



Why investors need a multi-layered approach to risk

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Equity risk management has changed significantly in the past 20 years, driven by roller-coaster markets, new demands from both clients and regulators, and advances in technology. It remains of central importance to active management, but the limitations of traditional measures of risk like tracking error and beta have prompted a search for new approaches. In the light of that, we conclude that investors should now use a much more extensive risk toolkit to support them in building robust portfolios to achieve their clients' targets.

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In active management, risk-taking is essential: investments are selected with the objective of beating a benchmark, but in the knowledge that the outcome could disappoint. Active managers should therefore manage risk, rather than avoiding it. The key risk management questions are: under what circumstances might the portfolio underperform, is the scale likely to be significant; and what can and should be done about it? Risk management tries to minimise unintentional and unnecessary risk-taking, but has clearly failed if it limits a manager so much that they are unable to generate outperformance.

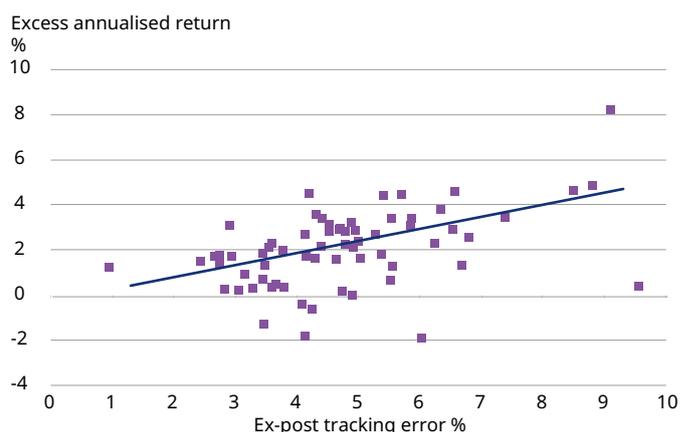
Figure 1 provides an illustration of the importance of risk. It plots the average annual excess return (gross of fees) against tracking error (the volatility of excess return) for all 66 of Schroders' equity strategies for which we have 10-year data, ranging from UK Smaller Companies to Global Emerging Markets. While the relationship is not totally consistent, the general direction is clear: higher return is associated with higher risk. Within the 10-year period, each portfolio has experienced some underperformance, but the cumulative result is typically positive, with generally higher returns where the journey has been bumpier. That may not be a bad thing if the investor is prepared. Risk management helps in that preparation by trying to predict the future distribution of returns. Tracking error is one measure of the "riskiness" of returns, but the conclusion of this paper is that portfolio managers and asset owners need a much broader set of measures and techniques to determine risk.

Keeping up with moving targets

The evolution of risk management has been driven by three shifts in asset owners' requirements.

The first is largely a consequence of the poor returns experienced during the Global Financial Crisis of 2008-09 and the earlier unwinding of the dot com bubble in 1999-2000. Portfolio managers were able to claim success if they outperformed a big fall in the market by a few percentage points. While meeting this objective may have met the

Figure 1: Higher return means higher risk



Data cover period from January 2007 to December 2016. Each dot represents a representative portfolio of each of Schroders' equity portfolios. All strategies with a history of 10 years or more are included. Source: Schroders.

stated aim of their mandates, it did not prevent clients from losing significant amounts of capital. The need to do better has contributed to the growth of "high alpha", "best ideas" or "unconstrained" strategies at the expense of "core" benchmark-relative mandates.

Secondly, there has been more demand for "absolute return" strategies that aim to beat cash or inflation by a healthy margin, while avoiding significant loss. These approaches, involving more extensive use of derivative instruments and sometimes a multi-asset component, have in their turn fostered more sophisticated risk management techniques that have also become available to benchmark-relative portfolio managers.

Thirdly, there has been a greater focus on the cumulative impact of fees on returns. This issue has become more pressing because of growing competition from low-fee passive alternatives (both index trackers and smart beta approaches), and regulators' increased focus on the asset management industry. This has put downwards pressure

on fees and made it incumbent on active investment managers to demonstrate that their fees are justified by results.

