CURRENCY HEDGING: ADAPTING TO VOLATILITY

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EXECUTIVE SUMMARY

In the past, institutional investors largely ignored currency hedging in their international equity portfolios. With the globalization of the equity portfolio and recent events that have sent shockwaves through currency markets,[1] they can no longer afford to do so. However, *how* to hedge their foreign exchange exposure is now receiving renewed scrutiny.

Since the late 1980s, asset owners have increasingly adopted passively hedged equity benchmarks, encouraging their asset managers to hedge currency risks. Historical data suggests that such static hedge overlay strategies have generally increased risk-adjusted returns of foreign equity portfolios over a long-term horizon. On the other hand, a passive hedge may severely lag an unhedged portfolio during a short-medium term horizon because of market regime changes.

While a number of investors apply a discretionary timing strategy in an effort to "outsmart" the passive hedge, this ad hoc approach may also incur significant risks, especially given managers' limited success in accurately anticipating the direction of exchange rates. An alternative approach is to hedge currency exposure dynamically, using well-documented systematic signals such as Value, Momentum, Carry and Volatility. This tactical approach has historically delivered better risk-adjusted returns compared to traditional static hedge methods and could help investors tackle the challenge of timing currency movements.

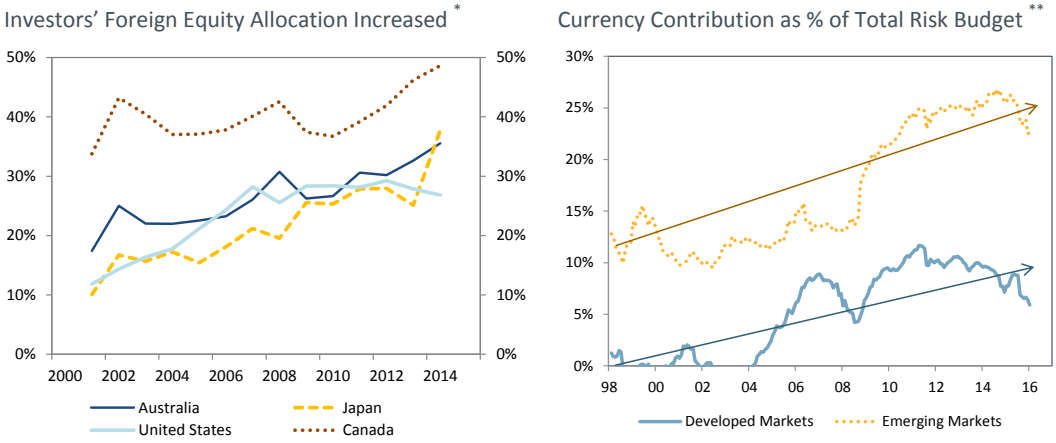
Whether institutional investors use a passive or active approach, foreign-exchange exposure is a risk they can no longer ignore. While a passive strategy targeting static hedge ratios could have served a long-term equity investor's goal of achieving better risk-adjusted returns, an adaptive hedge strategy historically could have helped both short-term and long-term investors better navigate market environment changes.

[1] In recent years, this higher currency risk has been increasingly transmitted through geopolitical events (e.g., possibility of Brexit , oil shocks) and central bank surprises (e.g., revaluation of the Swiss Franc by the Swiss National Bank and Chinese Renminbi by the People's Bank of China in 2015).

CURRENCY HEDGING IN EQUITY PORTFOLIOS

Thirty years ago, currency hedging was virtually unheard of: Institutional equity portfolios were heavily allocated to domestic assets. With the popularization of global equity investing, investors have allocated a growing portion of assets to international equities (Exhibit 1, left-hand chart). Thus, forex risk has become an integral part of institutional portfolios.

Exhibit 1: Foreign Allocation and Currency Risk Contribution in Equity Portfolios Rising



** Based on the IMF's Coordinated Portfolio Investment Survey (CPIS) database.*

*** Currency risk contribution is based on forecasted risk in Barra Global Total Market Model for MSCI World and MSCI Emerging Market Indexes.*

A security is exposed to foreign exchange rates both through its traded price (reflected in its denominated currency), and company fundamentals. Fundamentals reflect these economic exposures and thus are subject to currency risk. They are based on a company's costs, e.g., the cost of imports, and the sources of its revenues. Since the collapse of the Bretton Woods system during the 1970s, major exchange rates have fluctuated wildly, even measured over a medium-to-long-term horizon (5 to 10 years). Possible reasons for this currency risk are:

- **Fundamentals**: Changes in economic factors such as interest rates, expected inflation, balance of trade and investor sentiment could affect the currency value.
- **Macro Contagion**: Linkages between countries and regions lead to systematic correlation between currencies and financial assets such as equities and commodities.
- **Market and Regulatory Risks**: During market crises, risky currencies often depreciate while safer ones appreciate. Also, governments may switch their currency policies.

