RiskMetrics Group™ Research Monthly

Twenty Questions

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Introduction

One of the fastest growing segments for us over the last year has been the alternative investment space. The growth in the space has had the interesting effect of revitalizing market risk as an area of research and development. For a number of years, speakers at plenary sessions at the larger risk management conferences would state that market risk was either dead or complete (one and the same to the researchers in the crowd), meaning that risk models had become standardized and that systems were largely adequate to capture trading information for the risk analysis. The conference would then proceed, with the market risk sessions limited to questions of management and culture, and the technical presentations focused on credit risk and other topics. For us, though market risk has never ceased to be primary on our research agenda, our recent emphasis has been on the quiet work of refining data, adding pricing models and improving the granularity of our analysis, rather than on questioning the fundamentals of our approach to risk.

We attended a conference recently and noticed a different emphasis. Market risk topics are hot again, with no better evidence than that speakers are once again questioning and criticizing the standard VaR model assumptions. There is no doubt that future issues of this note will take up some of these topics. For this issue, however, we will take up related hot topic from the conference this year: the information needs of a hedge fund investor.

Investing in a hedge fund poses a new set of challenges to an investor who has come from a broker-dealer or traditional asset manager. The hedge fund represents an investment in a dynamic trading strategy for which the investor receives only limited information. In a sense, the hedge fund investor makes a more traditional risk manager seem spoiled, in that the traditional risk manager has almost unlimited access to information, and can ask as many questions as he sees fit. Particularly with advances in information systems, the traditional risk manager is able to delve into risk numbers that seem anomalous. The hedge fund investor is like a traditional risk manager who may only ask Twenty Questions of the portfolio, and that only once per month.[1]

From positions to strategies

With a limited number of questions, then, there is greater discipline needed of the hedge fund investor

[1] For readers with a different background from the author, Twenty Questions is a game (played often on long car trips with children) in which one player thinks of an object, and the second must guess the object by asking no more than twenty questions.

than of a risk manager with unfettered access to information. An important theme becomes which questions the investor should ask. At RiskMetrics Group, we have created a service, Hedge Platform, to provide risk transparency to hedge fund investors by producing periodic, aggregated risk reports based on a hedge fund's positions at a particular moment in time. The service has proved quite valuable to investors and hedge funds alike: investors receive information about their investments, particularly on exposure, sensitivity and the effect of potential short-term market shocks; at the same time, hedge funds are able to provide their investors a degree of risk transparency without fear of compromising the specifics of their positions.

As illuminating as this information can be to a risk manager, though, it is less than a perfect picture of risk, in that it cannot, by construction, account for the dynamic nature of the hedge fund portfolio. So as crucial as any improvement to how we price positions or forecast volatility are methods to capture the fund's trading behavior, and not just its current positions.

To illustrate this problem a bit further, consider a fund whose positions at present consist of a cash position and a long equity position. If we can assume these positions to be static over the next month or year, then we have a good sense of how the fund is exposed to the equity market, and how the fund might be correlated with our other investments. It could be the case, however, that the fund follows a strategy under which it will increase its equity position if the market falls and decrease it otherwise, in such a way to replicate a short position in an equity put option. If this is so, then the fund will stand to lose more in the case of a fall in the equity market than we would estimate based only on a naive view of its current positions. Without information about the strategy, we see only the stable cashflow generated by the fund, and not its inherent short gamma nature – its sensitivity to the market increasing as the market falls. Furthermore, comparing this fund to those with similar strategies, the position level view would likely produce an underestimation of the true correlations across funds, since it would not account for the funds becoming more volatile and more sensitive to the market under adverse conditions.

In summary, risk reports based on a snapshot of positions do not tell the entire story, but detailed information on the funds' strategies is not forthcoming. So what is a risk manager to do? There is a growing body of literature aimed at building a factor model to describe hedge fund returns. Conceptually, factor models are quite simple. They seek to represent the returns on individual securities or funds as a linear combination of returns on a small number of explanatory factors. The art in factor models is in the choice of these factors. Indeed, for hedge funds, we see that the standard market indices are rather poor predictors of returns. For example, Fung and Hsieh (2001) regress the returns of a set of hedge funds[2] on a selection of standard market indicators, and find regression R^2 values no higher than 7.5%.

In the same paper, the authors demonstrate that the same set of hedge funds realized their highest returns when the world market experienced large losses or large gains, and their smallest returns when the world market return was near its median. Lo (2001) also examines a simple non-linear relationship, treating positive and negative index moves as separate re-

[2] Specifically, a portfolio of funds that exhibit a trend-following strategy.

gressors, and observing that for many hedge fund strategies, the sensitivities to positive and negative moves were quite different. This is sensible, in that we expect the hedge funds to hold non-linear products, or to trade dynamically to produce non-linear returns.

