Deutsche
Asset Management

Exchange-Traded Funds

ETF currency white paper | April 2017

The New Neutral: The long-term case for currency hedging

Currency risk can impact international equity return and risk, but full exposure is often assumed to be the neutral position with asset allocation decisions. Examining the role of currency risk from a long-term asset allocation standpoint finds that currencies can add risk to international equities without improving returns. Reducing currency risk exposure can potentially improve long-term portfolio outcomes, and may be considered the "new neutral" for portfolios.

Overview

Strong portfolio construction is about balancing the risk and return of different assets. However, many investors who diversify their equity market holdings internationally may not be aware that they are, in fact, introducing a whole new asset class into their portfolios: currencies.

Currency exposure can have a significant impact on overall portfolio risk and return, but leaving exposure fully unhedged is often considered to be the "default" position when investing internationally. This mindset perhaps arises because currency comes implicitly packaged with international equities. Rather than accepting full currency exposure as a neutral baseline, we believe understanding and managing the currency risk of international equities is imperative when investing abroad.

When determining long-term asset allocation, what role should currency risk play? For an investor to justify maintaining full currency exposure, they must expect that the implicit currency risk of their portfolio will offer meaningful additional returns and/or will reduce overall portfolio risk through low correlation. We find that neither theory nor historical evidence suggests investors can expect either. Foreign currencies have not generated economically significant returns historically, and have added to volatility of international equities. Hedging international equities, at least partially, can therefore be expected to help improve portfolio outcomes.

In this paper, we examine the important inputs to the hedging decision: historical returns of international equities and currencies, the relative risk of each, and their correlations. We use historical data to develop reasonable forward-looking assumptions for these variables. Finally, we close by combining these findings into a simple framework for making the decision of whether to hedge currency exposure.

Our analysis reveals several findings:

- Return: Unlike equities, currencies do not have positive expected returns. Over short time periods, currency returns can have an additive or subtractive effect on overall portfolio returns, but the returns of a currency-hedged or unhedged investment in international equities should be expected to converge over time. Currencies are unlikely to improve portfolio returns.
- Risk: Currencies have significant volatility on a standalone basis that adds to overall portfolio variance. Currency volatility is typically about half that of its corresponding equity market. We find that currency risk consistently adds to total portfolio risk, especially over longer time horizons.
- Correlation: Given the lack of positive return expectations and the meaningful risk of currencies, the correlation between local equity market returns and currencies needs to be negative in order to justify inclusion on the basis of reducing overall portfolio variance. We find that equity-currency correlations are highly variable over short time periods, but trend to zero as the investment horizon lengthens, and are rarely negative enough to reduce total portfolio risk.

Contributors
- Robert Bush, ETF strategist
- Abby Woodham, ETF strategist

In summary, we find that currency exposure adds to the risk of international equities without improving returns. Consequently, we believe that fully hedging the currency risk of international equities should be considered the "new neutral" when making long-term asset allocation decisions. By doing so, investors can focus on "pure" international equity returns, and tactically overlay currency exposure if and when desired.

Equity and currency returns

International equity returns are determined by the return of the equities in local currency terms, and the return of the currency itself. Currency return is the change in the exchange rate between the U.S. dollar and a foreign currency. U.S. dollars must be converted into the relevant currency to buy foreign securities, and when the investment is repatriated (or its performance measured), the foreign currency is converted back to U.S. dollars. Any change in the exchange rate can have a significant impact on returns.

The return of an unhedged investment will be fully exposed to both equity returns and currency returns. Currency return is reflected in the formula below and is expressed as the change in U.S. dollars per unit of foreign currency from one period to another. Suppose for example that the EUR/USD exchange rate is 1.20 (dollars per euro) at the beginning of a month, and that over the course of that month the rate changes to 0.90 (the result of the euro weakening and the dollar strengthening). R_C would equal –0.25, or a 25% decline.

$$R_c = \frac{Spot_{t+1}}{Spot_t} - 1$$

The return of a currency-unhedged investment is shown in the following formulas with R_E representing the return of the equity market in local currency terms.

$$R_{unhedged} = (1 + R_E) \cdot (1 + R_C) - 1$$

$$R_{unhedged} = R_E + R_C + R_E R_C$$

Because the currency's impact on equity returns is multiplicative, unhedged returns have three drivers of performance: equity return, currency return, and the product of the two. The third term, $R_E R_C$, is typically very small in comparison to equity and currency returns.