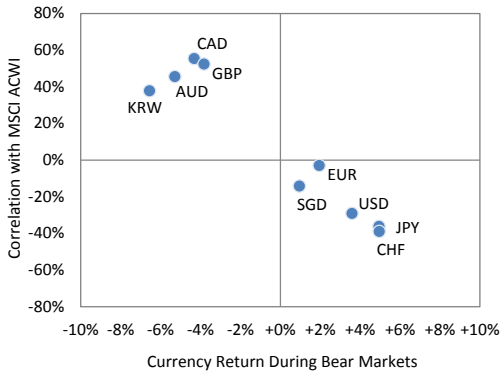
With an increase in economic fluctuations, macro uncertainty and central bank interventions over the past decade, currencies are gradually contributing a greater portion of the total risk

budget in both developed and emerging market equity portfolios (Exhibit 1, right-hand chart). Against this backdrop, institutional investors across the globe are now increasingly looking for strategies to better hedge their foreign-exchange exposures.[2]

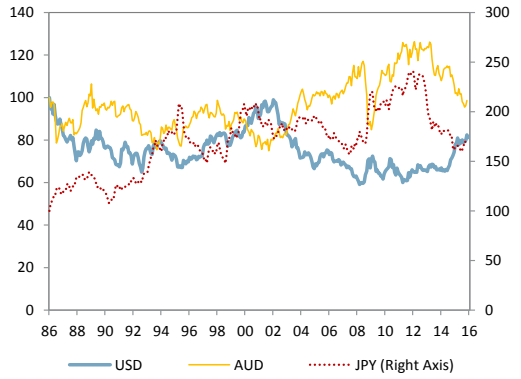
What are the main considerations in constructing a currency hedge strategy? To start with, investors need to understand currency-equity correlations as currency exposures could present both risks and opportunities for an equity portfolio.

Exhibit 2: Historical Currency-Equity Correlation and Major Foreign Exchange Rates

Currency and Equity Market Correlations *



Nominal Value of US Dollar, Australia Dollar and Yen +



** Correlation statistics on the vertical axis are based on annual returns 1994-2015. Currency returns on the horizontal axis are based on average annual returns of BIS NEER indexes 1994-2015, when MSCI ACWI delivered less than -5% in local currency returns.*

+ Based on trade-weighted nominal exchange rate indexes.

The left-hand chart in Exhibit 2 shows that currencies from export-oriented and commodity-focused economies tend to have a positive correlation with global equity markets and often serve to amplify equity drawdowns during bear markets.[3] Conversely, these currencies have often provided a source of carry and have appreciated during periods of capital inflows.

[2] For instance, the *Financial Times* reported in 2012 that some U.K. local authority pension funds, including those in Avon, Norfolk and Wiltshire, had added dynamic currency hedging to their portfolios (September 28, 2012). In addition, CalPERS and AUSCOAL reportedly also planned to switch from passive hedging to dynamic hedging in 2014 (*Pensions & Investments,* March 3, 2014; *Investment Magazine,* March 3, 2014). Separately, Mercer encouraged its pension fund clients to consider adopting dynamic hedging strategies in 2014, citing uncertainty around monetary policy, growth forecasts for developed market and emerging market economies and the direction of markets.

[3] The Swiss Franc and Japanese Yen offered diversification as "safe-haven" currencies. Neutral currencies like the Euro and the Singapore dollar have not experienced significant correlation with equity markets, whereas the U.S. dollar has behaved in between safe-haven and neutral currencies. These correlations, however, could characterize only periods of normal market behavior, and may not apply to extreme scenarios such as an abrupt change in government policies.

In addition, macro trends for an investor's base currency, typically triggered by political events, can have a significant impact on a currency hedge strategy. For example, a Japanese investor could have suffered heavy exchange rate losses from an unhedged international portfolio during the decade following the 1985 Plaza Accord, as the yen appreciated by more than 100% (right-hand chart of Exhibit 2). Recently, many U.S.-based investors feared a similar experience, allocating significant assets to currency-hedged products after the dollar rally began in 2014.[4] As a result, designing a sound currency hedging strategy requires a thorough analysis of the investor's base currency as well as macroeconomic conditions.

Besides the base currency, an optimal hedging strategy would depend on a number of other factors such as investor's investment horizon, leverage constraints, objectives (to minimize risk or enhance return), asset allocation and operational process (separate or integral part of the whole portfolio). Regardless of constraints and targets, a currency hedging strategy may be broadly classified into two categories:

- **Static Hedging**: Also called passive or strategic hedging, this approach involves setting a constant hedge ratio and periodically rolling the hedge. Examples: 100% and 50% hedges.
- **Dynamic Hedging**: Also called active or tactical hedging, this approach involves setting hedge ratios dynamically. Example: Monthly hedge based on momentum signals.

Historical data shows that long-term investors targeting appropriate constant hedge ratios have generally benefited from a better risk-adjusted performance in their foreign equity allocations. On the other hand, this type of passive hedge strategy may also severely underperform during a short-to-medium term horizon because of market regime changes.

While some may consider a discretionary timing approach in an effort to "outsmart" a static hedge, this ad hoc approach may also incur significant risks, especially given asset managers' limited success in accurately anticipating the direction of exchange rates.[5] An alternative approach is to hedge currency exposure dynamically according to a systematic procedure. This approach could potentially help address the challenge of timing currency trends.