The conclusion, then, is not that the funds are not exposed to the markets, but rather that their exposure to the market is non-linear. The misspecified linear model leads us to the erroneous conclusion that the fund returns are purely idiosyncratic. As we will see, there is often a more subtle dependence on the market, and furthermore, this dependence is not simply a result of a data-mining exercise: the results coincide with our intuition about hedge fund strategies, and are consistent across studies using different data sets and approaches.

The fallacy of the linear model is in itself an important lesson, in that a naive application of old techniques could mistakenly suggest that hedge funds provide more diversification or more excess return than they actually do. One reaction to this could be to abandon the linear factor model altogether; more sensible is to seek to capture the non-linearities through our factor construction. In a sense, the approach is analogous to looking at a static option portfolio: we could interpret the portfolio as a non-linear position on the option underlyings; alternately, we could interpret the portfolio as a linear combination of options, which in turn depend on the underlyings in a non-linear way.

In their analysis of trend-following hedge funds, Fung and Hsieh (2001) create factors by constructing a Primitive Trend-Following Strategy (PTFS). In a generalization of the Merton (1981) characterization of market timing strategies, Fung and Hsieh posit that a perfect trend-follower will, over any given time period, buy an asset at its lowest price and sell the asset at its highest price, thereby realizing a profit equal to the difference between the asset's minimum and maximum prices over the period. The lookback straddle option, which trades in the over-the-counter market, has precisely this payoff function, and can be replicated by a rolling series of standard straddles.[3] The PTFS factor associated with a particular index is obtained by regularly purchasing, holding to expiry and exercising lookback straddles on the index. Fung and Hsieh (2001) revisit the same hedge fund returns (which had almost no correlation to the standard indices), and show R^2 values close to fifty percent for regressions against the PTFS factors. Clearly, the factors are capturing a significant portion of the non-linearity in the funds' dynamic strategies.

Toward a factor model of hedge funds

In a more recent paper, Fung and Hsieh (2004) set out to compile a set of factors, including the PTFS, that can serve as the basis for a broad hedge fund factor model. We have performed a similar exercise with a different set of hedge fund indices. We examined ten years of historical monthly returns on the Tremont Hedge Fund indices representing eleven hedge fund strategies. For factors, we utilized the positive and negative equity market moves mentioned above;[4] the Fung and Hsieh (2001) PTFS factors, as well as the S&P Diversified Trends Indicator; the Fama-French

[3] See Goldman et al (1979).

[4] Note the signs of these factors are such that a positive coefficient on the Market Down factor indicates that the fund will tend to have a negative return when the market return is negative.

size (SMB) and book-to-market (HML) equity factors;[5] and four spread-related factors (10-year Treasury yield, Baa credit spread, CSFB High Yield index, and the EMBI+ emerging markets index). Overall, the explanatory power is encouraging: the R^2 is close to eighty percent for two indices, over fifty percent for three others, and near forty percent for two more. The R^2 and alpha values are shown in Table 1.

Furthermore, the factors that emerge as significant are consistent with our intuition about the various strategies, particularly for those strategies where the regression fit is strong. We display the signs of each coefficient that is significantly different from zero at the 95% level in Table 2. The Long/Short Equity strategy is long the overall equity market (though its sensitivity to up moves is roughly twice as large as its sensitivity to down moves), with a bias toward small capitalization and growth stocks. The Dedicated Short strategy appears to be short the market overall, with opposite style biases to the Long/Short strategy. The Managed Futures strategy is positively related to all three trend-following factors.

The Risk Arbitrage strategy is long the equity market, with a bias to small and value stocks. Interestingly, it also has a negative weight on the Bond PTFS factor. Recalling that the PFTS strategy is one that involves a series of purchases of option contracts, we can interpret the negative weight on this factor as an indication that the Risk Arbitrage strategy has demonstrated an overall short volatility position.[6] Moreover, the Risk Arbitrage strategy is one of four to exhibit a statistically significant excess return, even after accounting for our set of non-linear factors. Even the poor regression fits are informative: the Equity Market Neutral strategy is mostly insensitive to the equity market factors, as the strategy name would suggest.

