



ABSTRACT

Investing in foreign assets can improve the diversification profile of U.S. institutional investors, but this comes at the expense of introducing currency risk to a portfolio. Given that currency returns are volatile and difficult to predict, many investors consider implementing currency-hedging programs to reduce or eliminate the volatility that results from foreign currency exposures.

This paper examines the prospect of hedging currency risk, evaluating the different methods used to established hedges and types of currency management overlay programs, as well as the historical risk, returns and costs of hedging developed market and emerging market currency exposures.

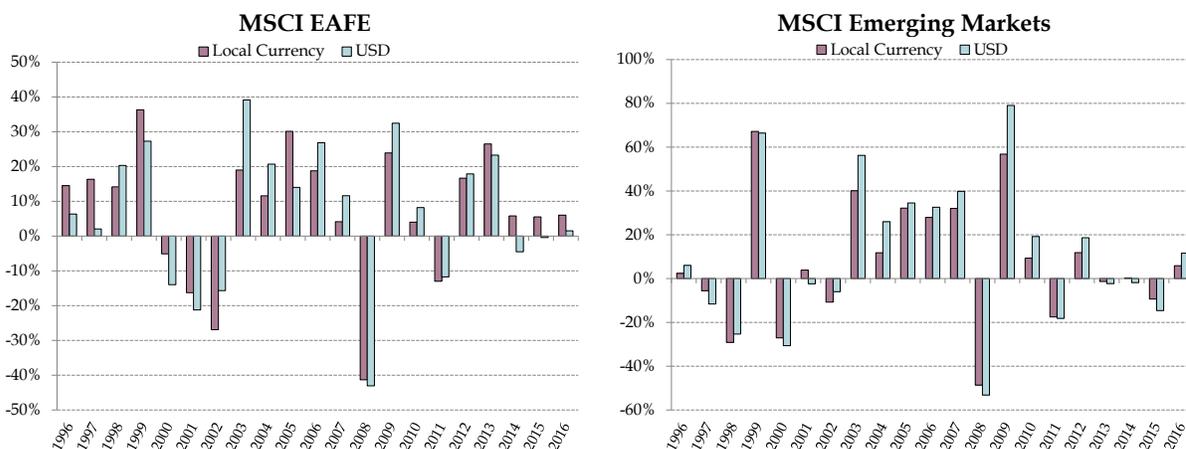
Meketa Investment Group recommends investors evaluate their currency hedging decisions from a total portfolio perspective that incorporates portfolio-wide exposure, hedging costs, and volatility and return targets.

INVESTING IN FOREIGN CURRENCY ASSETS

The vast majority of institutional investors in the U.S. diversify their portfolios by investing in foreign assets. This exposes their portfolios to a new risk: currency risk.

Currency risk is a result of purchasing assets denominated in a foreign currency. Doing so requires converting dollars into the foreign currency (e.g., euros) at the prevailing exchange rate. When these assets subsequently are sold, the proceeds must then be converted back into dollars at the new exchange rate. This new exchange rate will likely be different than the one at which the assets were purchased, either increasing or decreasing the value of the assets to the U.S.-based investor, and thus introducing additional volatility to the portfolio. Even the process of marking the portfolio to market on a daily basis requires using the prevailing exchange rate, which generates volatility.

Chart 1. Currency Effect on Foreign Asset Returns
Calendar Year Returns: 1996 - 2016

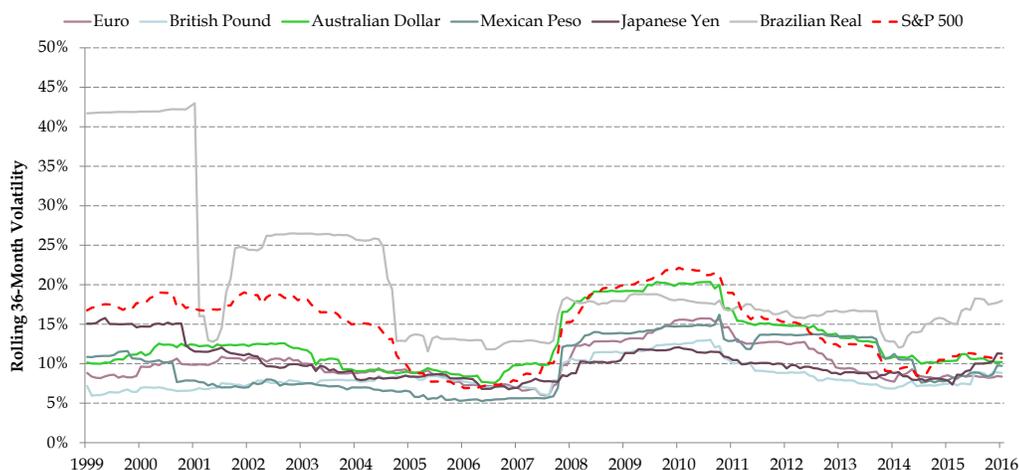


Currency Risk

The majority of the value of the world's currencies is in free-floating currencies, meaning their value is for the most part determined by supply and demand dynamics in the open market. This dynamic, while deemed generally positive for international trade and finance, introduces currency risk to foreign investments because the future value of a currency cannot be determined in advance. The following chart illustrates how the volatility of a currency varies by country and over time.