[4] The *Wall Street Journal* reported that "U.S. investors have been piling into currency-hedged ETF" since 2014 (March 20, 2015). Hedging into the U.S. dollar is also partially justified by the dollar's safe-haven status, leading to lower total risk for the hedged portfolio.

[5] Equity managers typically are more expert in picking stocks than in timing currency trends.

THEORIES AND EMPIRICAL EVIDENCE

The currency hedging topic has been fiercely debated ever since the popularization of global investing in the 1980s. Earlier research focused on a "risk-reduction" perspective.[6] Dale (1981), Kwok (1987), and Swanson and Caples (1987), for instance, applied the futures-based minimum-risk hedging concept — that one can create an optimal hedge ratio (short of a 100% hedge) which yields the lowest risk — introduced by Johnson (1960) and Stein (1961) to hedge currency risks in portfolio investments.[7]

STATIC HEDGE: TARGETING A STRATEGIC HEDGE RATIO

During the past two to three decades, researchers examined the pros and cons of the minimum-risk static hedging method and offered rationales to determine alternative passive hedge ratios in various portfolio contexts, ranging from 0% hedge to 100% hedge (Exhibit 3).

Exhibit 3: Research on Determining an Optimal Passive Hedge Ratio

Authors	Hedge Ratio	Summary of Main Findings
Dale (1981); Kwok (1987); Swanson and Caples (1987)	Minimum risk hedge ratio	• A complete hedge does not lead to the lowest portfolio risk and there exists an optimal hedge ratio which yields the lowest variance. • The presence of autocorrelation in foreign exchange markets overstates minimum risk hedge ratios and hedging effectiveness for some currencies.
Perold and Schulman (1988)	100%	• Foreign exchange should generate zero return over the long run as it is a zero-sum game between two sides of a currency trade. • Currency hedging is a "free lunch" as it reduces risk without loss of return. • U.S.-based investors should fully hedge their foreign currency risk exposures.
Black (1989)	A universal hedge ratio exists for all investors	• Under models of international equilibrium, investors holding foreign investments should hedge their currency risk. • The optimal hedge ratio is the same for all investors. The ratio depends on three things: the average expected excess return of the world market, the average market volatility and the average exchange rate volatility. • However, the universal hedge ratio formula is sensitive to data inputs and could range between 30% and 73%.
Froot (1993)	0%	• Currencies are naturally hedged given the existence of long-term Purchasing Power Parity (PPP). • Currency hedging could increase risk over the long run, as shown by US equity/bond markets during 1802-1990 from a UK investor perspective.
Gardner and Wuiloud (1995) Gary Gastineau (1995)	50%	• Currencies may have significant unexpected returns over the short term, leading to sizable "regret" in optimal hedged portfolio performance. • The existence of persistent opportunities for adding value with exchange-rate forecasting techniques suggests the 50/50 benchmark is no more — and no less — than a good place from which an active currency manager can start.

[6] Chang, K. (2009). "Currency Hedging: A Free Lunch?" MSCI Research Insights; Bender, J., R. Kouzmenko, and Z. Nagy. (2012). "Why Currency Returns and Currency Hedging Matters?" MSCI Research Insights.

[7] More recently, Kritzman (2000) argued that minimum-risk hedging reduces the risk of loss during a long horizon. See Appendix 2 for more details on minimum risk type of currency hedging strategies.

To see how constant hedge ratios performed historically, we compared the return and risk characteristics of an unhedged index, a 50% hedge (the traditional benchmark for overlay managers) and a fully hedged index of international equity portfolios from U.S., Japan and Australian investors' perspectives.[8]

Shown in Exhibit 4 below, a constant hedge ratio helped reduce risk or enhance return (and sometimes achieved both objectives) for international equity portfolios during the 13-year period from January 2003 to January 2016.

Exhibit 4: Performance and Risk of Constant Hedge Ratios for USD, JPY and AUD Investors

	EAFE hedged to USD			Kokusai hedged to JPY			World ex AU hedged to AUD		
	0%	50%	100%	0%	50%	100%	0%	50%	100%
Total Return (%) *	7.7	7.8	7.8	8.7	8.0	7.1	6.7	8.7	10.4
Volatility (%) *	17.3	15.3	13.9	19.3	15.9	13.4	11.5	11.3	13.8
Sharpe Ratio	0.35	0.41	0.45	0.44	0.49	0.51	0.17	0.34	0.40
% of Higher 3Y Return **	-	42%	39%	-	48%	46%	-	81%	79%
% of Lower 3Y Vol **	-	95%	92%	-	100%	100%	-	42%	25%
% of Higher 5Y Return **	-	45%	41%	-	55%	49%	-	89%	87%
% of Lower 5Y Vol **	-	100%	98%	-	100%	100%	-	37%	8%

** Full period return and volatility calculations are based on gross total returns of the MSCI Currency Hedged Indexes from January 2003 to January 2016.*

*** On a rolling 3-year and 5-year basis, we calculated the percentage of time when a 50% or 100% hedged index delivered a higher return or lower volatility compared with the corresponding unhedged equity index in investor base currency (i.e., US dollar, Japanese Yen and Australian dollar).*

On the other hand, a constant hedge ratio frequently reduced the return or amplified the risk versus an unhedged portfolio during a shorter-term horizon, as shown in the lower panel of Exhibit 4. During a three- or five-year investment horizon, a 50% hedge in MSCI EAFE and MSCI World ex Australia delivered lower returns and higher risks more than half of the time as compared with their corresponding unhedged indexes.

