What Currency Hedge Ratio Is Optimal?

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Abstract

Markowitz (1952) portfolio theory implies that the optimal currency exposure should be jointly determined with a portfolio's local asset holdings. Using a novel approach, we examine for a Swiss-based (CHF) global investor whether such ex ante mean-variance optimal currency hedge ratios improve portfolio performance ex post.

Our results suggest that for the sample period under examination, optimal hedge ratios for some currencies differ from either a full or no hedge benchmark. Moreover, they result ex post in higher portfolio return and lower risk, relative to the full and no hedge strategies. We conjecture that in the long-run, integrating the currency hedge with the tactical portfolio allocation decision leads to favourable results.
1 Introduction

Standard asset pricing theory suggests that investors can extend their opportunity set by investing abroad. This brings about the question of what currency exposure is optimal. To answer this question, we extend the Markowitz (1952) mean-variance framework to include foreign currencies. In the context of a Swiss-franc (CHF) based global investor, we then examine whether ex ante optimal currency hedge ratios improve the performance of an international portfolio relative to a no-hedge or full-hedge strategy.

For a classical mean-variance investor, the optimal currency hedge ratio depends on currency rate expectations, correlations of local asset and currency returns, the investor’s domestic currency and risk appetite. To illustrate the impact of currency rate expectations and correlations, consider a highly stylized example with a domestic investor holding a bond and equity position in a foreign currency. Suppose that the investor has formed return ($\mu_i$), volatility ($\sigma_i$) and correlation expectations according to the table below:

<table>
<thead>
<tr>
<th></th>
<th>$\mu_i$</th>
<th>$\sigma_i$</th>
<th>correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock</td>
<td>10%</td>
<td>18%</td>
<td>1</td>
</tr>
<tr>
<td>Bond</td>
<td>3%</td>
<td>5%</td>
<td>0.1</td>
</tr>
<tr>
<td>Currency</td>
<td>$\mu_c$</td>
<td>10%</td>
<td>$\rho$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$\rho$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

Assume furthermore that domestic and foreign interest rates $r_d$ and $r_f$ are at 1% and 3% respectively. Under the uncovered interest parity (UIP), it holds approximately that the expected currency return equals the interest rates differential: $\mu_c \approx r_d - r_f$. Suppose now that the investor expects the UIP to hold ($\mu_c \approx -2\%$) and that he assumes a highly negative correlation ($\rho = -0.5$) between local asset and currency returns. The upper right panel of Figure 1 reveals the efficient frontier for a fully hedged (dotted line) and unhedged (dashed line) international portfolio. Except for low portfolio volatilities, the unhedged case offers an opportunity set that is superior to the fully hedged case. This finding should not surprise, since the highly negative correlations lead to a diversification effect from taking currency exposure. The optimal solution (solid black line) is obtained when the hedge ratio is jointly determined with the local portfolio holdings. The upper right panel reveals the opportunity sets when the correlation $\rho$ is expected to be zero. In this case, the efficient frontier corresponding to the fully hedged case coincides with the optimal hedging strategy (solid black line), so nothing is gained from taking currency exposure.\(^1\) However, the lower right panel suggests that this finding is contingent upon the UIP. If for the example at hand, the investor does not expect the domestic currency to appreciate ($\mu_c = 0\%$), i.e. if the investor expects relative gains from holding the foreign currency, not hedging is superior to a perfect hedge for reasonably high portfolio volatilities. From any of the four scenarios it follows that the

\(^1\)See e.g. Campbell, Serfaty-de Medeiros and Viceira (2010) for a proof of this result in a minimum variance context.
Figure 1: Stylized Example

Figure 1 shows the efficient frontiers for a stylized example with an international bond and equity holding in a single foreign currency. The four panels correspond to different scenarios concerning the uncovered interest parity (UIP) and the correlation of local asset and currency returns. The solid, dashed and dotted lines correspond to an optimally set hedge ratio, a full currency exposure scenario and a full hedge strategy.

best opportunity set is obtained when the hedge ratio is simultaneously determined with the portfolio holdings.