Chart 2. Currency Volatilities Relative to U.S. Dollar

Monthly Returns: January 1997 - December 2016



The return of any foreign asset for a U.S. investor comes from two factors: the return of the assets in foreign currency and the return from the foreign currency relative to U.S. dollars:

$$\text{Foreign Asset Return}_{USD} \approx \text{Foreign Asset Return}_{LC} + \text{Foreign Currency Return}$$

Foreign currency returns will not only affect the total return of a foreign asset, they will also influence its risk. Currency returns can be volatile, causing disruptions that can greatly increase the volatility of a foreign investment. Below we describe how the risk of a foreign asset investment can be expressed in terms of the risk of the foreign asset in local currency and the foreign currency risk:

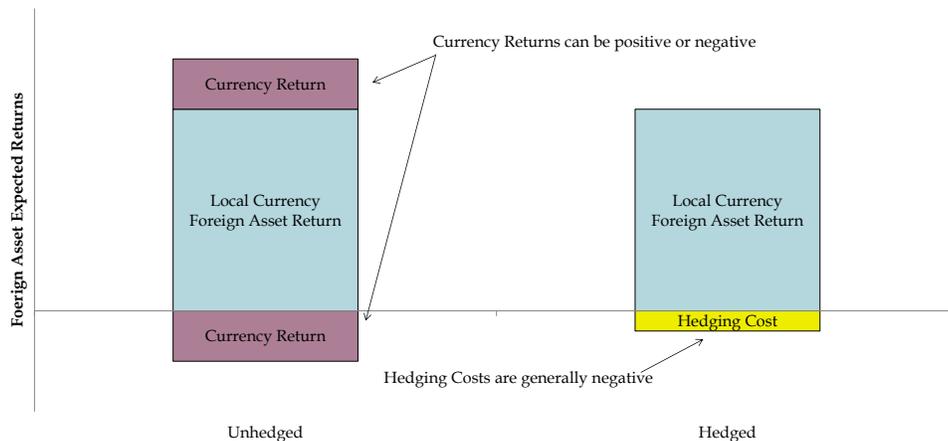
$$\text{Foreign Asset Risk}_{USD} \approx \text{Foreign Asset Risk}_{LC} + \text{Foreign Currency Risk} + \text{Correlation}$$

The relationship above is similar to the one between two assets in a portfolio, where correlations drive the total expected risk of the investment. We can observe that foreign currency risk adds to the total risk of a portfolio, with the exception of when the currency is negatively correlated with the asset.

Currency Hedging Introduction

Given that currency risk is a residual risk from investing in foreign assets, investors that wish to reduce or eliminate exposures to unwanted risks in their portfolios may consider a currency hedging strategy, that is, investments designed to reduce or eliminate a portfolio's foreign currency exposures.

Chart 3. Currency Hedging



Hedging currency risk requires entering into positions that counter the implied exposures introduced by investments in foreign currency assets. For example, a U.S. investor that buys a Japanese Government Bond (JGB) will receive coupons denominated in Japanese yen (JPY), implicitly creating a long position in JPY. To hedge this exposure away, the investor should enter into an agreement to sell JPY and buy U.S. dollars for the amount of its coupons and the bond's par value, and at the date they are expected to be received.

Below are the most popular instruments used to manage currency exposures:

- **Currency Forwards:** Customized over-the-counter derivative instruments in which two parties agree to buy or sell a currency pair at a specific future date, for a specific amount and at a fixed exchange rate. These are the most common instruments used to hedge currency exposures, as large banks can usually tailor the contracts to the needs and objectives of institutional investors. However, they introduce counterparty risk.
- **Currency Futures:** Similar mechanics to currency forwards yet are not customizable, as they are standardized contracts traded on an exchange, which specifies the contract's maturity dates and sizes. Futures, as opposed to forwards, virtually eliminate counterparty risk, but introduce basis risk¹ to portfolios.
- **Currency Options:** Derivative instruments that give the buyer the right, but not the obligation, to enter into a currency transaction (buy or sell) for a given amount and on a specified date.² Options provide the most convenient payoff given their execution flexibility, but at the cost of an option premium, which is a

¹ Basis risk refers to the mismatch that occurs when a specific currency hedge cannot be fully implemented through a future given their standardized nature of contracts. For example, an investor looking to sell 1,250 GBP in 13 months who finds out there are only GBP futures available for 1,000 GBP increments and maturities up to 12 months will incur basis risk.

² Most options contracts are European style, meaning they can only be exercised at the expiration date of the contract. In contrast, American style options can be exercised at any time before the contract's expiration date.

cash payment required to enter into the derivative contract. Options are available as both exchange-traded and over-the-counter instruments.

- **Currency Swaps:** Over-the-counter³ derivative instruments in which two parties agree on scheduled cash flow exchanges in two currencies for a determined period of time. Similar to forwards, swaps introduce counterparty risk to investors' portfolios. Swaps are generally used to hedge the currency risk of foreign bonds.

