
Invited Editorial

Volatility – The normally dormant factor exposure for hedge funds

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ABSTRACT This article examines 12 common hedge fund styles to determine their exposure to volatility. Results are presented demonstrating that although volatility remains a dormant factor generating de minimis affects on both return and risk, it will occasionally surface on a rare and infrequent basis, as it did in 2007 and 2008. During such periods, which have occurred only twice since 1966, hedge fund returns can suffer a profound negative impact. Historically, such periods have been followed by similarly sized favorable rebounds.

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INTRODUCTION

It is widely appreciated that hedge funds, just like traditional vanilla long-only managers, carry significant embedded factor risks.¹ Typically, such exposures include interest rates, equity risk premia, credit spreads, commodities or even inflationary expectations. If one develops an appropriate customized benchmark for a hedge fund that adequately reflects these embedded

exposures, then a relatively smooth pattern of monthly alphas results (whether positive or negative).

However, the typical hedge² fund lost –19.0 per cent in 2008 and then gained +20.0 per cent in 2009. The size of the 2008 loss far exceeded anything previously recorded since data were first collected,³ and delivered a loss far greater than would be expected from the

obvious embedded interest rate, equity premia or credit spread exposures. Moreover, these results are of a sufficient magnitude to draw into question whether all of the primary embedded factor exposures have been identified and properly accounted for. Events of 2008 and 2009 would be consistent with the existence of a previously unaccounted for and normally dormant factor exposure that came abruptly to life in a negative (positive) fashion in 2008 (2009). This is the question examined by this article and the universality or variation of its effect across differentiated hedge fund styles.

To explore these issues, I selected a representative cross-section of different hedge fund sector indices⁴ and obtained their monthly limited partner net returns for the 158 months ending 30 June 2010. I estimated their embedded factor exposures (betas) using a stepwise regression procedure wherein the first factor selected was forced to be a measure of volatility.⁵ In addition, the stepwise selection progressed until a total of four factors were selected for each hedge fund style index. Factors were independently chosen for each index, that is, customized, and the second, third and fourth factors were required to be more traditional beta exposures (that is, not measures of volatility). These more traditional factor risks were drawn from a universe of 238 alternative indices that included equities (domestic, international, emerging country and dispersion), fixed-income (domestic, international, emerging country, government, corporate, asset-backed and high yield), cash (domestic and international), commodities, precious metals and inflation. This approach allowed me to draw direct comparisons across the various hedge fund styles and for the specific examination of each style's exposure to volatility as an embedded factor risk.

VOLATILITY IS HIGHLY SIGNIFICANT

The initial question deals with the level of significance for volatility as an explanatory variable across hedge fund styles. If volatility is statistically significant, then the sign or the direction of such exposure must be determined. Table 1 provides summary statistics addressing both of these issues across the dozen hedge fund styles examined.

As demonstrated by the *t*-statistics and *P*-values, volatility remains highly statistically significant for a majority of the hedge fund styles. More noteworthy is the observation that all sectors remain short volatility with the sole exceptions being *Short Bias* and *Energy/Basic Materials-Equity Hedged*. However, the long-vol exposure of this second style (Energy) remains statistically irrelevant. That Short Bias funds are inherently long volatility is logically intuitive given their fundamental short nature. We can conclude from these data that hedge fund styles vary widely in their exposure to volatility – but most sectors will deliver short-vol risk.

As a result of *Global Macro's*⁶ favorable 2008 performance (up + 4.8 per cent), some have suggested that this hedge fund style is inherently long volatility. This conclusion is false, and results from a failure to properly strip out Macro's other embedded factor exposures before drawing a conclusion as to its sensitivity to volatility. Figure 1 provides a graphical portrayal as to the relationship between Global Macro's alpha (see note below) and varying levels of volatility.

