

PARAMETERS

RESEARCH PAPER

## Towards a better measure of risk

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*Investors face many risks, some of them easily quantifiable, others not. This paper proposes an overarching, client-centric risk measurement and management framework that can be used by asset consultants and financial advisers to identify and manage the various sources of risk faced by investors. It proposes that it is often best to focus on a primary measure of risk to use in a particular application, and that for many personal investors, that risk should be the uncertainty of real, long-term returns.*

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Markowitz's seminal paper "Portfolio Selection" published in 1952<sup>1</sup> described a process for trading off returns and variability of returns, as measured by standard deviation. As the influence of this groundbreaking work grew throughout both the academic and investment management communities, standard deviation or volatility as it is often described, became synonymous with risk – even though Markowitz did not describe variance as risk.

Today, the academic literature tends to use standard deviation as the accepted measure of risk, typically calculated from short-term returns. The institutional investment world agrees, and further breaks this down into two components: the short-term volatility of its benchmark; and, tracking error. Both acknowledge that short-term volatility has major problems as a universal measure of risk, but despite sporadic attempts to propose better measures of risk (Jeffrey 1984<sup>2</sup>, Balzer, 1995<sup>3</sup>) there has been little change in practice.

And it is not hard to see why volatility is the risk measure of choice for most. It works well in some cases, such as equities. It may be easily measured with the precision required for academic research. It can be applied to any asset class (rightly or wrongly). It can be measured over the short-term time horizons that dominate institutional thinking. Finally, nothing else is widely accepted. So, most continue to use volatility as if it was a universally sound measure of risk. This creates a situation where the majority of participants act as if these measures can be universally applied in a broad range of circumstances, even though they too know that it doesn't always make much sense.

### What's wrong with short-term volatility?

When applied over longer time horizons and to a broad range of assets, the shortcomings of short-term volatility as a risk measure become starkly apparent.

Consider a 10 year treasury bond yielding 6% a year. Over short-time horizons, its total return displays considerable volatility. But what level of uncertainty is there about the returns that will be earned over the 10 years? None. The return will be exactly 6% a year.

Consider appraisal-based assets such as direct property. How many studies tout such assets as having wonderful diversifying properties when mixed with equity investments? The more sophisticated studies do acknowledge that some of these marvelous characteristics are due to the different valuation methodologies, and some compensatory adjustments are performed. Invariably, the conclusion doesn't alter – these assets are still described as great diversifiers.

These studies miss a crucial point. As appraisal-based assets are generally substantially illiquid, the true measure of their diversifying characteristics is what they do at the end of the investment time horizon. In the event that other markets have been punished over the long term, will the appraisal-based asset produce a high level of returns to compensate, or will it succumb to the same broad economic forces that caused other assets to perform poorly? Until that question is answered, we really have no idea whether an appraisal-based asset a good diversifier for long-term investors.

Consider timing differences. Australian equity markets tend to take a short-term lead from overnight action on the US market. If the US market is sharply down on Monday, the Australian market, more often than not, will be sharply down Tuesday. If we naively measure the daily correlation coefficients of US and Australian equity markets, we find low correlation. Fortunately, this error is sufficiently obvious. Unfortunately, there are other asset classes, such as hedge funds, where such timing differences are less obvious but nonetheless believed to occur (Asnes, Krail & Liew, 2001<sup>4</sup>). A long-term perspective on correlation would make such timing differences irrelevant.

### Do the clients care?

How many studies show how strategy A is superior to strategy B because it reduces short-term volatility from, say, 11.5% pa to 11.3% pa? Which investor ever complained that the volatility of their portfolio rose from 11.3% to 11.5%? It is a meaningless improvement to a dubious measure.

## Tracking error

Tracking error can be categorised as another basically good idea that got totally out of control. Used appropriately, it can convey useful information, such as how far a manager's results are likely to depart from the returns of the broad market. But when asset consultants or fund managers start believing that tracking error is risk, it's time for investors to be very concerned. On this basis a manager of a US equity fund in 1999 would believe that a 25% holding in high tech stocks was a low risk proposition; a Japanese diversified fund manager in 1989 would have considered a 60% holding in Japanese equities a low risk proposition.

Essentially, tracking error is a measure of business risk for an agent. Why should an investor have to worry about someone else's business risk? Lower tracking error for an agent, such as a fund manager, often means high agency risks for an investor.

## So what is risk?

The answer must start, not with the assets or the individual sources of risk, but with the investor, the liability side of the equation. For every investor and every portfolio there is an objective. It may be funding income in retirement, it may be funding for a school building project, it may even be maximising returns just for the sake of it. However, without a clear identification of the investment objective, we are left asking "risk of what?" and all further discussion on the nature of risk is essentially empty.

