Reassessing the Approach to The Currency Hedging Policy

Despite the immense importance of the foreign exchange exposure for global investors, the generally accepted approach to currency hedging at euro-based pension funds is too generic, sometimes - counterproductive and often driven by inaccurate assumptions.

Pension funds in the Netherlands and elsewhere in Europe implement a foreign currency (FX) hedging policy with an aim of limiting the risk (measured in terms of volatility) of the investment returns and consequently, the funding ratio. A typical hedging policy consists of multiple ad-hoc rules by asset class and may include for instance a hedging ratio of say X (usually below 100)% for JPY, USD, HKD and GBP equity (and similar) exposures and 100% of developed market and USD-denominated emerging market bonds.

In this issue of Risk Wire we assess whether such ad-hoc rules can be improved by examining a large number of wholistic hedging policies for all asset categories in combination, and for the balance sheet of the fund (including liabilities). The question to be answered is whether the current typical policy can be improved by either limiting the costs of hedging at the same risk level or by achieving a lower volatility at the same cost.

The goal of the currency hedging policy is to strike a balance between:

- limiting the volatility of the assets and the funding ratio
- limiting the drawdowns in extreme circumstances and
- limiting the cost of currency hedging.

LINKS have carried out an empirical study based on actual monthly returns of the underlying asset classes, using a realistic portfolio rebalancing policy and multiple hedging policies. Our analysis shows that:

i. hedging the total US dollar exposure at a **significantly lower** level than the typical current policies would deliver better results given the period of analysis. The optimal hedging ratio of US dollar for the full period examined (2005-2018) is close to 20%.

ii. currencies other than US dollar may be hedged up to 100%, however, the only currency that has a meaningful impact on a typical pension fund portfolio if hedged at 100% is the British pound.

iii. at the balance-sheet (funding ratio) level, the hedging requirement of US dollar exposure is even lower, as liabilities become a partial natural hedge against the US dollar

iv. If the analysis period is expanded or assumptions changed, the optimal hedging ratio for US dollar may increase to as high as 40-50% driven by costs and number of extreme events in the period. We have not found circumstances in which higher hedging ratios for US dollar are beneficial for a fund's return or volatility.

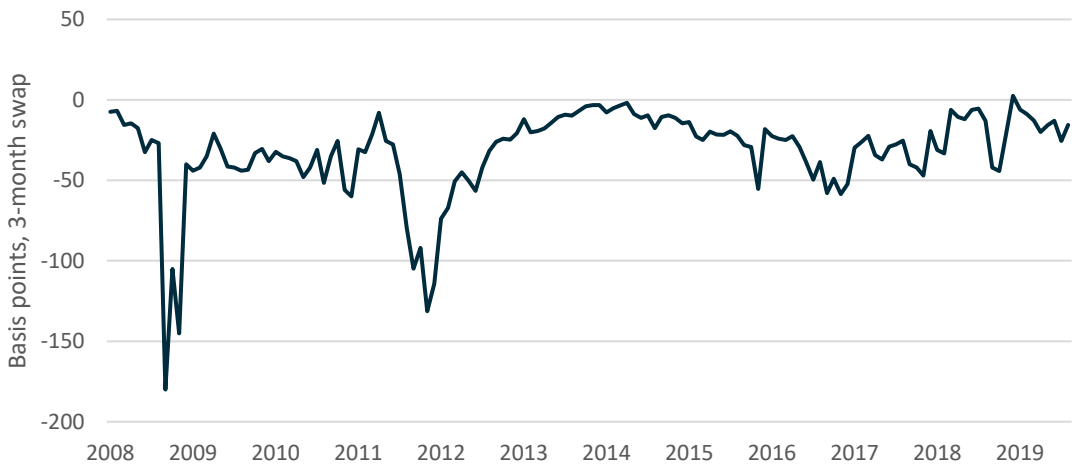
The complexity of hedging the US dollar is entirely due to its safe haven status. The conclusions in this report are valid only if the safe haven status of USD is retained. Any major macroeconomic or geo-political shift precipitating change in the safety perceptions of US dollar will require revisiting the conclusions of this study.

Research Approach and Data Used

Early academic research in FX hedging of global portfolios has been highly US-centric. Full hedging has been considered as "free lunch", since theoretically, currencies add volatility but provide no return. However, when the analysis is extended to other base currencies (e.g. EUR), significantly more globally diversified portfolios and to more current periods, we have found that the conclusions are very different. Several factors make the analysis more nuanced and the results very different:

i. **Cost of hedging:** broadly, cost of hedging consists of the "fair" cost of interest rate differential between currencies and the cross-currency basis spread, which arises due to supply-demand imbalance over and above any interest rate differential. *The fact that European investors on the average have larger exposure to USD than US investors to Euro results in occasional spikes in basis spread*(Figure 1). This requires additional assessment of sensitivity of the analysis to sudden cost increases, as any increase would result in lower optimal hedge ratio (see the section on sensitivity to costs).

