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# EXPLAINING HEDGE FUND INDEX RETURNS


## Executive summary

**The emergence of the Alternative Beta industry can be seen as an evolution in the world of investing. Certain strategies, previously only known to a few, have made their way into the public domain. As evidence of this shift, the work described in this short note shows that Hedge Fund returns are historically described principally by these previously unknown (now known) factors consistent with the idea that today's beta is yesterday's alpha.**

**We show that we are able to capture the returns of the Société Générale Commodity Trading Advisor (SG CTA) index and two of the HFR Global Hedge Fund indices through a regressed combination of Trend Following, developed and emerging market equities and delta hedged option portfolios. This observation helps to unblur the line between Alternative Beta and genuine Absolute Alpha.**



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# Introduction

Private investment vehicles were first created in the bull market of 1920s America with perhaps the most well-known being the Graham-Newman partnership, part founded by Benjamin Graham of value investing fame. The use of the term Hedge Fund is accredited to Alfred W. Jones, an Australian sociologist and investment advisor, to refer to a pooled investment vehicle available to wealthy individuals with the use of the term Hedge implying a reduction in risk. The strategies employed by such vehicles have historically been shrouded in secrecy and almost mystical in nature with Hedge Fund founders often becoming investment gurus. In fact, if we peel back the layers and, with the benefit of hindsight, look at explaining the returns of the aggregate hedge fund industry one sees that certain key strategies, now publically known and studied, are able to capture the performance drift and volatility of the industry's excess returns.

This observation is key to the birth of the Alternative Beta industry. Use of the Greek letters alpha and beta comes from a standard mathematical tool, described below, that of regression analysis. Given the returns of a strategy, one attempts to explain and regress those returns with the returns of something measurable and known. The beta refers to the amount of weight given to a particular regressor in the explanation while alpha refers to the rest of the performance that remains unexplained. Alpha in the hedge fund world refers, therefore, to excess returns unrelated to any known source of return while beta refers to the amount of exposure one has to any particular regressor. In the case of traditional markets the regressor is either equity or bond market returns. In the case of Alternative Beta, on the other hand, the regressor is the returns resulting from Trend Following, Carry, Value, Quality, Low Volatility etc. Alternative Beta, therefore, is distinct from but analogous to Traditional Beta.

Alternative Beta is now offered in programs offered by many firms often alongside their alpha programs. The market has evolved such that the "secret sauce" of yesteryear is no longer unknown. One such example of this is the fact that one is able to explain the returns of Hedge Fund Indices. These alternative benchmark strategies have long existed and delivered good performance, as evidenced by the outperformance of Hedge Fund Indices relative to equities and bonds. Here we look at the SG CTA index[1], the HFRX Global Hedge Fund Index[2] and the HFRI Fund Weighted Composite Index[3] as three such examples.

We first begin with a description of the regression technique before presenting the results applied to the three indices. We finish by commenting on the results.

# Regressing returns

In what follows we try to explain the techniques of regression. For those less mathematically minded readers, please feel free to move on to the next section.

Given a time series of the returns of a Hedge Fund (HF), $r_{HF}$ and the returns of a known strategy, $r_{strat}$ coded in simulation one can attempt to describe the returns of $r_{HF}$ using, $r_{strat}$ in the following way:

$$r_{HF} = \alpha + \beta r_{strat} + \eta$$

As already stated the beta corresponds to the exposure that the Hedge Fund has to the known strategy while the alpha is the outperformance of the Hedge Fund returns relative to the known strategy. The noise term corresponds to a statistical component which is random in nature and often referred to as white noise. In order to obtain the best fit for the parameters one needs to minimise the variance of the noise term averaged over the whole data set. Minimising the average of $\eta^2$ can be seen to be equivalent to calculating:

$$\beta = \langle r_{HF} r_{strat} \rangle / \langle r_{strat}^2 \rangle$$

Where the <X> corresponds to the average of a variable[4] X. One can now include other such regressors. For example, let's now use two such well known strategies say $r_1$ and $r_2$ such that the regression is written as:

$$r_{HF} = \alpha + \beta_1 r_1 + \beta_2 r_2 + \eta$$

Now minimising the average of $\eta^2$ over the data set amounts to calculating:

$$\vec{\beta} = \widehat{covar}^{-1} \vec{r}_{HF \cdot strat}$$

$\vec{\beta}$ is now a vector calculated with the inverse of $\widehat{covar}$, the covariance matrix of the strategies $r_1$ and $r_2$ while $\vec{r}_{HF \cdot strat}$ is a vector of the averages i.e.

