LONG-HORIZON CURRENCY HEDGING IN GLOBAL INDEX PORTFOLIOS

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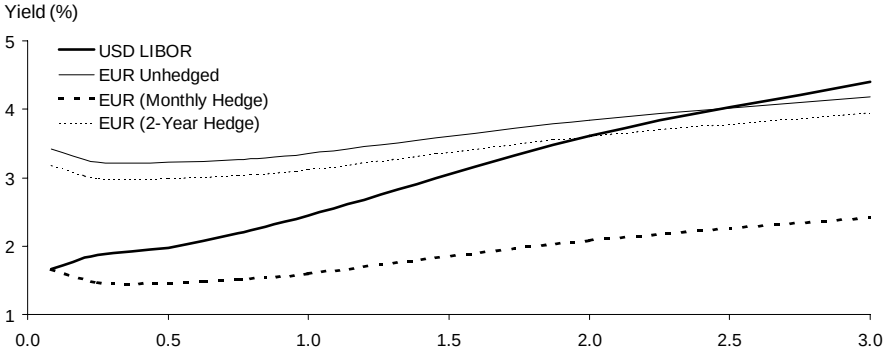
Introduction

The currency hedging strategy that underlies the calculation of hedged Lehman Brothers indices assumes that one-month forward contracts are rolled every month-end at mid-market exchange rates. As one-month rates in USD are currently lower than in EUR, hedging euro-denominated assets back to USD effectively locks in a depreciation of the euro. The difference between USD and euro rates reduces to zero for maturities just longer than two years, providing USD-based investors with an incentive to implement longer-dated hedges.

Particularly for hedged investors with a fairly stable currency allocation, the use of longer-term hedges seems to offer a significant savings in the cost of hedging over the long term. This month, we analyze the effect of using longer-term hedging strategies as a means of generating portfolio outperformance over a monthly-hedged benchmark.

Figure 1 shows the USD and EUR yield curves as of January 2, 2002 (par curves fitted to U.S. LIBOR and Euribor data, respectively). In addition, it sketches approximate curves corresponding to the effective yields available to a USD investor investing along the EUR curve on a hedged basis using two different hedge tenors: one month and two years. Essentially, the shape of these curves follows the shape of the EUR yield curve, shifted by a fixed cost associated with the hedging transaction. When the one-month hedge is used, the whole EUR curve is effectively shifted downward by the difference between the short rates in the two currencies, so that the 1-month EUR yield hedged to USD is the same as the 1-month

Figure 1. **Local Currency Yield Curves for USD And EUR, with Approximate Hedged EUR Yields for a USD Investor Using Different Hedge Tenors**



USD yield. With a 2-year hedge, the EUR curve is shifted by the much smaller difference in 2-year yields.

When we shift the curve by the difference in interest rates for the tenor of the hedge, as in Figure 1, we make a simplifying assumption: that the current shapes of the yield curves are also expectations of realized returns. This is equivalent to assuming that the current shapes of the two yield curves will remain unchanged. Thus, if both curves remain unchanged for one year, an investor in a 2-year EUR security yielding 3.84% can expect to earn a return of 3.61% (equivalent to the 2-year USD yield) by holding both the security and the 2-year hedge. Holding the same security for the year while rolling a monthly hedge will earn a return of 2.08%, if the monthly hedging cost of 1.76% in yield remains unchanged. However, if the yield differential narrows over time, the 1-month strategy will earn a higher return than shown above, as the hedging cost will be lower in later months. Similarly, the long hedge will be subject to mark-to-market interest rate risk that could make its return significantly different from that shown above. So the use of a different hedging scheme for the portfolio than that used for the benchmark exposes the portfolio to tracking error.

Choosing the Currency-Hedge Tenor

How should we implement our currency hedging? If we roll monthly forward contracts, just as in the index calculation, we certainly minimize tracking error risk. However, we will incur transaction costs each time we roll our position, and in current market conditions, our expected long-term hedging costs will be higher. We may, therefore, be tempted to select a longer-tenor hedging strategy, even though this will entail tracking error risk relative to the index.

How have such longer-tenor hedging strategies performed over time? A simple analysis of hedged returns shows that the effect of switching from the index assumption of monthly hedging to a hedge of a longer tenor is the same regardless of what EUR security is being hedged. This allows us to perform historical studies of hedging strategy performance in isolation from any particular security or index.