Generating the performance to meet asset owners' demands has led many equity managers to take more active risk. Rather than necessarily trying to dampen this risk, this trend makes it more important than ever to try to understand the sources of risk. This is challenging, but the good news is that the risk toolkit has also been growing.

Limitations of tracking error and beta

Tracking error has long been a cornerstone of measures to determine risk: a range for the predicted tracking error (e.g. 3% to 6%) is often among the guidelines specified in an investment mandate. Managers have traditionally been able to demonstrate compliance by calculating the tracking error using a standard risk model, and by reporting this to their clients with related details such as the portfolio's beta and the main types of risk to which the portfolio is exposed.

Tracking error and beta can be thought of as temperature gauges, derived from current holdings information and estimates of volatility and correlation. It means they can be compared for portfolios with similar benchmarks and, used in this way, can signal material changes in risk. The precise number (e.g. whether tracking error is 3% or 4%) is not hugely significant, but is a rough guide to the scale of possible underperformance (or outperformance) in "average" circumstances. This can help the manager to maintain a degree of safety, but its relevance is questionable because, as all portfolio managers know, "average" markets rarely occur. It is largely their performance in unusual markets that sets managers apart from the crowd.

Tracking error after the fact ("ex post") will also differ from ("ex ante") predictions as a result of market events and changes to a portfolio. It goes without saying that past experience is often a poor predictor of the future. Predictions of relative risk will generally turn out to be too low when volatility and/or dispersion increases and too high when they fall, but the timing and degree of difference are unpredictable. There have been periods when we observe an increase in the payoffs from stock selection and apparently higher information ratios. In reality, however, these reflect changing market patterns and the way risk models are calculated. Although risk model providers back-test and update their models periodically, the best that can be expected is that tracking error models are right on average. If a model is consistently biased towards under-prediction, then it is almost certainly not capturing all the risk factors that it should.

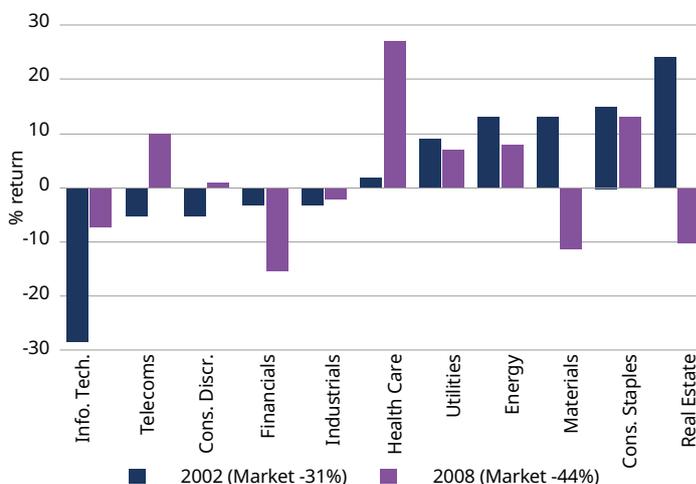
Beta is a statistical estimate of sensitivity to just one factor – the market or benchmark index – and as such has limitations. Firstly, while it is always possible to calculate a historical beta from past performance or to obtain a risk model's prediction, the estimate may be based on a weak statistical relationship. Secondly, in practice, there are multiple influences on share prices that could matter more than the market. For example, a portfolio with a performance target of 2% and a seemingly safe predicted tracking error of 3% and beta of around 1 might underperform by several percentage points in the space

of a few months. This could be due to a style rotation from growth to value, or a rally in mid-cap stocks in which the portfolio is under-represented, or truly stock-specific issues.

Figure 2 illustrates the difficulties in predicting whether a portfolio will show defensive or "low beta" characteristics in the event of a crash. In 2002, when the European market fell by 31%, IT was the weakest sector, while materials and real estate both outperformed. By contrast, in 2008, when the market fell by 44%, financials were the weakest but materials and real estate both underperformed. Telecoms were relatively weak in 2002 but strong in 2008. The point here is that the pattern of market returns has no fixed structure, so forecasts of beta are unreliable.

