

## Technical article

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# Take the long and short route

**The past 12 months have seen rapid growth in the number of hedge funds specialising in long/short equity strategies. Here, Giovanni Beliotti deploys the traditional stock-pickers measure, beta, to investigate the extent to which such strategies are market neutral**

Long/short equity portfolios are investments in long and short holdings of stocks, where either direct short-stock positions or over-the-counter derivatives such as contracts for differences (CFDs) are used by the fund manager to obtain the desired short exposure to a number of stocks in its selection universe. Early examples of long/short portfolio structures can be traced back to the first hedge funds in the 1950s. However, they did not hit the mainstream investment management business until the early 1990s, when some, mostly quantitative, investment houses started to manage money in this form for their institutional clients. Recent renewed institutional interest in hedge funds has led some large traditional investment houses, which have so far been managing money mostly in active long equity portfolios, to announce that they will launch their own long/short funds.

Long/short portfolios are a step forward from traditional, long-only equity structures, in that they attempt to measure and manage the various asset class, market and stock-level exposures of an equity portfolio. The long/short structure allows the investor to identify and manage separately the market and security-level exposure of the portfolio. At the same time, long/short portfolios are typically an easier and somewhat less traumatic way for institutional investors (and asset managers) to approach more complex portfolio structures typical of hedge fund investing.

It is not difficult to see that, in the end, a long/short portfolio is not dissimilar from a traditional long equity investment. Imagine a long-only portfolio invested in S&P 500 stocks. From the list of long holdings of this portfolio, subtract the corresponding S&P 500 percentage holding for each of the stocks. If the portfolio is overweight in a specific stock, the difference will be positive (and vice versa if underweight). The result is a portfolio of positive and negative holdings (ie, a long/short portfolio), and a portfolio of index holdings, which are held together in our original portfolio, and together constitute its long-only exposures.

One simple conclusion, which often surprises traditional investment managers and plan sponsors, is that a set of "implicit short" positions is present in any actively managed portfolio whose performance is benchmarked against an index. The real advantage of a long/short structure is therefore not that the manager can "go short". For a long-only manager, the long weightings of each stock in the benchmark are the maximum that he can short for each stock. A long/short manager can choose its short weightings purely on the basis of his active stock selection plans, without benchmark-specific holdings constraints.<sup>1</sup>

In a long/short portfolio, the short part has two functions. One is to get the desired negative exposure to securities that the portfolio manager considers overvalued. The other is that the "shorts" usually reduce the market exposure of the portfolio by taking away some of the market exposure provided by the "longs". A lower exposure to the underlying market can be a very attractive feature for an investment, particularly if it is put together with other risk-diversifying strategies to obtain portfolio diversification. The amount of market risk reduction in a long/short portfolio depends on the size of the relative market exposures of the long and the short part. It also depends on the size of short selling positions as a proportion of the total portfolio value. As a first approximation, if the relative

market exposures of the long and short holdings are similar, and if the amount of long and short selling is also roughly similar, the market exposure of the long/short portfolio should be pretty low.

Many long/short managers who apply qualitative or quantitative risk controls to the market exposure of their portfolios present their investment products as "market-neutral" portfolios. The evidence on long/short managers that claim to pursue some degree of market neutrality tends to be slightly controversial, with some strategies being affected more than one would have otherwise expected by periods of negative returns in their underlying markets.<sup>2</sup> This article looks at the information available to the end-user to assess a manager's track record in terms of market neutrality. In particular, it looks at two common ways of defining market neutrality, and at whether these measures are likely to constrain market exposure effectively.

## Deleveraging market exposure

Market neutrality can be an elusive notion. Arguably, the most popular way of measuring an investment's sensitivity to the underlying market movements is to look at its "beta". Beta is used as a measure of market risk exposure both within investment management firms, and in those firms' communications to investors. It is often argued that beta neutrality ensures that the portfolio is uncorrelated with the underlying equity market, thus helping diversify equity market risk.