Figure 1: USD-EUR cross-currency basis swap spread



ii. **Long-term trends, mispricing:** Under normal circumstances it is safe to assume that most currency rates mean-revert over the long-term. It should therefore be the case that over the long-term, currency hedging becomes unnecessary – a conclusion confirmed in (Froot & Rogoff, 1995). However, *more recent* studies suggest that even in the longer-term currency hedging still adds value (Schmittmann, 2010). This may well be due to less mean-reverting and more trending nature of FX behaviour in the past few decades (see the last section on long-term trends).

iii. **Unique nature of USD as "risk-off" currency of choice:** Our findings suggest that USD's status as the reserve currency of choice introduces a significant bias to hedging, particularly when it comes to hedging fixed income vs. equities in a portfolio and balance sheet (funding ratio) context.

iv. **Portfolio vs. asset class context:** Although it may be useful to consider an individual asset class exposure to FX risk purely for asset stand-alone risk-return analysis, the portfolio FX hedging decisions should be based on the portfolio as a whole. This is due to the fact that the total volatility of the portfolio is defined not just by the volatilities of individual assets, but also by the pair-wise correlations between the asset classes, and the asset classes and currency pairs. We therefore focus on the net impact of any currency hedging policy change by each currency across all asset classes on the portfolio as a whole.

Methodology

The generic approach to assessing the performance of the different hedging strategies is to compare the returns of the unhedged portfolio with that of the relevant hedging policy in terms of the standard deviation of returns[1]. Assuming there is no structural extra return to be gained from currency exposures, in theory, increasing the currency hedge percentage should result in lower standard deviation, lower drawdown and higher Information Ratio[2]. In this instance we calculate the information ratio as simply the average return over volatility, as we assume that there is no additional return "hurdle" to be gained from hedging (example: a 60% hedged portfolio should not yield higher returns than a 40% hedged portfolio, therefore the "benchmark" return can be assumed to be zero).

The penalty for increasing the currency hedging ratio is higher transaction costs (cost of carrying the hedging position). In reality the exposure to safe-haven foreign currencies like the US dollar can improve the risk/return characteristics of a portfolio. In addition, the exposure to some currencies could be too low in order to result in a meaningful improvement of the risk/return characteristics.

We begin with a strategic asset allocation of a typical fund as a starting point for assessing the hedging policy (Table 1). Return series are based on underlying benchmark indices, such as Bloomberg Barclays for bonds and MSCI for equities, with EUR as a base currency. Regional allocations of equity is Europe-centric, while bonds are entirely euro-based. We have also

[1] $Stdev = \sqrt{\frac{\sum_{i=1}^{N}(R_P)^2}{N-1}}$, where N is the number of days and R(P) are the returns under the currency hedging policy.

[2] $IR = \frac{R_P}{\sigma_P}$

replicated a realistic portfolio rebalancing policy of a pension fund to make sure that the results are as close to real life as possible.

Table 1: The Fund's current target allocation and rebalancing triggers

Asset category	Weight
Fixed Income	50%
Equity	35%
Property	10%
Private Equity	5%

We first calculate the following **target metrics** for judging the currency hedging strategies on a rolling 1-year horizon and for the full horizon of the data set:

- **Standard deviation:** Standard deviation of monthly returns, annualised.
- **Information Ratio:** Information Ratio of monthly returns, annualised; note that the Information Ratio includes the impact of costs (in the numerator) and volatility (denominator), so in this sense, the IR is the primary metric to focus on.

In contrast with some academic and practical studies, the approach taken in this report is empirical: **actual** historical return series of currencies and asset classes have been used instead of statistically generated series. Such an approach has strengths and weaknesses. A weakness of the approach is its dependence on the specific historical development of rates and asset returns, which may not repeat in the future. The strength of the approach, however, is that it is based on real life prices and all the pricing anomalies in terms of correlations and trends. We find that statistical replication of real-life series with sufficient degree of detail is difficult to accomplish.

Data Sources

LINKS have used Bloomberg Barclays and MSCI total return indices for evaluation of rebalancing policies. Data are available (Table 2) from 2000 for most indices, but only from 2005 for EM Bonds, so analysis is based on monthly returns for the past 13 years.

Table 2: Asset classes, indices and availability, source: Bloomberg, MSCI

Asset Category	Index	Daily Data Available From
NL Bonds LD	BB Netherlands Govt Over 10 Year	31/12/1999
EU Bonds	BB EU Govt All Bonds TR	01/03/2000
US High Yield	BB US Corp High Yield TR	31/12/1999
EM Bonds USD	BB EM Sovereign TR USD	25/10/2005
EU Equities Large Cap	MSCI Europe TR	02/02/2001
EU Equities Small Cap	MSCI Europe Small Cap TR	31/12/1999
US Equities	MSCI USA TR	02/01/2001
PC Equities	MSCI Pacific TR	31/12/1999
EM Equities	MSCI EM TR	31/12/1999

Significance of Hedging Policies

The choice of hedging policy may have a significant impact on the portfolio volatility and risk-adjusted returns (information ratios). Based on the ranges of policies we have considered, the portfolio standard deviation ranges between 5.8% and 6.2% (Figure 2), while the information ratio ranges from 0.94 to 1.07 (Figure 3). We can clearly conclude that what we call the current typical policy (75% of equities and 100% hedging ratio for bonds) has room for improvement both in terms of the volatility and information ratio.

Figure 2: Impact of various hedging policies on the volatility of the fund (assets only).