One consequence is that drawdowns experienced can be much larger than the tracking error appears to imply, and the problem with focusing on tracking error is that investors may not be prepared sufficiently for the range of possible outcomes. The biggest risks for equities currently include events that have not happened in recent times or else are unprecedented: for instance, a prolonged upwards shift in the yield curve, the potential impact on global growth of deteriorating US-China relations and (as always) the possible disintegration of the EU. A useful risk management framework would provide some insights into these areas, but tracking error and beta do not help portfolio managers with this.

Figure 2: Excess returns of European sectors in down markets have varied hugely



Source: Schroders.

Risk is not necessarily volatility

Standard measures of portfolio risk are ultimately based on individual stock volatility forecasts. It is generally agreed that we can expect higher volatility for certain types of stocks, such as commodity producers, companies in financial difficulty, financial market operators and emerging market companies. However, volatility is not universally accepted by investors as relevant, and it is worth reviewing the arguments to see how managers do actually think about risk.

The first proposition is that volatility forecasts are ultimately derived from historical time series of returns, and so will almost certainly be proved wrong in the future.

In our view, this is true, but does not make volatility useless, as some quite sophisticated volatility forecasting techniques can be used to react quickly to changing market patterns.

The second proposition relates to the way in which risk forecasts are derived. The typical input for risk models is the standard deviation of short-term (daily, weekly or monthly) returns, whereas tracking errors are expressed as annualised numbers in order to be more relevant to investors. To make the leap from short to long, a convenient “square root of time” multiplier is used. This does the trick but it assumes away the trending (or “autocorrelation”) of returns that is an important feature of markets. As a result, the models are likely to underestimate risk over longer periods. Few risk model vendors provide much analysis of this issue, and faith in volatility and tracking error can be eroded by periods of very strong or weak performance.

Thirdly, even if a share price is volatile and so might materially affect the portfolio value in the short term, this will not matter to end investors with sufficiently long time horizons. If an investment is well chosen and the purchase price low enough, a positive valuation trend should make volatility irrelevant. To the extent that investors care mainly about the possibility of a significant loss of capital, valuation measures are much more important than volatility. The chance of loss may be greater for more expensively-valued companies than for cheaper companies, so high volatility may be a signal of *greater* opportunity rather than a warning sign. Some investment strategies openly embrace risk for this reason¹.

Testing for possible stress

Stress-testing and scenario analysis can help to address these issues. Suitable software is now readily available as a result of the efforts of banks, hedge funds and absolute return strategies to quantify their complex risk exposures. Stress-testing shows how a portfolio might perform – assuming no change in holdings – if there was a significant rise or fall in some key market variables such as equity indices, interest rates, currencies or commodity prices.

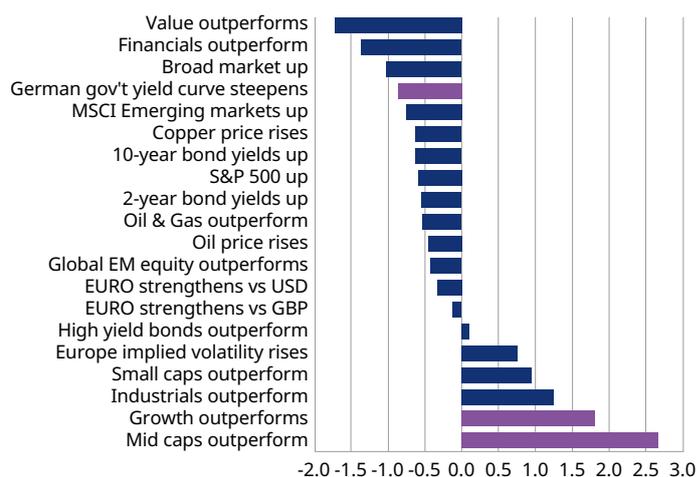
The tests can represent a re-run of a real market event from history, such as the Greek debt crisis, or a hypothetical yet plausible event, for example a 10% fall in the US dollar or a 300 basis point rise in US 30-year yields. The results can be instructive if they show losses that are worse than the asset owner is prepared to tolerate. Comparison of the results using more or less extreme assumptions (e.g. a range of up and down movements of +/-5%, +/-10% etc) is helpful for detecting potential non-linearity or asymmetry in the risk profile, perhaps resulting from options or option-like exposures.