For any investment in a security in a foreign currency (e.g., EUR) hedged back to domestic currency (e.g., USD), the foreign investment's hedged return can be approximated as follows:

(1) Foreign hedged return ~ Foreign investment local currency return
+ Return of a domestic zero coupon of the maturity of the hedge
- Return of a foreign zero coupon of the maturity of the hedge

Now we focus on the excess return and risk of adopting a different hedging tenor than the one used in index calculation. Let us define "hedge excess return" as the difference between the foreign hedged return of our security using a hedge of arbitrary maturity and that obtained using the standard one-month hedge. By writing out equation 1 twice for the two hedge tenors and subtracting, we can establish the following relationship:

(2) Hedge excess return ~ Return of a domestic zero-coupon of the maturity of the hedge
- Return of a foreign zero-coupon of the maturity of the hedge
- Return of (a rolling investment in) a domestic one-month zero-coupon
+ Return of (a rolling investment in) a foreign one-month zero-coupon

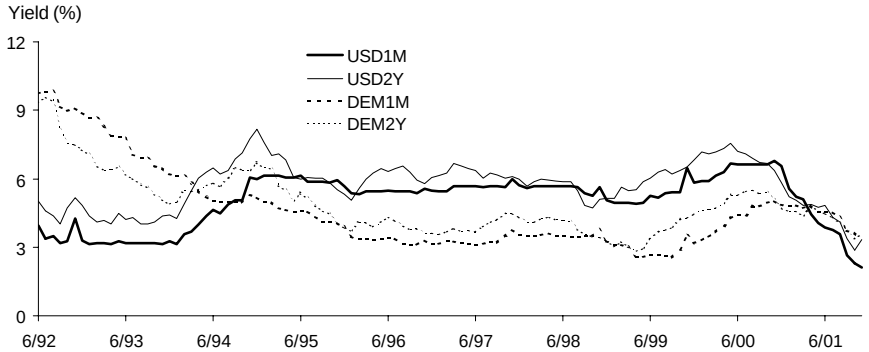
The excess return of our hedging strategy is essentially a function of the relative slopes of the foreign and domestic curves. When evaluating the risk of the long hedge strategy, we should identify the sources of relative risk: duration for the long zero coupons represented in lines 1 and 2 and reinvestment for lines 3 and 4 of equation 2. If the yield curve relative shape tends to be persistent—that is, if the current relative shape is a better predictor of future rates than indicated by the forward—then it may be possible to take advantage of the additional carry provided by longer hedge in a profitable strategy.

Note that the performance of the underlying asset is not included in equation 2. Varying the hedge tenor can effectively be seen as a non-core strategy that has nothing to do with investing the actual bond assets in the foreign market. This allows us to analyze the performance of this strategy in isolation.

We analyzed historical data since July 1992 for the USD and EUR (DEM) yield curves and tried to establish the viability of a long-horizon hedging strategy for hedging EUR positions back into USD. We considered hedge tenors of 2, 3, and 6 months, as well as 1, 2, and 3 years. For each hedge tenor, we projected the excess returns of the long hedge over the rolling one-month hedge using the approximation described above. We then calculated the realized excess return over the coming period, assuming that the long hedge would be kept in place until its maturity.

Figure 2 shows the historical yields relevant to our analysis of the 2-year hedge from July 1992 through November 2001. It includes the 1-month and 2-year rates

Figure 2. **Yield Histories for 1-Month and 2-Year Maturities in USD and EUR (DEM before January 1999)**

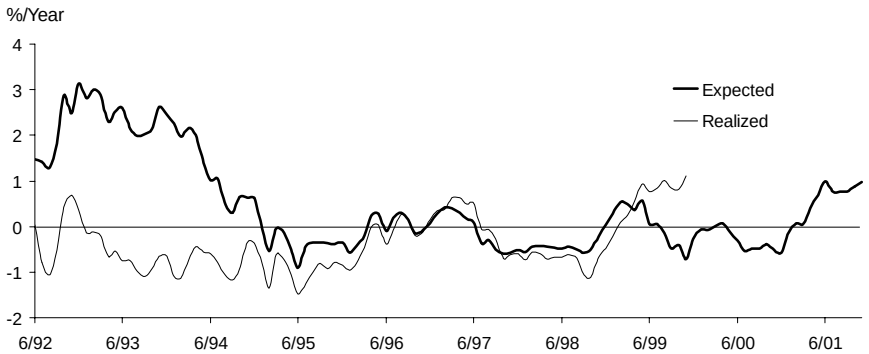


in both USD and EUR (before January 1999, we use DEM rates as a proxy). From 1992 through 1994, the USD yield curve was significantly steeper than the DEM curve—in fact, the USD curve was positively sloped, while the DEM curve was inverted. Thus, as in our Figure 1 example, there was ample incentive to use a longer hedge. The next few years brought drastic changes to the shapes and levels of both curves. For most of 1996 through 2000, both curves were positively sloped and relatively stable. During the last period shown, from the end of 2000 and through 2001, both yield curves were again very volatile.