## The risk pyramid

The risk pyramid (Figure 1) is a simple framework for thinking about risk in an integrated way. It breaks the problem into three levels: Level 1 – the investor's objectives; Level 2 – the key risks to meeting those objectives; and, Level 3 – the factors that drive those risks.

For the purposes of this paper, we will use as an illustration the portfolios of individual investors, funding income in retirement. However the principles are broadly valid. Clearly, this pyramid would apply in quite different ways to other types of investors.

### Level 1 – Client objectives

Client objectives may be simple or complex, singular or multi-dimensional. In the case of our hypothetical retiree we break them down to two objectives: sufficient cash flow to meet lifestyle needs, as needed; and, peace of mind along the way. These objectives may of themselves be broken down further. For example, cash flow needs may be summarised as a real income of \$50,000 per year after tax for 25 years; an extra \$10,000 per annum over that to fund luxuries; and, an absolute minimum of \$35,000 per annum.

Having clearly spelt out client objectives we can start thinking about what might go wrong and how we best manage against those eventualities.

### Level 2 – Key risks

At as high a level as possible, what are the things that could prevent the objectives being satisfied? For our retiree investors, these will often come down to three areas: insufficient long-term, real, after tax returns; insufficient liquidity; and, excessive anxiety.

**Figure 1: The risk pyramid – a client-centric risk management framework**



### Level 3 – Risk drivers

The various sources of risk can be identified and grouped. As shown in Figure 1, in our example, the drivers of real, long-term risk are long-term return uncertainty; inflation; credit risk; and, management risk (the possibility a manager may underperform a benchmark, at a time when returns are generally low). These can be grouped together into one number – the "what happens to returns if things go wrong" number. Liquidity is straightforward – the driver of illiquidity risk is illiquidity. The major drivers of anxiety are short term volatility and tracking error.

### Where should the focus be?

Rob Arnott, the editor of *Financial Analysts Journal* recently wrote: "Which measure of risk is most important? Answer. Whichever one hurts us, which we cannot know until after the fact"<sup>5</sup>

Implicit in that answer is that all sources of risk should be considered and managed.

However, it is often helpful to make one part of the risk pyramid the primary focus and secondary risks can be managed on a threshold basis. So, returns could be optimised against long-term risk while ensuring that

short-term volatility and illiquidity remained below thresholds acceptable for the client.

For many investors funding retirement income streams, the primary measure of risk will be long-term uncertainty of real, after-tax returns. Investor anxiety can be managed partly by education and coaching, and partly by portfolio construction. Liquidity is normally a relatively simple exercise to manage, but if long-term returns are insufficient to meet basic cash flow requirements, then real difficulties ensue.

#### Long-term, real uncertainty

While long-term, real uncertainty of returns (LTRU) may be the major risk faced by many investors, it is not a straightforward measure to adopt because its focus is on uncertainty of future returns. Everyone's expectations of the future are somewhat different and getting historical data is conceptually challenging.

To measure LTRU, we need to know for each period the expected level of return before the fact, and the final outcome. For example, a review of historic inflation-linked bond returns over rolling 10 year periods reveals substantial variability from period to period. Is this indicative of risk or uncertainty? No. When purchasing a 10 year inflation-linked bond there is a very high level of certainty as to the real outcome that will be achieved.

While bonds are easy, determining historic LTRU for other asset types is far more challenging. Nonetheless, in many situations, the concept is far more useful than the more accessible, but flawed, volatility of returns.

From a forward-looking perspective, LTRU can be determined by forecasting the range of return outcomes that may arise over the time frame. This approach allows the impact of a range of different factors to be formally considered together as one number – the final, real return for the period. A diverse set of factors such as uncertainty of investment returns, varying inflation scenarios, assessment of the impact of different levels of credit risk and credit failure, the impact (favorable or unfavorable) of active management risk, and the impact of differing levels of diversification, may be summarised in one return distribution.

To assess the uncertainty of investment returns, the author uses the approach espoused by John Bogle<sup>6</sup> which breaks returns into three components:

- income at the start of the period;
- the growth rate of income; and,
- the effect due to the change in valuation ratios.

For example when assessing equities, “income” is the divided yield, “growth in income” is represented by the average growth rate of Earnings Per Share, and “the effect due to the change in valuation ratios” is the annualised rate of change of the PE ratio.

Using this basic structure, it is possible to build a

range of scenarios (of which inflation is a key variable in each), and then forecast the likely range of return outcomes, and so, in turn, the inflation-adjusted returns for each asset class. Assessment of the impact of credit risk under the different scenarios can be factored in by applying historical failure rates to different quality securities under the different scenarios.

The end result of such an assessment is a range of real, after-tax returns around a central forecast. It is possible to calculate the standard deviation of the range, and use that as the measure of long-term, real uncertainty for any asset or portfolio.