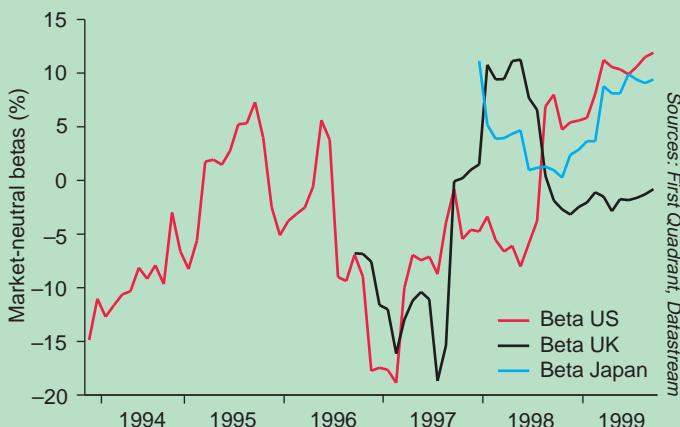
Beta is a concept originally derived within long-only investment theory. Theoretically, it is the appropriate measure of portfolio risk in the capital asset pricing model (CAPM). Regardless of whether one agrees with the CAPM view of the world, beta is often used in practice in its empirical form. It is estimated by the slope of the time-series linear regression between the excess return over Treasury bills of the security or portfolio, and the excess return to an equity market proxy for the market portfolio. This simple definition of beta is powerful enough to link it explicitly with another popular measure of market exposure, the correlation between a security or a portfolio and the market excess returns ( $\rho_{i,M}$ ):

$$\beta = \frac{\text{Cov}(R_i, R_M)}{\text{Var}(R_M)} = \rho_{i,M} \frac{\text{StDev}(R_i)}{\text{StDev}(R_M)} \quad (1)$$

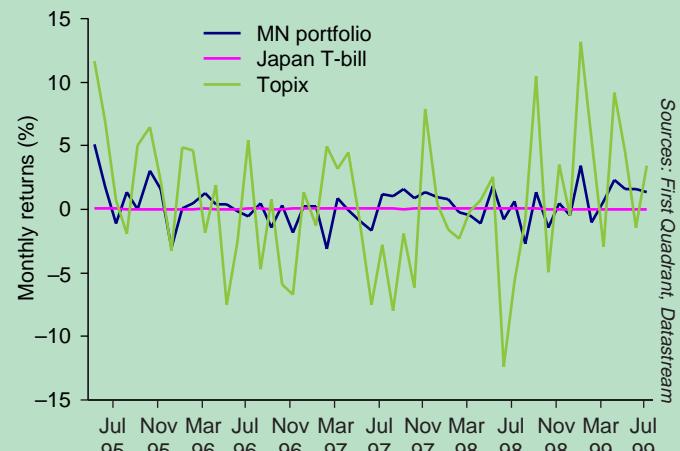
<sup>1</sup> There are other advantages to the long/short structure. For instance, the active investment risk is not defined in terms of tracking error with respect to the benchmark. Defining risk in terms of tracking error introduces a benchmark-dependent component into what is supposedly a measure of the manager's stock selection induced risk.

<sup>2</sup> A good introductory reference on market-neutral equity portfolios is J Lederman and R Klein, "Market Neutral", Irwin Professional Publishing, 1996. The Alternative Investment Management Association (AIMA) recently commissioned a study on the classification of all market-neutral strategies, not only equity-related ("Market Neutral and Hedged Strategies"), whose results are expected shortly. A very recent study on hedge fund returns (including market neutral) supporting their diversification potential, is: "The Benefits of Hedge Funds: Asset Allocation for the Institutional Investor" by T Schneeweis and G Martin, working paper, Isemberg School of Management, University of Massachusetts, Amherst, September 2000. A source of direct time-series information on market-neutral strategies returns is the hedge fund industry. The major international hedge fund data providers (Financial Risk Management, Hedge Fund Research, Tass/Tremont and others) maintain monthly equally and value-weighted indices of market-neutral managers returns that are available to professional intermediaries on their websites.