To achieve currency exposure through derivatives, investors must generally post initial collateral or margin on their positions. Most currency futures and forwards require 10% or less of the notional amount of the position to be posted in collateral. However, the regular marking to market of positions⁴ will cause fluctuations in the value of the cash posted as collateral, which requires strict collateral management policies to ensure compliance with required margins.

Furthermore, during extreme negative events, such as a drastic appreciation of a foreign currency being hedged by a U.S. investor, the cash collateral posted may not be sufficient to cover the losses generated by the derivatives position and investors may face a margin call, where the entity enforcing the derivatives contracts demands that the investor on the losing side of the derivatives position post additional cash collateral to cover its losses and re-establish the initial collateral level. If the investor does not have sufficient liquid assets to comply, they may need to liquidate positions in invested assets to support the margin call. If they are unable to do so, the derivatives position may be "unwound" against the investor's wishes, which eliminates the exposure and leaves the investor unable to participate in any gains from a subsequent rebound.

CURRENCY HEDGING AS AN INVESTMENT DECISION

Understanding the effect of currency risk in foreign investments, institutional investors can decide about how to deal with this risk in their portfolios. The decision to hedge or not hedge currency risk should be based on several factors that are specific to each investor.

- I. **Currency Outlook:** We have seen how currency returns affect the total return of a foreign asset investment and its risk. So a currency-hedging decision can be implemented strategically or tactically in an institutional portfolio. If an investor does not have any views on the return of currency and/or does not want exposure to currency risk, then a strategic decision to hedge away currency risk might be warranted. However, if current market conditions lead to expectations of positive currency returns, an investor can tactically lower or remove hedges to attempt to capture these returns. From the perspective of a U.S.-based investor, a

³ Swaps have historically been over-the-counter instruments, yet recent regulations have led to the creation of clearinghouses for exchange-traded swaps.

⁴ Marking to market refers to a process where the value of a derivatives contract is reset periodically (daily for futures and any exchange traded instrument) and gains (losses) are delivered to (collected from) the parties participating in the transaction.

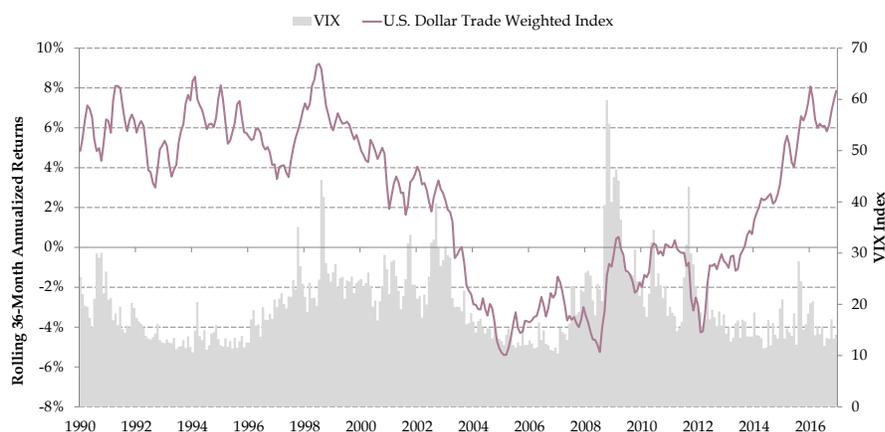
positive currency return will occur if the foreign currency is expected to appreciate against the U.S. dollar (i.e., the dollar is “weakening”).

However, currencies are very volatile (see chart 2), can deviate from equilibrium for long periods of times, and can be influenced by external non-market factors (e.g. central bank intervention), making tactical currency bets very risky.

One additional caveat for U.S. investors: the U.S. dollar is considered the base currency of the world, and as such it has historically behaved as a safe haven during periods of market stress, generating foreign currency losses to investments in foreign assets during these times (see chart 4, below).

Chart 4. Foreign Asset and Currency Return Correlations

Monthly Returns: January 1990 -December 2016.



II. Size of foreign currency exposure: The larger the allocation to foreign investments, the more foreign currency risk there is in a portfolio. Hence there might be some threshold of foreign currency exposure up to which the investor does not hedge, but over which they choose to hedge. Hedging foreign currency exposure probably represents a more important question for non-U.S. investors whose portfolios are not as heavily tilted towards domestic assets.

III. Cost of hedging: Hedging currency exposure through derivatives such as forwards and futures can be relatively inexpensive for developed market currencies such as the euro, Japanese yen, and British pound. However, less liquid currencies such as those of emerging market countries incur higher costs, which can detract from performance over the long term.

For U.S. investors, the cost of hedging currency exposure is related to the short-term interest rate⁵ differential between the U.S. and the other currency’s country or region, known as the cost of carry. The higher the difference between a foreign currency’s local interest rate and that of the U.S., the higher the cost to hedge it for U.S. investors. While the cost of carry has historically been low relative to developed market currencies, it has been high relative to emerging market currencies (see chart 5, below). The cost of carry can also be negative: in

⁵ The 3-month government bond rates are most commonly used.

cases where the U.S. interest rate is higher than the foreign currency's domestic rate, U.S. investors should expect a positive yield from their foreign currency hedges.

Furthermore, although still very liquid in an absolute sense, emerging market currency derivatives tend to be less liquid than developed market currency derivatives, introducing some liquidity risk for programs that aim to hedge emerging market currency exposures.