To better understand the effect of investment horizons on static hedging, Exhibit 5 and Exhibit 6 illustrate how using different time periods for investors based in different countries affected returns and volatilities of passively hedged and unhedged indexes.

[8] USD, JPY and AUD are chosen to show generic characteristics of reserve-status, safe-haven and commodity currencies.

Exhibit 5: Historical Return of 50% Hedged Indexes in Excess of Unhedged Indexes*

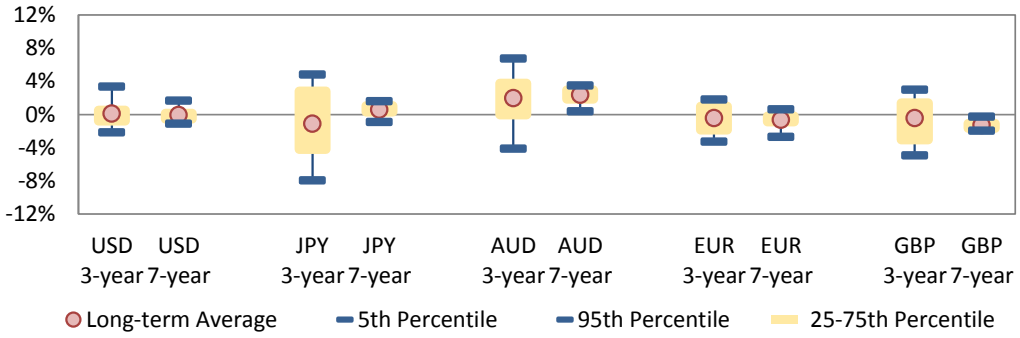
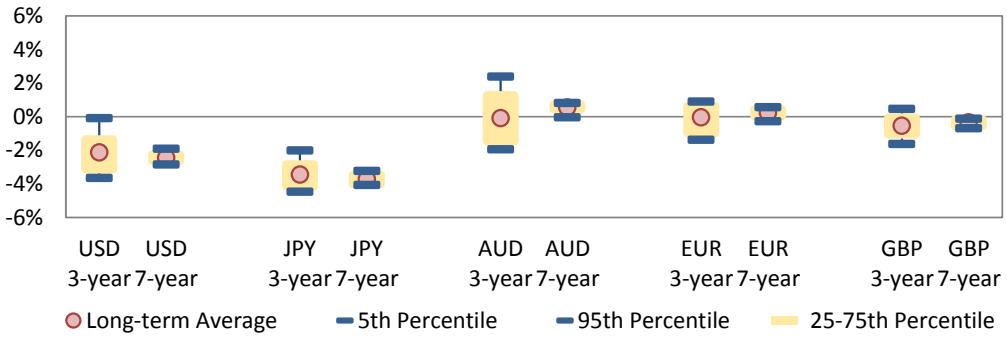


Exhibit 6: Historical Volatility of 50% Hedged Indexes in Excess of Unhedged Indexes*



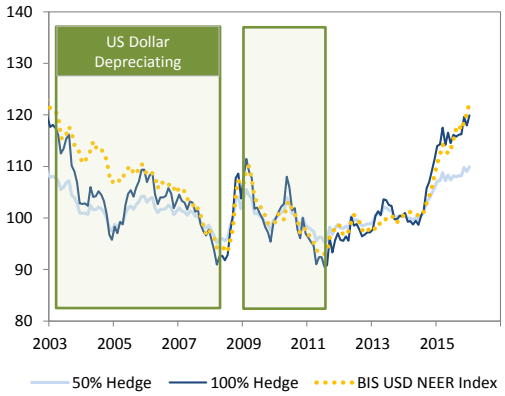
** Based on MSCI EAFE 50% hedged to USD, MSCI Kokusai 50% hedged to JPY, MSCI World ex Australia 50% hedged to AUD, MSCI World ex EMU 50% hedged to EUR and MSCI World ex UK 50% hedged to GBP, January 2003 – January 2016.*

A shorter investment horizon has often translated into greater uncertainty for a static hedging approach. For instance, during a three-year investment horizon, a 50% hedge in the MSCI Kokusai Index[9] has led to a reduction in return of more than 4 percentage points one-quarter of the time, and has underperformed the unhedged index half the time. On the other hand, with an investment horizon of seven years, the same strategy underperformed an unhedged MSCI Kokusai Index only 20% of the time.

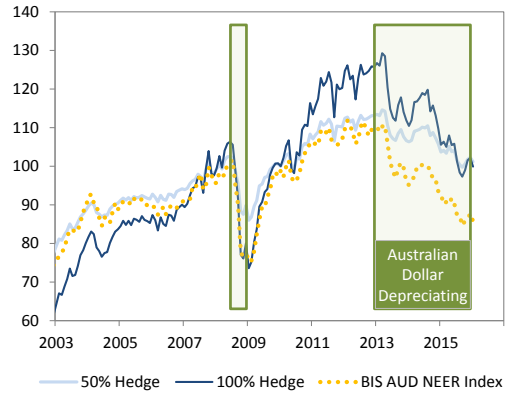
[9] The MSCI Kokusai Index is also known as the MSCI World ex Japan Index.