## 1. 30-month rolling betas of three live market-neutral strategies: Jan 1994–Sep 1999



## 2. Monthly simulated returns, Japan long/short market-neutral strategy and Topix



In practice, it is impossible to always achieve a portfolio's beta of zero along the entire investment life of a portfolio, even when the manager keeps a close eye on beta neutrality. Subsequent stock price changes on the long and short size of the portfolio change the relative weight of each stock in the two portfolios, in a proportion that is different from the relative weight change of the same stocks in the market proxy. Maintaining beta neutrality would require a frequent, ideally instantaneous rebalancing of the hedging between the long and short side of the portfolio.

To give an example of how beta varies over time in a long/short strategy where market neutrality is explicitly pursued, I have taken a sample of live monthly returns for a selection of US, UK and Japan long/short market-neutral equity strategies, and calculated the *ex post* 30-month rolling betas<sup>3</sup> for these strategies. This information is presented only as an example, as market-neutral strategies vary greatly in their market exposures and return patterns. Nonetheless, the time series of betas shown here are probably fairly typical beta information, generated by a long/short market-neutral strategy that has been running for a sufficiently long time (up to nine years) on institutional-size client portfolios. Assuming that the relevant market proxy returns in US, UK and Japan are, respectively, S&P 500, FTSE 350 and Topix 1st section, the *ex post* betas of the US, UK, and Japan strategies are shown in figure 1.

If beta neutrality guarantees market neutrality of the strategy, it seems that strategies with betas such as the ones presented in figure 1 have been, most of the time, comfortably within a low positive or negative level of market exposure. So what if we stop here? What kind of market neutrality, if any, is ensured by a low-beta portfolio?

If we focus again on equation (1), we may notice that beta is equal to a portfolio's market correlation, times a "scale factor" that multiplies the correlation up or down by an amount equal to the ratio of total risk (standard deviation) of the strategy and the market. In other words, if we compare the market and a strategy (both having a roughly similar volatility), the "scale factor" will be roughly equal to one, and a low beta corresponds to a low correlation. As the typical market-neutral strategy's total risk is equal to only a fraction of the market risk, the "scale factor" could be as low as one-fourth.

In this case, a relatively low beta, say 20%, might be entirely consistent with high and persistent levels of correlation between a long/short strategy and the market (in fact, up to 80%). So, in this case, a large fall in the market is unlikely to be linked to a fall in the strategy's value of equal absolute size. But if the correlation is high enough, it could be linked with a large relative fall in value of the market-neutral strategy – relatively large, that is, when compared with the strategy's average market return and volatility. What we see happening here is something similar to the "return leverage effect" identified by Modigliani & Modigliani with their risk-adjusted performance (RAP)<sup>4</sup>, only that in this case what we observe is the beta of a portfolio, not its return, being risk-leveraged or risk deleveraged.

## High market correlation and low beta

This section presents the results of a simulation of monthly returns to an active equity long/short portfolio invested in Japanese equities. The investment universe for this portfolio corresponds to the securities in the Topix index. The simulated portfolio is traded monthly, starting in July 1995.<sup>5</sup> In this strategy, to maximise the "market-neutral" effect, I built the portfolio so that for each dollar invested, the portfolio goes one dollar long and one short, and before trading beta is constrained to be close to zero with a 15% tolerance on each side. The simulation is run on a notional capital of \$100 million. The monthly returns of this market-neutral strategy are shown in figure 2, against the corresponding Topix and Japan Treasury bill monthly returns.

