Multi-asset inflation hedging portfolios

The advantages of taking a diversified approach to hedging against inflation – the theory and the practice.

Key points

- In this note, we revisit the 2012 academic article “Inflation-Hedging Portfolios: Economic Regimes Matter”, by including the last seven years of history. The findings, by and large, confirm the advantages of holding a diversified portfolio for inflation hedging purposes.
- The optimal solution depends on three factors; the economic regime, the target return and the investment horizon.
- We find that increasing the exposure to riskier assets (equities and alternatives) can provide higher target returns over inflation.
- The results are particularly interesting for investors that for whatever reasons – absence of a domestic inflation-linked bonds market, high real-return target and so on – need to look beyond inflation-linked bonds for inflation hedging purposes.
- We look at the benchmark allocations of different types of institutional investors who face inflation risk and whose returns must at least match inflation. High experienced institutional investors, adopt well-diversified portfolios, in particular by including an important exposure to alternative investments.
- The statistics are overall in line with academic results. Taking more risk is important when it comes to achieving potentially inflation-beating returns and a well-diversified portfolio generally tends to have the lowest shortfall probabilities.

The importance of preserving purchasing power

Over the last two years, inflation has moved up from around 0% to closer to 2.5% in the US and to 2% in the Eurozone. All investors, whether retail or institutional, should be looking to ensure their returns can beat inflation over time. However in an environment of low and /or declining inflation, the risk is that investors might consider this objective as less relevant and put it aside.

There are tools beyond inflation-linked bonds

In principle, inflation-linked bonds (ILBs), once held to maturity, are a risk-free asset that protects investors against the rising cost of living. However, these instruments may not satisfy all investors’ requirements. Indeed, many European ILBs are still delivering negative real yields. These bonds however, do not exist in all countries – the inflation bond space, is a market where liquidity has improved noticeably during years, but they can be still lower than many peer’s nominal bonds, especially during crisis periods. Additionally, many market players are looking for high (real) returns, which many bonds cannot provide. Typically, some large institutional investors may have this return constraint. For example, NBIM (Norges Bank Investment Management), which manages the Norwegian Government Pension Fund (largest sovereign wealth fund in the world),

1 Inflation Linked Bonds have coupon and principal indexed on realized inflation.
Inflation-Hedging Portfolios: Economic Regimes

Price Index, since 1962. All these investors must accept that inflation has been on average 1% higher than US Consumer Price Index, since 1962. All these investors must accept exposing themselves to other assets than simply ILBs. Already these first considerations underline the importance of looking beyond natural inflation hedges. A portfolio invested exclusively in ILBs seems somewhat uncommon, unless it is designed via a "liability-driven" management framework.

In view of these observations, it is important to examine other asset classes traditionally considered as good inflation protectors, such as equities, real estate and precious metals – and in particular gold. Certainly, their prices depend on many other factors besides inflation and they are typically considered riskier investments. Nevertheless their contribution to a portfolio needs to be considered, since they could provide a hedge against inflation (although imperfect), at a lower cost to ILBs.

**Economic regimes matter – as does the target return and the investment horizon**

The topic of hedging against inflation is far from simple but academic literature agrees in that there is no unique asset

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2 https://www.top1000funds.com/2017/03/return-targets-head-downward/

3 https://www.commonfund.org/

Other examples of these indices can be found also in Europe. Portugal has a similar one and higher educational people inflation is 6% higher on average than headline inflation.

4 The literature is not unanimous of the inflation hedging properties of equities. Most studies document a negative relationship between equity indices and inflation. However other studies show that equities have a correlation with inflation that increases with the investment horizon, such as Schweitzer, M. and Schotman, P., 2000. Horizon sensitivity of the inflation hedge of stocks, Journal of Empirical Finance, Published in Journal of Empirical Finance, 7, 301-315 or Boudoukh, J. and Richardson, M., 1993. Stock returns and inflation: a long horizon perspective. American Economic Review 83, 1346–1355

5 An investment in the real estate is considered a good inflation hedge because the companies that are part of it can usually pass on the increased costs to the customer, which partly protects them from inflation. In addition, if there is a general rise in the prices of goods, this is even more true for a rare good, land. Nevertheless, this alternative asset class is very heterogeneous and the results depend on the nature of the investment; publicly traded real estate shares some of the characteristics of an investment in equities.