Figure 3 shows the expected and realized excess returns for the two-year hedge over the rolling one-month hedge starting at each point in time since July 1992. The expected returns are obtained from the difference in the slopes of the two curves, as in Figure 1. This corresponds to the assumption that all rates will remain unchanged, or that relative curve shapes are persistent. For example, during all of 1993, when the USD curve was much steeper than the (inverted) DEM curve, the expected returns for the 2-year hedge were quite high. The realized returns cover the two-year period starting at each point and are, thus, affected by subsequent interest rate movements. The realized returns starting in 1993 were generally quite negative. Locking in the 2-year hedge would have been cheaper over the long run had interest rates remained the same, as indicated by our expected excess returns. But this was far from the case. As USD rates went up and DEM rates came down, the rolling monthly hedge became progressively cheaper, and even turned profitable.

The last point shown on the realized return plot of Figure 3 gives a similar but opposite example. This point shows that the 2-year hedge achieved an annualized excess return of 1.1% over the rolling one-month hedge for the period from 11/30/99 through 11/30/01. At the start of this period, USD rates were higher than EUR rates, with the difference even greater at the short end than at the 2-year point. The expected returns from our static analysis, therefore, favored rolling the 1-month hedge. Over the course of the next two years, though, the USD 1-month rate plummeted to 2.29%, while the EUR 1-month rate rose slightly, to 3.64%. The longer-term hedging strategy outperformed by locking in the advantageous yield differential, while for the short-term hedge used by the index, the differential got progressively smaller and eventually even turned the other way.

Figure 3. **Expected and Realized Excess Returns (Annualized) for a 2-Year Currency Hedge over a Rolling 1-Month Hedge**



In contrast with these two extreme examples, expected returns can be seen to be excellent predictors of realized returns during the middle part of Figure 3. This corresponds to a time in which interest rates in both currencies were relatively stable. While the correlation between the expected and realized returns shown in Figure 3 is only 0.01 over the entire time sample shown, it is 0.83 over the four years from January 1995 through January 1999.

A Simple Conditional Hedging Strategy

Could we have anticipated periods when the long hedge generated a positive excess return? We tried a very simple strategy: we implement a long hedge when it has a higher expected return than the rolling one-month forward. We tried this conditional long-hedge strategy for various tenors and obtained the results presented in Figure 4.

The results of Figure 4 are striking in two respects: the small outperformance generated by the strategy and the substantially negative information ratios obtained when investing in two- and three-year hedges.

Hedging strategies up to six months deliver positive information ratios. This may be due to the fact that, on a horizon up to six months, relative yield curve shape tends to be persistent. The small magnitude of the outperformance may be a reflection that for most of the time period analyzed, the strategy invested in the risk-free one-month contract.

The data sample is too small to draw significant conclusions at the longer hedge tenors. The longer the maturity of the hedge, the fewer data points we have for realized returns and the higher the correlations among the various observations. (There are fewer than five independent 2-year periods in our sample.) In addition, the binary nature of our strategy causes it to have zero excess returns for more than half of the months of the study.

The results above assumed that one holds the currency-hedge positions until maturity and, therefore, did not mark to market the long hedge as a function of changes in relative interest rates. This, however, will not be the case if one considers unwinding a position to enter a new one of a different tenor as a consequence of changes in views on relative interest rates. Without running a more extensive analysis, one can set the order of magnitude for the interest rate risk embedded in the long hedge strategy. The first part of equation 2 tells us that we are exposed to the volatility of relative interest rates as a function of the

Figure 4. **Excess Return of Conditional Long Maturity Hedge Strategy versus One-Month Rolling Contracts**

Long Maturity	**2-Mo**	**3-Mo**	**6-Mo**	**1-Yr**	**2-Yr**	**3-Yr**
Average Excess Return (bp/yr)	1.9	2.9	3.6	2.1	-16.1	-41.9
Standard Deviation (bp/yr)	2.8	3.5	5.6	8.8	13.4	16.7
Information Ratio	0.67	0.83	0.65	0.24	-1.20	-2.51

remaining duration of the long hedge. We measured the volatility of monthly changes in spreads between the EUR (DEM) and USD yields for the various tenors presented in Figure 4. The annualized standard deviations were between 88 and 105 bp/year, i.e., numbers similar to the absolute yield volatilities that we could observe in the USD curve.

Conclusion

One can conclude that implementing a long-horizon currency hedging strategy is effectively a view on the direction of relative interest rates between the domestic and foreign curves. Using carry as a predictor delivers good information ratios for maturities up to six months if we ignore the mark-to-market effects associated with the repricing of the long horizon hedge.

For maturities longer than six months, the long hedging strategy can effectively be seen as a non-core interest rate trading strategy aimed to implement views on the spread between the domestic and foreign yield curves.

Publications: L. Pindyck, A. DiTizio, B. Davenport, W. Lee, D. Kramer, S. Bryant, J. Threadgill, R. Madison, A. Acevedo

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