HEDGE FUND REPLICATION: TRADITIONAL BETA, ALTERNATIVE BETA, AND ALPHA

Jeffrey H. Mitchell, CFA, CAIA
Senior Consultant

Executive Summary

Hedge fund replication[1] products have a lofty goal: to provide the proposed benefits of hedge funds without the drawbacks. These products strive for attractive returns on a consistent basis, with low correlation to traditional investments, such as stocks. At the same time, they aim to steer clear of the potential drawbacks of hedge funds, for instance, the high fees, limited transparency and lower liquidity. In this paper we will define hedge fund replication and discuss the pros and cons of the various approaches. We will conclude with some thoughts on the role these strategies might play in institutional investment portfolios, large and small.

In summary, it is our view that the potential to generate alpha in hedge funds continues to exist for investors willing and able to invest with skillful managers that embrace illiquidity and complexity risk premiums. Nonetheless, for investors seeking to better diversify their portfolios through liquid and transparent strategies, hedge fund replication products may represent a viable solution. At NEPC, we have begun to research this new approach and, while there are limited products available, typically with short track records, we believe there may be some applicability for long-term investors.

What is Hedge Fund Replication?

Hedge fund replication begins by deconstructing the sources of hedge fund returns. Broadly speaking, hedge funds generate results through exposure to traditional betas, alternative betas, and alpha.

Traditional betas refer to the sensitivity of returns to traditional securities, such as stocks, bonds and cash. Alternative betas represent sensitivity to other systematic market factors, such as credit spreads, higher yielding or 'carry' currencies, volatility, illiquidity, and other potential return sources (Exhibit 1). 'Alpha' is often synonymous with manager skill, but perhaps is better thought of as that portion of returns not captured by the traditional and alternative betas specified.

FOR INVESTORS SEEKING TO BETTER DIVERSIFY THEIR PORTFOLIOS, HEDGE FUND REPLICATION PRODUCTS MAY REPRESENT A VIABLE SOLUTION

Traditional betas are relatively straightforward to capture with liquid, low cost and transparent investment vehicles such as index funds. Alpha, by definition, cannot be captured this way. Alternative betas lie somewhere in the middle and, therefore, are more difficult and expensive to capture than traditional passive index investments.

Hedge fund replication rests on the idea that alpha is a negligible component of broad hedge fund benchmarks. Replicators argue that although it may exist with certain managers, high fees and managers with negative alpha offset the positive excess returns at the total industry level. A replicator seeks to replicate the systematic risk

[1] Hedge fund replication has become a common term. However, many providers we call replicators here do not attempt to replicate any index. These are probably better referred to as 'alternative beta' providers, but for the sake of convenience we lump them all under the 'replicators' moniker.

Exhibit I: Examples of Traditional and Alternative Betas

Traditional Betas	Alternative Betas
Stocks	Value
Bonds	Carry
Cash	Momentum
	Event/Volatility
	Illiquidity
	Size
	Quality

Source: NEPC

factors (that is, the traditional and alternative betas) inherent in hedge fund indices such that performance comes close to matching the chosen index return. If done using liquid, index-tracking investments, such returns should come with lower fees, daily liquidity, and full transparency. This is the goal of hedge fund replication products.

Hedge fund replicators typically invest in securities such as derivatives, index funds, and exchange traded funds (ETFs). These investments also allow replicators to utilize leverage and shorting, two common practices in the hedge fund industry.

INVESTORS WHO SUBSTITUTE HEDGE FUND REPLICATION PRODUCTS FOR HEDGE FUNDS MAY SACRIFICE A VALUABLE SOURCE OF RETURNS.

Unfortunately, there is no standard definition of alternative beta. Defining and implementing these alternative betas are vital for determining a) whether alpha exists in the hedge fund industry; and b) the likely success of hedge fund replication products.[2] For our part, we believe that exposure to talented hedge fund managers operating in more complex and less liquid asset classes can add value on a go-forward basis. So investors who substitute hedge fund replication products for hedge funds may sacrifice a valuable source of returns. Nevertheless, as we will discuss later, for some, the additional benefits of replication may outweigh these expected costs.

Approaches to Hedge Fund Replication

The Factor-based Approach to Hedge Fund Replication

This approach to hedge fund replication attempts to mirror the returns for a chosen hedge fund index by first identifying the traditional and alternative betas, or factors, to which hedge funds are systematically exposed. Investments conforming to these factors are then selected as the investable opportunity set. Next, a regression analysis is performed in order to determine the appropriate mix of investments that would have most closely replicated the historical returns of the chosen hedge fund index.[3]

These regressions typically incorporate data from the most recent 24-36 months, since hedge funds' exposures change over time due to their often active trading approach. The regression is performed again in the following month and the mix of investments is altered to match the average factor exposure over the most recent time period analyzed.