6 Gold, has historically been touted as a hedge against inflation. Here below some references:


that can hedge against inflation, in all the cases. Inflation has different sources, it can be driven by money supply, by commodity price rises, by a general excess of demand, by self-fulfilling expectations and/or a currency war. Historically, we observed different economic regimes.

**Exhibit 1: Macroeconomic volatility**

5 years macroeconomic volatility

Source: DataStream and AXA IM R&IS calculations

A 2012 article entitled “Inflation-Hedging Portfolios: Economic Regimes Matter” analysed the properties of individual asset classes against inflation across two different economic regimes, across the US market. The study highlighted that optimal portfolios not only depend on the economic environment but also on the investment horizon as well as the target return. Across these three dimensions, the results demonstrated the advantage of holding a diversified portfolio for inflation hedging purposes. In this section we are revisiting the 2012 article, by examining the following years to the end of 2017. It is an interesting case study, given the timespan includes periods of deflationary fears, a massive global quantitative easing programme and the well-documented search for yield. These factors could have altered the behaviour of assets in the wake of inflation – and therefore the paper’s findings.

The original analysis is based on splitting the sample period into two very different economic regimes. The first corresponding to the 1970s and 1980s, a period with high macroeconomic volatility, where the economic cycle endured an oil-supply related inflationary shock (Exhibit 1). The second period starting in the 1990s was characterised by lower macroeconomic volatility and a decline in inflation to more moderate levels, partly due to greater central bank credibility. The characteristics of this second period are still applicable when we extend it until 2017.

**Individual asset classes and inflation**

There are two ways to look at the properties of asset classes vs. inflation. One is to look at returns (Exhibit 3) and estimate

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the probability of a shortfall, i.e. the probability that an asset class will not perform as much as the inflation. The second method is to look at correlations – in theory a good inflation hedge has a high, and positive, correlation with inflation (Exhibit 2).

**Exhibit 2: Simulated correlations of US asset classes with inflation 1973-1990**

![Graph showing simulated correlations of US asset classes with inflation 1973-1990](image)

Source: Authors and AXA IM R&IS calculations

Importantly, even taking into account the period up to 2017, the results found in the 2012 original article, remain true. The inflation hedging properties of the individual asset classes vary significantly with the investment horizon and with the underlying macroeconomic regime but overall there are two general results. First, all assets tend to improve their hedging capabilities when given a longer investment horizon, because shortfall probabilities decrease and correlation with inflation increases. Second, all assets exhibit better inflation hedging properties in the second period (1990-2017), where inflation and macroeconomic volatility are more moderate.

Both correlations and shortfall probabilities highlight how different the behaviour of individual assets classes can be with inflation, depending on the economic environment. Nominal bonds and equities are the asset classes, whose correlation with inflation changes more dramatically. Over the first period, a high and unexpected inflation spike particularly hits bonds, as well as equities, showing a strong negative correlation between nominal bonds and equity returns with inflation. The second period has been accompanied by a long period of disinflation followed by a relatively stable term. Inflation has been well anticipated by markets and is pro-cyclical, thus leading to a positive correlation between nominal bonds returns (as well of equities) with inflation.

**Exhibit 3: Probabilities of not performing as much as the inflation for US individual assets – shortfall probabilities**

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Sample period 1973-1990</th>
<th>Sample period 1990-2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 years</td>
<td>5 years</td>
</tr>
<tr>
<td>Cash</td>
<td>17%</td>
<td>21%</td>
</tr>
<tr>
<td>Nom bonds</td>
<td>38%</td>
<td>34%</td>
</tr>
<tr>
<td>IL bonds</td>
<td>48%</td>
<td>43%</td>
</tr>
<tr>
<td>Equities</td>
<td>38%</td>
<td>29%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>45%</td>
<td>41%</td>
</tr>
<tr>
<td>Precious Metals</td>
<td>48%</td>
<td>47%</td>
</tr>
</tbody>
</table>

Source: Authors and AXA IM R&IS calculations

By prolonging the second sample period from 1991 to 2010, up to 2017, overall all asset classes have further improved their inflation hedging properties. We see this as more evidence of the exceptional period we have recently experienced, wherein the mix of zero interest rate policies and quantitative easing have together pushed all assets classes higher. In our findings, the decrease of the estimated shortfall probabilities for equities is particularly striking, at 20% on average. Also nominal bonds and ILBs exhibit higher (and positive) correlations with inflation, even for short and medium-term investment horizons. Certainly, this is something to be taken into account when interpreting the results, especially in a context of normalizing monetary policies.