Of course, what is ex ante optimal need not be ex post. In this article, we examine whether mean-variance optimal hedge ratios as illustrated in the previous example achieve superior ex post performance. For this purpose, we extend the framework of Markowitz (1952) and treat currencies as distinct asset class with the difference that we set hedge ratios rather than portfolio weights. For the empirical part, we hypothesize a representative Swiss investor with foreign equity holdings in major currencies and suppose that he recurrently sets hedge ratios by minimizing the expected portfolio variance. After an optimal allocation has taken place, we track the ex post performance and compare it with two naive heuristics where the currency exposure is either fully hedged or deliberately taken. Since we determine the optimal portfolio strategy without hindsight, the approach can be considered a true out-of-sample test.
We report several interesting findings. First, ex ante optimal hedge ratios generally differ from both the full-hedge and no-hedge scenario, though they are closer to the former, in particular for the USD exposure. Second, a strategy with optimal hedge ratios increases the average return versus the naive benchmarks. At the same time, the average ex post portfolio risk is reduced, leading to an improved return-risk ratio. A closer inspection of the optimal hedge ratios over the sample time horizon suggests that these findings can be attributed primarily to tactically reducing the JPY hedge during and after the financial crisis of 2008.

The remainder of this article is organized as follows. In section 2, we explain the technical details of formulating the relevant optimization problem and elaborate on the data and the general approach for this study. In section 3, we reveal results for a purely international and a mixed portfolio. Section 4 concludes.

2 Modelling Approach

2.1 General Framework

We consider a portfolio with \( m \) domestic or foreign assets. The foreign assets are held in \( l \) different currencies, which we treat as distinct portfolio positions. For the total of \( n = m + l \) positions, we define a vector of weights \( w \), where the first \( m \) entries refer to the asset positions. The weights assigned to the last \( l \) entries are determined by whatever amount is allocated in a given currency. For example, if an investor holds 5% in U.S. equity and 10% in U.S. bonds, the entry corresponding to the USD position is 15%. To include into our framework the possibility of partial currency hedging, we further define a \( n \times 1 \) exposure vector \( h \). The following restrictions apply:

\[
\begin{align*}
w_i & \geq 0 \\
1_n' w & \in [1, 2] \\
h_i & = 1 \quad \text{for} \ i = 1...m \\
h_i & \in [0, 1] \quad \text{for} \ i = m + 1...n
\end{align*}
\]

The first is a no short-selling constraint. The second constraint maintains that the total portfolio weight must sum to anything between 100% and 200%. The lower boundary corresponds to the case when only domestic assets are in the portfolio (\( l = 0 \)). As soon as foreign assets are held, there is a corresponding weight on the currency resulting in a total weight which is larger than 100%. The upper boundary of 200% corresponds to a purely international portfolio. The third constraint maintains that we have full exposure to the asset risk. Finally, the last constraint prescribes currency hedge ratios between 0 and 100%.

The representative investor in a Markowitz (1952) framework optimizes the trade-off between expected return and risk to maximize expected utility. However, there are numerical caveats to beware: Michaud (1989) points out that mean-variance optimization suffers from input error maximization. Best and Grauer (1991) show that an optimal solution is highly sensitive to changes in asset means. Since
forming asset and currency return expectations is a difficult matter in the first place, we focus on the risk aspect of optimal currency hedging and determine hedge ratios such that the ex ante portfolio variance is minimal. Formally,

$$\min_{w,h} \quad \sigma_p^2 = (w \circ h)' \Sigma (w \circ h),$$

subject to the above constraints. $\circ$ denotes the Hadamard product and $\Sigma$ is a $n \times n$ covariance matrix. Since we simultaneously solve for the optimal weights and hedge ratios, we do not know a priori the sum of weighted exposure $1_n' (w \circ h)$. This and the fact that we include inequality constraints prevent an analytical solution. We therefore apply a sequential quadratic programming algorithm to solve the optimization problem in (1).

2.2 Data and Approach

We presume a representative Swiss investor with international holdings in USD, EUR, GBP and JPY. We proxy the USD local investment with the S&P 500 Composite, the EUR with the DAX 30 Performance Index, the GBP with the FTSE 100 and the JPY with the NIKKEI 225. Prior to the launch of the European Monetary Union, we use a synthetic exchange rate to reflect EUR currency risk. We do not consider international bond holdings. In a comprehensive empirical analysis, Schmittmann (2010) finds that hedge ratios for international bonds are almost always 100%. The reason for this finding is that currency rates are comparably volatile and hence dominate the bond risk component.

