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INVESTMENT MANAGEMENT

European and Japanese investors: Consider not fully hedging your USD exposure

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Europe- and Japan-based investors typically hedge all foreign currency exposure back to their local currencies, but is this the best practice? We have computed several FX hedge ratios and find that fully hedging USD exposures may be suboptimal. We estimate an optimal FX hedge ratio of around 66% for euro-based investors and 80% for Japan-based investors. When allowing for monthly rebalancing of the hedges, we find that the optimal FX hedge ratios are, on average, very close to the static ones, but are volatile and change drastically during episodes of heightened risk aversion.

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As an example of this common practice, an asset manager residing in the euro area with exposure to the USD-denominated JPMorgan EMBIG Index (a benchmark comprising hard-currency-denominated sovereign and quasi-sovereign debt), may offset the USD exposure by entering a matching long EURUSD (eurodollar) position through a derivative (usually, an FX forward or swap).

However, this practice can be expensive, particularly in the current environment where euro and Japanese yields are significantly below U.S. yields. That is, these hedges incur negative carry because being long EUR (or JPY) vs. the USD is equivalent to borrowing in USD at a given rate, and investing the proceeds at a much lower EUR (or JPY) rate. **Furthermore, given the typical underperformance of the EUR vs. the USD during spikes in global risk aversion, the cost of fully hedging USD exposure back to EUR**

could be even higher. The opposite may occur for Japanese investors: JPY tends to rally in risk-off scenarios and the optimal response would be to over-hedge.[1] Therefore, 100% FX hedge ratios are not necessarily the optimal way to manage the USD exposure.
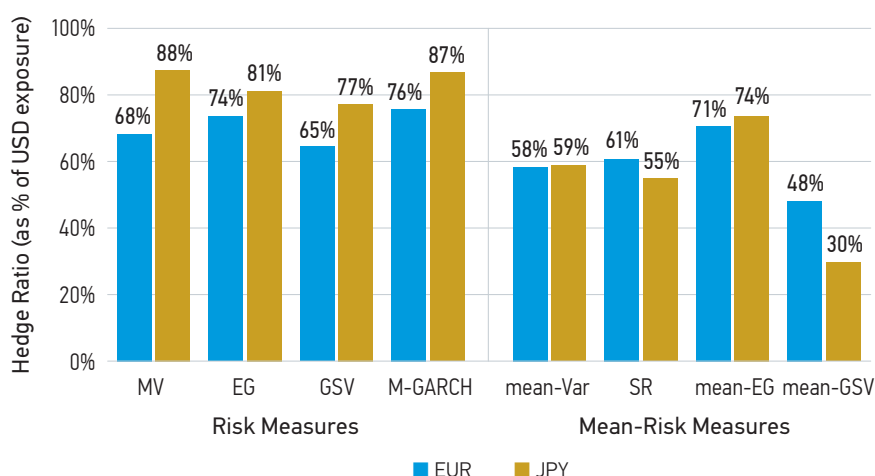
In this paper, we look at several FX hedging strategies proposed by finance literature with the goal of calculating an optimal FX hedge ratio of an underlying USD position. We will examine both **static** hedging strategies, where the FX hedge ratio remains constant throughout the investment horizon, and more realistic **dynamic** hedging strategies, where the hedge ratio is rebalanced frequently. **All the metrics considered in our sample suggest that euro- and Japan-based investors should consider only partially hedging their USD exposure.**

Moreover, dynamic FX hedge ratios are, on average, similar to the static ones. However, they are volatile and exhibit sudden spikes during periods of heightened risk aversion, leading to FX hedge ratios that can materially deviate from the static ones.

The results presented here are illustrative and do not imply investors should follow the recommendations, as the truly optimal hedge ratio will be a function of the underlying USD exposure, current market conditions, and individual investors' views about expected returns of both the underlying and hedging assets. However, we believe the computed FX hedge ratios are similar enough to provide managers with a useful framework on how to manage FX risks.