To summarize, the return of an international equity investment will principally be driven by:
— The return of the equities in local currency terms
— The return of the currency exposure

Investors take long positions in equities because they expect those markets to provide positive returns. But can the same be said for foreign currencies? Given 30 years of monthly returns for seven MSCI developed market equity benchmarks (Germany, the United Kingdom, Canada, Japan, Switzerland, Australia, and the MSCI EAFE Index) and 15 years of monthly returns for seven emerging market benchmarks (South Korea, Taiwan, South Africa, Brazil, India, Mexico, and the MSCI Emerging Markets Index) we found the average monthly return for all equity markets (with the exception of Japan and Taiwan) was significantly above zero. As a rule of thumb, t-statistics above 2.0 are considered statistically significant. It makes sense for investors to consider a long position in international equities, given their positive expected contribution to portfolio return.

The same cannot be said for currencies. Taking the currencies of the same seven international developed and emerging markets and examining their average monthly returns against the U.S. dollar over the same time periods, we found that unlike the equity markets, which had positive expected returns, foreign currency returns were not statistically different from zero.

Figure 1: Average monthly returns of DM equities and currencies

	Germany	United Kingdom	Canada	Japan	Switzerland	Australia	MSCI EAFE Index
Average monthly equity return	0.7%	0.7%	0.8%	0.3%	0.8%	0.9%	0.5%
T-statistic	2.2	3.2	3.3	1.0	3.0	3.7	2.4
Average monthly currency return	0.1%	0.0%	0.0%	0.2%	0.3%	0.1%	0.1%
T-statistic	0.8	0.2	0.4	1.0	1.4	0.4	1.0

Source: MSCI, Bloomberg, Morningstar Direct. Monthly data from 4/1986 through 3/2016. Standard deviation is often used to represent the volatility of an investment. It depicts how widely an investment's returns vary from the investment's average return over a certain period. The **MSCI EAFE Index tracks** the performance of stocks in select developed markets outside of the United States.

Figure 2: Average monthly returns of EM equities and currencies

	South Korea	Taiwan	South Africa	Brazil	India	Mexico	MSCI EM Index
Average monthly equity return	1.1%	0.6%	1.4%	1.2%	1.4%	1.4%	1.0%
T-statistic	2.4	1.2	3.7	2.5	2.7	3.7	2.6
Average monthly currency return	0.1%	0.0%	–0.2%	–0.1%	–0.1%	–0.3%	–0.1%
T-statistic	0.5	0.2	–0.6	–0.4	–0.3	–1.4	–0.4

Source: MSCI, Bloomberg, Morningstar Direct. Monthly data from 4/2001 through 3/2016. Standard deviation is often used to represent the volatility of an investment. It depicts how widely an investment's returns vary from the investment's average return over a certain period. The **MSCI Emerging Markets Index** tracks the performance of stocks in select emerging markets. Past performance does not guarantee future results.

The lack of evidence for excess currency returns makes intuitive sense. Currencies are generally believed to behave differently from equity and fixed income securities, moving in cycles around a long-term equilibrium rate. We believe a reasonable assumption for the expected return of foreign currencies (R_c) is zero.

Next we turn to the return of a currency hedged international equity investment.

Currency hedging aims to reduce the effects of currency fluctuations on investment risk and return. Hedging can be accomplished by a variety of methods and instruments, but the most common strategy utilizes currency forward contracts. With such contracts, the international investment's currency of denomination is sold in the forward currency market, which hedges a specific amount of foreign currency risk for a set time period (typically one month).

For example, a U.S.-based portfolio manager with ¥ 50 million of Japanese equities could hedge her yen FX (currency) risk by selling a ¥ 50 million forward contract on yen against U.S. dollars for settlement in a month's time at today's forward rate. The forward rate is the rate at which currencies will be exchanged in the future, and is primarily a function of the current spot exchange rate and the interest rate differential between the U.S. dollar and the foreign currency. The return of a forward contract is approximately equal to

$$\text{Forward contract return} \approx \frac{\textit{Forward rate} - \textit{Spot}_{t+1}}{\textit{Spot}_t}$$

In addition to offsetting the effect of exchange rate fluctuations, forward contracts have an additional return (an embedded premium or discount) approximately equal to:

$$\text{Forward premium/discount} \approx \frac{\textit{Forward rate}}{\textit{Spot}_t} - 1$$

The forward premium/discount is also called cost of carry. If U.S. dollar interest rates are higher than the respective foreign currency's rates, the interest rate differential reflected in the forward rate will be a net positive return for investors. This return is "locked in" through the forward contract. The converse is true if foreign rates are higher. Carry is typically small for developed market currencies, which has been particularly true in the years following the financial crisis. However, interest rate differentials can be significantly higher for emerging market currencies.