Exhibit 7: Static Hedge Underperformed When Investor Base Currency Depreciated

MSCI EAFE hedged into USD*



MSCI World ex Australia hedged into AUD*



** Based on the relative performance of static hedge to unhedged index, rebased to 100 on Jan. 31, 2010.*

A main driver of shorter term relative performance for a static hedge strategy is the direction of the investor base currency, which is affected by both technical factors and macroeconomic conditions. A constant hedge ratio has in general imposed a drag on performance when an investor's base currency depreciates (Exhibit 7). For investors based in more volatile currencies such as the Australian dollar, this underperformance has usually occurred when diversification to the equity portfolio was most needed.

Our key takeaways from the preceding historical analysis on static hedge strategies are:

- Investors with a longer-term investment horizon (more than 10 years) would have achieved better risk-adjusted returns, benefiting from at least partially hedging their foreign currency exposures during the sample period. For instance, by implementing a full hedge from January 2003 to January 2016, a U.S. dollar-based investor would have reduced its foreign equity risk by 20% without impacting long-term returns.
- Investors with a short- to medium-term investment horizon could have made use of passively hedged index products to express views on currency movements or currency-equity correlations, based on a comprehensive analysis of fundamental and technical factors as well as macroeconomic conditions. In particular, investors should consider the ex-ante cost (or gain) of implementing a passive hedge strategy.[10]

[10] See Appendix 1 for a discussion on the carry and the cost (or gain) of currency hedging. For example, given there are interest-rate gains for passively hedging into higher yielding currencies, the case for hedging foreign currency exposures for an Australian dollar-based investor is compelling.

DYNAMIC HEDGE: INCORPORATING SYSTEMATIC STRATEGIES

With increased volatility and regime changes in financial markets, institutional investors are rethinking whether to stick with a constant hedge ratio or take an active approach that depends on currency characteristics and the macroeconomic regime. For instance, overlay managers often apply a discretionary timing approach that hedges the foreign-exchange exposure if the foreign currency is expected to weaken, but leaves the currency exposure unhedged if the foreign currency is expected to appreciate. Such approaches have been employed since the mid-1980s. However, they may incur unrewarded risks due to behavioral biases, given the difficulty in predicting exchange rates.[11]

An alternative method is to incorporate rule-based strategies traditionally used in active currency management to harvest the long-term return premium available from currency factors.[12] The use of systematic foreign-exchange strategies directly tackles the challenge of timing the hedge in a regime-shifting macro environment. For example, Cenedese (2012) finds that foreign-exchange markets exhibit asymmetric correlations and investors would be better off by pursuing a dynamic hedge policy that varies by market regime (such as risk on/off) and employs identified fundamental and technical currency characteristics.[13]

Based on decades of academic research, we find the following four currency characteristics to be useful in harvesting the systematic risk premium of active currency exposures. The four indicators can be divided into fundamental (carry and value) and technical (momentum and volatility) types.

[11] Statman (2005): Investor hindsight and regret could lead to bad switches between hedged and unhedged portfolios. This type of behavior could lead to negative alpha from discretionary currency hedges in equity portfolios.

[12] Pojarliev, M. and R. M. Levich. (2008). "Do Professional Currency Managers Beat the Benchmark?" *Financial Analysts Journal*, Vol. 64, No. 5, pp. 18-32; Melvin, M. and D.D. Shand. (2010). "Active Currency Investing and Performance Benchmarks," *Journal of Portfolio Management*, Vol. 37, No. 2, pp. 46-59; Pojarliev, M. and R. M. Levich. (2011). "Active Currency Management Part II: Is There Skill or Alpha in Currency Investing?" NYU Working Paper No. FIN-11-002.

[13] Academic references by main types of currency factors: Carry: Fama (1975, 1984), Bilson (1981), Froot and Thaler (1990), Burnside et al. (2006), Menkhoff et. al (2012a); Value: Froot and Rogoff (1995), Rogoff (1996), Sarno and Taylor (2002), Taylor and Taylor (2004) and Taylor (2006); Momentum: Poole (1967), Sweeney (1986), Levich and Thomas (1993), and Okunev and White (2003), Menkhoff et. al (2012b).