Finally, transaction costs vary based on the type of hedge and frequency of implementing the hedge. Rolling over contracts more frequently provides a better hedge (i.e., less basis risk), but incurs greater trading costs.

Chart 5. Cost of Hedging⁶

Annual Rates: January 1996 - September 2016



IV. Types of foreign assets in portfolio: To effectively hedge currency exposure, investors need to estimate future values for their foreign assets. The inherent volatility of foreign assets can be a source of basis risk⁷ in currency hedges. Less volatile assets such as developed market investment-grade bonds can have their currency exposure hedged with lower basis risk than more volatile asset classes such as emerging market equities.

Currency accounts for more than half the volatility in foreign bonds (see Chart 6, below). On the surface, this would imply that hedging a foreign bond position would reduce overall volatility. However, a hedged foreign bond portfolio will behave much like a U.S. bond portfolio (see Chart 7), thus reducing the diversification benefits. For international equities, on the other hand (see Chart 8), hedging out their currency has not led to a noticeable increase in correlations to domestic equities.

⁶ Cost of Hedging is defined as cost of carry, or the difference between the 3-month government bond rate of the given country and the 3-month U.S. Treasury Bill rate. For each index, the weighted average cost is calculated based on a representative sample of currency exposures.

⁷ Basis risk in this context refers to the mismatch between an established fixed currency hedge level and the variable rate of return of the foreign currency asset. If at the end of the hedging period, the value of the asset differs from the estimation used to establish the hedge, an undesired exposure remains.

Chart 6. Asset and Currency Volatility
 Monthly Returns: January 1997- December 2016

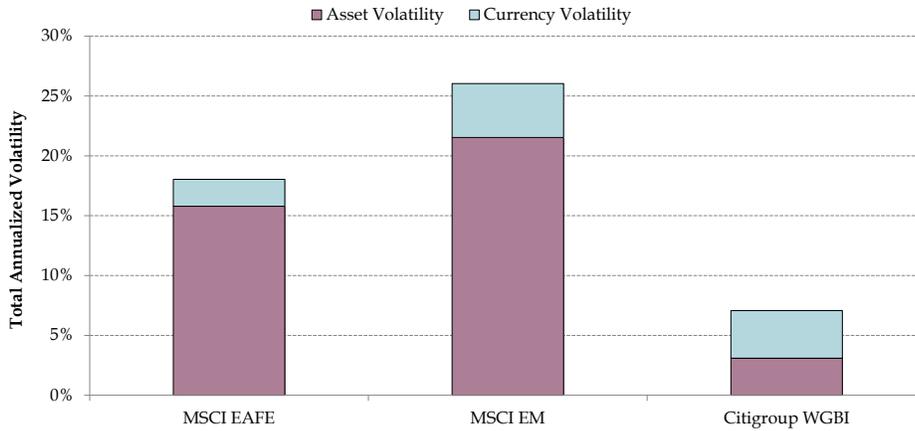


Chart 7. Rolling Three-Year Correlations to Barclays U.S. Aggregate
 Monthly Returns: January 1996 - December 2016

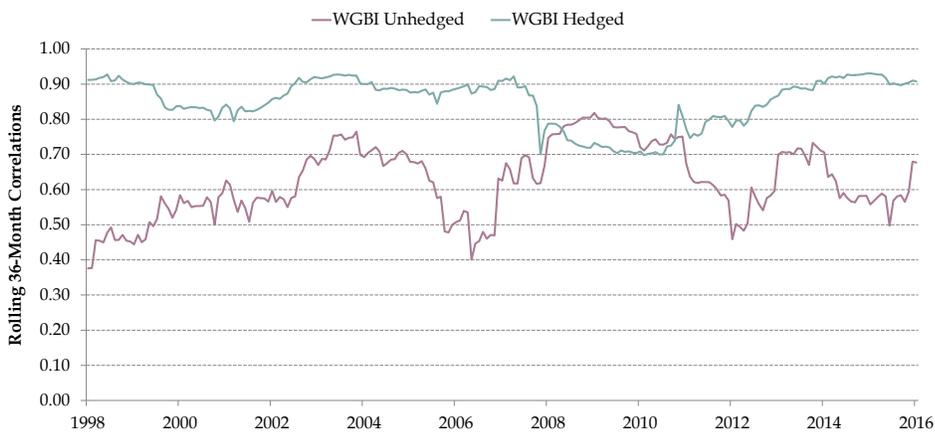
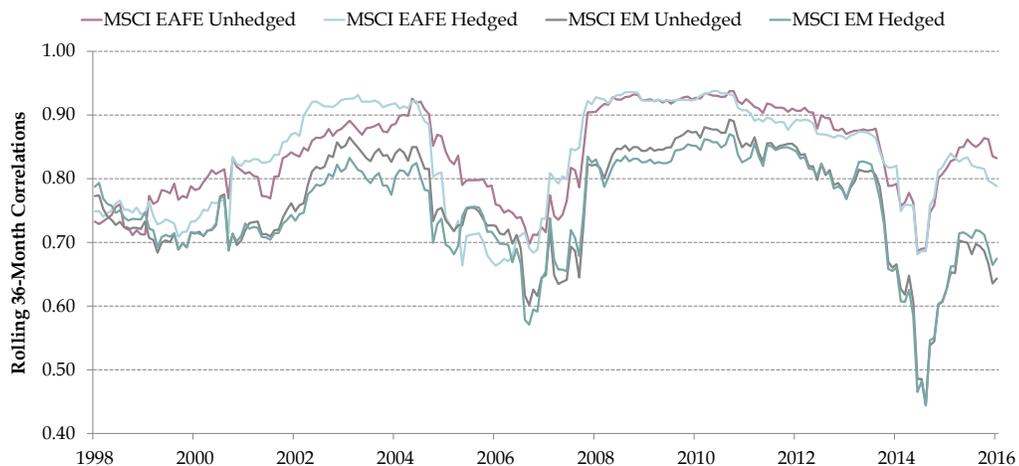