$$\vec{r}_{HF \cdot strat} = \begin{matrix} \langle r_{HF} r_1 \rangle \\ \langle r_{HF} r_2 \rangle \end{matrix}$$

One can also write this as an explained component of the returns and an unexplained component as follows:

[1] https://cib.societegenerale.com/en/prime-services-indices/ or https://www.barclayhedge.com/research/indices/calyon/

[2] https://www.hedgefundresearch.com/hfrx-indices-index-descriptions

[3] https://www.hedgefundresearch.com/hfri-indices-index-descriptions

[4] The average over N realisations being calculated as $\langle X \rangle = \frac{1}{N} \sum_{i=1}^{N} X$

$$r_{HF} = \alpha + \beta_1 r_1 + \beta_2 r_2 + \eta = r_{explained} + r_{unexplained}$$

Where $r_{explained}$ is then simply equal to $\beta_1 r_1 + \beta_2 r_2$ or the contribution from the known strategies. This return stream can then be correlated with the original return stream $r_{HF}$ to give a measure of how well the returns of the Hedge Fund are explained by our strategies (a goodness of fit measure). We are now fully equipped to be able to model the returns of our Hedge Fund Indices with known strategy returns.

# Regressing the SG CTA index

The archetypal Alternative Benchmark strategy is Trend Following (TF), a robust strategy that has been backtested over long histories by many including CFM[5]. The strategy forms the core of the Commodity Trading Advisor (CTA) activity and a multibillion dollar industry has grown around it. TF is generally a high capacity strategy, being directional in nature and trading the most liquid futures in the world. CTAs are therefore generally open and generally publish their returns in order to attract investment. Société Générale takes such returns and aggregates them together to form indices. Other firms also build indices but we have come to prefer the SG CTA index as being the benchmark that we try to beat. The SG CTA index has daily data available over the past 17 years and is therefore a rich data set with which we can attempt to explain the returns of the CTA industry.

The regressors we use in this case correspond to combined return streams from applying the trend to each underlying futures contract in a pool of 100+ such instruments. We group contracts together into sub-sectors with a liquidity weighting, a common technique in the CTA industry to weight each contract according to its capacity, and the return streams of TF applied to these sub-sectors become the regressors. The trend is defined using an Exponential Moving Average (EMA) as follows:

$$TF_n(\tau) = \frac{\sum_{k=0}^{\infty} e^{-k/\tau} X_{n-k-1}}{\sum_{k=0}^{\infty} e^{-k/\tau}}$$

Where the index *n* corresponds to today and the sum is over previous realisations of the price returns X defined as follows:

$$X_n = (p_n - p_{n-1})/\sigma_n$$

Where $\sigma$ is defined as the volatility of price returns, defined similarly as the square root of a 100 day EMA of past realisations of the squared price returns $(p_n - p_{n-1})^2$

We regress on three timescales – 2 months, 6 months and 12 months and find that the 6 month timescale has the highest fitted weight in the explanation of the SG CTA index. For the sake of simplicity, therefore, we retain only the 6 month timescale and regress using the return streams of TF defined on that single timescale.

Applying TF to futures gives us excess returns to which one should then include the interest income from excess cash. CTA returns are normally presented in such a manner where total returns including interest income are reported. Rather than adding the risk free rate, in our case a 1 month dollar Libor rate, we choose to remove the risk free rate from the SG CTA index before we do our regression in order to compare like with like. These excess returns from the index itself are a fairer reflection of the P&L of the CTA industry in not including the interest income from the arbitrarily varying risk free rate.