We consider two base cases: In the first case, the representative Swiss investor holds a purely international portfolio. In the second case, the international holdings are mixed with a 25% position in domestic equity and a 25% position in domestic bonds. We proxy these positions with the Swiss market index (SMI) and the Citi-group World Government Bond Index Switzerland (all maturities). In line with the standard practice of defining a strategic allocation, we keep the domestic weights fixed.

Although expectations may change rapidly, monitoring and transaction costs prevent the continuous adjustment of the portfolio. In this analysis, we determine optimal weights and hedge ratios on a quarterly basis. Given this rebalancing frequency, we expect the deviation from the optimal hedge ratios through intermediary changes in local assets values to be minor. Regarding the covariance matrix estimate $\Sigma$, we consider three regimes. First, we set $\Sigma$ equal to the historical estimate over the most recent 2-year horizon. This approach may have the disadvantage that hedge ratios over the sample period are highly time varying. To cope with this problem,

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2The reason we prefer these proxies over some MSCI series is because they offer a long history of daily data.

3The stylized allocations considered in these base cases are not compatible with Art. 53ff. BVV2. Nonetheless, the example is illustrative for a Swiss pension fund since the base case is easily adjusted to comply with the regulatory framework.
we consider secondly a shrinkage estimator, where we shrink the historical estimate towards the identity target. Formally,

\[ \Sigma^* = (1 - \alpha)\Sigma + \alpha I_n \sigma^2, \quad (2) \]

where \( \alpha \in [0, 1] \) is the shrinkage parameter, \( I_n \) the n-dim identity matrix and \( \sigma^2 = \sum_{i=1}^{n} \sigma_i^2 / n \). We expect \( \Sigma^* \) to result in more stable, albeit biased hedge ratios. Finally, we consider an estimate analogous to (2), but where the entries corresponding to the currencies are unchanged from the historical covariance matrix (partial shrinkage). To estimate \( \Sigma \), we use daily return series. With this choice of data frequency, the estimator in (1) provides an accurate proxy for the true (historical) portfolio variance, even though it ignores the cross terms between asset and currency returns.

The aim of our analysis is twofold: First, we wish to determine the ex ante optimal hedge ratios. Second, we want to evaluate the ex post performance of an international portfolio where the hedge ratios have been set optimally. We compare the performance of the optimal portfolio with two benchmarks: an unhedged and a fully-hedged portfolio. To evaluate the performance, we construct an index \( Q \) based on monthly data which tracks the respective strategies. We define a divisor \( D_t \) and on each rebalancing date set it equal to the inverse of the previous period index level. Next, we define a \((n+1) \times 1\) vector of cumulative gross returns \( U^c \) and a vector \( R^c \) with the following restrictions

\[
R_i^c = \begin{cases} 1 & \text{for } i = 1...m, n + 1 \\ 1 + (r_d - r_{f,i})/(1 + r_{f,i}) & \text{for } i = m + 1...n, \end{cases}
\]

where \( r_{f,i} \) refers to the foreign interest rate for the ith currency. The reason for setting up a vector \( R^c \) is that it reflects the costs associated with hedging the currency exposure. To hedge, we can buy a forward contract to sell the foreign currency. In a discrete time setting, the covered interest parity implies that the 1-period return on the hedged currency position is equal to the interest rates differential discounted at the foreign interest rate. Since we rebalance on a quarterly basis, we select 3-month Interbank rates and scale them to the 1-month horizon. The index level at any time \( t \) follows from

\[
Q_t = \left( (w \circ U_t^c)'KU_t^c + (w \circ (1-h))'R_t^c - (w \circ (1-h))U_t^c \right)/D_t, \quad (3)
\]

The first term reflects the fact that local asset gains or losses are fully exposed to currency risk. Accordingly, the \((n+1) \times (n+1)\) matrix \( K \) with zeros and ones combines the local asset returns with the corresponding currency returns. The

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5The shrinkage estimator moderates extreme negative correlations towards zero. Therefore, hedge ratios will be biased towards 100%.
6The last entry corresponds to a pseudo gross return of 1 for the CHFCHF exchange rate. This entry is necessary to correctly reflect earnings on the domestic asset positions.
second and third term represent the return from the hedging activity, where \((1 - h)\) is a vector of hedge ratios.