A portion of hedge fund alpha is likely due to opportunistically changing market exposures over time. This rolling-window regression technique, although backward-looking, allows factor-based replicators to try to capture some of the market-timing ability of the hedge fund industry.

An important distinction between factor-based providers is the factors included in the portfolio. Initial strategies using this approach focused primarily on the traditional asset classes. Therefore, these strategies may be missing important sources of returns. Furthermore, investors likely already have significant exposure to these traditional betas. More recent products seek to capture alternative betas as well. These tend to fall under the rules-based approach, which we discuss later in this section.

The Distributional Approach to Hedge Fund Replication

This approach replicates the chosen index's distribution of returns instead of matching each month's return. The idea behind it is that futures trading strategies can be designed to replicate

[2] Good summaries of the academic literature dissecting hedge fund returns and explorations of alternative beta appear in Ang, Goetzmann and Schaefer (2009) and Antti Ilmanen's 2011 book, Expected Returns.
[3] For more information on hedge fund indexes, please see NEPC's whitepaper, 'Absolute Tracking: Moving Past Absolute Return for Hedge Fund Benchmarking,' available at www.nepc.com.

the higher moments of the hedge fund index return distribution (for example, the standard deviation, the skewness, and the kurtosis). The assumption is that if the risk profile is replicated, the returns will follow.[4]

The strategy addresses one of the drawbacks of the factor-based approach: the assumption that the relationship between the index returns and the factors is linear and normal. Hedge fund returns are typically neither, and, instead, exhibit meaningful skewness and 'fat tails.' The reasoning behind this approach is that if a strategy can be designed to replicate all aspects of the historic hedge fund index's return distribution, then it possesses a high probability of successfully replicating the returns (and the distribution of returns, or risk profile) going forward.

This approach is yet to catch on, most likely because it requires a 'if you build the distribution, the returns will follow' mindset. In addition, returns are prone to deviation, perhaps even substantially, from the selected index because this strategy does not aim to match the next month's index return. This will make it difficult for investors to trust this strategy if returns fall short of the target returns for an extended period of time.

The more practical application for this approach may be in benchmarking. An investor's hedge fund program could be compared against the futures trading strategy mimicking the program's risk profile. This is an important attribute of all replication products: they can serve as investable benchmarks for a plan's hedge fund managers (as opposed to common hedge fund benchmarks, which are often un-investable).

The Rules-based Approach to Hedge Fund Replication

Rules-based approaches design simple trading rules that mimic the typical trades of hedge funds. The merger arbitrage strategy provides perhaps the clearest example. Traditional merger arbitrage involves selling short the acquiring firm and investing long in the acquisition target. As long as the deal goes through, this position typically yields a small profit. Merger arbitrage managers are selective in the deals they pursue in an attempt to avoid the ones that fall through, but it is arguable whether the excess returns more than make up for the fees charged. Instead, a more passive rules-based approach can be implemented, which would expose an investor to all announced deals over a certain size. Such an approach accesses a 'merger arbitrage beta,' without the alpha—or excess returns that some managers may generate—but it also comes at a lower cost.

Additional rules-based strategies are most applicable to other arbitrage strategies. That said, even large categories, such as long/short equity or managed futures, can be implemented in a similar fashion. Long/short equity, for example, can be implemented by going long low price-to-book value stocks and shorting high price-to-book value stocks to take advantage of the so-called value premium, a typical exposure of hedge funds. Managed futures funds, on the other hand, typically own positions showing recent price momentum and sell short positions exhibiting negative price momentum to capture a momentum factor.[5]

A potential advantage of the rules-based approach: it need not attempt to replicate the returns of any particular hedge fund index. This can be an edge if such strategies avoid the drawbacks of these indices, namely their high correlation with the stock market. In NEPC's view, many long-term investment programs have a disproportionate share of their risk from equities. Therefore, they may not be adequately diversified. Rules-based products may allow investors to obtain a better mix of betas, that is, less traditional beta (particularly equities) in favor of more alternative ones. Rules-based strategies that do not constrain themselves to tracking a benchmark can also take a forward-looking view on which exposures are more likely to be rewarded with higher risk-adjusted returns in the future (or they could be agnostic and equal asset weight or equal volatility weight their exposures). Contrast this with the factor-based approach that establishes exposures by looking through the rear-view mirror.