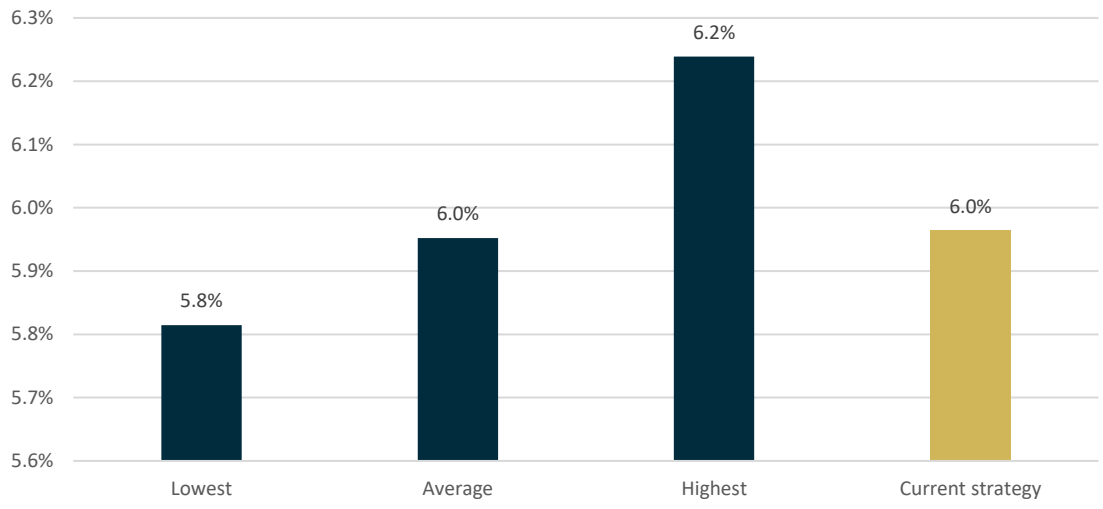
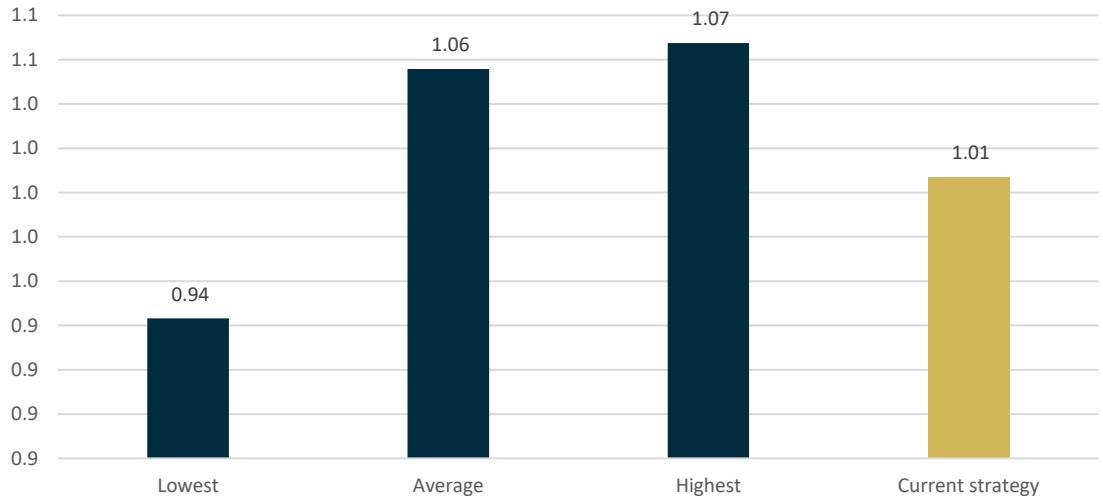


Figure 3: Impact of various hedging policies on Information ratio of the fund (assets only).



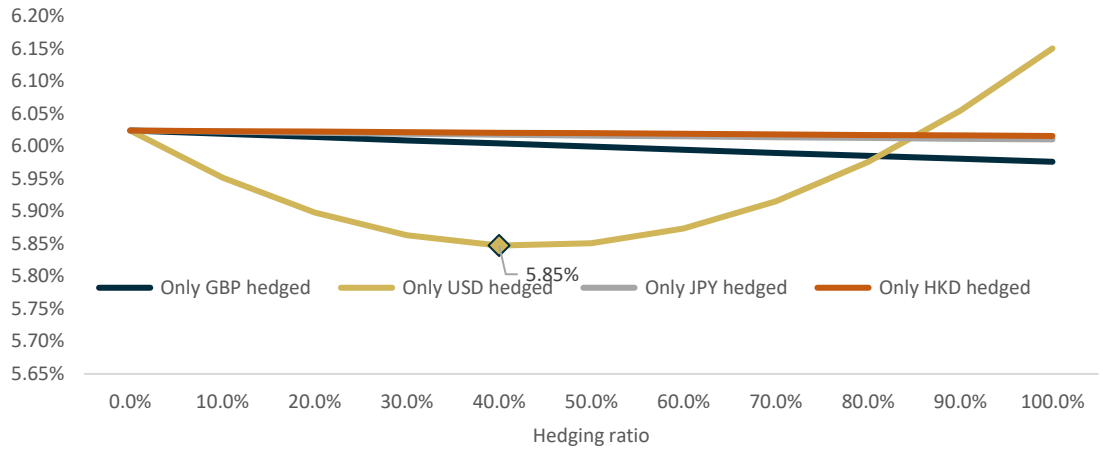
General discussion on finding the optimal hedging strategy

The first significant observation is the unique relevance and position of USD exposure: due to the significant costs of hedging, its position as safe-haven currency and the fund's size of exposure to

the US dollar, ***there is a large difference between the appropriate treatment of US dollar and other currencies***.