3 Results

3.1 Pure International Holding

In the subsequent analysis, we consider a 16-year time period from January 1995 to December 2010. To compare the various currency hedging regimes, we normalize the portfolio value on January 1995 to 100. Table 1 shows the results. Following a full-hedge strategy (FH), the portfolio value is at 182.8 by the end of 2010. The corresponding per annum return and standard deviation are 3.8\% and 14.9\%, resulting in a return-risk ratio of 0.26. Under a scenario where the Swiss investor decides to take the full currency exposure (NH), the portfolio grows to a value of 178.6. This is not materially different from the full-hedge case. However, the standard deviation is considerably higher, at 17.4\%. The return-risk ratio drops to 0.21.

<table>
<thead>
<tr>
<th></th>
<th>FH</th>
<th>NH</th>
<th>OPT_N</th>
<th>OPT_P</th>
<th>OPT_A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index</td>
<td>182.8</td>
<td>178.6</td>
<td>191.7</td>
<td>199.3</td>
<td>191.1</td>
</tr>
<tr>
<td>Return (p.a.)</td>
<td>3.8%</td>
<td>3.7%</td>
<td>4.2%</td>
<td>4.4%</td>
<td>4.1%</td>
</tr>
<tr>
<td>Std (p.a.)</td>
<td>14.9%</td>
<td>17.4%</td>
<td>14.2%</td>
<td>14.7%</td>
<td>14.8%</td>
</tr>
<tr>
<td>RR Ratio</td>
<td>0.26</td>
<td>0.21</td>
<td>0.29</td>
<td>0.30</td>
<td>0.28</td>
</tr>
<tr>
<td>Avg USD</td>
<td>100%</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Avg EUR</td>
<td>100%</td>
<td>0%</td>
<td>66%</td>
<td>99%</td>
<td>94%</td>
</tr>
<tr>
<td>Avg GBP</td>
<td>100%</td>
<td>0%</td>
<td>99%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Avg JPY</td>
<td>100%</td>
<td>0%</td>
<td>80%</td>
<td>82%</td>
<td>87%</td>
</tr>
</tbody>
</table>

Table 1: Summary Statistics for the International Portfolio

Table 1 summarizes the return and risk characteristics for the benchmarks and the three variants of the ex ante optimally hedged portfolios. Further displayed are the average hedge ratios for each foreign currency. All statistics are computed for the time horizon from January 1995 to December 2010.

When the investor sets optimal hedge ratios on the basis of the historical covariance matrix \((OPT_N)\), the index value ends at 191.7. The corresponding per annum return is 4.2\% which is roughly 40 respectively 50 basis points above the benchmarks. Moreover, the standard deviation, 14.2\% in this case, is reduced. Whether the superior performance comes from slightly different local asset weights or the different hedge ratios is not determined. However, we conjecture that it is worthwhile to treat currencies as distinct portfolio positions and optimize their exposure jointly with the other portfolio holdings. Except for the USD, the optimization procedure leads to average currency hedge ratios that are different from either 0\% or 100\%. For the EUR, the average hedge ratio over the time horizon lies at 66\%. For the GBP, an almost perfect hedge is ex ante optimal. For the JPY, the average hedge ratio is 80\%.

The return-risk ratio is further improved if we choose to determine the optimal
hedge ratios using the partial shrinkage estimator \((OPT_P, \alpha = 0.5)\). In this case, the index ends at 199.3. The hedge ratios are slightly higher. In fact, they are (almost) 100% for USD, EUR and GBP. The average hedge ratio for the JPY remains close to 80%. When the shrinkage estimator is applied to the whole covariance matrix \((OPT_A, \alpha = 0.5)\), the return-risk ratio gets somewhat worse. However, it is still considerably better compared to the naive benchmarks.

![Figure 2: Wealth Accumulation for the International Portfolio](image)

Figure 2 shows the wealth accumulation over the time horizon from January 1995 to December 2010 for the unhedged benchmark (dashed blue line), the fully-hedged benchmark (solid red line) and the strategy with optimal currency hedge ratios (dashed black line). For the latter case, hedge ratios have been determined using the historical covariance matrix.