EUR and JPY investors should consider only partially hedging their USD exposure

Source: Morgan Stanley Investment Management, Bloomberg. As of May 31, 2019.
Notes: MV = Minimum Variance, EG = Extended Gini, GSV = Generalized Semivariance, M-GARCH = Multivariate GARCH (average), mean-VAR = Mean-Variance, SR = Sharpe Ratio, mean-EG = Mean Extended Gini, mean-GSV = Mean Generalized Semivariance. Please see appendix for definitions.

Two frameworks to calculate optimal FX hedge ratios

There are many criteria that may guide the search for the optimal FX hedging ratio.[2] The general approach is to pick the FX hedge so that it optimizes a certain objective. Typically, the investor chooses an FX hedge ratio that minimizes the volatility of the hedged portfolio return.[3] Such a risk minimization framework may provide useful results, particularly when the expected return of the FX futures contract is zero, that is, when the positive interest rates differential exactly offsets the expected FX depreciation implied by the forwards.

However, when investors' views about the currency differ from those implied by the market, the risk minimization framework is not flexible enough.

Therefore, we also study a risk-adjusted maximization framework to reflect the risk-return trade-off in hedging FX exposure. The appendix provides definitions for the specific criteria we consider when implementing both approaches.

Static and dynamic FX hedge ratios

The metrics we considered are typically calculated under the assumption that the FX hedge ratio will remain unchanged throughout the entire investment horizon, regardless of possible changes in market conditions. However, the volatilities and correlations among asset returns vary: an FX hedge ratio that fails to adjust to changing market environments is likely to underperform. Therefore, we also calculate an FX hedge ratio alternative[4] that can be adjusted every month, and

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[1] A comprehensive study of currency responses to risk-off events can be found in De Bock and De Carvalho Filho, "The Behavior of Currencies during Risk-off Episodes," IMF Working Paper No. 13/8, 2013.

[2] For those interested in the broad issue of hedging a position (it could be equities, bonds, FX, commodities, etc.) with futures contracts, please refer to a comprehensive survey by Chen, Lee and Shrestha, "Futures Hedge Ratios: A Review," The Quarterly Review of Economics and Finance, 43 (2003) 433-465.

[3] The variance is the traditional measure of risk or volatility, but the financial literature has examined alternative metrics that are less restrictive. In particular, risk measures, such as the Gini coefficient and the semi-variance can also be considered to compute optimal FX hedge ratios. Please refer to the appendix for definitions.

[4] The specific approach we consider is a multivariate GARCH method. See appendix for further details.

depends on estimates of volatilities and correlations of asset returns at the time of each rebalancing.

Euro- and Japan-based investors: you may be better off partially hedging your USD exposure

Both static and dynamic FX hedge ratios are computed for hypothetical euro- and Japan-based investors holding a single USD exposure, represented by the JPMorgan EMBIG benchmark index. The data for the analysis consists of unhedged EUR and JPY monthly EMBIG returns, and returns for 1-month EURUSD and USDJPY FX forwards, spanning the period January 1999-May 2019, for a total of 248 observations. All the data is available in Bloomberg.
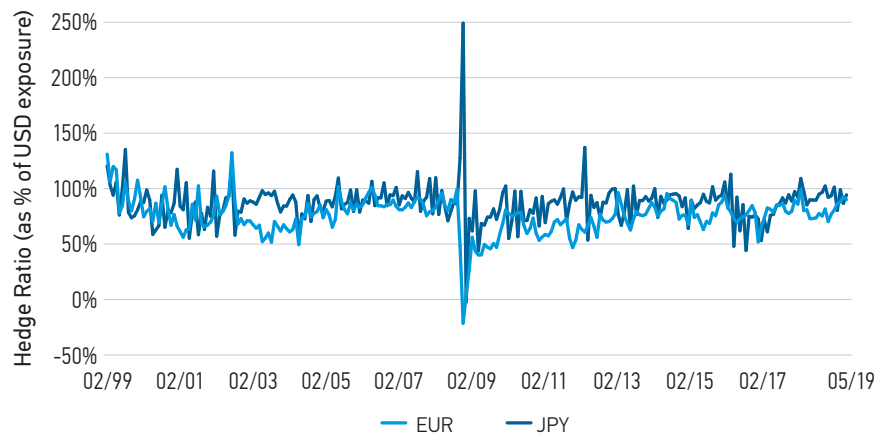
Optimal FX hedging ratios for EUR-based investors are typically in the 60%-80% area though there is some variation depending on the optimality criterion (see left side of *Display 1*). All these metrics imply lower FX hedge ratios than the usual practice of fully hedging one's FX exposure.