In Figure 1, the vertical axis measures Global Macro's monthly alphas. However, these so-called alphas are the residuals of the regression after only three of the four embedded factors have

Table 1: Volatility is highly significant for some, but not all, hedge fund styles^a

<i>Hedge fund style (or sector)</i>	<i>t-statistic</i> <i>(on volatility</i> <i>factor)</i>	<i>P-value</i> <i>(on volatility</i> <i>factor)</i>	<i>Direction</i> <i>of volatility</i> <i>exposure</i>	<i>Adjusted R²</i> <i>(of four-factor regression,</i> <i>including volatility)</i>
HFRI relative value (total) index	12.3	0.000	Short	0.78
HFRI (event driven) distressed/restructuring index	10.1	0.000	Short	0.75
HFRI event driven (total) index	8.1	0.000	Short	0.83
HFN distressed index	8.0	0.000	Short	0.82
HFRI (relative value) fixed income convertible arbitrage index	7.0	0.000	Short	0.81
HFN market neutral equity index	4.8	0.000	Short	0.39
HFN CTA/managed futures index	3.3	0.001	Short	0.27
HFN macro index	3.2	0.001	Short	0.47
HFN short bias index	2.8	0.006	Long	0.88
HFN statistical arbitrage index	0.9	0.385	Short	0.34
HFRI (equity hedge) energy/basic materials index	0.8	0.415	Long	0.47
HFRI emerging markets Latin America index	0.0	0.976	Short	0.84

^aIn this table, the direction of the volatility exposure identifies the sign of the factor loading to volatility. In each case, the regression statistics presented in this table represent the results of a four-factor OLS simultaneous regression.

Statistics based on the 158 months ending 30 July 2010 and a four-factor model for each hedge fund style (where the first factor is volatility).

been stripped out of the total hedge fund index return series. The impact of volatility was left in (that is, the first of the four factors). The horizontal axis measures the type of volatility that most closely correlated with Macro (note the *t*-statistic and *P*-value of 3.2 and 0.001, respectively, for this factor, as reported in Table 1). A visual inspection of Figure 1 shows either a negative relationship between Macro's net alpha performance and volatility (that is, a short volatility exposure) – or a neutral relationship. Clearly, over the last 158 months, Macro has been unable to deliver a long-vol exposure (despite 2008's favorable performance). On the basis of these data, we can safely conclude that Global Macro hedge funds, taken in the aggregate, are much like most

other hedge funds in that they deliver short volatility.

VOLATILITY MAY BE STATISTICALLY SIGNIFICANT, BUT IS IT IMPORTANT?

The statistics presented above demonstrate the high statistical significance of volatility as an explanatory variable underlying hedge fund returns – at least for a majority of sectors. But does it have a large enough impact to actually be something that we should be concerned about? Table 2 provides an answer to this question.

The second column provides the standard deviation of the monthly alphas (that is, for the residuals of the regression after all four