Choosing to set optimal hedge ratios is not in any case better. Figure 2 shows the performance of the full-hedge scenario (red solid line), the no-hedge scenario (blue dashed line) and the optimal scenario \(OPT_N\) (dashed black line) over the time horizon. Up to the burst of the dotcom bubble, not hedging the currency exposure is clearly the best strategy. The same holds for the bull market period from 2003 to 2007. During the crises, the full-hedge and optimal hedge strategies perform better. Clearly, the role of the CHF as safe haven currency is in effect.\(^7\)

Figure 3 shows the time line of hedge ratios (dotted lines) and the portfolio weights (red lines) for the \(OPT_P\) strategy for each foreign currency. The average exposures for USD and EUR are roughly 35% respectively 15% and about 25% for GBP and JPY. The hedge ratios for USD and GBP remain at 100% over the entire

\(^7\)Refer to Ranaldo and Soederlind (2010) for more details.
Figure 3: Hedge Ratios for the International Portfolio

Figure 3 shows the ex ante optimal currency hedge ratios over the time horizon from January 1995 to December 2010 (dotted lines). The red lines mark the corresponding weights in the local asset. Hedge ratios and weights are jointly determined using a covariance estimate with partial shrinkage.

time horizon. The EUR hedge ratio drops to 80% during the Russian crisis but otherwise stays at 100%. The JPY marks the big exception: Prior to the financial crisis of 2008, it is ex ante optimal to fully hedge the currency exposure. At the onset of the financial crisis, the hedge ratio drops to 0% and remains there until the end of the time horizon in December 2010. Given that the minimum variance optimization prescribes an almost full-hedge for all currencies up to 2008, it is this tactical shift that results in the superior performance of the optimized strategies relative to the FH benchmark. This finding is confirmed in Figure 2.

3.2 Mixed Portfolio

The truly representative Swiss investor will likely hold a significant portion in domestic assets. In this section, we repeat the above analysis for an investor with 25% in each domestic bonds and equities. The remainder is again split between USD, EUR, GBP and JPY assets, whereby the optimal holdings are jointly determined with the currency hedge ratios. Table 2 reveals the results.

The return performance for the mixed portfolio is generally better than for the
purely international portfolio. We have not investigated into this difference, but suggest that it can be attributed to the relatively strong performance of the domestic bond and equity holdings and the costs associated with currency hedging. Now that only 50% of the portfolio are invested abroad, these costs are significantly reduced.\textsuperscript{8} The full-hedge benchmark (FH) attains an index level of 215.1 by the end of December 2010. This translates into a per annum return of 4.9%. Not hedging the currency exposure leads to an index level of 210.9 or alternatively, a return of 4.8% (p.a.). The two strategies primarily differ in terms of risk: The standard deviations for the full-hedge and no-hedge benchmarks are 10.9% respectively 12.0%. Hedging is thus ex post superior, with a return-risk ratio of 0.45 versus 0.40.

Optimally determining the hedge ratios still improves the results. When the historical covariance matrix is used for the computations ($OPT_N$), the index ends at 221.8 by the end of December 2010. The corresponding return is 5.1% (p.a.). The standard deviation of 10.5% is lower than in either benchmark case, leading to a return-risk ratio of 0.49. Very similar results are obtained when the optimal hedge ratios are determined using a partial shrinkage estimator for the covariance matrix. The performance of the optimal strategy is somewhat worse when the full shrinkage estimator in (2) is used. However, the standard deviation of 10.6% is still lower than for the benchmarks and results in a favourable return-risk ratio of 0.46. In general, the return and risk differences between the optimal and the naive strategies are smaller than for the purely international portfolio. Since the hedging decision for the mixed portfolio only affects 50% of the portfolio holdings, this should not surprise. The magnitude of the differences suggests that the hedging decision has a similar impact.

When we compare the mixed with the international portfolio, we note that the

\begin{table}
\centering
\begin{tabular}{|c|c|c|c|c|c|}
\hline
 & FH & NH & $OPT_N$ & $OPT_P$ & $OPT_A$ \\
\hline
Index & 215.1 & 210.9 & 221.8 & 219.3 & 214.5 \\
Return (p.a.) & 4.9% & 4.8% & 5.1% & 5.0% & 4.9% \\
Std (p.a.) & 10.9% & 12.0% & 10.5% & 10.5% & 10.6% \\
RR Ratio & 0.45 & 0.40 & 0.49 & 0.48 & 0.46 \\
Avg USD & 100% & 0% & 100% & 100% & 100% \\
Avg EUR & 100% & 0% & 52% & 78% & 72% \\
Avg GBP & 100% & 0% & 80% & 100% & 99% \\
Avg JPY & 100% & 0% & 80% & 81% & 85% \\
\hline
\end{tabular}
\caption{Summary Statistics for the Mixed Portfolio}
\end{table}