By looking at the direction and magnitude of returns, and particularly if one focuses on the different scale of the large drawdowns of the Topix in the past three years, regarding the corresponding returns of the simulated market-neutral strategy, one could be led to assume that the level of correlation between the latter and the Topix is reasonably low. Indeed, the beta of this strategy over the interval considered (June 1995 to September 1999) is quite low – around 13%. But the average correlation level, as measured by 30-month rolling correlation, is around 50%, reflecting a ratio of roughly one to four between the risk of the simulated, low-risk strategy, and the market. The correlation varies widely, between near zero in mid-1997 to end-1998, and 70–90% in early 1995 and in the first half of 1999. These are certainly very high values, and might generate concern if correlation is to be trusted as a measure of market exposure.

The "scale factor" makes low betas compatible with high market correlations. The same intuition can be used to analyse the whole return history, rather than just summary risk measures such as beta and volatility. We can use a simple statistical trick to eliminate the "scaling down" effect

<sup>3</sup> All major commercial portfolio management software vendors (Barra, Quantec, Vestek, Northfield etc) usually measure the beta of each stock by calculating it on a rolling return window (in case of Barra, it is a 60-month window). The 30-month rolling window, which might appear ad hoc, is chosen as it allows a relatively long calculation window even for the shortest-running strategy, Japan long/short, which was started in July 1995. I tried using 36-month and 24-month windows for the longer running strategies (US and UK long/short) and the results do not differ substantially from the ones presented here although the 24-month beta is naturally more volatile, and the 36-month less volatile

<sup>4</sup> "Risk Adjusted Performance", *Journal of Portfolio Management*, winter 1997

<sup>5</sup> That was the starting date for an in-house product and allowed me to use a set of live trading cost and market price data from other live long/short portfolios traded in the same market, hopefully making the simulation more realistic

in the time series of returns. This is achieved by "standardising" returns to both the simulated market-neutral strategy and the Topix, so that we can compare like with like. We obtain two time series equivalent to those in figure 2, but this time with the same mean (zero) and standard deviation (one).<sup>6</sup> The standardised returns of the strategy and the Topix are plotted in figure 3, with upper and lower confidence bounds.

The picture now looks quite different. What could be happening here? First, measuring betas and correlations is a tricky business. They are typically fairly unstable, and the time span of the results presented earlier is short (only a few years of data), which complicates things further. So any conclusion should discount a certain amount of statistically induced error that is certainly present here. But, given these results, let us focus on the amount of market risk and on the market neutrality of this low-beta portfolio.

What the analysis suggests is that the simulated long/short strategy's risk has been roughly equivalent, from a market risk perspective, to the risk of a long-only portfolio invested in the underlying market (in this case the Topix), and in cash or bonds in varying proportions.<sup>7</sup> These proportions go from almost 100% invested in bonds in mid-1997 to 1998, to as little as 10–15% in bonds in 1999. In other words, a hypothetical manager running this active long/short strategy could have been substantially long the Japanese market in 1995–96, then switched off his market exposure throughout 1997–98, to get back into a large long market exposure in early 1999. This clearly is not market neutrality. How can this be reconciled with the fact that the strategy's *ex post* beta is only slightly higher than 10%, so that the hypothetical manager could safely claim that his strategy was reasonably beta-neutral over this period? The effect of cash, or non-correlated risk on beta is to "deleverage" it. This can be achieved with a risk-free asset whose beta with the underlying market is zero, or with residual active positions that are typically uncorrelated with the market. The effect is that the investment is low-beta, and "looks" market neutral – although it may or may not be so. Beta seems to be an inadequate tool to measure market neutrality for low-risk (with respect to the market) investments such as "market-neutral" portfolios.

Does this matter? After all, one could just measure correlations instead of betas. Correlation, a linear relative measure of the statistical relationship between two variables, is certainly a better measure of market neutrality. However, other tools are needed to deal with investment strategies such as long/short investments, which are most likely to generate non-linear conditional returns. In particular, this means that the sign and proportion – not just the absolute value – of market-induced changes in the strategy's value, are different depending on whether the market gained or dropped by, say, two as opposed to three standard deviations from its mean. To delve into this topic is not the objective of this present work, but I can show some anecdotal evidence, drawn from the previous simulation exercise.

