



Towards a better measure of risk

"The real risk in holding a portfolio is that it might not provide its owner, either during the interim, at some terminal date or both, with the cash he requires to make essential outlays"

Robert Jeffrey, 1984.

Investors face many risks, some of them easily quantifiable, others not. This paper proposes an overarching, client-centric risk measurement and management framework than can be used by asset consultants and financial planners 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.

Risk? The investment community has lost the plot.

Harry Markowitz' seminal paper, Portfolio Selection published in 1952, described a process for mathematically making the trade off between return and variability of returns, as measured by standard deviation of returns. As the influence of this groundbreaking work grew throughout both the academic and asset management communities, standard deviation or volatility, as it is often described, became synonymous with risk, even though Markowitz did not describe variance as risk in his paper.

Today the vast majority of the academic finance literature not only uses standard deviation as it's only measure of risk; it uses standard deviation of short-term returns. The institutional investment world agrees, and further breaks this risk down into two components, the short-term volatility of its benchmark, and tracking error, the active risk the manager takes when they depart from the benchmark. We have come a long way from Kansas, Dorothy!

Both acknowledge that short-term volatility has major problems as a universal measure of risk, but despite some sporadic attempts to propose better measures of risk (Jeffrey 1984, Balzer, 1995) there has little change in the practices of both academics and money managers. And it is not hard to see why volatility is the measure of choice for most

- It does work well in some situations, such as for equities, which are of particular interest to many
- it may easily be measured with the precision required for academic research
- it can be applied to any asset class, (rightly or wrongly as we shall see)
- it can be measured over the short-term time horizons that dominate institutional thinking
- nothing else is widely accepted

So, in the absence of another accepted measure, most continue to use volatility *as if* it were a universally sound measure of risk. This creates a situation where the majority of participants in the system act as if these measures can be universally applied in a broad range of circumstances, even though they too feel, deep down, that they don't always make much sense.

So what's wrong with short-term volatility?

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

Consider a 10 year treasury bond yielding 6%pa. Over short time horizons it displays considerable volatility. But what level of uncertainty is there about the level of returns that would be earned by that security over a 10 year time horizon? None, the return will be exactly 6%pa. Short-term volatility and long term return uncertainty are simply not the same thing. If I am only concerned about the return I will get over the time horizon of an investment, the short-term volatility of bonds is a complete irrelevance.

Consider appraisal based assets such as direct property. How many studies have we seen where such assets are touted as having wonderful diversifying properties when mixed with equity investments? The more sophisticated of these studies do acknowledge that some of these marvelous characteristics are due to the different nature of the valuation methodologies, and try and perform some compensatory adjustment. Invariably however the conclusion doesn't alter, these assets are still described as great diversifiers.

These studies miss a crucial point. As these assets are generally substantially illiquid, then the only true measure of their diversifying characteristics is not what they do along the way, but 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 they produce a high level of returns to compensate, or will they 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 they are, or are not, 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. Thus if The US market is sharply down on Monday, the Australian market, more often than not, will be sharply down Tuesday. As a result if one were to naively measure the calendar daily correlation coefficients of US and Australian equity markets (i.e. compare Monday's US returns with Monday's Australian returns) one would find low correlation, even if Australian markets exactly replicated US market behavior from the previous evening. Fortunately, this error is sufficiently obvious for all but the most naive, or duplicitous, to miss. Unfortunately, there are other asset classes, such as Hedge Funds, where such timing differences are less obvious but nonetheless believed to occur (Asness, Krail & Liew, 2001). A long-term perspective on correlation would make such timing differences irrelevant.

Do the clients care about small differences in volatility?

How many studies have we seen that show how strategy A is superior to strategy B because it reduces short-term volatility from, say, 11.5%pa to 11.3%pa? Even if the measurement was meaningful the improvement isn't. What investor ever complained that the volatility of their portfolio had risen from 11.3% to 11.5%? It's a meaningless improvement to a dubious measure. Why does academia or industry tolerate it?

Tracking error, the king of wrongheaded ideas about risk.

This is something that can be categorized as another one of those basically good ideas that has got totally out of control. Used appropriately, tracking error can convey useful information to investors, such as how far a manager's results are likely to depart from the returns of the broad market. But when agents such as asset consultants or fund managers start believing that tracking error **is** risk, as many do, 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 holding of 25% 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. One wonders whether investors, 5 or 15 fifteen years and 70% or more underwater, share their views.

Essentially, tracking error represents a measure of business risk for an agent. Why should an investor have to worry about someone else's business risk? But worry they should. 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.

Risk of what?

Answering this question provides the gateway into the true nature of risk.

For every investor and for every portfolio there is an objective, (stated or unstated), an investment purpose. It may be funding income in retirement, it may be funding for a school building project, it may even be maximizing returns just for the sake of it. However, without a clear identification of the objective we are left asking the question "risk of what?" and all further discussion on the nature of risk is essentially empty.