Exhibit 8: Four Indicators for Adaptive Currency Hedging Strategies

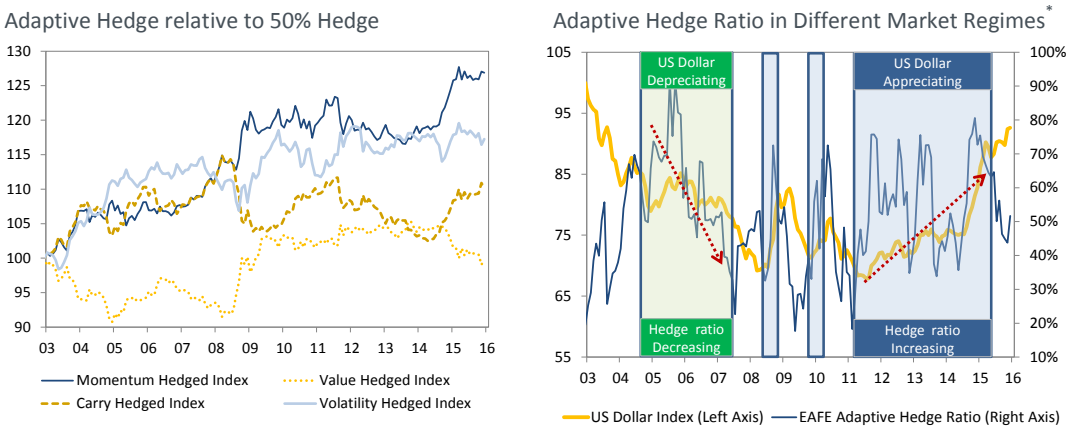
Indicator Type	MSCI Definition	Economic Rationale
Carry	Three-year rolling z-score of the difference between two-year sovereign yield rates in foreign currency and base currency	• Buying high interest-rate currencies and selling low interest-rate currencies (or carry trade) has been profitable historically. Currency carry strategies are exposed to liquidity risk and related to ”peso events” in the financial markets. • The currency carry indicator is similar to investing in high-yield securities in an equity universe.
Value	Three-year rolling z-score of the ratio of the three-month average spot FX rate to the PPP estimate	• Mean reversion is the underlying basis of the Value indicator, which relies on currency fundamentals to determine the hedging decision. • If a currency has appreciated over time, it could mean-revert and weaken in the future. In such a scenario, the investor’s currency exposure should be hedged to avoid a negative impact.
Momentum	Six-month currency returns	• Currency investors often use trend-following strategies, investing in past winners and trading out of losing currency pairs. • This indicator is analogous to the trend-following equity momentum factor wherein stocks that have had high returns over the past three to 12 months tend to continue their outperformance.
Volatility	One month average of daily volatility vs. six-month average of historical daily volatility	• Currency volatility is an indicator of investor risk appetite in currency markets. Volatility signal can be used to reflect risk-aversion trading – it is comparable to a defensive, low volatility strategy in equities. • “Defensive” or low-risk risk premium is documented across asset classes. Low-risk currency factor also has been related to the carry. [14]

The left-hand chart in Exhibit 9 shows the performance of the adaptive hedge strategy based on a single indicator relative to the MSCI EAFE Index 50% hedged in U.S. dollars. While both technical indicators showed fairly consistent outperformance when used in a dynamic hedging strategy during the sample period, the fundamental indicators exhibited more episodic strong outperformance interspersed with periods of weaker returns.

Given the significant diversification benefits of these currency characteristic-based hedging strategies, one could combine the four signals to form a dynamic currency hedge strategy. For instance, the MSCI Adaptive Hedge Index applies equally weighted hedge ratios based on the four indicators. The overall effect is that each currency pair can be unhedged, 25% hedged, 50% hedged, 75% hedged or fully hedged, relative to the investor base currency. As shown in the right-hand chart in Exhibit 9, the overall hedge ratio (weighted by currency exposure) of our adaptive hedge strategy is able to respond to different U.S. dollar regimes by following the four types of currency indicator.

[14] See: Doole, S., S. Katiyar, J. Krishna. (2016). “The MSCI Adaptive Hedge Indexes: Flexible Hedging Using a Combination of Currency Indicators.” MSCI Research Insight; Menkhoff, L., L. Sarno, M. Schmeling, and A. Schrimpf. (2012). “Carry Trades and Global Foreign Exchange Volatility,” *The Journal of Finance*, Vol. 67, No. 2, pp. 681-718; Israel, R., and T. Maloney. (2014). “Understanding Style Premia,” *The Journal of Investing*, Winter 2014, Vol. 23, No. 4, pp. 15-22.

Exhibit 9: Effectiveness of Currency Indicators and Adaptive Hedge Ratio



** The adaptive hedge ratio is calculated as the currency exposure-weighted average of hedge ratios.*

This market regime adaptivity contributed to better performance and lower risk as compared with the static hedge method during the sample period. From January 2003 to January 2016, the MSCI EAFE Adaptive Hedge Index realized annualized active returns of 1.1% and 1.0% and information ratios of 0.29 and 0.74 versus unhedged and 50% hedged benchmarks respectively.

Besides being effective for U.S. dollar-based investors, the adaptive hedge strategy also achieved risk reduction or return enhancement as compared with static hedge for Euro, Japanese Yen and Australian dollar-based investors (Exhibit 10).