In contrast with other currencies, there is a clear trade-off/optimal hedging level of US dollar. The level that achieves **lowest volatility (minimum variance hedging)** of the portfolio (assets only) is 40%[3] hedging ratio of US dollar (Figure 4) across the whole portfolio (equities and fixed income).

Figure 4: Volatility of the portfolio given various hedging ratios of specific currencies (in isolation).



The 40% hedging level of US dollar exposure appears to be well below the 75% (equities) and 100% (fixed income) assumptions of a current typical policy and requires further analysis and validation. The period under consideration – 2005 to 2018 appears to be **highly significant**.

For testing purposes, we look at the minimum-variance hedging ratio[4] of a simple S&P 500 portfolio for the periods between 2005-2019 and 1998-2019 (Table 3).

Table 3: Minimum variance hedge ratio of S&P 500 portfolio EUR returns, hedged without consideration of transaction costs.

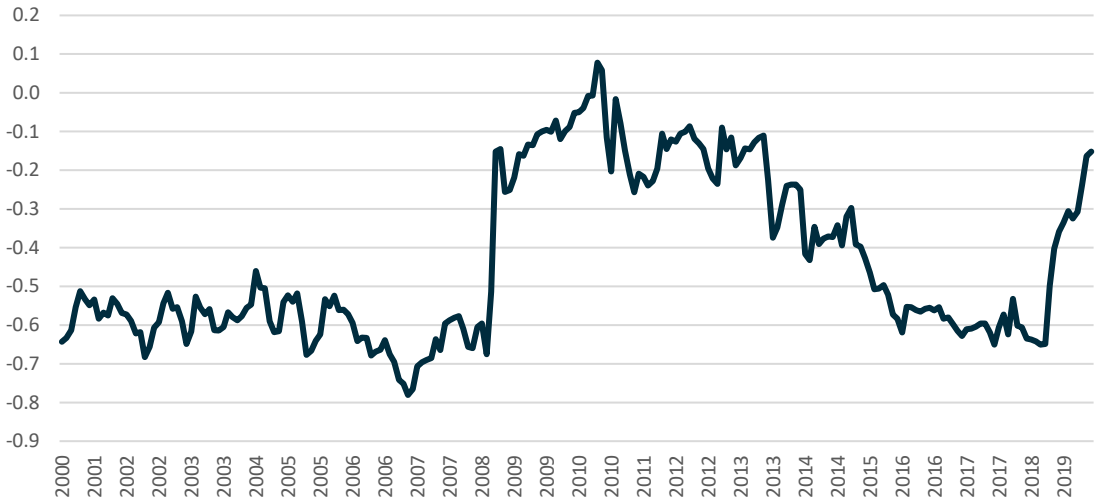
Period	Minimum Variance Hedge Ratio
1998-2019	58.19%
2005-2019	34.06%

The difference in optimal ratios in different periods is explained by the time-varying correlation coefficient: it is the correlation coefficient that defines the minimum variance, but unfortunately, that coefficient is not stable (Figure 5).

[3] Note, that minimum variance hedge ratio does not consider costs and is higher than the hedge ratio that maximises the information ratio.

[4] Defined as the regression coefficient between EUR-based returns of a USD asset and USD-EUR rate: $H = -\rho_{p,FX}\left(\frac{\sigma_p}{\sigma_{FX}}\right)$.

Figure 5: Correlation coefficient between S&P500 monthly returns converted into Euros and EUR-USD exchange rate.



The correlation in Figure 5 is a reflection of the safe haven status of US dollar. In extreme negative environments the euro depreciates relative to the US dollar (as the markets fall). Converted to euros, US-dollar asset (such as S&P 500) returns cancel out their conversion exposure, so euro-based returns become uncorrelated with EUR-USD rate. The average correlation in the 2005-2019 period is significantly closer to zero than the full period, which results in lower hedging ratio. In essence, the question of the hedging ratio for US dollar is that of a risk environment: ***the optimal hedging ratio depends on the extent of the uncertainty in the market.***

With respect to other currencies, there is a clear direct benefit of hedging them fully, however, the impact on portfolio of hedging smaller exposures, such as JPY and HKD are very marginal.

The minimum variance level of 40% however does not include the consideration of costs and return (Figure 6). The hedging ratio that maximizes the information ratio (risk-adjusted returns) depends additionally on:

i. Cost of carrying a hedging position, that at the time of writing this report was at around 2.8% for the US dollar,
ii. Return impact of excess hedge in negative environments

As a result, the hedging ratio that maximizes the fund's information ratio is closer to 20%.

Figure 6: Information ratios given various hedging ratios of currencies for the full portfolio (assets only).

To summarize, it is fair to expect that the portfolio would have high information ratios with a hedging policy of 20% of US dollar exposure and 100% of GBP exposure (with the remaining currencies mostly having a marginal impact due to the small weight in the asset mix). We have considered many several alternative policies to compare with the more optimal policy. The results suggest that the hedging policy currently used by most pension funds can be improved in terms of volatility, costs and returns (Table 4).

