REAL RETURNS AND PORTFOLIO ALLOCATION

Inflation is a major threat to the future value of any investment and, as with any risk, preparing for it is an essential part of sound portfolio management. In a previous article[1] we discussed the characteristics of inflation-linked bonds and how they can be used to manage inflation risk. The purpose of this paper is to analyse the effect of inflation on mainstream asset classes, and consider approaches to asset allocation in the context of inflation.

How does inflation affect investment outcomes?

In the short term, inflation is fairly predictable. Indeed, most economists use current inflation as a reasonably reliable indicator of short-term inflation. On the other hand, variations in inflation, particularly inflationary shocks, are very difficult to forecast as historic data suggests that adverse supply-side shocks, such as wars and commodity price spirals, have been a significant and recurring cause of monetary erosion.

However, aside from inflation, investors face many other uncertainties when constructing their portfolios. With the exception of known cash outflows which are liability-matched by inflation-linked bonds, a portfolio's real return (nominal return less inflation) is usually far from certain. Estimating how inflation will affect the short- and long-term returns of different asset classes is therefore a key consideration for portfolio managers.

Before examining how inflation affects the assets side of the balance sheet it is useful to first consider the nature of the liabilities. When the sequence of future outflows is known, liabilities generally fall into one of two categories. The first is an income stream such as that paid out by a pension scheme, in which case longevity risk must be taken into account. The second is a liability that arises at a single future target date: for example meeting the costs of decontaminating a nuclear power station.

The nature of inflation risk is different in these two cases. In the first case, short- and long-term effects of inflation must be taken into account, and a dynamic adjustment of asset allocation is possible for the long-term cash flows.

In the second case, the single cash outflow creates a specific "one-shot" risk which becomes more imminent as time passes. The nature of the inflation component, construction prices, for example, and the currency in which liabilities are to be met, are key inputs. Of course, a general price shock would affect all the elements involved and would affect many currencies, but the specific inflation of individual components or countries tends to be more volatile than general inflation.

Given these differences, portfolio construction will be quite distinct, even if investors have the same risk appetite in both cases. In the following section we shall consider the second case for sake of simplicity in examining the link between inflation and nominal asset returns.

How does inflation affects asset returns?

In answering this question, we need to address three main questions. First, what are asset returns? Secondly, what are the real returns of the various asset classes? Finally, what are the volatilities of these real returns?

A recent empirical study from Bekeart and Wang[2] examines how inflation has affected returns from bonds and stocks over the past 40 years in a sample of 40 developed and emerging countries. As part of this study they consider "inflation betas", which are defined within the following equation as:

1. Dr Jean-Francois Boulier and Denis Lehman, "Inflation-linked bonds: A Better Understanding of the Asset Class", The Investors Journal Vol. 2, no.1, April 2011.

2. G Bekeart and X. Wang, "Inflation Risk and Inflation Risk Premiums", Proceedings of Inquire Europe Seminar, 2009.

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Nominal asset return = beta x inflation rate + residual

An inflation beta is a measure of the average proportion of an asset's return that is affected by inflation. It can be lower or higher than one, and positive or negative, because a financial asset may produce cash flows that are positively or negatively affected by inflation. If, for example, equity dividend rates can adjust to the prevailing inflation rate over time, assuming, of course, that companies are able to pass on costs to customers (a bold assumption), stocks could have an inflation beta of greater than one. By contrast, a nominal fixed income bond that is unable to adjust to inflation other than by trading at a higher yield as a consequence of a fall in price, would be expected to have an inflation beta of less than one.

Inflation betas can be estimated from the sample covariance between nominal returns and inflation rates. Of course, such a measure relates to a given time period, but if the period under consideration is long enough it can give a reasonable indication of future inflation betas.

