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Online appendix for BIS Bulletin no 123: "Investment funds' de facto currency risk exposure"

Data and methodology

The data comprise a subset of the Lipper panel funds domiciled in the euro area and investing in US assets, of which roughly two thirds are equity funds and the remaining are bond funds. Of the funds, 94% are mutual funds, with another 5% exchange traded funds and the remaining residual distribution consisting of insurance and pension funds.

We compute the measure of the hedge ratio across an unbalanced panel of almost 3,400 funds over a 10-year period, on a 52-week (*t*) rolling window basis per each individual fund (*i*). The rolling window method assigns equal weights to all observations in the sample, and its choice is motivated by simplicity. Other filtering choices, such as a Kalman filter, or shorter windows may be used to derive hedge ratio proxies that are more responsive to the latest observations, at a trade-off with the robustness of the results.

Our computational method follows a two-step approach, under the assumption that fund managers first decide on their investment policy for their core underlying asset class and only then determine their currency overlay. In the first stage, we regress individual fund weekly returns on their respective benchmark return, in line with the standard Capital Asset Pricing Model (CAPM). The coefficients α_{iM} and β_{iM} will thus capture the fund's systematic sources of return, corresponding to fund manager skill and exposure to market risk. The unexplained variability is absorbed by the estimated residuals $e_{i,tM}$.

$$Return_{i,t} = \alpha_{iM} + \beta_{iM} \cdot Benchmark\ Return_{i,t} + \varepsilon_{i,tM}$$

Subsequently, we regress the residuals obtained from the first stage regression on the change in the EUR/USD exchange rate ($\Delta S_{i,t}$). The objective is to measure the sensitivity of the unexplained portion of fund returns to exchange rate movements.

$$e_{i,tM} = \alpha_{iFX} + \beta_{iFX} \cdot \Delta S_{i,t} + \varepsilon_{iFXt}$$

A large negative β_{iFX} would imply that the fund's excess return is driven by exchange rate moves, indicating the presence of no, or limited, currency hedging.

Finally, given β_{iFX} from the previous regression for each rolling window across the whole sample period (τ), we define the individual weekly hedge ratio as:

$$HR_{i,\tau} = 1 + \beta_{i,\tau FX}$$

With this approach, a $\beta_{i,\tau FX}$ coefficient of zero would imply perfect FX hedging; whereas $\beta_{i,\tau FX} = -1$ would set the hedge ratio to zero, equivalent to no hedging, providing a standardised measure of the hedge ratio which is consistent with the literature and market practice.

To obtain a robust aggregate measure of the hedge ratio representing the general market trend, we aggregate the individual weekly hedge ratios across funds within each asset class (equity and bond), weighted by the respective average weekly individual total net assets ($\omega_{i,\tau}$).

$$Aggregate\ HR_{\tau} = \sum_{i=1}^{n} \omega_{i,\tau}\, HR_{i,\tau}$$

To account for large contemporaneous market moves, we also propose an adjusted estimate of the hedge ratio, reflecting the fact that funds may find themselves under- or over-hedged simply by virtue of sudden shifts in the value of their underlying assets and before they can make a conscious adjustment to their hedge ratio. Intuitively, a fund with a larger exposure to equities $\beta_{i,\tau M}$ will end up mechanically more over-hedged following a large decline in the stock market:

$$Adjusted\ HR_{i,\tau} = HR_{i,\tau} \cdot \left(1 + \beta_{i,\tau M} \cdot Benchmark\ Return_{i,\tau}\right)$$

which we then aggregate across funds to obtain the adjusted aggregate hedge ratio:

$$Adjusted\ Aggregate\ HR_{\tau} = \sum_{i=1}^{n} \omega_{i,\tau}\, Adjusted\ HR_{i,\tau}$$

Given that results for the adjusted and non-adjusted hedge ratio are not markedly different, we report our main results for the non-adjusted case, though they also hold for the adjusted scenario.

① The panel consists of an average of 1,700 unique funds per week, oscillating between a minimum of 865 and a maximum of 2,449 funds per week, increasing across the covered time frame. ② Alternatively, we can express the sensitivity of the unexplained portion of fund returns to exchange rate movements as $e_{i,tM} = \alpha_{iFX} + \lambda\,\beta_{iFX} \cdot EURUSD_{i,t} + \varepsilon_{iFXt}$, where λ is a scaling parameter calculated such that the sum of squared residuals is minimised to overfit the returns. We set λ = 1 in our estimation, as it increases the stability of our estimates.