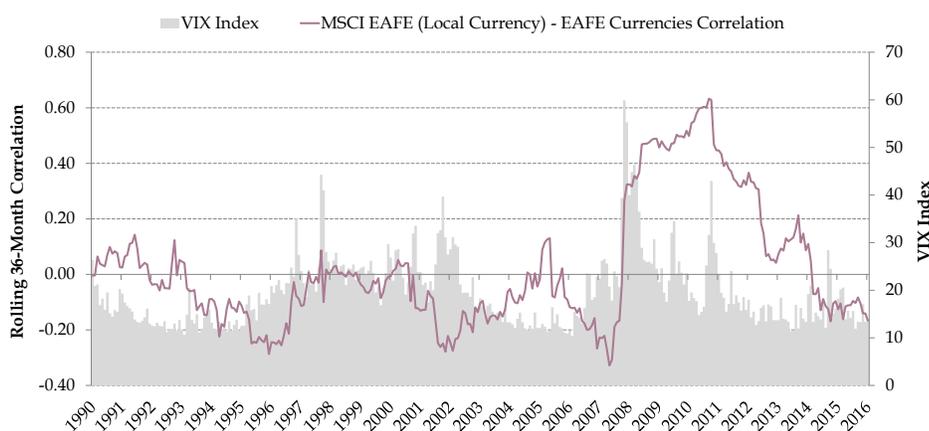
Chart 8. Rolling Three-Year Correlations to S&P 500
 Monthly Returns: January 1971 - December 2016



- V. **Correlation between foreign currencies and securities:** Currency returns with negative correlations to asset returns can be risk diversifiers to a foreign investment. However, correlations vary over time and tend to rise in periods of stress, eliminating potential diversification benefits when they are needed most (see Chart 9, below). In general, the higher the correlation between a currency and a foreign asset, the stronger the case for hedging the exposure.

Chart 9. Foreign Asset and Currency Return Correlations

Monthly Returns: January 1988 – September 2016



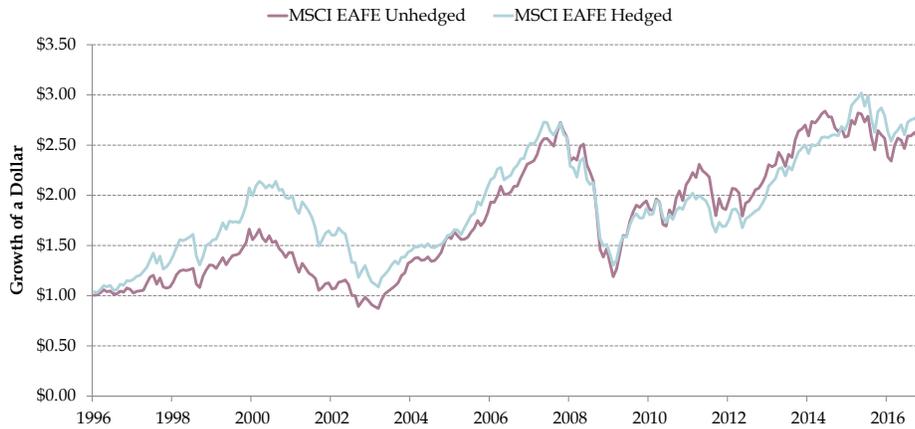
Recent History as a Guide

The following section reviews twenty years of historical performance to evaluate the results of hedged and unhedged foreign asset class exposures. While these results may show benefits for one option or the other, it is important to keep in mind that these figures suffer from end-point bias, as the date of writing of this paper influences the results of the analysis. Nevertheless, this exercise is helpful in illustrating the consequences of hedging currency exposure of foreign asset investments when taking into account the cost of hedging.

The case for hedging based on historical returns varied by region and asset class. For example, U.S.-based investors would have been better off hedging their foreign currency exposure to developed market equities over the last 20 years (see the following chart).