The result of this regression can be seen in Figure 1. The correlation between the SG CTA index and the regression is 82% with an outperformance in the regression of 4% per year[6]. The Sharpe ratio of the excess returns of the SG CTA index is 0.4 while that of the replicator is 0.9. This outperformance comes from two distinct sources – firstly we have not included the costs of trading and secondly the manager fees are not included. In using our regressors as described we are able to remove a 2% management fee and a 20% performance fee such that the Sharpe ratio of our regressed returns falls to still be in excess of the benchmark. Execution costs complete the description of the index such that the overall drift of the returns are exactly in line. The cost from execution is about 50% higher than that from the 2/20 investment advisor fees.

[5] Please see our academic paper "Two Centuries of Trend Following" published in the Journal of Investment Strategies

[6] It is worth noting that the 4% annualised outperformance of the replicator can be bettered by including some FX carry as an extra regressor. The correlation with the SG CTA index is slightly higher with an outperformance that approaches 4.5%.

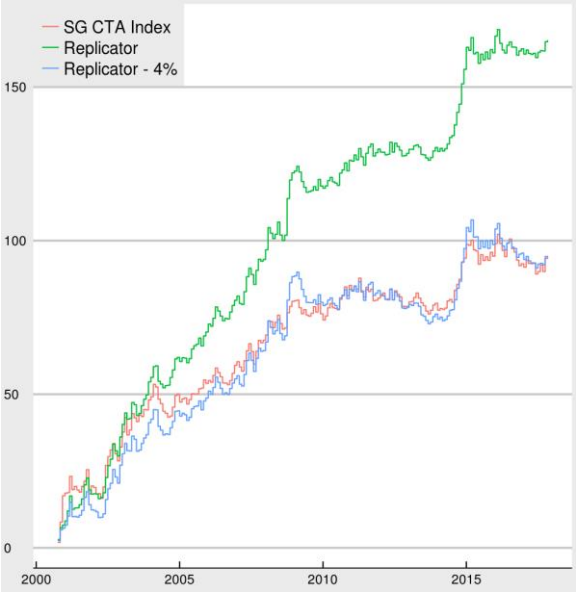


Figure 1 - The P&L of the SG CTA index (red) against the result of the replicator (green) using moving averages of returns as described in the text. The blue line has 4% removed from the return of the replicator every year in order to finish at the same end point as the SG CTA index. The returns of the replicator are normalised to match the volatility of the SG CTA index. Interest income is included in all P&Ls

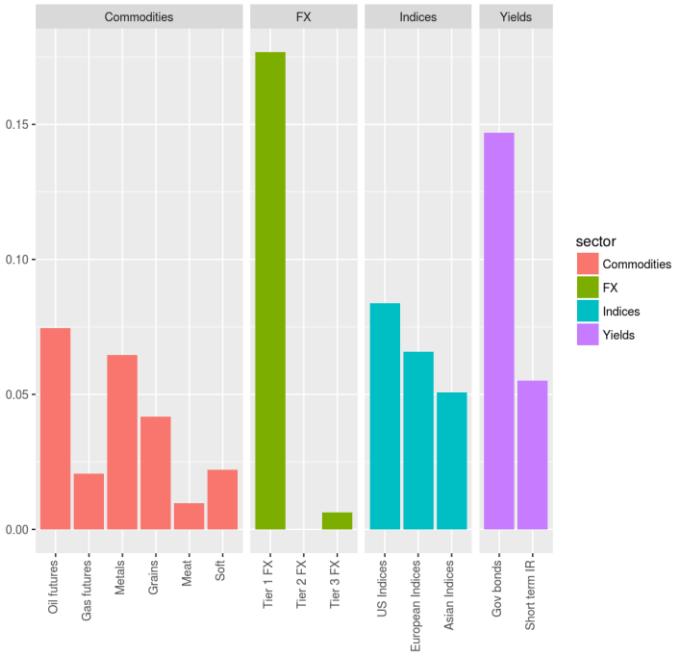


Figure 2 – The fitted weights from the regression described in the text. Within each sub-sector, contracts are weighted according to their liquidity. Sub-sectors are formed based on a correlation analysis of the contract universe and is the classification likely used by many CTAs in their portfolio construction