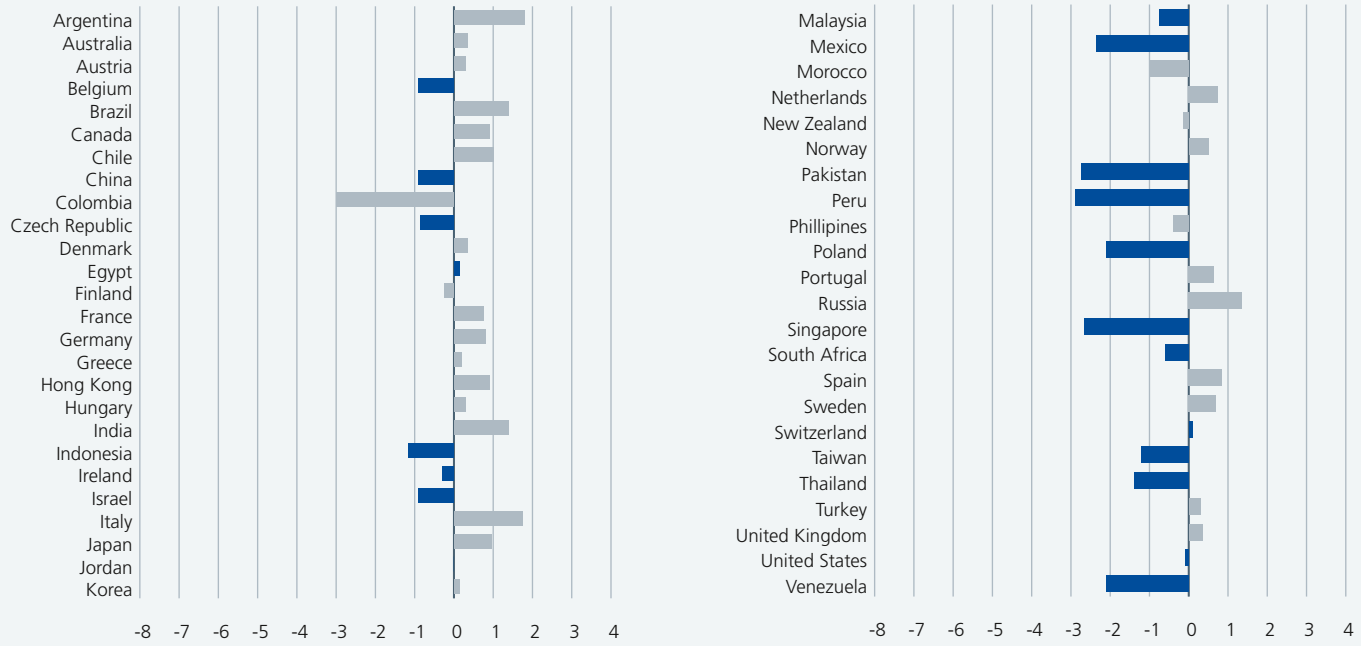
Table 1 shows bond and stock inflation betas for various time horizons during the period 1970 to 2005. Let's take the example of the inflation beta for developed economy nominal sovereign bond returns over a one-year time

Table 1. Inflation betas for various time horizons during the period 1970 to 2005

	Bonds					Stocks				
Horizon	**1-Year**	**2-Year**	**3-Year**	**4-Year**	**5-Year**	**1-Year**	**2-Year**	**3-Year**	**4-Year**	**5-Year**
Developed countries	0.28	0.59	0.84	1.04	1.12	-0.25	-0.11	-0.05	0.01	0.12
Emerging countries	0.98	1.63	2.02	1.21	2.11	1.01	1.02	1.03	1.03	1.00

Source: G Bekeart and X. Wang (2009)

Figure 1: One-year inflation betas for bonds by country, 1990 to 2005



Notes: The vertical bars indicate the inflation beta as per equation on page 11. Dark bars indicate that the beta is statistically significantly different from 1. Note that the data point for Jordan is missing.

horizon, which has averaged 0.28. Taking this in conjunction with the equation above implies that the average nominal return, although positive, has been a mere 28 per cent of the prevailing inflation rate. This is a very poor inflation hedge indeed, given the resulting negative real return.