Chart 10. Growth of a dollar - International Developed Markets Equities⁸

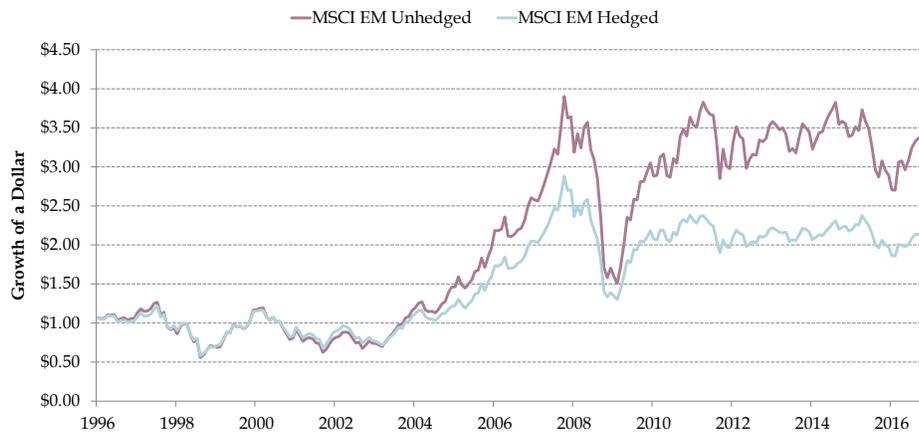
Monthly Returns: January 1996 - December 2016



In contrast, fully hedging would have proved highly detrimental in emerging market equities for U.S.-based investors over the last 20 years (see the following chart).

Chart 11. Growth of a Dollar - Emerging Markets Equities

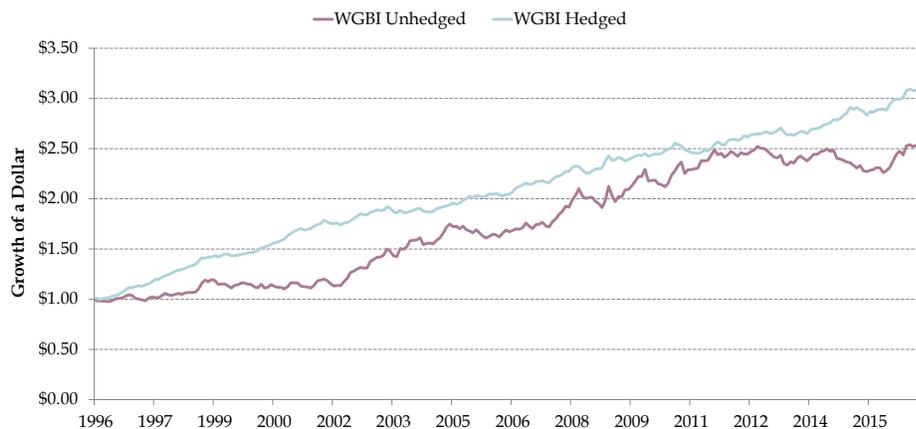
Monthly Returns: January 1996 - December 2016



⁸ Hedged returns for MSCI EAFE (Chart 10), MSCI EM (Chart 11), and WGBI (Chart 12) include cost of hedging based on cost of carry estimates seen in Chart 5.

Finally, U.S.-based investors would have been better off hedging their foreign currency exposure to developed markets bonds historically.

Chart 12. Growth of a Dollar – Foreign Bonds
Monthly Returns: January 1996 – December 2016



In theory, one currency (or basket of currencies) should not have a positive expected return relative to another currency (e.g., the U.S. dollar) over a long enough period of time, such as a full market cycle. A mean variance optimization-based forward-looking analysis that assumes a 0% expected return for currencies can only lead to risk reduction expectations for a portfolio. That is, currency fluctuations should neither add to nor detract from returns, but should add volatility, so hedging should lessen volatility and improve risk-adjusted returns provided that the cost of hedging is not too high.

In reality, some currencies may have a positive expected return vis-à-vis others over a sufficiently long period. We believe this is likely for the majority of emerging markets currencies vs. the U.S. dollar in the current environment. This is due to:

- Current account differentials
- Higher nominal and real growth
- Some currencies moving away from a pegged history

This would argue for (in addition to the high cost of carry) leaving most EM currencies unhedged. That said, these factors are not permanent characteristics, and other factors, such as central bank policies, can change. These factors make it hard to predict currency returns and reduce the expected benefit of any tactical currency hedging decision.

Implementation Options and How Much to Hedge

For investors who have decided to hedge foreign currency exposures, two follow-up questions generally arise: how much to hedge, and how to implement hedges.

With regard to the amount of foreign currency exposure to hedge, generally defined as the “hedge ratio⁹,” practitioners and academics have advocated for various levels: starting at no hedge at all (a 0% hedge ratio) and going up to full (100%) currency hedging. A 50% hedge ratio, the midpoint between full hedging and no hedging, is often chosen as a starting point for a currency hedging program, as it is viewed as minimizing regret (it is “half right all the time” rather than “fully wrong half the time”).

As with any investment risk, Meketa Investment Group recommends determining the amount of currency risk to hedge under a total portfolio framework, considering the tradeoffs of the various risks that foreign assets, currencies, and currency hedging introduce to a portfolio. This way, an optimal hedge ratio solution can be found that incorporates investors’ views and preferences on several topics such as: expected return and volatility, cost of hedging, liquidity, and others. For example, an investor may prefer to accept a higher level of volatility in the portfolio in exchange for saving on the higher costs of hedging emerging market currencies exposures. Others may be indifferent to cost and prefer to hedge away all currency exposure.