What is the significance of this result? The aggregate of the CTA industry is well described by TF and the performance of the remaining unexplained return stream is flat, after accounting for investment advisor fees and execution costs. On aggregate, therefore, CTAs only offer exposure to TF with the contribution from all non-TF strategies being zero. Of course, individual programs and firms can outperform the index by doing non-TF strategies but there is as much outperformance as there is underperformance from individual managers and summing up these contributions gives returns equivalent to TF plus noise (or extra risk and ultimately a lower Sharpe ratio!). Of course, one way to outperform the index is to have lower fees, a development we are observing in the industry and one that we feel is inevitable as TF becomes more and more commoditised.

# Regressing HFR indices

The Hedge Fund Research[7] database covers a broad range of HF strategies and includes indices that are constructed and split into different categories. HFRX indices are those corresponding to an aggregate of funds in the database that are open to new investment. HFRI indices, meanwhile, are constructed using an aggregate of funds that are open to new investment together with those that are closed. Generally the HFRI indices of a particular category outperform the equivalent HFRX index.

We have chosen to regress two global indices – the HFRX Global Hedge Fund Index (HFRXGL) and the HFRI Fund Weighted Composite Index (HFRIFWI). The HFRXGL is "including but not limited to convertible arbitrage, distressed securities, equity hedge, equity market neutral, event driven, macro, merger arbitrage, and relative value arbitrage"[8] while the HFRIFWI is a "global, equal-weighted index of over 2,000 single-manager funds that report to HFR Database" and "does not include Funds of Hedge Funds"[9].

The regressors with which we choose to model these indices, include developed and emerging market equity indices. These HF returns are to a large extent correlated with equities, presumably due to the inclusion of strategies such as equity long/short that inherently have an equity beta. We include our newly created SG CTA replicator as a global proxy for TF. We also include a long history of systematically selling volatility, an insurance selling strategy involving selling delta hedged options. The HF indices have a large Risk Premium[10] component, as

[7] https://www.hedgefundresearch.com/hfr-database

[8] https://www.hedgefundresearch.com/hfrx-indices-index-descriptions

[9] https://www.hedgefundresearch.com/hfri-indices-index-descriptions

[10] Please see our academic paper "Risk Premia: Asymmetric tail risks and excess returns" published in Quantitative Finance

evidenced by the difficult period of performance through the 2008 Global Financial Crisis. Our Short Volatility (SV) strategy is diversified across many different underlyings including a contribution from option markets in each of equity indices, fixed income, FX and commodities. In summary we use the following:

- The MSCI World index made up of 23 developed country equity indices. The Sharpe ratio of the excess returns of the index is 0.3
- The MSCI Emerging Market index which consists of 24 emerging countries' indices. The Sharpe ratio of the excess returns of the index is 0.4
- Our CTA replicator with a Sharpe ratio of 0.9 when looking at excess returns
- A systematic SV strategy diversified across 4 asset classes. The Sharpe ratio of excess returns is 1.0

With again excess returns calculated using financed total return indices in each case. We then subtract the risk free rate from the HF index under study in order to compare like with like.

The results of the regression for the HFRXGL index can be seen in Figure 3. The regression is 81% correlated with the index itself and outperforms by a significant margin. The Sharpe ratio of the excess returns of the HFRXGL index is 0.2 while that of the replicator is 0.8. As is the case for the SG CTA index, this outperformance can arise from investment advisor fees and execution costs with an outperformance measured to be 3% annually after correcting to have the same level of volatility as the index. The high level of correlation and outperformance is interesting indeed and shows that the index can, to a large extent, be explained by known traditional and alternative benchmarks.

