor | Shorting 7 Factor | HFRX Global Hedge Fund Index |
|---|---|---|---|---|---|
| **Annualized Return** | 1.73% | 1.47% | 2.49% | 2.09% | 0.19% |
| **Volatility** | 7.00% | 6.96% | 7.57% | 7.52% | 7.68% |
| **Correlation HFRX Global** | 0.88 | 0.88 | 0.85 | 0.85 | 1.00 |
| **Returns by Year** | | | | | |
| **2004 (Oct to Dec)** | 3.46% | 3.39% | 3.37% | 3.26% | 3.21% |
| **2005** | 5.91% | 6.34% | 6.69% | 6.79% | 2.70% |
| **2006** | 10.27% | 10.13% | 10.05% | 10.68% | 9.01% |
| **2007** | 7.98% | 6.46% | 8.12% | 5.90% | 4.89% |
| **2008** | -17.61% | -17.69% | -16.09% | -15.89% | -23.11% |
| **2009 (Jan to Aug)** | 1.22% | 1.27% | 2.52% | 1.81% | 8.34% |

## Conclusions

Recent academic research suggests that baskets of hedge funds can be replicated with reasonable ease and accuracy using basic exchange traded securities. The simple factor models presented corroborate these findings. Investors intrigued by the diversification and added alpha offered by hedge funds may find similar benefits – likely with lower fees, excellent liquidity and more transparency – from a replication product.

## About the Author

Jeremy Frank is portfolio manager and head of quantitative analysis for 361 Capital. Jeremy has extensive investment industry experience centering on portfolio construction, manager due diligence, quantitative modeling and financial software development. As Senior Analyst for a regional investment advisor he was responsible for analyzing investment strategies with a focus on quantitative, fixed-income and alternative strategies as well as derivative structures. Additionally, he developed a proprietary research and reporting database. Jeremy began his career as a Quantitative Analyst where he was responsible for hedge fund manager due diligence and risk analysis as well as developing in-house risk management software and a proprietary research database. Jeremy holds a B.A. in Business Administration from Northwest University and an M.S. in Finance from Boston College.

## References

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## Notes

(1) Weekly data used a Tuesday week end. Stats that have been calculated using monthly or annual data create month ends on the last Tuesday of a given month therefore calculations may not match those using regular month-end data.

(2) The replication model returns may differ from what an actual investor may have received. Factors that could impact the true return include market impact, shorting costs/rebates, other transaction costs and investment management fees. Some of the underlying instruments did not have investable index products for some periods of the backtest. When this was the case returns were backfilled with reported index returns.