Table 4: Alternative policies of currency hedging

Policy choice	Volatility	IR	Hedging Costs (annual)
Current policy	6.0%	1.002	3.0%
(Option 1) 20% USD, 100% GBP, 0% other	5.9%	1.072	0.9%
(Option 2) Equities (20% USD, 100% GBP), Fixed Inc. (100%)	5.8%	1.054	1.9%
(Option 3) Equities (20% USD, 100% GBP), Fixed Inc. (75%)	5.8%	1.062	1.6%
(Option 3) Equities (50% USD, 100% GBP), Fixed Inc. (100%)	5.9%	1.027	2.7%

It should be noted that the separation of asset categories and individual asset-class hedging policies are sub-optimal, as the correlations between different asset categories change the optimal hedging ratio. Consequently, although for instance fixed income portfolio on a stand-alone basis may warrant higher level of hedging, from the overall portfolio perspective this may not be relevant: cost of hedging is the same for all assets, yet volatility "gain" (pay-off from hedging) is smaller for fixed income.

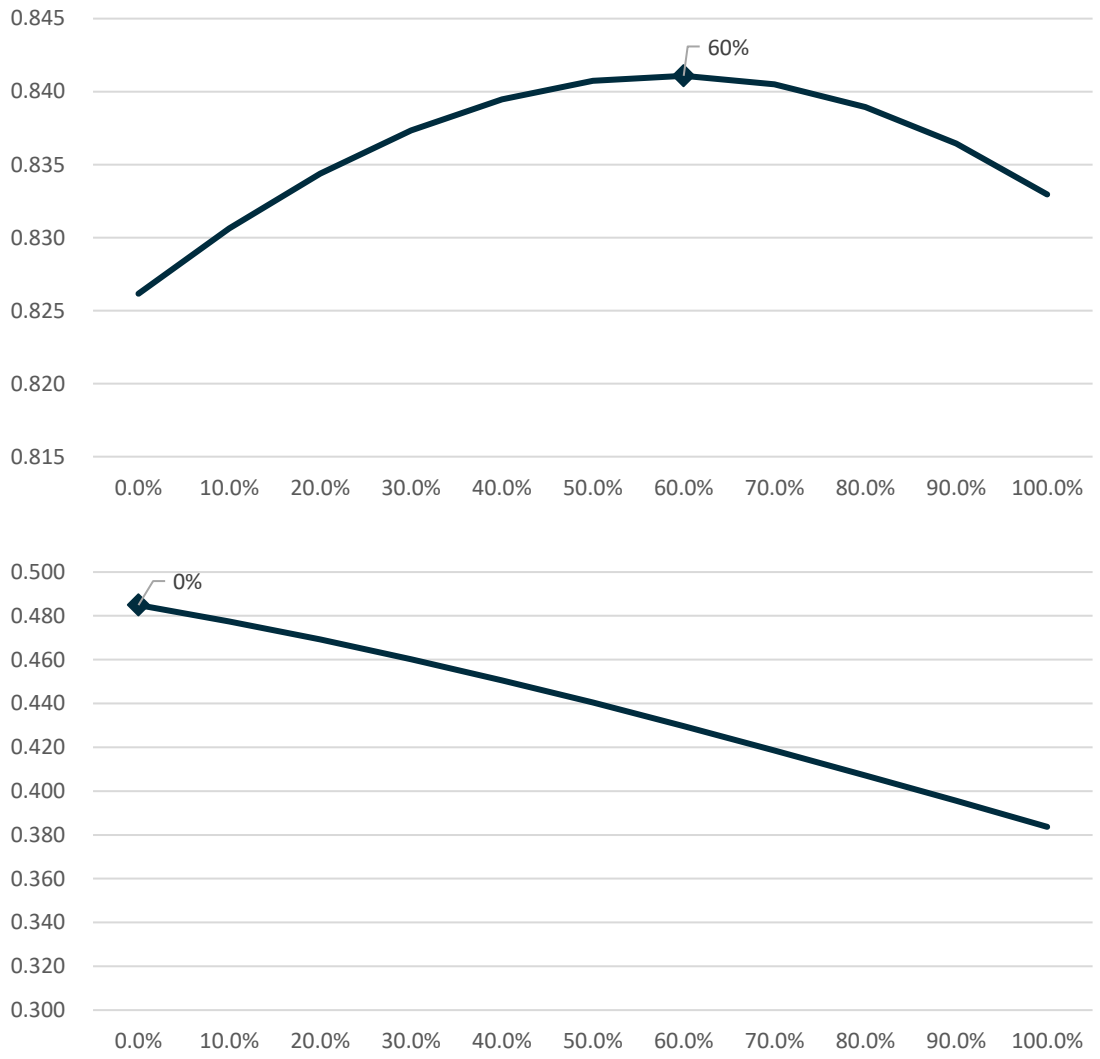
This last point is important to elaborate on. Taken separately, the fixed income portfolio has its own optimal USD hedging ratio – **60%**, clearly higher than the 20% for the overall portfolio (Figure 7 top). This is a function of the overall asset mix in the fixed income portfolio, including the proportion of risk-free and risky (duration vs. spread) components, even if those components are not in US dollars.