In a nutshell, these two measures tend to lead to the same conclusions, with some exceptions. The most striking exception is cash, and that’s where we understand the importance of looking at both correlation and returns. In fact cash returns are highly correlated with inflation, independent of the economic regime (higher inflation coincides with higher policy rates), however this inflation protection is purely optical. In fact, from 1991 onwards, cash returns exhibited the worst shortfall probabilities. Changing the

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8 Returns on cash are represented by 3 month T- bill rate, Nominal bonds by Morgan Stanley 7-10 Index, Inflation linked bonds by US Global Barclays inflation index after 1997, reconstructed before following Kathory and Shanken methodology. Equities returns are represented by US MSCI index, Real estate by FTSE NAREIT composite index and Precious Metal by Goldman Sachs Precious metal index.US inflation by the headline consumer price index.


10 Shortfall probabilities are based on simulated returns and inflation.
sample period from 1991-2010 to 1991-2017, the shortfall probabilities of cash have markedly worsened, by 15% on average. This should not surprise us, considering how two decades of low yields have driven cash to nil or negative returns. This backdrop has in turn encouraged more people to take on more risk (via portfolio rebalancing). Put simply, cash (money market investments) are failing to keep up with the pace of inflation.

A well-diversified portfolio appears to be the best inflation hedge

The latter part of the study moves from the analysis of individual asset classes to the computation of optimal inflation hedging portfolios. The goal of the optimization is to minimize the probability of not achieving the real target return i.e. the shortfall probability.

Exhibit 4: An allocation map for inflation hedging portfolios

<table>
<thead>
<tr>
<th>Volatile economic environment</th>
<th>Stable economic environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term investor</td>
<td></td>
</tr>
<tr>
<td>“pure inflation-hedgers”</td>
<td>Mainly cash (+small allocation to IL bonds, precious metals)</td>
</tr>
<tr>
<td>“ambitious inflation-hedgers”</td>
<td>Decrease cash weight, increase equities</td>
</tr>
<tr>
<td>Long-term investor</td>
<td></td>
</tr>
<tr>
<td>“pure inflation-hedgers”</td>
<td>Decrease cash weight, increase IL bonds, equities and precious metals</td>
</tr>
<tr>
<td>“ambitious inflation-hedgers”</td>
<td>Mainly equities</td>
</tr>
</tbody>
</table>

*Cash has been getting out from optimal allocations by the inclusion of the most recent period of ultra-low short term yields. For illustrative purposes only. Optimal allocations may vary depending on the individual circumstances of each investor and this information should not be considered as solicitation or investment, legal or tax advice, a recommendation for an investment strategy or a personalized recommendation to buy or sell securities. Source: Authors and AXA IM R&IS calculations

Importantly, the inclusion of the last seven years of history does not alter the main findings of the seminal paper.

We can summarize the findings with general guidelines for investors, who are aiming to hedge against inflation (Exhibit 4).

1. There is no miracle solution for hedging against inflation
2. The optimal solution depends on three factors - the economic regime, the target return and the investment horizon
3. A well–diversified portfolio can help you to better hedge against inflation, than say investing into a single asset class - and at the same time they can hedge against other possible risks
   - With more ambitious inflation hedges, there must be the acceptance of a higher probability of not achieving the target return and the need for a greater exposure to riskier asset classes
   - Shortfall probabilities tend to decrease with the investment horizon. For a longer investment horizon, data typically shows that a portfolio should be biased towards riskier assets, equities and alternatives
   - For a pure inflation hedge (for less ambitious investors), in an unstable economic environment (e.g. 1973-1990), cash and inflation-linked bonds are generally preferred to nominal bonds and vice versa in a more stable economic environment

What are investors doing?

In the previous section we addressed the topic of inflation hedging via an academic angle. But what does this mean in the real world? What are investors doing when they are confronted with this problem? Are their asset allocations in line with the academic findings? Are these allocations good for inflation hedging? These are questions we try to answer below.