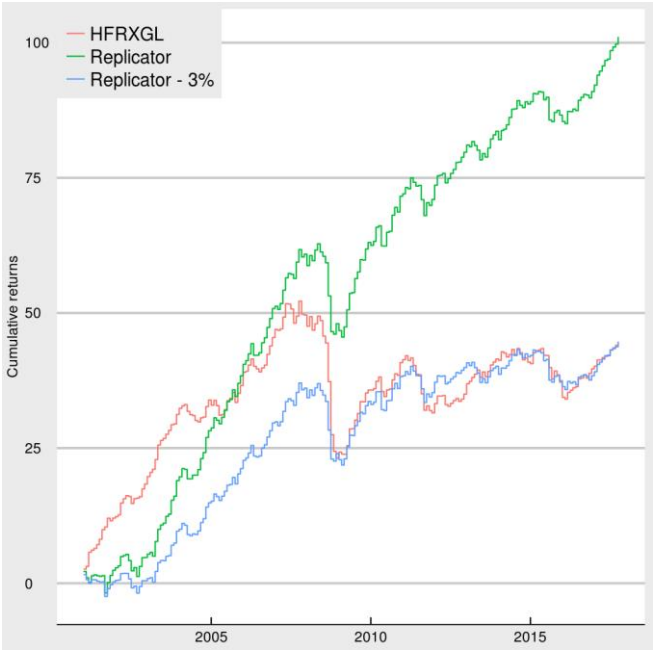


Figure 3 – The P&L of the HFRXGL index (red) against the result of the replicator (green) using the four regressors described in the text. The green line has 3% removed from the return of the replicator every year in order to finish at the same end point as the HFRXGL index. The returns of the replicator are normalised to match the volatility of the HFRXGL index. Interest income is included in all P&Ls

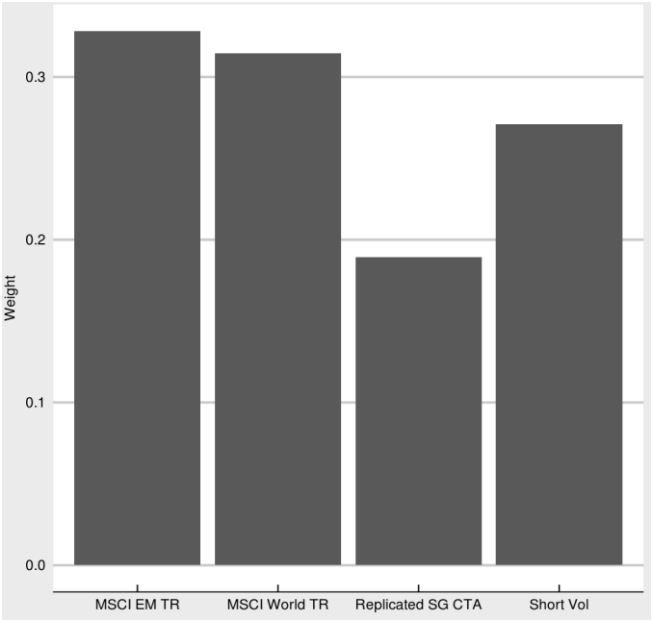


Figure 4 – The fitted weights from the regression of the HFRXGL index as described in the text

Now switching our attention to the HFRIFWI index we repeat the exercise to find this time a more robust drift in the index itself with a Sharpe ratio of 0.6. The regressors are identical to that presented for HFRXGL although the weights that come out of the regression are slightly different. In this case we are not able to outperform the

index, although the level of correlation observed is even higher at 94%. The regressions and weights are seen in the figures below. The HFRIFWI index seems to require more equity exposure than HFRXGL which makes the overall Sharpe ratio lower, the SV and TF strategies having higher Sharpe ratios. One could outperform the HFRIFWI index by adding in extra SV and TF weight but at the expense of correlation to the index. This may represent genuine skill (alpha) in the HFRIFWI index in its ability to outperform the regressors. It could also be that we are missing other alternative benchmark strategies from our regressor set - such as Value, Quality, Carry etc. These strategies are now very much in the public domain and known to the industry. This represents future work and potentially an updated publication.