Exhibit 10: Performance and Risk of Currency Hedging Strategies for Global Investors

	MSCI EAFE hedged to USD				MSCI Kokusai hedged to JPY			
	0%	50%	100%	Adaptive	0%	50%	100%	Adaptive
Total Return	7.7	7.8	7.8	8.8	8.7	8.0	7.1	8.4
Volatility	17.3	15.3	13.9	15.1	19.3	15.9	13.4	15.3
Sharpe Ratio	0.35	0.41	0.45	0.47	0.44	0.49	0.51	0.54

	MSCI World ex EMU hedged to EUR				MSCI World ex AU hedged to AUD			
	0%	50%	100%	Adaptive	0%	50%	100%	Adaptive
Total Return	8.4	8.0	7.5	8.4	6.7	8.7	10.4	8.3
Volatility	12.4	12.1	13.3	12.3	11.5	11.3	13.8	11.2
Sharpe Ratio	0.54	0.53	0.44	0.55	0.17	0.34	0.40	0.31

Calculation is based on gross total returns from January 2003 to January 2016.

The risk reduction effect comes from the dynamic hedge ratio switches based on currency signals, which also provides diversification. Exhibit 10 also shows that the adaptive hedge strategy has historically delivered a long-term risk similar to a 50% hedge strategy, as well as a better return than a static hedge strategy, with equal or less total risk during the sample period.[15]

Dynamic hedging's adaptive response to market regimes and long-term risk-adjusted out-performance makes it an interesting investment strategy for investors with either short-term or long-term investment horizons. With demand rising for dynamic hedge strategies during the past few years, an adaptive hedged index could also serve as a better benchmark for overlay managers applying techniques such as carry and trend following.

[15] For instance, a passive hedge strategy has enhanced returns for Australian investors' foreign equity portfolios during the period January 2003 - January 2006. However, a 100% (full) hedge strategy also increased portfolio risk (both the total risk and correlation with domestic equities). On the other hand, the adaptive hedge strategy was able to capture this additional return premium without increasing the risk as compared with the unhedged foreign equity portfolio.

ALTERNATIVE PORTFOLIO CONSTRUCTION APPROACHES

There are many other ways that investors could define or use currency signals in constructing dynamic hedging approaches. For example, investors with long-term fundamental perspectives may opt to not adjust for historical PPP ranges in Value signals, whereas investors with a technical focus may wish to adopt a strategy driven solely by Momentum.

Alternatively, investors may seek to extend the Volatility signal by minimizing the portfolio volatility of an equity index and a basket of FX forwards. This "dynamic optimal hedging" allows the level of hedging to be directly influenced by changes in correlation between equity market returns and currency returns. It is a natural extension of a static optimization-based minimum risk hedging strategy.[16]

In addition, one could adopt a "voting model" to combine indicators rather than the averaging technique we used in the adaptive hedge strategy. In other words, the hedge decision is applied only when confirmed by a majority of the signal votes. This voting approach tends to have less gradual hedge ratio changes, which may be an attractive feature for some investors. However, if one signal is particularly volatile during a given period, it may overwhelm other signals and become the "swing voter" that determines hedge decisions.

We have so far focused our discussions on fundamental and technical indicators. Rules-based dynamic hedging strategies can also be based on a more detailed use of country or regional macro data (e.g., GDP surprises, current accounts, borrowing, credit ratings and changes in macro data). However, macroeconomic data may not be available on a timely basis and backtests tend to be susceptible to biases due to subsequent data revisions.

Finally, a hedging strategy could go beyond the listing currency of security holdings. For instance, investors can create a hedging strategy for a cap-weighted index where the amounts of hedge are determined by the economic exposure of the underlying securities rather than the listing currency. These economic exposure-based hedge strategies attempt to factor in the geographic influence of a company's business activities rather than the stock listing locations.

[16] See Appendix 2 for more details on minimum risk-type currency hedging strategies.

CONCLUSION

Investors in international equities bear the risk of foreign exchange rates going against them. Hedged and unhedged international equity portfolios can sometimes present drastically different return and risk characteristics. As a result, the careful design of currency hedging strategies tied to equity allocations is critical. In addition, choosing an appropriate currency-hedged benchmark index could help asset owners better evaluate the performance and risk of their currency overlay mandates.

In recent decades, institutional investors have tended to apply static hedging strategies in their international equity allocations — where they hedge at all. A fully hedged exposure seeks to remove the direct impact of currency from equity asset allocations. On the other hand, a partially hedged currency exposure aims to satisfy specific investment needs such as a better portfolio return and risk tradeoff.

While specific currency exchange rates are generally hard to predict, the use of currency indicators based on well-known forex investment strategies allows us to define a rules-based model which adjusts hedged currency exposures dynamically. This flexible hedging approach has helped improve the performance of the hedged portfolio with reduced risk, compared to an unhedged equity portfolio and static hedge strategies.

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APPENDIX 1. CARRY AND THE COST (OR GAIN) OF HEDGE

A common way of removing (or hedging) foreign exchange (FX) exposure in the context of portfolio investing is through the use of derivative contracts such as futures and forwards.[17] For example, a U.S. institutional investor could hedge portfolio exposure to the Australian dollar by shorting an AUDUSD forward contract and rolling the short position periodically (e.g., daily or monthly).