#### Liquidity risk

Of the three key risks, liquidity is by far the easiest to manage. Most investors tend to have far more liquidity than they need. There are many approaches to managing liquidity – the one proposed here is as follows. A certain part of the portfolio (R) is held liquid at all times. The remainder is divided up over the time horizon of the investment strategy (T), so that some fraction of the remaining assets becomes available for consumption or reinvestment each year. Thus the proportion of assets that may be illiquid until maturity in Y years time is:

$$\text{Minimum liquidity} = (1-R) \times (T-Y)/T$$

Figure 2 illustrates how this would be used for a hypothetical investor with a 10 year investment horizon requiring a minimum of at least 40% liquidity.

#### Anxiety

The key drivers of investor anxiety seem to be short-term volatility (on the downside) and tracking error issues which tend to manifest themselves in statements such as “one of my equity funds is up by 10% and the market is up 20%, what's going on?” or “My friend at the golf club is making a fortune in high tech stocks and I don't have any, my adviser is too conservative.”

Measurement of both short-term volatility and track error is straightforward. Management of these risks on the other hand is more complex, being partly about what happens at the portfolio construction stage, and partly what happens at the investor education stage. As a broad generalisation, as investors become more knowledgeable and experienced, their capacity to accept volatility and tracking error generally increases. For some investors, the driving risk factor will be anxiety and its cousin, short-term volatility, and therefore short-term volatility should perhaps be the primary measure of risk when making portfolio construction decisions. It is a matter of horses for courses, which is the point of the risk pyramid.

#### When should these concepts be applied?

The risk pyramid can be applied to any situation, even if only as a quick check as to which forms of risk should be considered. While the example here focuses on retirees, applying the risk pyramid to other applications can quickly highlight the most relevant forms of risk. For example, a hedge fund manager with the objective

of producing annual returns above a cash benchmark would in most cases be most concerned about short-term investment returns and illiquidity. For such an investor, short-term volatility would probably be the most relevant primary risk factor.

The concept of LTRU is obviously best applied in situations relevant to long-term investors. Financial planning is clearly an application where LTRU will be a superior measure of risk for many investors in developing asset allocation strategies, determining sustainable saving and spending levels, and determining what level of portfolio risk is relevant to a particular client. Assessment of investment merits of alternative asset types is an area where the likely range of long-term outcomes should clearly be of more concern to most decision makers than the short-term volatility along the way. ■

### Conclusion

Assets don't exist in a vacuum – the most relevant measures of risk for any particular situation will depend on the investor's objectives, and the risks that can stand in the way of those objectives being achieved. All risks should be considered and managed. For long-term investors, the concept of long-term real uncertainty is a measure of risk that should be considered in a wide variety of situations where short-term volatility is currently being used as the only measure of risk.

### END NOTES

1. Harry Markowitz, 1952. Portfolio Selection, *Journal of Finance*, Vol VII, No 1, March, pp 77-91.

**Figure 2: Permitted liquidity profile for a hypothetical investor**

Permitted illiquidity profile for a plan with a 10 year investment horizon (T) and a permanent 40% liquidity buffer (R)	
Maturity profile (Y)	Maximum exposure (%)
>1 year	56
>2 year	48
>3 year	42
>5 year	30
>8 year	12

2. Robert Jeffrey, 1984. A New Paradigm for Risk, *Journal of Portfolio Management*, Vol 11, No 1.

3. Leslie Balzer, 1995. Measuring Investment Risk, a Review, *Journal of Investing*, Vol 4, No 5, pp 5-16.

4. C. Asness, R. Krail & P.Liew, 2001. *Journal Of Portfolio Management*, Vol 28, No 1, pp 6-19.

5. Robert Arnott, 2003. What Risk Matters? A Call for Papers. *Financial Analysts Journal* Vol 59, No.3.

6. John Bogle, 1991. Investing in the 1990's: Occam's Razor Revisited, *Journal of Portfolio Management*, Vol 18, No 1.

## Editorial Board comments..

With response from Tim Farrelly

1. **EB:** There is nothing wrong with the statistical notion or properties of variance (or standard deviation). However, in practice, it does have problems if it is to be regarded as part of the decision-making tool kit applied to non-normal distributions or translated to utility functions that are inconsistent with a mean-variance framework. Variance does not have to equal risk, however it is defined. Variance is but one measure of risk which applies under certain conditions and assumptions – no-one ever claimed otherwise.

**TF:** I agree the first part of my paper comes across as damning the whole concept of variance as a proxy for risk and largely repeats information that is well understood by the

academic community. Outside of the academic community, the shortcomings of variance are not well understood, and decisions are made as if variance was a true measure of risk in virtually all circumstances. Furthermore, a very large number of academic articles do refer to variance as risk – with full knowledge of the shortcomings – but these papers are, in turn, read uncritically by non-academic audiences who then make inferences that are not necessarily applicable. As the Journal is aimed at the non-academic audience, I felt it was necessary to highlight the shortcomings of current practices before going on to propose an alternate way of thinking about risk.