Related to this, factor sensitivity analysis can show how an equity portfolio’s excess return might be affected by a change in a non-equity factor, such as the oil price or the shape of the yield curve. This can be an interesting angle for equity investors who do not usually focus on these factors. Figure 3 contains sample output from a flexible factor analysis tool that Schroders has developed, applied to a eurozone equity portfolio. Choosing one of the factors as an example, the interpretation is as follows: in the

circumstances in which the German government yield curve steepens with a one standard deviation move (based on five years’ data), this portfolio is likely to underperform its benchmark by around 0.9%. Conversely, the portfolio is likely to do well when growth stocks and mid caps are outperforming. These sensitivities need to be monitored as they can change quickly due to portfolio activity or new patterns in the market.

Scenario analysis involves thinking about sets of occurrences, either simultaneous or sequential, and the consequences for portfolio returns. This can also include how a manager might react if “A, B and C” or “D then E then F” happened: would they need to change some positions, or should they put in place some insurance now, if indeed the mandate allows them enough flexibility? For example, with the benefit of hindsight, it would have been useful in late October 2016 to have thought through the implications of an “unlikely” Trump victory for US bond markets, commodity prices, the dollar and the prospects of emerging versus developed markets. The crystal ball would not have got the picture right, but it might have prompted investors to establish contingency plans.

Figure 3: Percentage impact on excess return of one standard deviation move



Source: Schroders as at 31/12/2016.

Back to basics: active share and fundamental risk scores

While stress-testing and scenario analysis represent more sophistication than tracking error and beta analysis, other recent developments represent a degree of simplification. One example is the great interest in active share, which is a straightforward measure of the extent of “bets” being taken, defined as (one half of) the total magnitude of a portfolio’s overweight and underweight positions. Essentially active share represents the tracking error but with the volatility and correlation components stripped out. The seminal research of Martijn Cremers and Antti Petajisto, published in 2009², concluded: “Active Share predicts fund performance: funds with the highest Active Share significantly outperform their benchmarks, both before and after expenses, and they exhibit strong performance persistence. Non-index funds with the lowest Active Share underperform their benchmarks.”

1. For more on this subject, see “Is volatility risk?”, *Investment Horizons* 2, 2014.

2 “How Active Is Your Fund Manager? A New Measure That Predicts Performance”, Martijn Cremers and Antti Petajisto, International Center for Finance, Yale School of Management, 31 March 2009.

The conclusion has been controversial in both academia and the industry, but active share has quickly taken firm root. It is already common for core managers to talk about the importance of keeping active share high and for managers of unconstrained mandates to quote a high active share as evidence that their portfolio is very different in its performance to the benchmark (see box). Active share is also among the measures that regulators have suggested monitoring to detect possible “closet” index-trackers. There is some merit in this, although it can be misleading to compare active share numbers for portfolios with different strategies. For example, an active share of 80% would be high for a pan-European large cap fund but low for a small cap fund, while 70% would be high for UK equities but not for Europe ex UK because the relative benchmarks have different degrees of concentration.

In similar vein, some active managers who recognise the limitations of volatility have developed alternative approaches which ascribe “risk scores” to individual stocks. The scores are calculated as weighted averages of “fundamental” risk factors, such as operating and financial leverage, which can have a real impact on future earnings, exposure to adverse environmental, social and governance (ESG) issues and political or country risk. In the long run, these fundamentals should drive share prices. Figure 4 is based on data for a Schroders global equity portfolio: the “fundamental risk scores” that the investment team use are plotted against the active weights in each stock in the portfolio. There are bigger bets on stocks with below-average risk, and smaller bets where risk is greater.