On the other hand, there is clearly still room for further research. There are four strategies for which the R^2 is around twenty-five percent, indicating either that their returns are mostly idiosyncratic or that we have not identified factors that drive their performance. Convertible Arbitrage and Fixed Income Arbitrage both typically involve positions in volatility in their respective markets, while it is reasonable that Equity Market Neutral, by virtue of offsetting positions, would also be explained well by volatility strategies. This suggests that factors other than the PTFS that mimic the trading of volatility may well be useful. As a simple example, we considered monthly changes in the CBOE VIX index. The coefficient on the VIX was significantly positive for both the Fixed Income Arbitrage and Convertible Arbitrage strategies, though the goodness-of-fit increased markedly for Fixed Income Arbitrage only.

Potential applications

In all, we are encouraged enough by these initial results to speculate about how a hedge fund factor model could be used to augment position level risk reports for an investor. Factor models have been applied in traditional equity portfolios for some time. Among their applications are estimating expected returns (under the CAPM or APT models, where ex-

[5] The SMB factor is a measure of how much the equity of small firms outperforms that of large firms in a given period, and the HML of how much firms with high book-to-market ratios (value stocks) outperform those with low ratios (growth stocks). See `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html` for further details.

[6] This is consistent with the findings of Mitchell and Pulvino (2001), who show that risk arbitrage strategies tend to mirror short put positions.

Table 1: Factor model regression results. Alpha values significant at the 95% level are listed in bold.

Strategy	R^2 (%)	Alpha (bp)
Long/Short Equity	79	6
Dedicated Short	79	58
Event Driven	64	**77**
Distressed	60	**96**
Emerging Markets	55	-3
Risk Arbitrage	40	**62**
Managed Futures	37	-73
Equity Mkt Neutral	27	**56**
Convertible Arbitrage	25	30
Fixed Income Arb	23	38
Global Macro	23	30

Table 2: Signs of coefficients significant at the 95% level

Strategy	Mkt Up	Mkt Down	SMB	HML	Bond Trend	FX Trend	DTI	HY Index	EMBI +
Long/Short Equity	+	+	+	-			+		+
Dedicated Short	-	-	-	+					
Event Driven		+	+					+	+
Distressed		+	+					+	+
Emerging Markets			+						+
Risk Arbitrage	+	+	+	+	-				
Managed Futures		-			+	+	+		
Equity Mkt Neutral	+					+			
Convertible Arbitrage								+	
Fixed Income Arb	-						+	+	
Global Macro							+		+

pected returns are governed by undiversifiable, or factor-explained risk); constructing diversified portfolios; evaluating risk-adjusted performance; calculating sensitivities; and managing risks. As applied to mutual fund portfolios, factor models are utilized in style analysis, in order to assess what risks a manager is taking (regardless of his fund's label) and to ascertain on a rolling basis whether a manager's style, or factor allocation, has changed.

For the hedge fund investor, a number of these applications are natural. When allocating to a portfolio of hedge funds, a manager will seek to construct a portfolio that is adequately diversified across common drivers of risk. When assessing a specific fund, the manager can use factor model information to benchmark the fund's performance, and to calculate the true historical excess return and correlation to other portfolio risks. As we have seen in this note, a naive application of simple factor models can lead us to attribute realized returns to idiosyncratic manager skill rather than to a particular market strategy; the result is a potential overestimation of excess return and underestimation of correlation with other investments, both of which lead to an overestimation of risk-adjusted return.

Similar to mutual fund applications, a manager may use a factor model to assess whether a hedge fund has significantly altered its strategy, either by examining the factor regressions over rolling windows, or by comparing the regression results on either side of a significant market event. For a traditional long-only manager, a shift in position allocations is an indication of a shift in strategy or market view. In contrast, a shift in positions for a hedge fund manager can either be a disciplined application of a dynamic strategy or a true change; only by examining both the position-level results and the factor sensitivities can we distinguish these two cases.

For risk, to bring us back to our original point, the hedge fund factor model can provide an excellent complement to risk measures derived from position-level information. The position-level measures are most relevant for short-term shocks, where the actual positions and not the manager's behavior or strategy will determine performance, and for compliance testing. For medium horizons, the dynamic nature of hedge fund portfolios, as manifested in the manager's reaction to market events, will have a greater effect on portfolio performance. The factor models discussed in this note are designed to capture this.

We can imagine, then, a next generation of hedge fund risk reports with a consistent set of scenarios side-by-side: the effect of the scenarios as short-term shocks based on position details, and the effect of the scenarios over medium horizons based on factor models and the funds' established strategies. These new reports will perhaps account for fifteen of our Twenty Questions, leaving the balance for discussion in future notes.

Further reading

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