The return of international equities currency hedged using forward contracts will equal the unhedged return plus the return of the currency forward contract. Taking the formulas for the return of a currency forward contract, the forward premium/discount, and currency return:

$$R_{hedged} \approx R_{unhedged} + \frac{\textit{Forward rate}}{\textit{Spot}_t} - \frac{\textit{Spot}_{t+1}}{\textit{Spot}_t}$$

$$R_{hedged} \approx R_{unhedged} - R_c + \textit{Carry}$$

As expected, hedging with forward contracts removes the currency return from the equation, leaving investors with equity return, the cross product of equity and currency return, and carry. The principal drivers of currency hedged equity returns will be

- The expected return of the equities in local currency terms
- The interest rate carry, also called the forward currency premium

In practice, realized results will differ from these formulas, which is why we have denoted them as approximations. The formulas assume a 1-month horizon window, and several FX hedge rolls would bear a compounding effect. The relationship between forward rates and interest rate carry (called the cross currency basis) is not perfect, and there will be transactional costs as well.

On average we have observed that currency hedged equity returns are very strongly similar to local equity market returns. Since the inception of the MSCI EAFE US Dollar Hedged Index in 1993, the average monthly return of the hedged index has not differed from the average monthly return of the MSCI EAFE Index in local currency terms to a statistically significant degree. We think investors can reasonably expect that international equities hedged with monthly rolling forward contracts will be primarily driven by equity returns.

.

Volatility of equities and currencies

Foreign currency exposure is not expected to improve returns, but could it improve portfolio outcomes by lowering overall volatility? That will be a function of the volatility of equities, currencies, and the correlation between them. Taking the variance of hedged and unhedged returns, we find:

$$VAR_{\text{unhedged}} = VAR(R_E) + VAR(R_C) + 2 \cdot COVAR(R_E, R_C) + ST$$

$$VAR_{\text{hedged}} = VAR(R_E) + ST$$

In these equations, ST stands for "small terms," which are much smaller in size than the other terms. Because they are not significant contributors to volatility, they have been left out of this paper for simplicity's sake.

The variance of a hedged international equity investment is principally composed of the variance of the underlying equities in local currency terms. However, the variance of an unhedged investment is composed of the volatility of the equities, and the volatility of the currencies, and twice the covariance of the two.

Using the same data from our exploration of equity and currency returns, we calculated the standard deviation of monthly developed and emerging market equities and currencies and the results are shown in Figures 3 and 4. The volatility of monthly equity returns is about twice the volatility of the respective currencies. For both developed and emerging markets, equity volatility is the dominant term, and currency volatility is significant and additive to total investment volatility.

Figure 3: Standard deviations (annualized) of DM equity and currency returns

	Germany	United Kingdom	Canada	Japan	Switzerland	Australia	MSCI EAFE Index
Standard deviation of equity	21.5%	15.4%	15.0%	19.7%	16.5%	16.2%	15.3%
Standard deviation of currency	10.8%	9.7%	7.6%	11.2%	11.5%	11.7%	8.4%

Source: Bloomberg. Monthly data from 4/1986 through 3/2016. Standard deviation is often used to represent the volatility of an investment. It depicts how widely an investment's returns vary from the investment's average return over a certain period. The **MSCI EAFE Index** tracks the performance of stocks in select developed markets outside of the United States. Germany represented by MSCI Germany Index and euro (EUR), United Kingdom represented by MSCI UK Index and British Pound (GBP), Canada represented by MSCI Canada Index and Canadian dollar (CAD), Japan represented by MSCI Japan Index and Japanese yen (JPY), Switzerland represented by MSCI Switzerland Index and Swiss franc (CHF), and Australia represented by MSCI Australia Index and Australian dollar (AUD). See last page for country-specific index definitions. Past performance does not guarantee future results.