On the negative side, benchmarking becomes more difficult for rules-based products that don't

[4]The details of this approach are documented in a series of academic papers by Harry Kat and Helder Palaro.
[5] Momentum has been shown to be a relatively reliable source of return. Rational markets theorists have difficulty with this since there is not a clear risk associated with this return. For additional information on momentum, we refer the reader to Tobias J. Moskowitz, Yao Hua Ooi, and Lasse Heje Pedersen, "Time series momentum," Journal of Financial Economics 104 (2012). SciVerse ScienceDirect. doi:10.1016/j.jfineco.2011.11.003.

track an index. In addition, fees are typically higher, given the greater skill required in executing this approach and the potential for additional active management. This approach may also be subject to capacity constraints, whereas factor-based approaches that focus on traditional asset classes have substantial capacity. Crowded trades may also become a concern, especially as these products gain assets.

A disadvantage of all replication products is that, by design, they are not likely to capture the excess returns attributable to illiquidity and complexity, a potential source of alpha for hedge fund practitioners.

Even If Replicators Are Successful, Are They Worth It?

Although "only" down roughly 20% in 2008, compared to the 37% decline in the Standard & Poor's 500 Index, many hedge fund investors were disappointed hedge funds did not fare better. Over the subsequent four years, hedge funds have failed to keep pace with the equity markets. So why bother with either hedge funds or replicators?

While we agree that hedge fund returns of late have been disappointing, it is worth keeping in mind that over the 10-year period from 1998-2007, the HFRI Fund Weighted Composite, a broad hedge fund index, outperformed the S&P 500 by approximately 400 basis points on an annualized basis with roughly half of the volatility of stocks. So despite their recent struggles, hedge funds have proven their worth over the long term (Exhibit 2). The key question is whether the environment has changed such that the shorter-term experience is a better predictor of future hedge fund performance than the long-term.

Dissecting returns in 2011 helps explain why we believe the long-term matters more. During 2011 the S&P 500 gained 2.1% and the HFRI Fund Weighted Composite lost 5.3%. In our view, the poor performance of hedge funds in 2011 was due to the fact that traditional and alternative beta exposures did not add value. For example, the S&P 500 was one of the few global equity markets that did not decline, credit spreads widened, carry currencies declined, illiquidity premiums rose, momentum did not work nor (depending on how you define it) did value. What many proclaim as "the death of hedge fund alpha" is perhaps better described as a lack of compensation to traditional and alternative betas (especially since hedge funds don't typically own much duration or interest rate exposure, which was one of the few betas that was well compensated from 2008 to 2011).

Hedge fund returns would be more valuable if they were uncorrelated with the stock market. Unfortunately, as seen in the table, the correlation of the HFRI index and the S&P 500 from 2008-2012 has been 0.84. This is why we favor replication products that don't replicate. Stated differently, we prefer alternative beta products that aim to minimize exposure to traditional (particularly equity) betas.

The Role of Hedge Fund Replication in Investors' Portfolios

Institutional investors—small and large—may benefit from hedge fund replication products. For instance, investors with smaller plans with greater liquidity requirements may favor these products over hedge fund of funds. Hedge funds of funds are a convenient way to access hedge funds because they provide instant diversification and professional oversight of a hedge fund portfolio. Unfortunately, hedge fund of funds come with an added layer of fees, and even lower transparency and additional auditing delays compared to direct hedge fund investments. Hedge funds of funds

Exhibit 2: Historical Returns of Hedge Funds and Stocks*

	1998 - 2007				2008-2012				1998-2012			
	Returns	Volatility	Sharpe Ratio	Correlation	Returns	Volatility	Sharpe Ratio	Correlation	Returns	Volatility	Sharpe Ratio	Correlation
HFRI FWC	9.94%	7.16%	0.88		1.54%	7.75%	(0.21)		7.06%	7.42%	0.50	
S&P 500	5.91%	14.72%	0.23	0.72	1.66%	19.04%	0.00	0.84	4.47%	16.24%	0.14	0.76

Source: PerTrac
*Hedge fund returns are represented by the HFRI Fund Weighted Composite Index; stocks are represented by the S&P 500 Index.

also lack performance fee netting.[6] To this end, we expect hedge funds of funds will be particularly susceptible to increasing competition from hedge fund replication products, especially as replicators establish longer track records.

Replication products may also sit alongside hedge fund of funds, either by themselves, or by forming the 'core' portion of a 'core-satellite' approach. In the latter instance, funds of funds have historically represented the 'core' and single-strategy funds represent the 'satellite' exposure. This is a popular strategy with many mid- and larger-size plans. As replication products are added to the core, investors should determine the impact on the satellite portion of their programs. Satellite exposures may be altered to emphasize less liquid and more complex hedge fund strategies with the potential to provide further diversification and attractive returns (distressed strategies, for example).