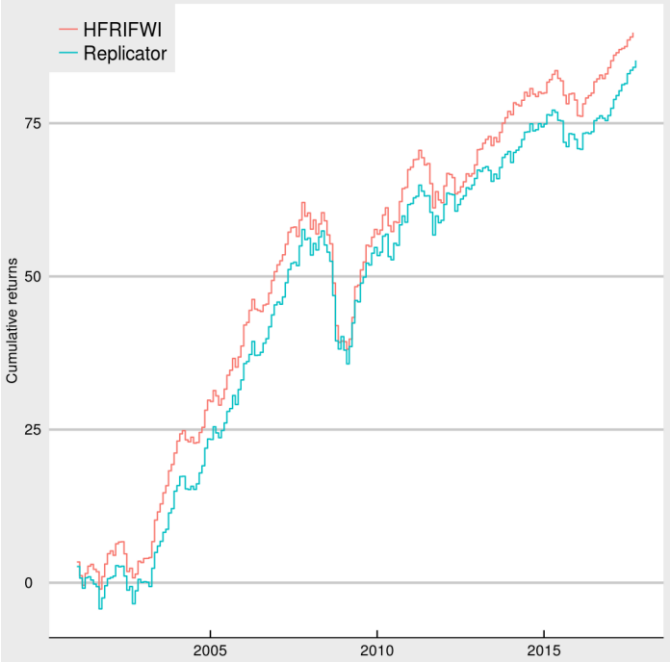


Figure 5 – The P&L of the HFRIFWI index (red) against the result of the replicator (blue) using the four regressors described in the text. The returns of the replicator are normalised to match the volatility of the HFRIFWI index. Interest income is included in all P&Ls

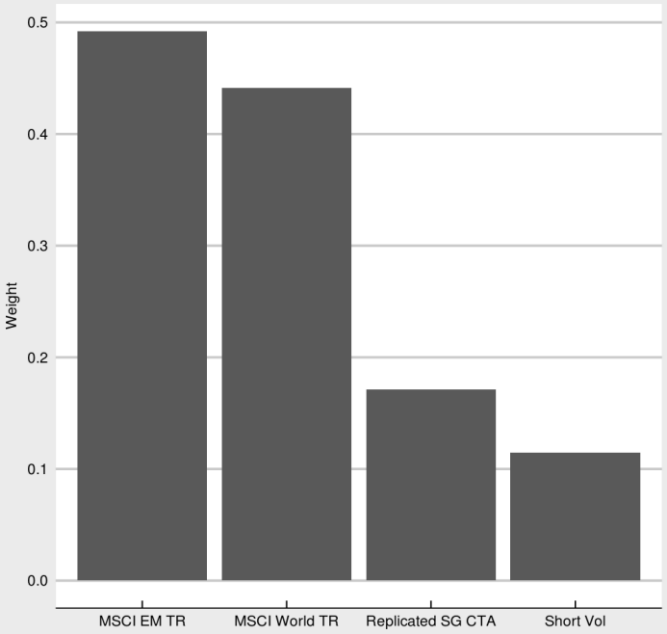


Figure 6 – The fitted weights from the regression of the HFRIFWI index as described in the text

# Conclusions

Our ability to explain CTA and Global HF indices with a mix of traditional and alternative benchmark strategies and investments leads us to believe that the market is evolving. Today's beta was once a source of unknown alpha for the industry, and charging HF-style high fees with low levels of investment manager transparency for these types of strategies is becoming a thing of the past.

The implementation of these non-traditional strategies is however non-trivial. It is our belief that the superior manager, able to deliver superior risk-adjusted returns, does so through superior implementation skills in being able to build better diversified portfolios, execute at lower cost and risk control to deliver a constant level of volatility.

# Disclaimers

# CFM has pioneered and applied an academic and scientific approach to financial markets, creating award winning strategies and a market leading investment management firm.

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