The optimal hedging ratio of the equity part of the portfolio taken separately, is closer to zero (Figure 7 bottom). This is also intuitive, as the combined equities portfolio is a risk-related asset,

which means it already negatively correlates with US dollar rate (as equity markets fall, US dollar appreciates). Although only the US-dollar denominated portfolio might warrant a hedge, the rest of equity portfolio creates the opposite requirement, resulting in increasing volatility with increasing hedging ratio.

When we make a step from individual asset classes to a portfolio hedging, the optimal hedging ratio of the portfolio is not the same as the hedging ratio based on all individual asset classes separately (in this case, assuming 50/50 split – average of 60% and 0% or 30%), i.e. if we hedge equities at their optimal hedging ratio and fixed income at theirs, the combined hedging outcome will not be as efficient as the total portfolio optimal hedging ratio. The latter depends on the correlations between equities and fixed income and between equities, fixed income and USD-EUR exchange rate.

Figure 7: Information ratios of the fixed income portfolio alone (above) and equity portfolio (below) , given various hedging ratios of US dollar.



It is intuitive to expect that if the weight of equities in the total asset mix increases, the optimal hedging ratio should fall. We have tested this sensitivity by checking the optimal hedging ratio for the same portfolio, but with 10% increased equity weights, i.e. 60% equities and 40% bonds. **The results suggest that for the 10% increase in the weight of equities the optimal hedging ratio falls by 10%.** It should be noted that this conclusion is valid only for the pro-forma portfolio that we

use in this paper and in the weight ranges close to 50/50; the sensitivity may increase or decrease for weights significantly different from the 50/50.

We have additionally found that Japanese Yen exhibits similar characteristics to US dollar in terms of the safe haven status to an extent, moreover, since the exposure of the Fund to JPY is small, hedging of the currency makes little difference for the overall volatility.

Hong-Kong dollar, on the other hand, has no safe haven characteristics and would theoretically require 100% hedging, however, once again the size of the exposure in the portfolio is too small for a hedging program to have a meaningful impact on portfolio returns and the volatility.

Hedging the Balance Sheet: Relevance of Liabilities

So far, we have limited the discussion to the assets only. The stated goal of the hedging policy of a pension fund is to manage the volatility of the Funding Ratio, which includes the liabilities. To the extent that Liabilities may have correlation with USD-EUR exchange rate, the balance-sheet perspective may have an impact on the optimal hedging ratio.

Although we do not have the historical actual performance of liabilities of a pension fund, we have used an approximation – long dated Euro government bond index (Barclays Euro AAA 20+ Treasury index).

Since liabilities are discounted by the risk-free rate, increase in liabilities (falling interest rates) coincide with increasing value of US dollar. This means that liabilities are a form of a “short dollar”. The correlation between the bond index and EUR-USD exchange rate in the period of 2005-2019 is -0.31 – nearly the same level as the asset exposure to US dollars. Although in theory liabilities are entirely in Euros and should not depend on US dollar, the fact that interest rates are correlated with USD-EUR rate means that liabilities too are “exposed” to US dollar. In this sense, in order to hedge the balance sheet (rather than the assets alone), we would need to hedge both liabilities and assets.

Hedging the liabilities would mean buying (going long) US dollar (since liabilities increase at the same time as US dollar goes up). The theoretical optimal hedging ratio of liabilities based on the assumptions above is 37%. If the funding ratio is close to 100 (i.e. assets are equal to liabilities), this would mean that hedging the balance sheet requires long 37% USD for liabilities and short 20% for assets. In other words, the hedging ratio is -17% (i.e. certainly no need for hedging).

The caveat here once again is the risk of treating the status of US dollar as constant. There may be multiple eventualities in which this conclusion can change:

- The status of US dollar as a safe haven currency may suffer due to political and economic US-specific risks.
- EU currency may become the currency of choice due to better performance of EU.
- Overall return to calm and prosperous economic period (such as 2002-2006) may result in lower relevance of the safe-haven currency status and higher hedging ratio.

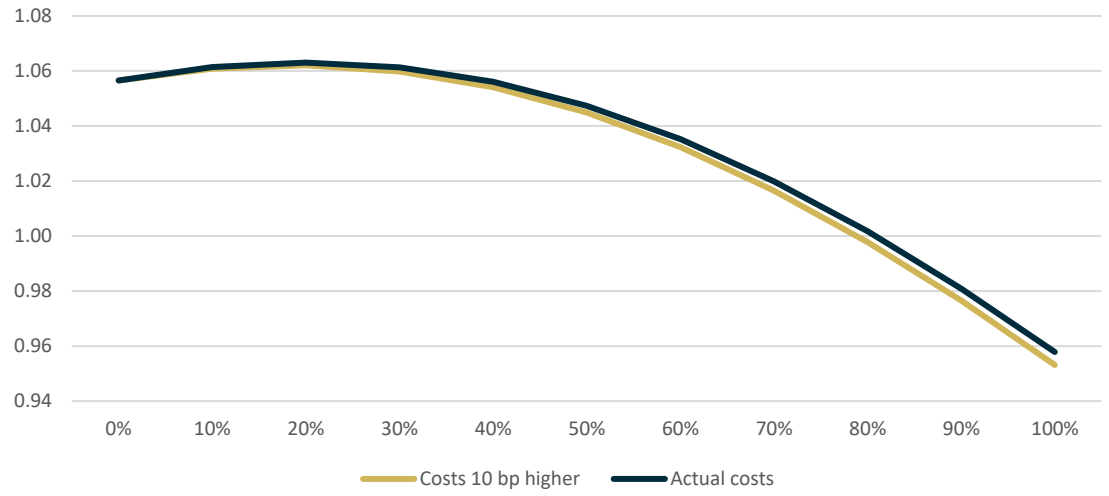
All of the considerations above should be weighed against the actual data for the recent period before arriving at the appropriate policy.