Table 13. Impact of Hedging on Trailing 20-Year Return & Risk for a Diversified Portfolio¹⁰

Monthly Returns: January 1996– December 2016

| | Unhedged Portfolio | Fully Hedged Portfolio | Half-Hedged Portfolio | Portfolio That Fully Hedges Developed Markets Only |
|--------------------|--------------------|------------------------|-----------------------|--|
| Annualized Return | 7.7% | 7.5% | 7.6% | 7.8% |
| Standard Deviation | 12.3% | 11.5% | 11.9% | 12.0% |
| Sharpe Ratio | 0.44 | 0.45 | 0.44 | 0.45 |

Over the past 20 years, a diversified portfolio would have produced the highest absolute return by hedging its developed markets foreign currency exposure. While a fully hedged portfolio would have experienced lower volatility, the full currency hedge would have resulted in reduced returns. A portfolio that hedged its developed markets exposure but not its emerging markets exposure would also have produced the best risk-adjusted return (as determined by the Sharpe ratio).

Furthermore, there is no clear trend of a hedged portfolio outperforming an unhedged portfolio under various actual historical stressed scenarios. The hedged portfolio performed better in several of them, with the clearest difference being during periods of significant dollar strength or weakness.

⁹ Hedge Ratio = % Foreign Currency Exposure Hedged / Total Foreign Currency Exposure.

¹⁰ The Diversified Portfolio is represented as 40% US equities, 10% EAFE equities, 10% EM equities, 10% core real estate, 10% US bonds, 10% US TIPS, 5% high yield bonds, 5% foreign bonds. Returns are net of estimated cost of hedging (Chart 5).

Table 14. Historical Return Scenario Analysis for a Diversified Portfolio¹¹

| Scenario: | Unhedged Portfolio | Fully Hedged Portfolio | Half-hedged Portfolio | Portfolio That Fully Hedges Developed Markets Only |
|--|--------------------|------------------------|-----------------------|--|
| Global Financial Crisis (4Q07 thru 1Q09) | -30.1% | -28.7% | -29.4% | -29.8% |
| Calendar Year 2008 | -26.5% | -25.6% | -26.1% | -26.5% |
| Popping of dot.com Bubble (2Q00 thru 3Q02) | -16.9% | -15.1% | -16.0% | -16.5% |
| Interest Rate Spike (1994) | 1.3% | 1.8% | 1.6% | 0.5% |
| Crash of 1987 (September thru November 1987) | -13.9% | -15.5% | -14.7% | -14.5% |
| Weak U.S. Dollar (January 1986 thru August 1987) | 45.4% | 33.2% | 39.3% | 41.8% |
| Strong U.S. Dollar (1Q81 thru 3Q82) | 1.8% | 8.5% | 5.2% | 4.4% |
| Stagflation (January thru March 1980) | -5.5% | -4.0% | -4.8% | -4.9% |
| Stagflation (1Q73 thru 3Q74) | -24.5% | -25.4% | -24.9% | -24.8% |

Moving to implementation options, below we highlight some of the most common ways for institutional investors to establish currency-hedging programs:

- I. **In-House Currency Management:** Some institutions are large enough that their investment staff can directly implement currency hedges. This may save management fees but requires governance and infrastructure capacities that are not achievable for the vast majority of investors. Institutions that manage their hedges in-house require freedom and flexibility to regularly trade around foreign currency positions, while managing and monitoring the risk objectives of the hedging program.
- II. **Passive Management:** This is probably the most widely-used vehicle for currency hedging. A passively-managed program will define some basic rules regarding hedge ratio, currencies to hedge, and tenor of hedges¹² to establish rules-based static hedging programs. This is the least expensive solution in terms of fees, yet it is also the least flexible, as it is usually based on a static hedge ratio that cannot fully incorporate all of the investor's objectives and constraints.
- III. **Semi-Active Management:** Similar to passive managers, semi-active managers employ systematic, rules-based programs to manage currency hedging, with the advantage of having more flexibility to implement time-varying hedging ratios within a specified range,¹³ and cash flow management that aims to provide more

¹¹ The Diversified Portfolio is represented as 40% US equities, 10% EAFE equities, 10% EM equities, 10% core real estate, 10% US bonds, 10% US TIPS, 5% high yield bonds, 5% foreign bonds.

¹² The tenor of hedges refers to the maturity of the derivatives, generally forwards, used to implement the currency hedge. One- to three-month maturity contracts are the most widely used.

¹³ A semi-active currency hedging strategy may have a 50% hedge ratio target but flexibility to vary the hedging ratio between 30% and 70% to attempt to capture additional currency returns.

efficient currency hedging profiles based on traditional return signals such as carry, momentum, and value.

IV. Active Currency Management: Active currency managers may escape the spectrum of currency hedging programs, given that their main objective is to capture currency returns within an “absolute return” benchmark, not taking into account an investor’s existing currency exposures. Active currency programs are often offered through hedge fund vehicles and are classified as return seeking rather than currency hedging strategies.