Hedging via the use of futures and forwards comes at an additional loss of carry, which may be treated as ex-ante opportunity cost (or gain) of hedge. For forex hedging, the carry is simply the difference between short-term interest rates of the foreign currency and investor base currency. Hence, in addition to profits or losses due to changes in spot exchange rates, hedging higher yielding currencies into lower yielding currencies would incur hedging costs, whereas the other way around contributes to hedging gains.[18]

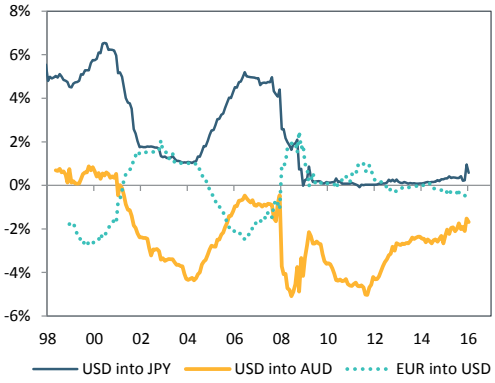
The magnitude of hedging cost or gain could be quantified by the portfolio-level interest rate differential, based on weights of the currency exposure. This weighted average interest rate differential explains the performance difference between an equity portfolio's fully hedged returns and local currency returns. For instance, the left-hand chart in Exhibit 11 shows the cost of hedging USD into JPY has fallen to close to zero since November 2008, when the U.S. Federal Reserve launched its quantitative easing programs. Given the decline of global interest rates, a fully hedged equity portfolio could have better tracked local returns in recent years for Japanese investors in the U.S. and global markets (Exhibit 11, right-hand chart).

[17] According to BIS' Triennial Central Bank Survey in 2013, daily turnover of OTC foreign exchange forward stood at USD 680 billion, compared with USD 160 billion for exchange traded foreign exchange futures and options.

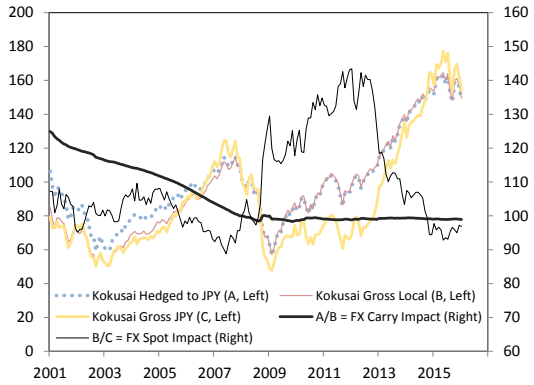
[18] Carry can be theoretically justified by valuing currency forward/futures based on Uncovered Interest Rate Parity.

Exhibit 11: Interest Rate Differential (Currency Carry) and Two Channels of Hedge Impacts

Annualized Cost (or Gain if Negative) of Hedge*



Currency Hedging: Two Channels of Impacts**



** Calculation is based on 3-month local deposit rates*

*** Calculation is based on MSCI gross total return indexes.*

This carry perspective is also consistent with Exhibit 2 (left-hand chart) and partly explains the risk of investing in equities denominated by higher yielding currencies. In other words, as unwinding the carry trade typically coincides with a financial crisis, there is significant positive left-tail correlation between high-yield currencies and equity markets.

APPENDIX 2. MINIMUM RISK CURRENCY HEDGE STRATEGIES

At times, equities and currency have moved inversely, thus offering potential risk reduction. Institutional investors seeking to lower the risk in their international equity portfolios could hedge their portfolios by using a mean-variance analysis. This mean-variance analysis can be used to determine an optimal hedge ratio.

We use the Barra global equity risk model (GEM2L) for equity and currency forecast covariance metrics. The optimizer calculates the optimum currency weights to minimize risk for the international equity portfolio, given its underlying currency exposures. For the purpose of this analysis, matrix transformations are used to get the covariance matrix for the equity portfolio and the underlying currency exposures; the optimizer solves for the currency weights for which portfolio risk is minimized on a monthly basis. The optimization problem is constrained so that post-hedging currency weights lie between zero and the pre-hedge currency exposure, i.e., we neither go net short on any of the currency exposures nor increase currency exposure, to minimize risk.

The impact of using optimal hedge ratios for equity portfolios can be seen in Exhibit 12. An optimal hedge strategy would have helped reduce risk in a single currency equity portfolio (e.g., one replicating the MSCI Japan Index, where the total risk was reduced from 16.1% on an annualized basis to 15.8%). The strategy would also have reduced risk in a multi-currency portfolio (e.g., one replicating MSCI EAFE where the total risk reduces from 17.3% to 13.8%). The optimal hedged portfolios also outperformed both the unhedged and passively hedged benchmarks during the sample period.

Exhibit 12: Performance and Risk of Optimal Hedging Strategies

	MSCI Japan Hedged to USD				MSCI EAFE Hedged to USD			
	0%	50%	100%	Optimal Hedged	0%	50%	100%	Optimal Hedged
Total Return	5.9	6.5	6.8	6.6	7.7	7.8	7.9	8.7
Volatility	16.1	16.8	18.6	15.8	17.3	15.3	14.0	13.8
Sharpe Ratio	0.27	0.29	0.28	0.32	0.35	0.41	0.45	0.52

Calculation is based on gross total returns from January 2003 to January 2016.

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