When we consider mean-risk hedge ratios, that is, those that attempt to strike an optimal balance between risk and expected return, the results for the euro-based investors are in line with intuition: they tend to prescribe slightly lower FX hedge ratios than those obtained from a pure risk-minimization framework. This is because mean-risk hedge ratios take into account the expected return of the long one-month EURUSD forward contract, which we estimated as slightly negative, at 6 basis points per month.[5] That is, there is a cost to hedging the USD exposure because the appreciation of the EUR vs. the USD during the sample period did not compensate for the negative EUR-USD rate differential.

We ran the same calculations for a hypothetical Japanese manager with a USD exposure via the EMBIG benchmark. The minimum-variance

DISPLAY 2
Dynamic FX hedges are volatile and jump in episodes of market stress

Source: Morgan Stanley Investment Management, Bloomberg. Data from January 1999 through May 2019.

(MV) approach recommends a Japanese investor to hedge about 88% of the USD exposure. Other risk-based measures prescribe similar FX hedge ratios, but one interesting result of these calculations is that the optimal FX hedge ratios for Japan-based investors are uniformly higher than those prescribed to the EUR-based investor. This is partly explained by the fact that the JPY forward is a better hedging asset than the EUR forward, because the JPY forward returns correlate better with the unhedged returns of the underlying, than in the EUR case.

However, when we consider risk-adjusted measures of expected returns, the optimal FX hedges for a Japan-based manager can sometimes be lower than those calculated for the euro-based manager. These results reflect the higher negative carry of long JPY positions (versus EUR longs) used to hedge the USD exposure. In other words, because JPY rates in the time sample considered were, on average, lower than their EUR equivalents, hedging with short USDJPY forwards is more expensive, thus lowering the optimal hedge ratios prescribed by mean-risk based approaches.

Dynamic hedge ratios are volatile and react significantly to spikes in risk aversion

In this section, we go beyond constant FX hedge ratios to consider frequently rebalanced hedges based on monthly estimates of return volatilities and correlations among assets. *Display 2* reports these dynamic FX hedge ratios for both euro- and Japan-based managers.

Dynamic FX hedge ratios exhibit significant variation, typically fluctuating in an interval between 50% and 100%. The average EURUSD hedge ratio is about 76%, which is broadly in line with static hedges. Similarly, for Japan-based investors: the average FX hedge ratio is about 87%, very close to the constant hedges.

However, there are significant spikes in hedge ratios, most notably during the global financial crisis in the second half of 2008. Up to September 2008, a euro-based investor following a dynamic hedging strategy would have been fully hedging the USD exposure, whereas a Japanese investor would have hedged about 90% of it. In the two subsequent

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[5] We use historical average monthly returns as proxies for expected long EURUSD one-month forward and EUR-unhedged EMBIG returns. In turn, EMBIG unhedged returns can be broken down into two components: a USD-denominated return (due to carry and duration) and an FX return (for eurozone-domiciled investors, a depreciation of the EUR against the USD is another source of positive return).