Risk scoring techniques are particularly applicable to unconstrained mandates. Here, managers need a way to demonstrate – without reference to the benchmark – that position sizes reflect expected risk as well as expected returns, and also that the portfolio is well diversified, with capital allocated to a spread of investments with different drivers. A fundamental risk framework would meet these requirements, by-passing the need to use volatility and correlation as measures. (See box on the next page for some of the practical implications of using risk scoring.)

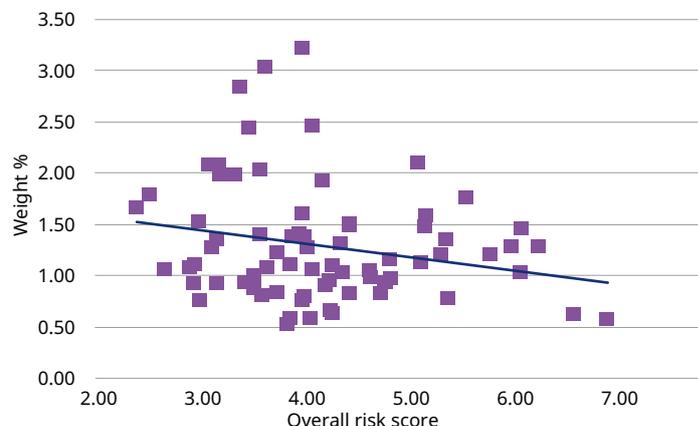
The principal benefit of this approach is that investment analysts already use fundamental factors as part of their evaluation of potential returns, so the risk assessment can be an integral part of the research process rather than done in isolation. The methodology is flexible, with scope to add new factors as appropriate, and also dynamic, as inputs can quickly reflect new information about companies’ businesses rather than having to wait for volatility data to evolve. Overall, portfolio managers are much more likely to engage in a discussion about fundamental risks than in one about volatility. Indeed, asset owners should expect portfolio managers to have a discipline of this sort built into their investment process.

Really useful risk reports

The most useful risk reports for portfolio managers and asset owners show which positions contribute the greatest part of the portfolio’s risk. A position will rank higher if it is a large holding, and/or a riskier instrument, and/or potentially highly correlated with others in the portfolio. There is no strict rule about what is an excessive

concentration of risk, except that risk-taking should be aligned with where the investor has an “edge”, either from better information or from a greater ability to bear risk, such as a longer time horizon.

Figure 4: Position sizes broadly follow the fundamental risk scores



Source: Schroders as at 31 December 2016.

How much active share do you need?

The answer to this question very much depends on the skill and/or luck of the investment manager, as well as prevailing market conditions. Suppose the asset owner is looking to outperform the benchmark by 2.5%, before fees:

Scenario 1:

Let’s say the manager is skilful and/or lucky. On average, 55% of the stocks selected outperform the benchmark over time, typically by about 15%, while losing stocks underperform by 10% on average. How much outperformance could we expect them to generate? If they were given free rein over the entire portfolio, the sums would theoretically look like this:

$$\text{Outperformance from 100\% active share} = 55\% \times 15\% - 45\% \times 10\% = 3.75\%$$

But the outperformance target is only 2.5%, so the required active share is reduced accordingly: $2.5\% / 3.75\% = 67\%$.

Scenario 2:

Let’s now suppose the manager is only marginally successful with their investment choices – a “hit rate” of just 52% – but the results are more extreme: the winners typically outperform by 20%, while the losers underperform by 16%. We would expect their ability to pick stocks would generate slightly lower returns:

$$\text{Outperformance from 100\% active share} = 52\% \times 20\% - 48\% \times 16\% = 2.7\%$$

So the required active share to hit our 2.5% target would need to rise: $2.5\% / 2.7\% = 92\%$.

Clearly, most of the factors involved are outside the control of the managers and only known after the fact, but experience can still inform the level of active share they are taking. If this is too low, the likelihood is that they are unnecessarily inhibiting their ability to outperform.

Implementing fundamental risk scores

Fundamental risk scores are dependent on a range of factors, including the type of business involved and the way it is managed. But they can change quite quickly – both for the better and the worse – if something happens to the company. Some examples of risk-reducing events include: the sale of a division with high operating leverage, or large debts or improved corporate governance and disclosure.