We selected three types of US and European institutional investors, whose investment strategies have an explicit (or implicit) commitment to deliver at least in line with inflation – these are pension funds (PF), sovereign wealth funds (SWF), and endowments. As we have seen in the introduction, these are the typical long-term investors who target their return objective in “real” terms, either because their liabilities mainly increase with inflation, as is the case for pension funds and endowments, or because they have an explicit “real” target return, which is the case for many SWFs.

For each type of investor we looked at their average benchmark asset allocation between 2011 to 2017 (Exhibit 5) and examined their performance in terms of hedging against inflation.

1. The full results of minimum shortfall probability portfolios with real returns target equal to 0%, 1%, 2%, 3%, for different investment horizons and economic regimes are available upon request from the authors.

12 We are not analysing here the performances of active portfolio management of investors.
Exhibit 5: Benchmark allocations of different institutional investors 2011-2017\(^\text{13}\)

<table>
<thead>
<tr>
<th>Equities</th>
<th>Cash &amp; Fixed Income</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pension fund</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>50.0%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Euro</td>
<td>30.2%</td>
<td>52.4%</td>
</tr>
<tr>
<td>Endowments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US University</td>
<td>16.7%</td>
<td>6.4%</td>
</tr>
<tr>
<td>France Foundation</td>
<td>16.0%</td>
<td>60.0%</td>
</tr>
<tr>
<td>Sovereign Wealth Funds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norway</td>
<td>61.7%</td>
<td>36.8%</td>
</tr>
<tr>
<td>Globala</td>
<td>39.4%</td>
<td>34.0%</td>
</tr>
</tbody>
</table>

*Real Estate, Hedge funds, Private Equity ** Real Estate, Hedge funds, Commodity, Private Equity *** Real Estate, Hedge funds, Commodity, Private Equity **** Real Estate a Average of all SWF as computed by the Sovereign Wealth Funds Center

Source: AXA IM Financial Engineering, as of second quarter of 2018. Investments in Real Estate, Private Equity, Commodity, and Private Debt are direct illiquid investments.

One commonality of these allocations, is they are well diversified, not only through the geographical diversification but also through asset class diversification and in particular by including an important exposure to alternative investments. In fact alternatives investments are quite heterogeneous and the weight of alternative investments varies from 2% for the Norway SWF to 77% for the US Endowments, the Yale endowment in our case study.\(^\text{14}\) Diversification within the alternative bucket seems also to be embraced by US investors. French foundations are invested only in real estate while Yale is invested in real estate, hedge funds, commodity and private equity. However, diversification may take different forms according to the investment horizon, liquidity need, and other factors influencing their risk/return appetite.

The allocations confirm the common idea that European investors are more conservative than those in the US, with the latter more exposed to equities and alternatives. The same is true when we compare the allocation of the European SWF vs. that of other SWFs. European investors have an exposure to alternative investments between 2% and 24%, mainly composed of real estate except for European pension funds who use almost the whole spectrum of the alternatives universe. European SWFs display the biggest exposure to equity and simultaneously the smallest exposure to alternatives. French foundations appear the most conservative with almost one-third in cash (to address regulatory liquidity needs) and a preference for local real estate, to get stable income and higher sensitivity to inflation. It is also interesting to look at the evolution of allocations over time. One common finding is that investors have changed their benchmarks, by increasing the weight of alternative investments. In Exhibit 6, we show an example of the breakdown of the Yale endowment. The allocation in 2001 exhibited a quite balanced weighting against different asset classes, while nowadays the alternative investments exposure is close to 80%.

Exhibit 6: US Endowment asset allocation evolution, 2001-2017

Source: AXA IM Financial Engineering, as of second quarter of 2018. Based on the same source as cited in the footnote 11.

The prolonged environment of low-yields has made investors move from traditional investments towards less liquid but higher yielding alternatives in order to access illiquidity risk premiums, achieve better diversification and gain superior inflation hedging capabilities.