WE POSIT THAT INVESTORS DRAWN TO THE CONCEPT MAY BENEFIT FROM EXPANDING THEIR OVERALL ALLOCATION TO HEDGE FUNDS AS CERTAIN REPLICATION PRODUCTS ARE INCLUDED.

Even the largest, most sophisticated investors may find a role for replicators. The liquidity and capacity of replication strategies offer a simple and quick way for large investors to increase their exposure to hedge funds. In the short-term, hedge fund assets could be parked in replication strategies until appropriate managers are identified. Conversely, customized negative exposures could be created to express a negative tactical view or to temporarily reduce exposures. Also, it may be difficult for very large institutional investors to secure adequate capacity with talented and in-demand hedge fund managers. In this case, these investors may turn to hedge fund replication products, with this allocation acting as a liquidity buffer. This would enable a more efficient re-balancing of alternatives exposures with the rest of the portfolio.

Hedge fund replicators may also play a larger role in portfolios as investors place greater emphasis on risk factor analysis. This approach recognizes that asset classes are exposed to a variety of risks (equities, for example, are vulnerable to the risk of disappointing economic growth, inflation risk, and also, potentially, value, size, and momentum risk). Many investors are analyzing risk this way and discovering that their portfolios are overexposed to one of the many risk factors that might offer attractive return potential going forward. This large bet on the risk of disappointing economic growth (one definition of the fundamental risk factor embedded in equities) could potentially be lowered by pursuing more of a 'hedge fund replication' approach, or more equal weighting of traditional betas, alternatives betas, and alpha. More narrowly defined alternative beta products are coming to market that target a sub-set of the hedge fund universe, or a particular risk factor, thus allowing large and small investors alike the opportunity to start along this path.

Investors considering these replication products must determine how to size their allocations. Traditionally, most investors in hedge funds have limited their allocations due to the inherent drawbacks, including high fees, lack of transparency and liquidity, and headline risk. Gauging the right size will depend on key forward-looking measures of expected return, risk, and the correlation with investors' existing portfolios. We posit that investors drawn to the concept may benefit from expanding their overall allocation to hedge funds as certain replication products are included. This will not only fuel richer diversification of potential return sources, but also lower fees by not paying alpha-seeking fees for what can be accessed as beta.

Conclusion

Hedge fund replication is an attempt to generate the risk and return characteristics of the hedge fund industry, under the assumption that hedge fund returns can be captured, while limiting the inherent drawbacks of hedge funds. What is sacrificed relative to hedge funds is alpha potential, which, in our view, is driven by manager skill and exposure to illiquidity and complexity premiums.

Although some foretell the "death of alpha," we believe that returns fueled by manager skill and other not easily captured risk premiums will be a

[6] With fund of funds investments, performance fees can be paid despite negative performance if some managers deliver positive returns despite the fund as a whole losing money. For additional detail on hedge fund of funds, we refer the reader to NEPC's white paper, 'Assessing the Value of Multi-Strategy Fund of Hedge Funds,' available at www.nepc.com.

meaningful component of hedge fund returns on a go-forward basis. Thus, investors who replace hedge funds with hedge fund replication products are sacrificing a potentially valuable source of returns. That said, for many, the benefits of lower fees, better liquidity and full transparency may offset this expected cost.

In our view the bigger potential benefit of hedge fund replication lies in better understanding the drivers of hedge funds' returns. Alternative betas have been and, we believe, will continue to be important sources of returns. The ability to customize one's exposure to these alternative betas, and pay lower fees in the process, is an important development that has the potential to revolutionize the way investors think about asset allocation and portfolio construction.

Bibliography

Amenc, N., W. Géhin, L. Martinelli, and J.C. Meyfredi. *"The Myths and Limits of Passive Hedge Fund Replication: An Attractive Concept … Still a Work-in-Progress."* EDHEC Risk and Asset Management Research Centre (2007).

Ang, A., W. Goetzmann, and S. Schaefer. *"Evaluation of Active Management of the Norwegian Pension Fund – Global."* A special report prepared at the request of the Ministry of Finance. Oslo, Norway (2009).

Bali, T., S. Brown, and M. Cagalayan. *"Do Hedge Funds' Exposures to Risk Factors Predict Their Future Retuns?"* Working paper, Social Science Research Network, doi: 10.2139/ssrn.1553911 (2010).

Berger, A., D. Kabiller, and B. Crowell. *"Is Alpha Just Beta Waiting to Be Discovered?"* AQR Capital Management, http://www.top1000funds.com/attachments/081_Is%20Alpha%20Just%20Beta.pdf (2008).