months, these optimal FX hedge ratios would have drastically changed: the euro-based investor would have reduced FX hedges to a net USD exposure of 121% of the underlying USD position by November, while a Japan-based investor, on the contrary, would have overhedged by increasing short USDJPY positions to 250% of the USD exposure in November 2008 (see *Displays 3* and *4*).
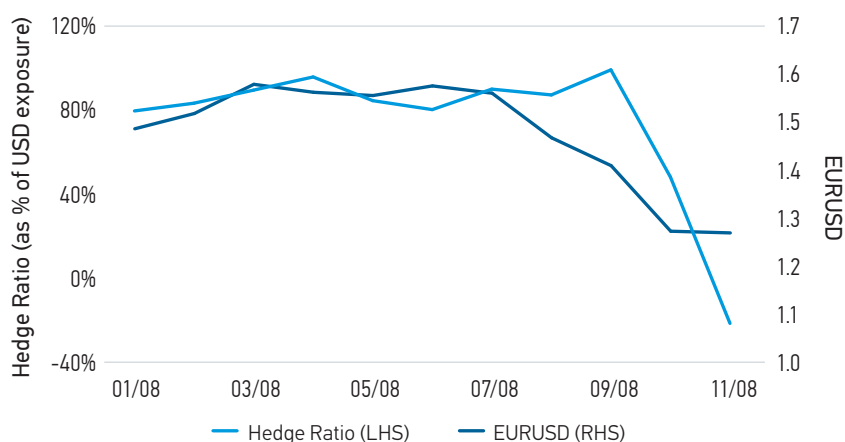
The sharply asymmetric response of the EUR and JPY FX hedges in stress scenarios reflects the fact that in risk-off environments, the USD tends to appreciate versus the EUR (because of the latter's high beta to the VIX, a proxy for risk aversion), but typically depreciates against the JPY (as spikes in risk aversion prompt investors to unwind carry trades, which are funded by low yielding currencies, such as JPY or CHF).[6] In fact, during the October-November 2008 period, the EUR depreciated by 11% against the USD, while the JPY strengthened by the same amount.

Conclusion

We put the theory of futures hedging to use to address the situation European and Japanese investors face when managing USD exposure. The main takeaway is that fully hedging USD exposure back to domestic currencies appears to be suboptimal, as all the risk-based approaches we examined point to optimal FX hedges around 66% for euro-based investors and 80% for Japan-based managers. Mean-risk approaches, which factor in the cost of hedging USD exposure with long EURUSD and short USDJPY positions, suggest even lower hedge ratios. Finally, to account for time-varying volatilities and correlations, we explored dynamic hedge ratios that are, on average, close to those prescribed by static methods, but that exhibit significant volatility and change suddenly in response to spikes in global risk aversion.
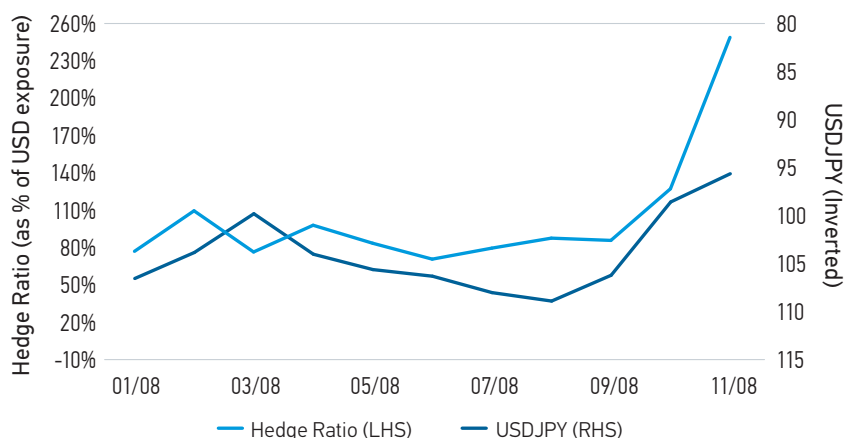
Euro-based investor would have gone net long USD during the Global Financial Crisis…

Source: Morgan Stanley Investment Management, Bloomberg. Data from January 1999 through May 2019.

…whereas a Japan-based manager would have overhedged the USD exposure

Source: Morgan Stanley Investment Management, Bloomberg. Data from January 1999 through May 2019.

[6] See reference in fn.1.

Appendix

In this section, we introduce the specific objective functions that we used to calculate the optimal FX hedge ratios:[7]

- **MINIMUM VARIANCE (MV):** under this approach, the investor picks the hedging ratio that minimizes the variance of the return of a portfolio comprising the USD exposure and FX forwards (either a long EURUSD or short USDJPY forward). The MV objective is consistent with an investor that is extremely risk-averse and/or when the expected return of the forward is zero (i.e., the interest rate differential between USD and EUR (or JPY) exactly offsets the expected change in the EURUSD (or USDJPY) spot).

- **MEAN-VARIANCE (MEAN-VAR):** this method takes into consideration the trade-off between risk and return when deriving the optimal hedging ratio. Unlike the MV approach, it can accommodate for FX views that differ from what is being priced in by the forwards.