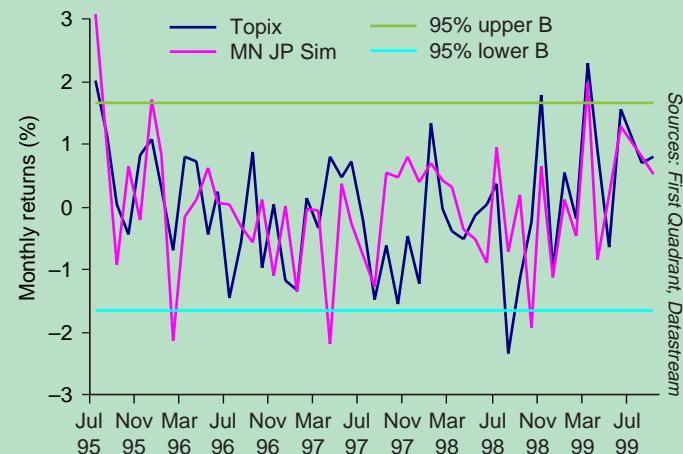
Table A shows monthly returns to the simulated long/short strategy and the Topix index in various months when the Topix experienced particularly large deviations from its mean return.<sup>8</sup> In seven out of nine of these events, when the Topix experienced unusually high positive or negative returns, the market-neutral strategy experienced returns of the same sign (ie, positive or negative) and, most of the time, comparable magnitude to the index – even at times when the 30-month trailing correlation is low. This suggests, to some extent, that the largest positive and negative returns of the simulated long/short strategy may be driven mostly by market returns of the same (relative) size and direction.

## Conclusion

Market-neutral long/short strategies are a welcome first step towards a more sophisticated approach to identify and hedge the sources of portfolio risk for traditional buy-side portfolios. But some of the most common tools used to manage their market exposure need to evolve to reflect the different nature of long/short investments. To estimate the beta of a low-risk, long/short market-neutral strategy, and then maybe claim that the strategy is market neutral, is simply not enough. Worse still, it can lead to potentially misleading conclusions on the amount of market risk exposure of the strategy over time – and consequently to disappointments at times when markets are volatile or exhibit unusually large positive or negative returns.

Correlation is better, but needs to be integrated by other tools for a

### 3. Standardised monthly simulated returns, Japan long/short market-neutral strategy and Topix



### A. Simulated long/short strategy and Topix monthly returns for selected months

Month	Topix	MN portfolio
August 1998	-2.39	-0.95
March 1999	2.32	1.91
July 1995	2.04	3.15
November 1998	1.81	0.98
June 1999	1.60	1.12
October 1997	-1.59	0.89
August 1997	-1.50	-1.31
July 1996	-1.49	0.38
Jan 1997	-1.35	-1.71

Sources: First Quadrant, Datastream

proper risk management of the strategy. As more advanced investment structures spill over from smaller-scale, hedge-fund investment into mainstream institutional portfolio management, the challenge is for risk professionals to come up with more appropriate tools to measure and manage the risk exposures of more sophisticated and carefully engineered portfolios. The importance of this future contribution cannot be overstated, as more and more institutional capital seeks to profit from a more rigorous and accurate selection and management of asset class, market and security-level exposures. ■

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<sup>6</sup> The reader can verify through equation (1) that in this special case, beta equals the market correlation of the portfolio

<sup>7</sup> From a market risk mean-variance perspective, the investment in market-uncorrelated investments, whether cash or well-diversified truly market-neutral long-short risky portfolios, is the same. So the risk-equivalent strategy could have been invested in a long equity position, a certain amount of Treasury bills and a long-short truly market neutral overlay portfolio of equities – with the longs financed by the shorts or by borrowing, and vice versa for the shorts. Naturally, these alternatives have different implications from an expected returns perspective

<sup>8</sup> Again, what is shown here is standardised monthly returns, so that each observation can be taken as standard deviations away from the series' mean over this period