\textsuperscript{8}By costs, we mean the forward discount that is paid away when an investor from a low interest rate country enters a forward contract to hedge the currency exposure from a high interest rate country. For the sample period examined, interest rates for the CHF have been lower on average than for USD, EUR and GBP. Only the JPY has carried lower interest rates than the CHF.
ex ante optimal hedge ratios are lower now. For USD, the average hedge ratio is still at 100%. For EUR, the ratio is 52% when the historical covariance matrix is used and about 75% for the shrinkage estimator variants. The corresponding GBP hedge ratio is 80% respectively close to 100%. The JPY hedge ratio is consistently around 80%.

![Figure 4: Wealth Accumulation for the Mixed Portfolio](image)

Figure 4: Wealth Accumulation for the Mixed Portfolio

Figure 4 shows the wealth accumulation over the time horizon from January 1995 to December 2010 for the unhedged benchmark (dashed blue line), the fully-hedged benchmark (solid red line) and the strategy with optimal currency hedge ratios (dashed black line). For the latter case, hedge ratios have been determined using the historical covariance matrix.

In Figure 4, we consider the different strategies over the time horizon from January 1995 to December 2010. In general, patterns alike those for the international portfolio emerge. Before the burst of the dotcom bubble, not hedging the currency exposure (dashed blue line) is the ex post optimal strategy. By the end of the subsequent bear market, all strategies are back on a similar index level, from whereon they move in sync. Again, a notable difference between the full-hedge benchmark and the ex ante optimal strategy is seen for the period around the financial crisis of 2008.

Figure 5 reveals the international portfolio holdings (red lines) with the corresponding hedge ratios (black dotted lines) for the optimal strategy with a partial shrinkage covariance estimator. The average portfolio holdings are roughly 20% for the USD, 5% for the EUR, 10% for the GBP and 15% for the JPY. The USD and GBP hedge ratios remain at 100% throughout the entire period. For the EUR, we
observe a number of tactical shifts, the first occurring during the Russian crisis. For a time period of about 2 years, the hedge ratio is around 10%. The second notable reduction is seen during the bear market following the dotcom crisis. The third period with a hedge ratio different from 100% occurs between 2003 and 2006. However, the EUR portfolio holdings during this time are nearly 0%, so the effect of an optimal EUR hedge is negligible. In contrast, with a portfolio weight of about 20%, the decision to take the full JPY exposure during and after the financial crisis of 2008 has a material impact.

Figure 5: Hedge Ratios for the Mixed Portfolio
Figure 5 shows the ex ante optimal currency hedge ratios over the time horizon from January 1995 to December 2010 (dotted lines). The red lines mark the corresponding weights in the local asset. Hedge ratios and weights are jointly determined using a covariance estimate with partial shrinkage.

4 Conclusion
The portfolio selection theory of Markowitz (1952) suggests that currency hedge ratios and thus currency positions should be concurrently determined with the portfolio weights. However, it is not clear whether ex ante optimal hedge ratios lead to superior ex post performance. In this article, we examine from the perspective of a Swiss-franc based global investor to what extent optimal hedge ratios differ from
two naive benchmarks with either zero or full currency hedging. Furthermore, we investigate whether a strategy with optimal currency hedge ratios indeed leads to improved ex post return-risk portfolio characteristics.

We find that for some currencies, in particular the EUR and JPY, the average optimal hedge ratios differ materially from the naive zero and full-hedge benchmarks. Furthermore, choosing to hedge according to an optimal rule results in higher return and lower risk. This holds for a purely international portfolio and to a smaller extent for a portfolio where international equity holdings are mixed with domestic assets. Although the proposed optimal strategy does not deliver superior results for every sub-period, the results suggest that in the long-run, investors fare better by integrating the currency hedging discussion with the tactical asset allocation decision.

The framework proposed herein is easily narrowed down to a setting where the tactical asset allocation is given and only the currency hedge ratios need to be determined. On the other hand, it can be extended to the case where the investor has return expectations too. In this case, the investor would set hedge ratios such that the portfolio Sharpe ratio is maximized.
References