Time-Varying Cost of Hedging

Cost of hedging may have a significant effect on the hedging ratio. We have estimated the effect based on real historical pricing by moving the whole history of 3-month forward hedging costs up by 10 basis points. In our assessment, the optimal hedging ratio does shift to the left (Figure 8), however the size of the move is small – 3%: for every 10 bp of increase in hedging cost of US dollar, the hedging ratio with highest information ratio is ~3% lower.

The value may be impacted by the period of analysis, as inclusion of more calm periods would result in higher optimal hedging ratio, which in turn means the costs would have a greater impact on the hedging ratio. The reason for this is the fact that the gap between higher and lower-cost curves in Figure 8 is larger at higher hedging ratios.

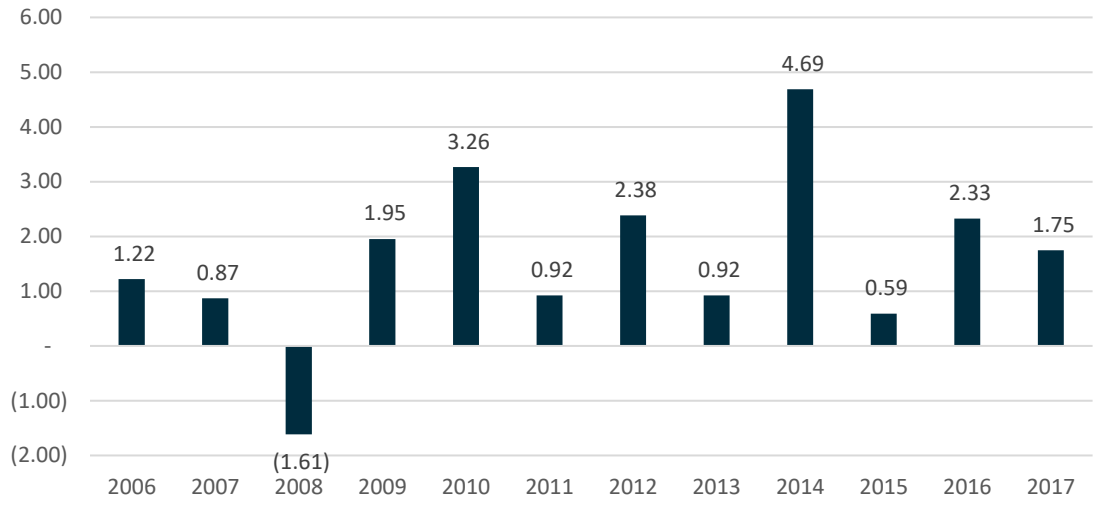
Figure 8: Information ratio with actual and 10 bp higher costs



Time-varying Nature of Optimal Hedging Ratio

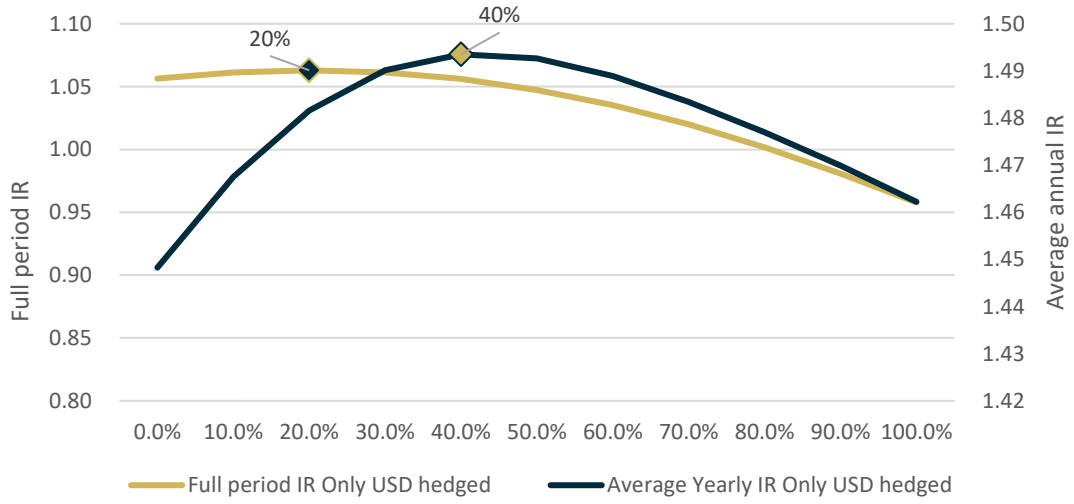
Unsurprisingly, there is a significant difference of results by year even in the short-term period. For instance, the annual Information Ratios of a portfolio with a 20% USD and 100% GBP hedging (Option 1 portfolio) ranges from -1.6 to 4.7 (Figure 9).

Figure 9: Information ratios by year for the portfolio hedged at 20% USD and 100% GBP.