Cai, L., and B. Liang. *"On the Dynamics of Hedge Fund Strategies."* The Journal of Alternative Investments 14, no. 4: 51-68 (2012).

Cao, B., and S. Jayasuriya. *"Volatility and the Cross-Sectional Performance of Emerging Market Hedge Funds."* The Journal of Alternative Investments 14, no. 4: 40-50 (2012).

Centre for Hedge Fund Research Imperial College, London. *"The Value of the Hedge Fund Industry to Investors, Markets, and the Broader Economy."* KPMG International, https://www.kpmg.com/KY/en/Documents/the-value-of-the-hedge-fund-industry-part-1.pdf (2012).

Chan, N., M. Getmansky, S. Haas, and A. Lo. *"Systemic Risk and Hedge Funds."* Working paper 11200, prepared for the NBER Conference on the Risks of Financial Institutions, National Bureau of Economic Research, http://www.nber.org/papers/w1120 (2005).

Fung, W., and D. Hseih. *"Hedge Fund Benchmarks: A Risk Based Approach."* Working paper for Financial Analyst Journal, Fuqua School of Business, Duke University, http://faculty.fuqua.duke.edu/~dah7/HF-RF.pdf (2004)

Hasanhodzi, J., and A. Lo. *"Can Hedge-Fund Returns Be Replicated?: The Linear Case."* Working paper, Social Science Research Network. doi: 10.2139/ssrn.924565 (2006).

Ibbotson, R., P. Chen, and K. Zhu. *"The ABCs of Hedge Funds: Alphas, Beta, and Costs."* Working paper, Social Science Research Network, doi: 10.2139/ssrn.1581559 (2010).

Ilmanen, A. *"Expected Returns."* Wiley Finance (2011).

Ilmanen, A., and D. Villalon. *"Alpha Beyond Expected Returns."* AQR Capital Management, http://www.aqr.com/Portals/1/176%20-%20Alpha%20Beyond%20Expected%20Returns.pdf (2012).

Joenväärä, J,, R. Kosowski, and T. Tolonen. *"Revisiting 'Stylized Facts' About Hedge Funds."* Working paper, Social Science Research Network, doi: 10.2139/ssrn.1989410 (2012).

Jurek, J., and E. Stafford. *"The Cost of Capital for Alternative Investments."* Working paper, Harvard Business School (2011).

Kat, H., and H. Palaro. *"Who Needs Hedge Funds? A Copula-Based Approach to Hedge Fund Return Replication."* Alternative Investment Research Centre Working Paper No. 27, Cass Business School Research Paper, Social Science Research Network, doi: 10.2139/ssrn.855424 (2005).

Kat, H. *"Alternative Routes to Hedge Fund Return Replication: Extended Version."* Alternative In-

vestment Research Centre Working Paper No. 37, Cass Business School Research Paper, Social Science Research Network, doi: 10.2139/ssrn.939395 (2007).

Kosowski, R., N. Naik, and M. Teo. *"Do Hedge Funds Deliver Alpha? A Bayesian and Bootstrap Analysis."* Working paper, Social Science Research Network, doi: 10.2139/ssrn.829025 (2005).

Moskowitz, T., Y. Ooi, and L. Pedersen. *"Time Series Momentum."* Journal of Financial Economics 104: 228-250. SciVerse ScienceDirect, doi:10.1016/j.jfineco.2011.11.003 (2012).

Patton, A., and T. Ramadorai. *"On the Dynamics of Hedge Fund Risk Exposures."* Working paper, Social Science Research Network. doi: 10.2139/ssrn.1573218 (2010).

Tancar, R., T. Poddig, and P. Ballis-Papanastasiou. *"Hedge Fund Replication: The Asymmetric Way."* The Journal of Alternative Investments 15, no. 1: 68-84. Institutional Investor Journals, doi: 10.3905/jai.2012.15.1.068 (2012).

Tuchschmid, N., E. Wallerstein, and S. Zaker. *"Hedge Fund Clones are Still to Count on."* Working paper, Social Science Research Network, doi: 10.2139/ssrn.1729109 (2010).

Disclaimers and Disclosures

- Past performance is no guarantee of future results.
- All investments carry some level of risk. Diversification and other asset allocation techniques do not ensure profit or protect against losses.
- The information in this report has been obtained from sources NEPC believes to be reliable. While NEPC has exercised reasonable professional care in preparing this report, we cannot guarantee the accuracy of all source information contained within.
- This report contains summary information regarding the investment management approaches described herein but is not a complete description of the investment objectives, portfolio management and research that supports these approaches. This analysis does not constitute a recommendation to implement any of the aforementioned approaches.