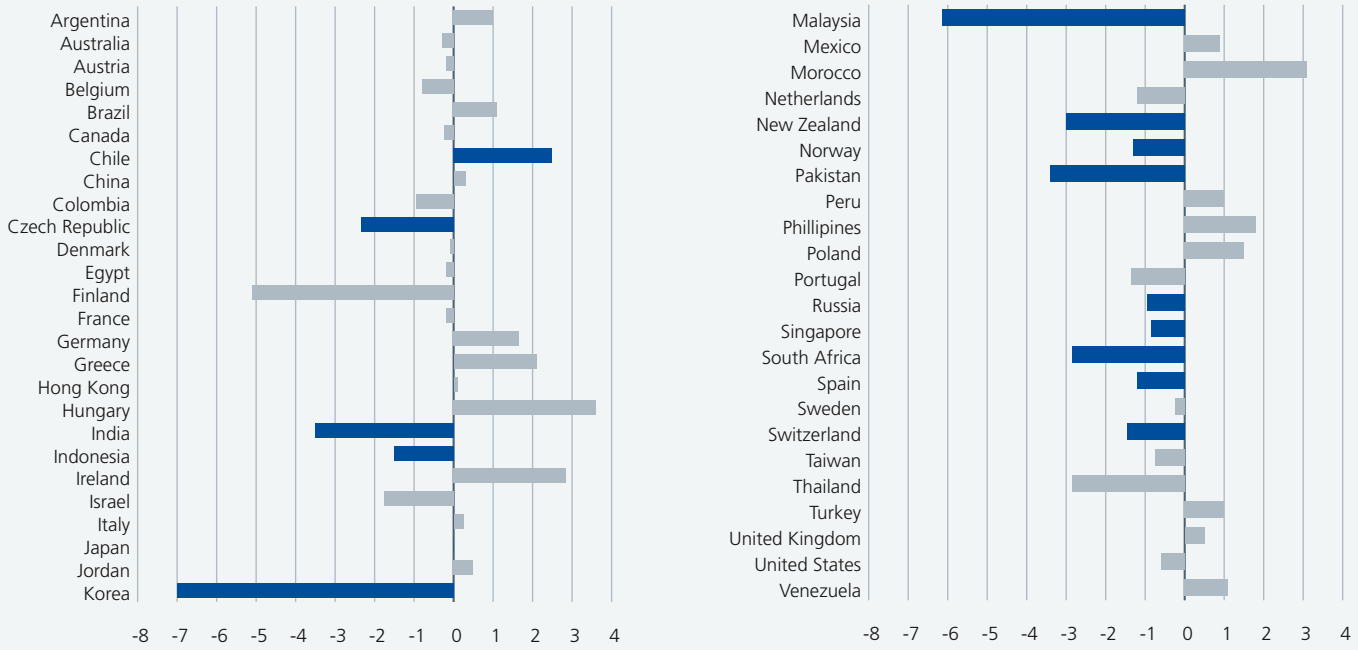
However, taking the equivalent beta for one-year developed economy stock returns at minus 0.25 implies an even poorer nominal and real return outcome, as this implies that both nominal and real returns have been negative.

Figures 1 and 2, which present the inflation betas for one-year stock and bond returns in over 40 countries, drawing on the same Bekeart and Wang data, show a high level of dispersion between countries. Even between some major markets, inflation betas can vary from near to one in Germany to almost zero in the US, and emerging markets exhibit even more dramatic dispersion given this variability. Estimates of inflation sensitivity should therefore be taken with a pinch of salt. Relying on past data alone is clearly insufficient, and it is important to take into account the role and credibility of central bank monetary policies.

The average beta of emerging bond returns as shown in Table 1 (on the previous page) over one-year horizons at close to one, is satisfactory, as returns have integrated inflation. This outcome is probably tied to the short maturity of emerging market debt. For example, in Brazil during the hyperinflation of 1986 to 1994, the longest bond maturities were just a few months because investors forced issuers to compensate them for expected inflation in order to keep real returns positive. This effect may be even stronger for emerging market debt over five-year horizons, where the average beta is close to double inflation.
In developed markets the situation appears quite different, with a small positive beta over one year and a full incorporation of inflation on a five-year horizon.

A more unexpected outcome is that developed market equity inflation betas are negative for one-, two- and three-year time horizons, and begin to be slightly positive only when we reach five

Figure 2. One-year inflation betas for stocks by country, 1990 to 2005



Notes: The vertical bars indicate the inflation beta as per the equation on page 11. Dark bars indicate that the beta is statistically significantly different from 1.