The average information ratio (across the years) is 1.5, which is higher than the full period information ratio of 1.07[5]. Moreover, the hedge ratio that optimises this annual average IR is higher (Figure 10). This result suggests that aiming at longer-term optimal information ratio requires lower hedging ratio compared to targeting annual information ratio.

Figure 10: Full-period IR and average annual IR's of the same hedging policy.



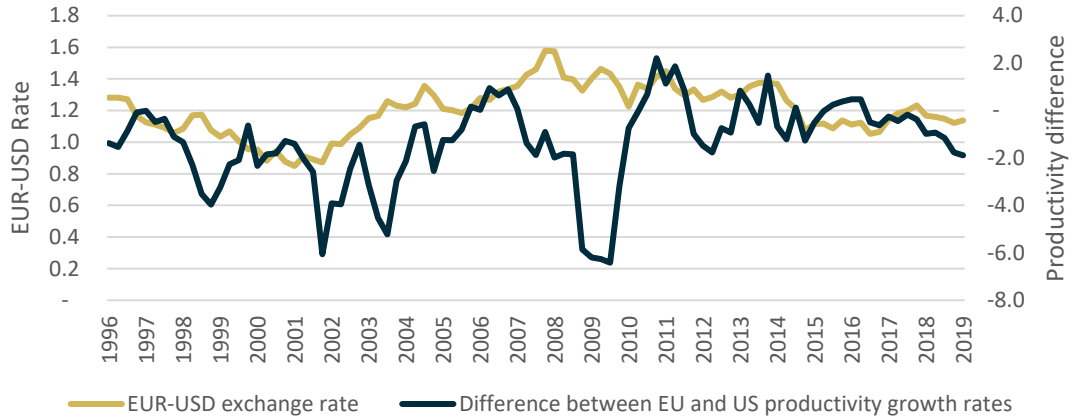
Long-Term Considerations and Trends

In an ideal world, the behaviour of currency rates is mostly mean-reverting and there are no trends. In reality, of course, there are major long-lasting trends shaping currency performance. Although the very notion of hedging assumes the necessary ignorance of directional moves, there is still the argument to be made that should such long-term evident trends exist, it would be imprudent to ignore them.

[5] Since IR is return over standard deviation, average of standard deviations across periods is not the same as standard deviation over the whole period, which results in different IR's.

Although it is notoriously futile and difficult to second-guess short-term currency moves, the long-term behaviour of **free-floating** currencies should in principle reflect the **potential** strength of underlying economies. Such potential at the macroeconomic level can be measured by productivity growth rate differences between the currency zones (Figure 11).

Figure 11: Difference between Euro area and US productivity growth rates and EUR-USD exchange rate, Source: Bloomberg, LINKS



Following the financial crisis in 2008 there has been a significant divergence in productivity growth rates between the US and Europe, driven by stronger regulatory restriction and less developed technology sector in Europe. Whether this trend will continue, or reverse is up for debate, however, should this continue, the implication would be a bias towards lower USD hedging ratio.

Having mentioned the trend, it should also be noted that any new structural, geo-political or economic "game-changing" trend specific to the US, such as ***excessive isolation of the US economy*** or ***excessive cost of expanding wars*** may actually reverse the trend and pause additional risks for US dollar, even threaten its status as a safe haven currency. In such an event, all of the conclusions of this report would need to be revisited.

Conclusions

LINKS have carried out a replication of a typical pension fund portfolio and various currency hedging alternatives in the period from 2005 to 2018 based on monthly returns. There are several key observations:

i. The hedging policies currently used by pension funds, for instance hedging of 75% equity exposure in USD, GBP, HKD and JPY seems to be sub-optimal, delivering information ratio of 1.01 vs. the achievable 1.07 (Figure 3). This means that it is possible to achieve lower costs and better returns at the same level of volatility.

ii. Given the period in question, the optimal hedging ratio is closer to 20% for the US dollar and 100% for GBP – a combination, which yields an information ratio of 1.072 (Table 4). The other currencies may be hedged to 100%, however, their impact at the portfolio level is marginal. Hedging fixed income portfolio exposure to US dollar at 100% results in slightly lower information ratio but lower volatility, so this may be considered as a viable alternative.

iii. The optimal hedging policy depends a great deal on the period in question. The hedging ratio for US dollar, as a safe-haven currency, is higher if the "quieter" market environment of 2000-2006 is included. In this period the optimal hedging ratio is closer to 30-40%, which is still below the typical pension fund hedging ratio of 75%-100%.

iv. At the balance sheet (Funding Ratio) level and assuming the liabilities can be replicated by a long-dated bond portfolio, hedging becomes nearly unnecessary, as the exposure to liabilities (safe haven assets) is correlated with the exposure of EUR-USD rate. This analysis is predicated on the US dollar remaining a safe haven currency.

v. Increasing costs of hedging the US dollar exposure has a negative impact on the hedging ratio. Every 10 basis point in cost increase results in ~3% decrease in the optimal hedging ratio.

vi. Unsurprisingly, a more short-term focus results in higher hedging ratio (e.g. 40% vs. 20% for hedging annual IR's rather than the full-period information ratio). Still, annual focus results in 40% hedging ratio, which is below the 75% policy of the fund.

vii. Finally, there is an argument to be made that a long-term macroeconomic trend is favouring the US dollar and low hedging ratio. This argument however can change if the current macroeconomic and geo-political environments change drastically.

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