Figure 4: Standard deviations (annualized) of EM equity and currency returns

	South Korea	Taiwan	South Africa	Brazil	India	Mexico	MSCI EM Index
Standard deviation of equity	21.9%	22.0%	17.1%	22.8%	24.0%	17.0%	17.7%
Standard deviation of currency	11.5%	5.1%	16.8%	17.9%	12.0%	9.9%	6.5%

Source: Bloomberg. Monthly data from 4/2001 through 3/2016. Standard deviation is often used to represent the volatility of an investment. It depicts how widely an investment's returns vary from the investment's average return over a certain period. The **MSCI Emerging Markets Index** tracks the performance of stocks in select emerging markets. South Korea represented by MSCI Korea Index and South Korean won (KRW), Taiwan represented by MSCI Taiwan Index and new Taiwan dollar (TWD), South Africa represented by MSCI South Africa Index and South African Rand (ZAR), Brazil represented by MSCI Brazil Index and Brazilian real (BRL), India represented by MSCI India Index and Indonesian Rupiah (IDR), and Mexico represented by MSCI Mexico Index and Mexican Peso (MXN). See last page for country-specific index definitions. Past performance does not guarantee future results.

From this we see that foreign currencies are not expected to improve portfolio return, but have meaningful associated risk. The only way to justify an allocation to foreign currencies is if it reduces portfolio volatility through low correlation with equity returns. If the correlation between the two is not sufficiently negative to offset the standalone volatility of foreign currencies, then currency exposure can be expected to increase the volatility of unhedged international equities without compensating investors with higher returns.

Correlation

Correlation is an often-overlooked but absolutely vital consideration in investment analysis. It is easy to forget that the addition of an asset with a very low or even negative expected return, or very high volatility, can actually improve a portfolio's risk-adjusted return if it has a sufficiently low (i.e. negative) correlation with other portfolio assets. Generally speaking, investments that "zig" when others "zag" are keenly sought after by market participants.

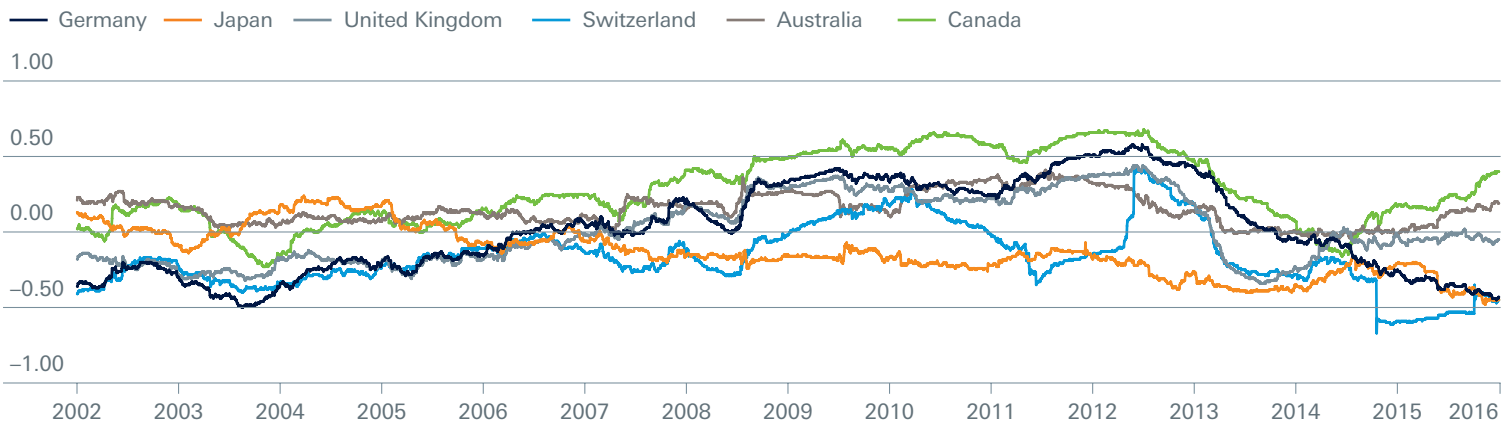
The problem with forecasting correlation is its notorious instability. The statistic is sensitive both to the time periodicity of returns (daily, weekly, or monthly) and the amount of historical data incorporated (one year, five years, ten years, or more). On top of that, empirical evidence shows that equity/currency correlations can vary wildly across samples. It is very difficult to make high conviction out-of-sample forecasts because of the fluctuations in value from time period to time period.