While some examples of risk-increasing events could be: the appointment of a new chief executive without a proven track record, or the outcome of the Brexit referendum changing the risks for companies operating in the UK.

Some scores will be more useful than others in determining the risk of an overall portfolio, hence it is important to determine how much weight to give to each. The table shows one possible weighting scheme.

Factor	Weight	Indicators/inputs
Financial leverage	20%	Fixed charge cover ratio, net debt/EBITDA
Operating leverage	20%	Revenue and margin volatility
Business and industry quality	20%	Analyst's industry expertise
Management quality	10%	Judgment, comparison to peers
Company transparency	10%	Analysis of financial reports
ESG profile	10%	Detailed review of factors
Country risk	10%	Analysis of business exposures
Combined	100%	

High correlation between investments can result from shared traits such as country, sector, style, momentum, volatility and macro-economic factor exposures. The key ideas are that stocks with common characteristics tend to move together and that markets move in cycles (often called “mean reversion”). The correlation variable is what causes a portfolio's risk level to be less than the average risk of its parts, so it is critical but also very difficult to predict. Complexity increases when considering the active risk of a portfolio relative to a benchmark: for example an apparently significant overweight position could be cancelled out by the effect of an underweight if a shared factor exposure leads to high return for both.

There is no single correct risk profile – it all depends on the investment objectives and the process. For example, managers who predominantly use bottom-up stock selection would expect to see a high percentage of stock-specific risk as evidence that performance should be driven by the results of the research process. Careful portfolio construction reduces the chance of good stock selection being outweighed by an unintended factor position that goes wrong.

We should remember that a risk profile can change, even if the manager has made no transactions, because of changes in relative prices or corporate actions such as takeovers. The “dynamic” nature of active risk makes it vital for automated IT processes to be in place so that managers can always view the most current risk reports. There is no substitute for a frequent review of positions and thinking about where unintended risk may lurk.

Future developments

Risk management has evolved significantly in the past 20 years, necessitated by financial market events and changing demands from clients and regulators, and facilitated by the availability of computing power at ever-diminishing cost. The scope for interrogating market data to identify what is driving financial markets seems huge. For example, clustering algorithms can be used to identify similarities between patterns of returns that traditional risk models have missed or that a portfolio manager has not previously considered. Data may show that stocks in different countries and sectors have moved together in surprising ways, with further investigation revealing what they have in common.

The growth of e-commerce and the internet has expanded the array of data from which we can derive insights that are relevant to businesses and ultimately to share prices. For example, information about credit card transactions and word usage in social media can reveal patterns, trends or changes that should matter to markets³. Similarly, new data sources can be used to assemble maps of supply chain linkages and geographic revenue exposures, from which a more comprehensive view of fundamental business exposures can be built. The increased availability of this information and its quantity mean investment managers are increasingly building “Big Data” capabilities to create a stronger overall risk management framework.

³ See our paper on “Harnessing the data science revolution”, Schroders, January 2017

Conclusion

Taking risk is vital if an active portfolio is to have a chance of achieving excess returns. Risk management helps to ensure that bad outcomes are less likely, without diluting the impact of the manager's best ideas. Good risk management is multi-layered. Firstly, and most importantly, portfolio managers need to consider risk on a continuous basis as they review actual and potential investments and check their portfolio's overall structure. Secondly, asset owners need to ensure that their managers are taking the right risks by regularly monitoring a variety of measures. In addition to tracking error and active share, this means they should periodically review stock-level risk reports, factor exposures and stress-test results. Fund managers are already required to include stress tests when submitting new fund proposals to regulators, so this should be within managers' capabilities. Thirdly, asset owners should seek assurance that a comprehensive risk framework is in place to support portfolio managers when they are running substantial levels of active risk. This should ensure that the strategy is well documented and that important limits and risk indicators are clear, without constraining the manager's ability to take sufficient risk. Managing risk is not an exact science and is constantly evolving. It is therefore vital that a manager has access to the whole toolkit.

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