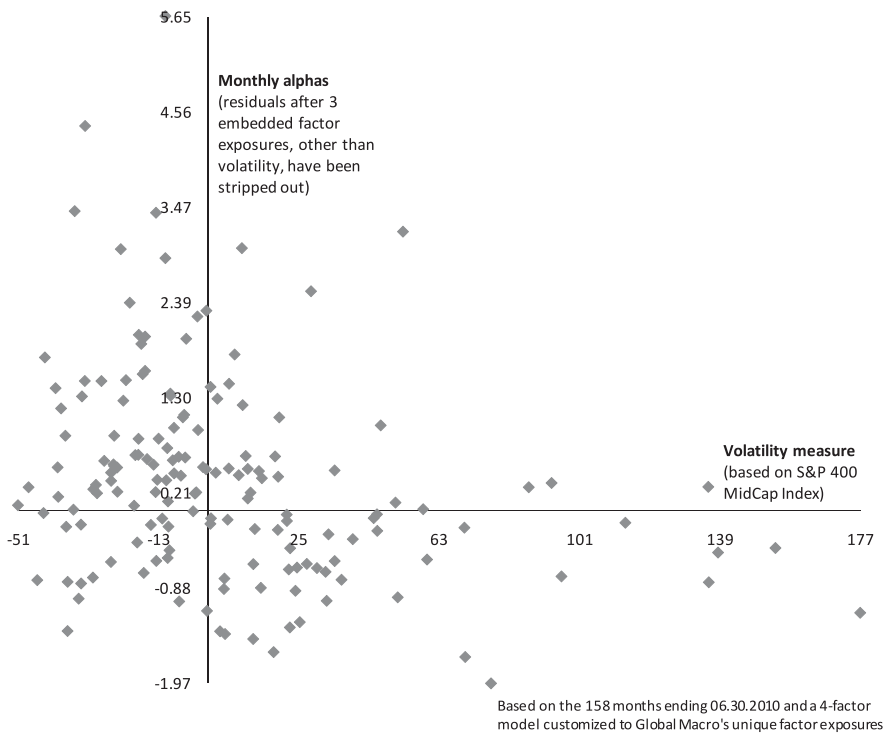


Figure 1: Global macro remains short (or neutral) to volatility.⁷

embedded factor exposures, including volatility, have been stripped out of the hedge fund returns). The third column provides the same standard deviation, but now for regression residuals where the embedded exposure to volatility was left in (that is, only the second, third and fourth factors were removed). The far right-hand column shows how much the risk of the monthly alphas is increased (proportionately) if one fails to strip out the fund's exposure to volatility. We can conclude from these data that volatility is an important embedded factor for many hedge fund sectors – but not all.

However, this view to the issue is incomplete, because it focuses on the average result measured over the last 158 months, and therefore fails to identify just how profound an effect volatility can have during isolated moments in time. Table 3 attempts to address this specific issue.

The framework utilized within this article attributes total hedge fund performance to six distinct sources:

- the return on cash equivalents;
- the return resulting from the embedded volatility exposure;
- the return resulting from the three embedded traditional factor risks (that is, non-volatility); and
- Alpha.

Collectively, these six sources of return sum to the total index return. Table 3 reports the portion of these six returns that was attributable to embedded volatility during 2008, 2009 and the remaining 11.2 years. On the basis of these statistics, we can conclude that exposure to volatility was a highly

Table 2: Hedge fund styles differ radically in their exposure to volatility^a

Hedge fund style (or sector)	Annualized standard deviation of residuals (alphas)		Failure to strip out volatility increases alpha standard deviation by this proportion (%)
	When all four factors exposures are stripped out (%)	When only three of the factor exposures are stripped out (volatility is left in) (%)	
HFRI relative value (total) index	2.2	3.3	51.7
HFRI (event driven) distressed/ restructuring index	3.4	4.7	38.3
HFN distressed index	3.2	4.2	30.7
HFRI (relative value) fixed income convertible arbitrage index	3.5	4.5	29.7
HFRI event driven (total) index	3.0	3.8	27.3
HFN market neutral equity index	2.1	2.3	8.1
HFN macro index	3.9	4.1	4.6
HFN CTA/managed futures index	7.1	7.4	4.5
HFN short bias index	4.9	5.0	3.3
HFRI (equity hedge) energy/basic materials index	13.0	13.0	0.4
HFN statistical arbitrage index	3.4	3.4	0.3
HFRI emerging markets Latin America index	6.9	6.9	0.0

^aThe results presented in this table are for the four-factor OLS simultaneous regressions based on the entire 158 month time period ending with 30 June 2010.

Statistics based on the 158 months ending 30 June 2010 and a four-factor model for each hedge fund style (where the first factor is volatility).

important explanatory variable for a majority of hedge fund styles during the events of both 2008 and 2009. Moreover, we can conclude that during more normal times (that is, the remaining 11.2 years of this study), embedded volatility has little affect on total hedge fund performance for almost all styles. It is important to observe that this affect holds more

strongly for *Relative Value* than any other hedge fund sector. During 2008, 46 per cent of the return was attributable to embedded volatility – while during more normal times, this proportion falls to just 8 per cent. This would suggest that Relative Value trades are a dangerous trap waiting to catch the unwary or misinformed investor.

Table 3: Volatility's importance during 2008 and 2009 varied radically across hedge fund styles^a

<i>Hedge fund style (or sector)</i>	<i>What proportion of the calendar-year return resulted from a simple exposure to the volatility factor, during ...</i>		
	<i>2008 (%)</i>	<i>2009 (%)</i>	<i>Rest of the time (remaining 11.2 years) (%)</i>
HFRI relative value (total) index	46	36	8
HFRI (event driven) distressed/restructuring index	34	28	15
HFRI event driven (total) index	30	18	11
HFRI (relative value) fixed income convertible arbitrage index	29	20	8
HFN distressed index	27	15	11
HFN market neutral equity index	22	14	7
HFN macro index	15	17	6
HFN CTA/managed futures index	10	21	8
HFRI (equity hedge) energy/basic materials index	8	9	2
HFN short bias index	7	8	5
HFN statistical arbitrage index	1	1	1
HFRI emerging markets Latin America index	0	0	0

^aIn calculating the proportion of each year's returns that were to be attributed to a specific contributor (for example, to volatility), the absolute value of each of the six contributors was used (that is, return to cash, embedded volatility, the three non-volatility traditional betas and alpha).