As a final point in this section, we should highlight that instead of implementing formal overlay currency management programs, many small and mid-sized institutional investors have traditionally placed the currency hedging decision in the hands of their active managers, giving them the discretion to hedge (or not to hedge) as the managers deem it appropriate. While this decision can generate cost savings, it is not very efficient from a portfolio perspective, as each active manager can only look at a portion of the investor’s portfolio, ultimately leading to a group of independent hedging decisions that cannot be properly integrated or managed.

CONCLUSIONS

When evaluating the decision of hedging foreign currency exposure, investors need to consider several factors, including: 1) any outlook on the prospective returns of foreign currencies, 2) the size of foreign currency exposure in portfolio, expected correlation between foreign assets and foreign currency returns, 3) the types of foreign assets in the portfolio, 4) the correlations of these assets with the rest of the portfolio, and 5) perhaps most importantly, the cost of hedging.

If an investor decides to hedge currency exposures, the next question to answer is how much to hedge. While a 50% hedge or full hedge are the most common approaches in the industry, Meketa Investment Group recommends evaluating this decision from a total portfolio perspective, taking into account the risk and return trade-offs that foreign assets, foreign currencies, and a hedging program introduce to a portfolio. This allows the establishment of efficient hedging programs that can incorporate all of an investor’s objectives and constraints regarding expected return, volatility, tracking error, costs, and liquidity, among many others.

With regard to implementation options, currency hedging programs can range from in-house implementation all the way to active currency management funds that are less focused on hedging than on capturing currency returns. Intermediate options such as passive rules-based hedging programs and semi-active hedging programs are most widely-used.

As a general guideline, Meketa Investment Group does not recommend implementing tactical currency hedging decisions/programs. Currencies can be very volatile and we believe it is very difficult to predict which, if any, have a positive expected return over the long term.

Furthermore, while strategic currency hedging decisions can provide risk reduction and slight risk-adjusted return improvements, this comes with the trade-off of added hedging costs and operational complexity, both for managing the hedges and for establishing hedging policies. For plan sponsors with the resources and governance capabilities to implement and manage a strategic currency hedging program, Meketa Investment Group can work with them to advise them on the determination of the optimal hedging ratio, the currencies to be hedged, and the most efficient vehicle or program to implement such hedges. Constant monitoring is very important however, as changes in interest rates levels can lead to changes in hedging costs, so clients who outsource their currency hedging programs need to be able to regularly monitor both their hedging program and their managers.

On a related note, we recommend clients with significant foreign currency exposures hedge a portion of their international developed markets currency exposures.¹⁴ Whereas most developed market currency exposures can be hedged at very low costs, emerging market currencies are generally much more expensive to hedge, given their high costs of carry and lower liquidity of derivatives. These conditions lead us to generally prefer not to hedge emerging market currencies.

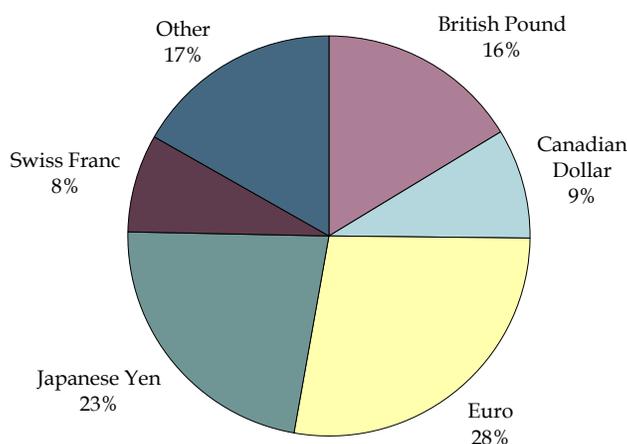
¹⁴ We define foreign currency exposure as significant when it exceeds one-third of total assets. For some plan sponsors, a lower threshold may be appropriate.

Appendix I

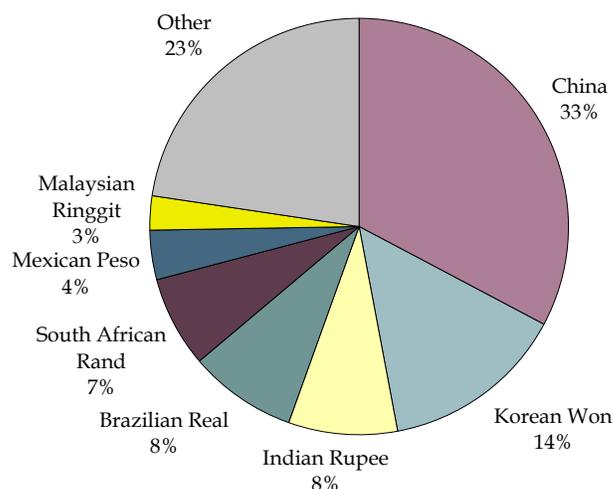
Chart 12. Currency Exposure of Foreign Equity Markets

As of September 30, 2016

MSCI World ex-U.S.



MSCI Emerging Markets



In developed markets (as proxied by the MSCI World ex-US), the euro, yen, and pound account for the vast majority of currency exposure. In emerging markets (as proxied by the MSCI EM), exposure is more widely distributed, with China¹⁵ representing the largest exposure.

¹⁵ China exposure represented by Hong Kong dollar (HKD) and Taiwan dollar (TWD) exposures.