3. Campbell, John Y and Luis M. Viceira, "The Term Structure of Risk of Risk Return Trade-off", Proceedings of Inquire & Q Group Seminar, 2003.

year horizons. By contrast, the one-year inflation beta for emerging market stocks is close to one. This suggests that it takes a long time before dividends in developed markets reflect inflation once price rises have been passed on to customers. So, while real assets have not provided an inflation hedge in developed countries, stocks returns (on average) have clearly done so in emerging markets.

Interestingly, the authors have performed a parallel analysis of unexpected inflation (taken as the variation of inflation rates), which shows that the one-year unexpected inflation beta for developed market equity is close to minus 0.5, while the five-year unexpected inflation beta is near to plus one-third. Investors therefore appear to be poor predictors of inflation, underestimating inflation in the short term and insufficiently integrating it in the long run. Amazingly, emerging market betas for expected inflation and unexpected inflation are similar over that period.

Real returns and risks over the long run

Given the dispersion of inflation betas referred to above, it is useful to try to model the real returns of asset classes in order to construct efficient portfolios. Campbell and Viceira[3] and other researchers have attempted to estimate future returns by means of vector autoregressive models. Historical data can enable us to gain a better idea of likely future outcomes, if the structure of markets and economies remains similar. While such an assumption might appear heroic, the average equity premium has, in fact, remained reasonably stable across the past two centuries.

Looking at the more recent long term, US data for 1952 to 2002 gives the following average annualised real returns:

Three-month bills	1.5%
Five-year government bonds	2.9%
Equities	7.8%

These estimates are in line with other studies of returns from non-US markets. Only the positive short-term bill real return appears unusually high. Of greater interest for our purposes is the resulting risk structure, shown in Figure 2, which depicts the standard deviation of US real returns over various horizons, from one to 50 years.

As common sense would suggest, real risks increase over time for Treasury bills and zero coupon bonds. Only inflation-linked zero coupon bonds could provide almost zero real risk over a specific horizon. Perhaps more interestingly, the standard deviation of equity real returns decreases sharply and falls below that of zero coupon bonds after around 32 years.

Allocating assets in an inflationary context

Suppose the goal now is to maximise wealth in real terms at the end of the investment period. This is a commonly studied theoretical example, but quite rare in practice. Using the approach of Campbell and Viceira, allocations would vary widely over the short, medium and long term. In a mean-variance optimisation, where risk corresponds to the volatility of real returns and historical returns are considered, the allocation to equities would be:

1 year	47%
10 years (with a short position in bonds)	145%
25 years	72%
100 years	67%

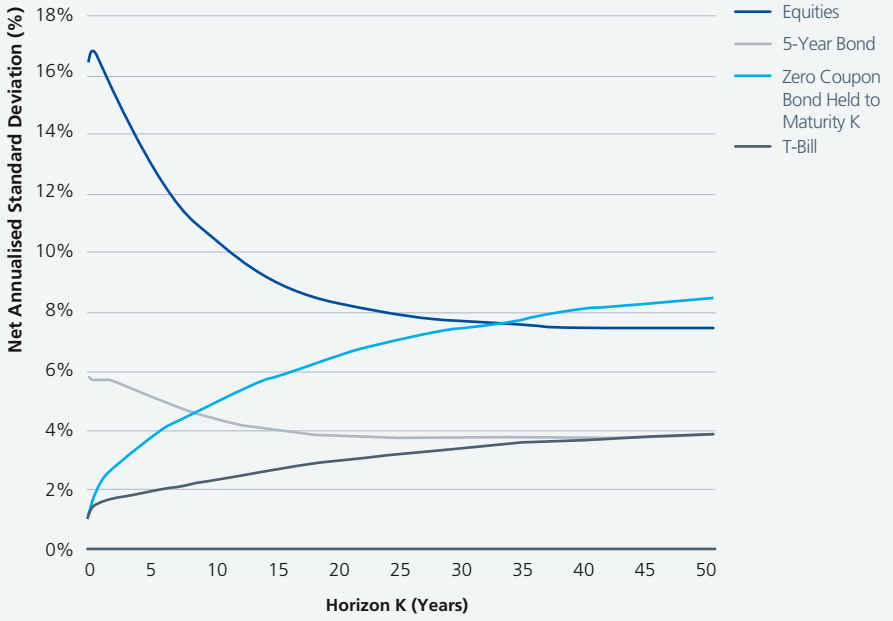
Clearly the maturity element has a dramatic effect on portfolio composition. Take a ten-year investment horizon, for example. This appears very favourable for stocks, even though the history of the past decade argues strongly against such a position. But what is captured clearly is that nominal bond inflation risk premiums do not compensate for the uncertainty associated with fixed income returns, highlighting once again the need for inflation-linked bonds. However, over longer time horizons asset allocation appears more "normal", with a sizeable proportion of bonds.