- **SHARPE RATIO (SR):** this approach offers another way to account for the risk-return tradeoff of the hedging portfolio that does not require specifying investors' preferences toward risk (unlike the mean-Var approach). More specifically, the investor adjusts the hedging ratio of the USD bond position to maximize the risk-adjusted expected return of the hedged portfolio, net of a risk-free rate (given by U.S. LIBOR).

- **EXTENDED GINI (EG):** the Extended Gini coefficient is an alternative measure of risk, which has better statistical properties than the previous MV criterion, and is less restrictive on assumptions regarding the distribution of returns or investors' risk preferences. Within this approach, the manager picks the FX hedge ratio that minimizes the EG function.

- **MEAN-EXTENDED GINI (MEAN-EG):** this measure builds on the EG criteria by also incorporating the expected return on the hedged portfolio. Therefore, the investor will pick the hedge ratio that maximizes the mean-EG objective function.

- **GENERALIZED SEMIVARIANCE (GSV):** unlike the traditional variance measure, which captures dispersion around the mean on both sides of it, the GSV captures the notion of downside risk, thus better aligning with the asymmetric way portfolio managers tend to view risk (for example, negative returns are perceived as more risky than positive returns).

- **MEAN-GSV:** this approach adds the expected return of the hedged portfolio to the GSV metric, to compute an optimal hedge.

- **MULTIVARIATE-GARCH:** this approach, by assuming asset return correlations and volatilities change with time, allows us to compute dynamic FX hedge ratios that vary month-to-month depending on market conditions. GARCH stands for Generalized Autoregressive Conditional Heteroskedasticity. In plain English, this approach attempts to capture the tendency of a financial variable's volatility to change through time and its persistence ("volatility begets volatility").

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[7] See reference in fn.2.

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Fixed income securities are subject to the ability of an issuer to make timely principal and interest payments (credit risk), changes in interest rates (interest rate risk), the creditworthiness of the issuer and general market liquidity (market risk). In the current rising interest rate environment, bond prices may fall and may result in periods of volatility and increased portfolio redemptions. **Longer-term securities** may be more sensitive to interest rate changes. In a declining interest rate environment, the portfolio may generate less income. Certain **U.S. government securities** purchased by the strategy, such as those issued by Fannie Mae and Freddie Mac, are not backed by the full faith and credit of the U.S. It is possible that these issuers will not have the funds to meet their payment obligations in the future. **Public bank loans** are subject to liquidity risk and the credit risks of lower-rated securities. **High-yield securities (junk bonds)** are lower-rated securities that may have a higher degree of credit and liquidity risk. **Sovereign debt securities** are subject to default risk. **Mortgage- and asset-backed securities** are sensitive to early prepayment risk and a higher risk of default, and may be hard to value and difficult to sell (**liquidity risk**). They are also subject to credit, market and interest rate risks. The **currency market** is highly volatile. Prices in these markets are influenced by, among other things, changing supply and demand for a particular currency; trade; fiscal, money and domestic or foreign exchange control programs and policies; and changes in domestic and foreign interest rates. Investments in **foreign markets** entail special risks such as currency, political, economic and market risks. The risks of investing in **emerging market** countries are greater than the risks generally associated with foreign investments. **Derivative instruments** may disproportionately increase losses and have a significant impact on performance. They also may be subject to counterparty, liquidity, valuation, correlation and market risks. **Restricted and illiquid securities** may be more difficult to sell and value than publicly traded securities (liquidity risk). Due to the possibility that prepayments will alter the cash flows on **collateralized mortgage obligations (CMOs)**, it is not possible to determine in advance their final maturity date or average life. In addition, if the collateral securing the CMOs or any third-party guarantees are insufficient to make payments, the portfolio could sustain a loss.

DEFINITIONS

Duration is a measure of the sensitivity of the price (the value of principal) of a fixed-income investment to a change in interest rates. Duration is expressed as a number of years. Rising interest rates mean falling bond prices, while declining interest rates mean rising bond prices.

Forward is a derivative security that is a non-standardized contract between two parties to buy or to sell an asset at a specified future time and price.

A **swap** is a derivative contract through which two parties exchange financial instruments.

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