Statistics based on the 158 months ending 30 June 2010 and a four-factor model for each hedge fund style (where the first factor is volatility).

VOLATILITY HAS LITTLE IMPACT MOST OF THE TIME

It would be helpful to understand the likely impact of volatility on hedge fund returns over the long expanse of capital market history. Unfortunately, reliable hedge fund data have only been available for a short period of time – this study restricts itself to the last 158 months. However, we may be able to take a useful step towards improving our understanding by extrapolating the results of this study back into

time. Specifically, the stepwise regression procedures identified both *a type* and *a quantity* of embedded volatility exposure for each of the 12 hedge fund styles examined. Table 4 provides an extrapolation of these results for two of the more noteworthy sectors, that is, Relative Value and *Convertible Bond Arbitrage*.

For these two sectors, the stepwise regression found that a volatility measure based on the NYSE Composite Index provided the greatest correlation – explanatory power. If we apply the

Table 4: Volatility's impact remains remarkably quiescent most, but not all, of the time^a

<i>Hedge fund style (or sector)</i>	<i>Return impact on hedge fund index resulting from exposure to short volatility, during ...</i>				
	<i>First major upward spike in volatility since 1 July 1966</i>	<i>Period following first spike</i>	<i>Second major upward spike in volatility since 1 July 1966</i>	<i>Period following second spike</i>	<i>Remaining 442 months (since 1 July 1966)</i>
	December 1985 – November 1987 (%)	December 1987 – September 1989 (%)	January 2007 – November 2008 (%)	December 2008 – April 2010 (%)	Annualized return impact (geometric mean) (%)
HFR1 relative value (total) index	-7.6	+6.1	-13.2	+10.6	-0.1
HFR1 relative value fixed income convertible arbitrage index	-8.8	+7.1	-15.2	+12.3	-0.2
					standard deviation (%)
					1.0
					1.2

^a Although the remaining 442 months (the entire period less December 1985 to September 1989 and less January 2007 to April 2010) generate a near zero geometric mean return and an extremely low standard deviation, it is possible that one could examine the historical return pattern and conclude that a third quite MINOR upward spike in volatility occurred during the period January 1973 to October 1974.

Statistics based on the time period 1 July 1966 – 15 July 2010. The measure of volatility for these two hedge fund styles was based on the NYSE Composite Index.

factor loadings derived from these regressions back in time, we synthesize the results appearing in Table 4. This table covers the time period spanning 1966 through the present, because this is the period during which the NYSE volatility measure was available. Since 1966, this measure of volatility experienced *only two* meaningful upward spikes – the first occurred from December 1985 to November 1987 and the second during January 2007 to November 2008. In both cases, embedded volatility had a profound negative impact on hedge fund index returns, for example, Relative Value would have been theoretically impacted by a -7.6 per cent return, from exposure to short volatility alone, during the first vol-spike.

Interestingly, both periods of increased volatility were followed by periods of rapidly declining volatility (for example, December 1987 through September 1989 and December 2008 through April 2010). During such periods, the embedded exposure to short-vol handsomely rewarded these two hedge fund styles. The right-hand columns provide the return and risk derived from embedded volatility during the remaining 442 months. Note the *de minimis* impact of embedded volatility on both return and risk. Similar results can be developed for each of the other hedge fund styles. Table 5 provides similar synthesized statistics for *Market Neutral Equity*.