In addition to this kind of long structural view of portfolio construction, it is worth looking at the relative importance of the level of inflation on asset allocation. This is precisely what Brière and Signori did in a recent paper[4] that examines portfolio composition in two different inflation regimes: high inflation during the 1970s and 1980s, and low inflation in the following 25 years. The study includes a larger set of asset classes, with cash, inflation-linked bonds, real estate and commodities being considered, in addition to equities and nominal bonds. The optimisation criteria are somewhat different, but they capture the same element of risk. The difference in portfolio composition is visible in the outcome of this empirical study also performed on US data.

For example for a targeted two per cent annual real return over a five-year horizon, in the high inflation period the portfolio would have been allocated 47 per cent in stocks and 53 per cent in commodities. For the low-inflation period, bonds would

4. Marie Brière and Ombretta Signori, "Inflation Hedging Portfolios in Different Regimes", Proceedings of Q Group Seminar, 2003.

Figure 3. Annualised standard deviations of US real asset returns (1952 to 2002)



Source: Campbell and Viceira (2003)

have accounted for 76 per cent of the portfolio, with the rest split between stocks (13 per cent) and commodities (11 per cent). The difference between this portfolio and the portfolio based on the findings of Campbell and Viceira highlights the extent to which model portfolios can vary, depending on whether the focus is placed on inflation risk or the level of inflation.

What conclusions can we draw from the past?

Managing inflation risk is an art rather than a science. Our present level of knowledge is inadequate for the task and there remain many uncertainties about the quantitative impacts of inflation. Nevertheless, such a situation is quite commonplace when investing. It is, however, possible to make several recommendations and observations:

- Try to gain as accurate a picture as possible of an investment's expected outcome.
- Secondly, the transitory nature of inflation makes intermediate periods of two to ten years more prone to inflation risk.
- Fixed income bonds are short-term victims of inflation, but can be very efficient over long time periods.
- Analysis of a bond market's stage of development and the credibility of a central bank's monetary policy is probably a more useful guide than past history.
- Emerging market bonds tend to do better than those of mature markets.
- Credit risk must be included in the analysis. Do not forget that cash (depending on the conduct of monetary policy) and inflation linked bonds (depending on their price) might be used to reduce inflation impact.
- Equities are not a good inflation hedge over the short term, but offer an attractive risk/return trade-off over intermediate horizons unless there is a low long run inflation risk.

To end on a more optimistic note, there will come a time – a time without adverse supply side-shocks – when inflation is harnessed and a long-term allocation of two-thirds equities and one-third fixed income would appear to offer an optimal portfolio mix for both real and nominal returns.

References

Bekeart G. and X Wang. "Inflation Risk and the Inflation Risk Premiums", Proceedings of Inquire Europe Seminar, 2009.

Campbell, John Y and Luis M. Viceira, "The Term Structure of Risk of Risk Return Trade-off", Proceedings of Inquire & Q Group Seminar, 2003.

Marie Brière and Ombretta Signori, "Inflation Hedging Portfolios in Different Regimes", Proceedings of Q Group Seminar, 2003.

Key points

- Inflation is a major threat to the performance of portfolios of mainstream financial assets.
- Looking at the impact of inflation on liabilities or the desired financial outputs is important.
- Asset returns have varied with inflation, too slowly in developed markets but quite quickly in emerging markets.
- Empirical studies show that the optimal asset allocation with respect to real returns is critically dependent upon the investment horizon and the general level of inflation.
- Over periods longer than half a century, inflation-linked bonds remain the key de-risking asset and a portfolio comprising 40 per cent nominal bonds and 60 per cent equities appears empirically to be mean variance optimal.

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