Figure 5 shows the rolling one-year correlation of six developed market equities and currencies. We used correlation, rather than covariance, because many investors are more comfortable recognizing and using correlation data (it is essentially a "standardized" version of covariance that is bounded between plus and minus one). Clearly, realized correlations have ranged quite markedly over this period. We believe a reasonable assumption for the third term in the variance equation, $2 \cdot COVAR(R_E, R_C)$, is zero—especially over long time periods. To assume otherwise would require high conviction on the part of investors as to the drivers and magnitude of correlations.

Although equity-currency correlations are unstable and range widely over the short 1-year periods shown, what about the relationship over longer time periods, which are more relevant to the asset allocation decision? In fact, the relationship becomes clearer over longer time periods. Equity and currency correlations trend to zero as the time horizon lengthens. The longer an investor's time horizon, the more likely that the covariance of developed equity market returns and currency returns will be zero, meaning that currency exposure is likely to add uncompensated risk to the portfolio.

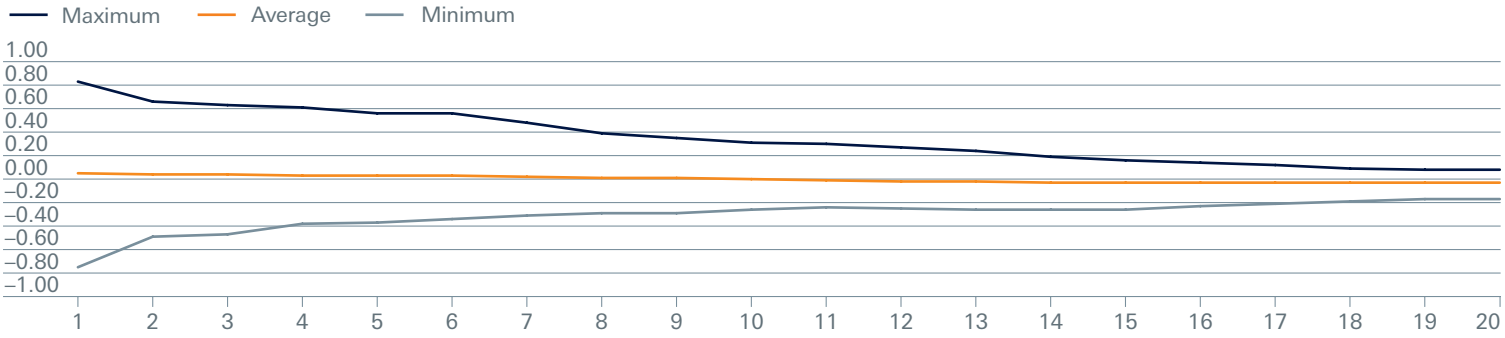
This very important point is illustrated by empirical evidence using the MSCI EAFE Index. We chose this aggregate benchmark because it is widely used by investors, and can serve as a proxy for broad developed market international equities. Taking the monthly returns of the MSCI EAFE Index in local currency terms and the monthly currency returns of the index since 1973 (when the dollar became truly free-floating), we calculated correlations over every rolling period between 1 and 20 years. This provides a data set of every realized correlation over 20 different investment time horizons. Figure 6 shows the maximum and minimum realized correlation and the average for each time horizon. For example, over all rolling 10-year time periods ending March 2016, the average correlation between equity and currency returns was zero. The highest observed correlation was 0.31, and the lowest observed correlation was –0.26. As the time horizon increased, correlations converged to zero. Across time periods, the average correlations were not statistically different from zero.

Figure 5: Rolling one-year correlation of local equity returns and currency returns



Source: Bloomberg. Daily data from 3/30/2001 through 3/31/2016, calculated based on a 252-trading day year. Germany represented by MSCI Germany Index and euro (EUR), Japan represented by MSCI Japan Index and Japanese yen (JPY), United Kingdom represented by MSCI UK Index and British Pound (GBP), Switzerland represented by MSCI Switzerland Index and Swiss franc (CHF), Australia represented by MSCI Australia Index and Australian dollar (AUD) and Canada represented by MSCI Canada Index and Canadian dollar (CAD) Past performance does not guarantee future results.