Realised excess return, shortfall probability, and diversification ratio of benchmark allocations

In this section we assess the inflation hedging capability of the benchmark allocations of institutional investors. Each type of investor can bear different inflation risks. For instance, a university’s endowment bears an inflation risk related to the university spending which could be higher than standard inflation (see above). For a retiree, compared to the general population, the inflation risk should be adjusted to take into account their daily spending, which has a large health-care component (Exhibit 7). For the purpose of simplicity and comparability, we compared the historical performance of all investors with the same Consumer Price Index (CPI) as reference in each market.

To assess the inflation hedging capability of each allocation, we focused on first, the annualised excess return over inflation and second, the realised shortfall probability based on a five-year-rolling window. The rationale for this choice is

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\(^{13}\) US PF allocation is taken from the Global Pension Assets Study 2011-2017, Willis Towers Watson, it includes the average allocation of 22 480 billion US pension assets (including 40% DB and 60% DC). The global SWF is an average allocation of government and sovereign funds covered by Sovereign Wealth Center (How do Sovereign Wealth Funds Invest, State Street Global Advisors, Jan 2018). US universities endowments are proxied by the Yale University’s endowment asset allocation(Yale Investments Office official site http://investments.yale.edu/endowment-update). The Europe PF is proxied by the average allocation of Dutch PF (Dutch National Bank official site https://statistiek.dnb.nl/en/dashboards/pensions/index.aspx) the asset allocation of the largest Norge SWF is taken from official site (https://www.nbim.no/en/investments/benchmark-index). Average allocation of France foundations is provided by the consultant Amadeis.

\(^{14}\) Yale University’s endowment, known as the “Yale model”, is the pioneer example of investment model and the most famous due to its continued success in delivering superior return through asset allocation and manager selection.
The performances of allocations in both markets (Exhibit 9) indicate a similar breakdown, they all delivered decent excess return over inflation, except for the period of global crisis in 2008, and the sovereign debt crisis (2011–2013) in Europe for European investors. During crises, assets classes’ performances tend to re-correlate with inflation but strong negative performances of riskier assets prevail. The performances have significantly improved after 2013. Global quantitative easing has pushed up the prices for all asset classes. Also a low/moderate inflation environment generally helps to stimulate economic growth, boosting equity market performance. This also lowers the yields of fixed income instruments, but generates higher marked-to-market price in a rolling strategy.

Exhibit 10, we present the comparison of these portfolios vis-à-vis that of ILBs. Over the sample period, ILBs have delivered an average 2.8% of excess return over inflation in the US, and 1.6% in Europe. Certainly, these high performances are justified by the strong decrease of global real interest rates, which led for the first time the yields of inflation linked bonds to negative levels. Yields of ILBs then turned positive for European investors. During crises, assets classes’ performances tend to re-correlate with inflation but strong negative performances of riskier assets prevail. The performances have significantly improved after 2013. Global quantitative easing has pushed up the prices for all asset classes. Also a low/moderate inflation environment generally helps to stimulate economic growth, boosting equity market performance. This also lowers the yields of fixed income instruments, but generates higher marked-to-market price in a rolling strategy.
The statistics of benchmark allocations highlight that taking more risk is generally important in terms of achieving returns superior to inflation and that a well-diversified portfolio tends to have the lowest shortfall probabilities. The best example is that of US universities’ endowment (Yale). Its benchmark allocation has the highest real return (6%) and the lowest shortfall probabilities. The diversification ratio is quite high, 1.32 compared to the 1.21 of US PF or 1.16 of Norway SWF.

We also computed the realized shortfall probabilities for a real return objective of 3%. Not surprisingly and in line with the theoretical studies, a more ambitious target return leads to higher realized shortfall probabilities (Exhibit 10). The shortfall probability of ILBs, who did well compared to inflation (real target return of zero), strongly worsened for a 3% real target return – from 11% to 56% for European ILB and from 0% to 91% for US ILB. This corroborates the importance for investors with ambitious return expectations to look beyond ILBs, at the expenses of taking on more risk in the portfolio.

To sum up, the findings are in line with academic results i.e. well-diversified portfolios can potentially help investors to better hedge against inflation – while also offering them access to a variety of sources of returns.

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17 We did not compute the back test for the Global SWF due to data availability. For Norway SWF, we used the Norway CPI as the reference inflation index.

18 The frequency that an allocation failed to outperform inflation occurred among all 5-year-rolling calculations.
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