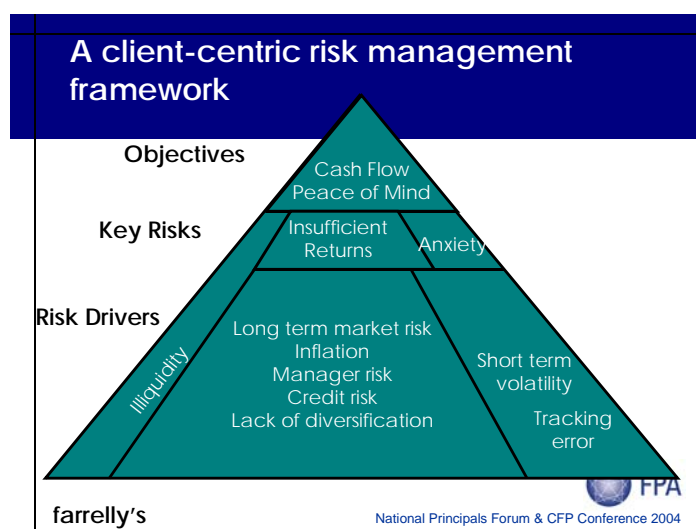
The risk pyramid

The risk pyramid is a simple framework for thinking about risk in an integrated way. To do this we break the problem into three levels

- Level 1. The investors objectives
- Level 2. The key risks to meeting those objectives
- 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. Clearly, this pyramid would apply in quite different ways to other types of investors, such as hedge fund managers. Nonetheless long-term individual investors represent an important segment of the investment community. The conclusions reached over the remainder of this paper apply particularly to them, however the principles are broadly valid.

The chart shows a schematic depiction of the risk pyramid from a retiree's perspective.



Level 1: Client objectives

These 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 their lifestyle needs, when they need it
- Peace of mind along the way

These objectives may of themselves be broken down further. For example, their cash flow needs may be summarized as something like

- A real income of \$50000 per year after tax for 25 years
- A possibility of funding an extra 10000pa over that to fund luxuries
- And, if the markets are unkind, an absolute minimum of \$35000 pa

Having clearly spelt out client objectives in this way we are now in a position to start thinking about what might go wrong and how we best manage against those eventualities.

Level 2 : Key risks

Here we try to describe at as high a level as possible 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; i.e. "I have the assets but I can't get my hands on them"
- Excessive anxiety, "I can't sleep at night" or worse, "I can't live with this volatility, I am changing strategy (inevitably at the market bottom)."

Level 3 : Risk drivers

This is where the various sources of risk can be identified and grouped.

As is shown on the schematic, in this case, the drivers of real, long-term risk are

- Long term return uncertainty
- Inflation
- Credit risk
- Management risk; the possibility that a manager may underperform a benchmark, at a time when returns are generally low

The power of this approach is that all of these factors can be grouped together into one number, "what happens to returns if things go wrong".

Liquidity is straightforward; the driver of illiquidity risk is ...illiquidity!

The major drivers of anxiety are

- Short term volatility-“my portfolio has fallen 15%, will I ever recover? How much am I going to lose?”
- Tracking error; “Gee the market is up 20% this year and I’ve only been getting 10, I must be doing something wrong” or “All my friends have been told to invest in shares, but I’m mainly in bonds, am I doing the wrong thing?”

Where should the focus be?

Rob Arnott the editor of the 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”, Arnott (2003). 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, for example where portfolios are to be optimized on a risk- return basis. Secondary risks can be managed on a threshold basis. Thus, one could optimize returns against long term-risk while ensuring that short-term volatility and illiquidity remained below thresholds that were acceptable for the client.

For many investors funding retirement income streams, long term uncertainty of real after tax returns will be the primary measure of risk. Investor anxiety can be managed partly by education and coaching 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 this 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 past long-term real uncertainty (LTRU) we need to know for each period the expected level of return before the fact, and the final outcome. Simply measuring the volatility of past returns will not do. 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 one has 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, and will be the subject of ongoing research. Nonetheless, in many situations the concept is a far more useful one to think about than the more accessible, but flawed, volatility measure.

From a forward-looking perspective one arrives at LTRU by forecasting the range of return outcomes that may arise over the time frame under review.

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. Thus a diverse set of factors such as those shown below may be summarized in one return distribution

- Uncertainty of investment returns
- Varying inflation scenarios
- Assessment of the impact of different levels of credit risk and credit failure
- Impact (favorable or unfavorable) of active management risk
- Impact of differing levels of diversification

To assess the uncertainty of investment returns, the author uses the approach espoused by John Bogle(1990), which breaks returns down 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 annualized rate of change of the PE ratio.

Using this basic structure one can build a range of different scenarios, of which inflation is a key variable in each, and forecast the likely range of return outcomes, and in turn, 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 one can determine a range of real, after tax returns around a central forecast, calculate the standard deviation of that 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 require.

There are many approaches to managing liquidity, but one proposed here is as follows

A certain part of the portfolio is held liquid at all times (R), and 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 given by

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

The table illustrates how that would operate for a hypothetical investor with a 10 year investment horizon and a requirement for a minimum of at least 40% liquidity.

Permitted Illiquidity profile for a plan with a ten 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%

Anxiety

The key drivers of anxiety in investors seem to be short term volatility, (on the downside!) and tracking error type 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 these risks is straightforward. Management of these risks on the other hand is more complex, it is partly about what happens at the portfolio construction stage, and partly what happens at the investor education stage. As investors become more knowledgeable and experienced their capacity to accept volatility and tracking error generally (and this is a broad generalization) increases.

For some investors the driving risk factor will be anxiety and it's cousin, short-term volatility. For those investors 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 of course is the whole point of the risk pyramid.

When should these concepts be applied?

The risk pyramid should be applied to any situation, even if only as a quick check as to which forms of risk should be considered in that application. 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 that investor short-term volatility would probably be the most relevant primary risk factor.

The concept of long term real uncertainty 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.

- Developing asset allocation strategies
- Determining sustainable saving and spending levels
- Determining what level of portfolio risk is relevant to a particular client
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Comparison of investment strategies for long-term investors

- Should currency exposure be hedged?
- Impact of market timing strategies

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

- Direct property
- Rural property
- Private equity
- Hedge funds
- Timber

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.

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