In the case of Market Neutral Equity, a measure of volatility based on the NASDAQ 100 Index provided the greatest explanatory power. This measure only goes back to 1986, therefore Table 5 covers a shorter time period. As before, this vol-measure experienced only two upward spikes since 1986. During each episode, Market Neutral suffered a meaningfully negative impact. But once again, these periods were followed by a collapse in volatility that served to reward the

Table 5: Volatility's impact remains remarkably quiescent most, but not all, of the time^a

Hedge_fund style (or sector)	Return impact on hedge fund index resulting from exposure to short volatility, during ...				
	First major upward spike in volatility since 1 January 1986	Period following first spike	Second major upward spike in volatility since 1 January 1986	Period following second spike	Remaining 216 months (since 1 January 1986)
HFN market neutral equity index	April 1986 – October 1987 (%)	November 1987 – May 1989 (%)	January 2007 – November 2008 (%)	December 2008 – April 2010 (%)	Annual return impact (geometric mean) (%) Annualized standard deviation (%)
	-6.9	+1.8	-3.5	+1.8	-0.4 0.8

^aThe impact of embedded volatility on Market Neutral Equity is considerably less than for styles such as Relative Value, Distressed/Restructuring or Event Driven. This is because Market Neutral Equity exhibits a far lower factor loading. Statistics based on the time period 1 January 1986 – 15 July 2010. The measure of volatility for this single hedge fund style was based on the NASDAQ 100 Index.

short-vol attribute of Market Neutral. Finally, during the remaining 216 months, the affect of embedded volatility was *de minimis* as expressed by the return and risk shown on the right-hand side of Table 5.

CONCLUSIONS

Most hedge fund styles have embedded within them statistically significant levels of volatility. In a majority of these cases, such exposure is short in nature, serving to expose the investor to pronounced upward spikes in this factor. Several hedge fund styles that are sometimes referred to as long-volatility, or at least neutral to volatility, are in fact actually short volatility. This misunderstanding probably results from a failure to properly account for the other embedded factor exposures within these sectors.

The impact of embedded volatility on hedge fund returns is generally *de minimis* during the vast majority of the time. Since 1966, there have been only two significant periods when volatility spiked upward by a sufficient amount to meaningfully undermine hedge fund returns. In both cases, these episodes were shortly followed by collapses in volatility during which fund styles with significant short exposure were handsomely rewarded.

The policy implications of these findings are four. First, hedge funds should only be used if their embedded factor exposures can first be identified and parameterized with sufficient accuracy and timeliness. Second, in each case, it must be determined whether some measure of volatility comprises one of the hedge fund's meaningful embedded betas. Third, the investor needs to estimate the impact of an inevitable future upward spike in volatility on their portfolio, and determine whether they will be able to

maintain their existing positions and structures through such an occurrence. Fourth, the investor should attempt to cost-effectively mitigate their exposure to embedded short volatility through the use of derivative instruments – or more likely, through the avoidance of portfolio constructions that excessively concentrate on those specific hedge fund styles that are most exposed to short volatility (that is, Relative Value, Distressed/Restructuring and Event Driven).

NOTES

- 1 Hedge funds are not a separate or distinct asset class. They do not bring a unique or differentiated factor exposure to the investor. Nothing about them in any way suggests that they have any basis for being identified as a separate asset class.
- 2 Hedge fund returns are based on the HFRI Fund Weighted Composite Index provided by Hedge Fund Research Inc. This is an equal-weighted index of individual hedge funds and is the most comprehensive index that HFRI provides. It was last updated on 9 August 2010 and covers the time period from 1 January 1990 through 31 July 2010.
- 3 The 2008 loss exceeded any loss recorded by Hedge Fund Research Inc whose data extend back to 1 January 1990 or any loss recorded by HFN, Hedge Fund Network whose data extend back to 1 January 1977.
- 4 I selected a representative cross-section of 12 hedge fund styles. Six were taken from HFRI, Hedge Fund Research Inc and six were selected from HFN, Hedge Fund Network. Individual monthly returns were provided directly by these two database vendors.
- 5 The stepwise regression could select from several hundred alternative measure of volatility that were taken from the equity, fixed income and precious metals arenas. These measures differed in the time period over which they measured or how quickly they adapted to changing conditions.
- 6 Year 2008 performance for Global Macro was represented by the HFRI Macro (total) Index provided by HFRI, Hedge Fund Research Inc.
- 7 The monthly alphas plotted in Figure 1 are the result of the four-factor OLS simultaneous regression – but with the impact of the embedded exposure to volatility ignored (that is, left in the monthly alphas). Global Macro is represented by the HFN Macro Index provided by HFN, Hedge Fund Network.