Figure 6: Maximum, minimum, and average correlations of MSCI EAFE local currency index returns and currency returns over various time horizons

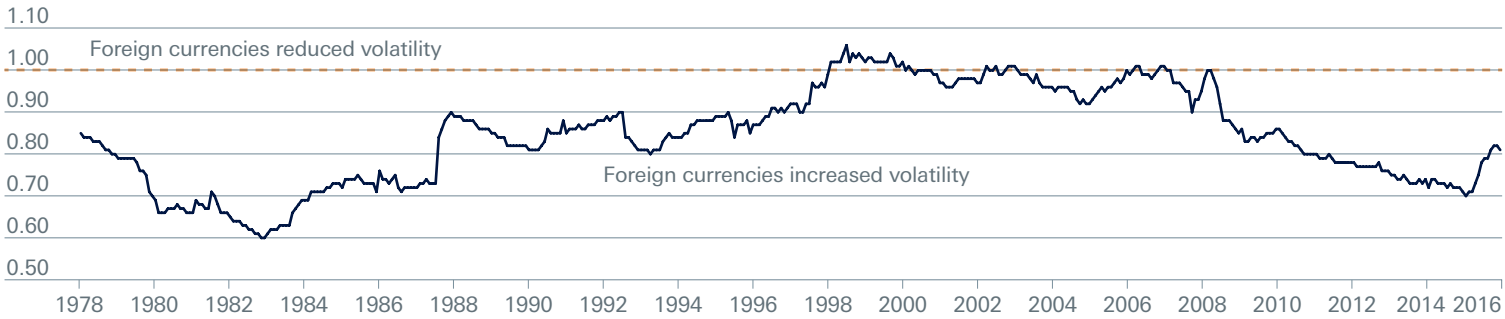


Source: Morningstar. Monthly data from 3/1/1973 through 3/31/2016. Past performance does not guarantee future results.

Given our assumption of zero correlation between developed market equities and currencies, especially over longer time periods, we expect currency exposure to increase overall volatility of international equities. To assess our prediction, we considered the historical impact of currency exposure on the volatility of the MSCI EAFE Index. We are interested in not only if currency exposure increased volatility, but also if the effect was persistent and increasingly pronounced over longer time periods. Figure 7 shows the ratio of the rolling 5-year standard deviations of MSCI EAFE without currency exposure and with. When the ratio is below 1, foreign currencies increased volatility. The ratio tells us the extent of the increase. Since 1973, currency exposure has added to overall risk in almost all 5-year time periods. At times, MSCI EAFE with no foreign currencies had a 40% volatility reduction. The average volatility reduction across sub-samples was 16%.

Figure 8 expands this analysis to longer time horizons. The longer the time horizon, the greater the likelihood that currency risk added incremental volatility to international equities.

Figure 7: Ratio of rolling 5-year volatility of MSCI EAFE without, and with, foreign currencies



Source: Morningstar. Monthly data from 3/1/1973 through 3/31/2016. Past performance does not guarantee future results.

Figure 8: Incremental volatility from currency exposure in the MSCI EAFE Index (1973-2016)

	5 years	10 years	15 years
# of rolling periods	458	398	338
Number of rolling time periods currency exposure increased volatility	418	389	338
% of periods currency exposure increased volatility	91%	98%	100%

Source: Deutsche Asset Management and Morningstar as of 3/31/16. Rolling difference in annualized volatility of monthly index returns. The **MSCI EAFE Index** tracks the performance of stocks in select developed markets outside of the United States. Past performance does not guarantee future results.

Bringing it together: a framework for the currency hedging decision

We have provided readers with a comprehensive discussion of the inputs for the currency hedging decision: currency and equity returns, risks, and correlations. Now we bring together this information to form a simple framework for considering the role of foreign currencies in a strategic asset allocation. For the sake of simplicity, we assume that fully hedged international equity returns are composed of a single asset: local equity market returns (no hedging costs or other frictions). In contrast, an unhedged position can be thought of as a two-asset portfolio of local equity market returns and

currency returns. Given our earlier discussion of the zero expected return of passive currency exposure, we assume that foreign currencies as an asset will not be additive to portfolio returns. Foreign currency exposure from an asset allocation standpoint, then, hinges on two assumptions: the relative volatility of equity and currency returns, and their correlation. Currency volatility is not trivial, and the larger it is relative to the volatility of the other portfolio assets, the larger its contribution to overall portfolio volatility. This is important when constructing equity portfolios, but is especially relevant for portfolios that include an allocation to lower-volatility assets like fixed income. Correlation is also central: for currency exposure to be attractive from a portfolio volatility minimizing perspective, it must be sufficiently negative to offset the standalone volatility of currency returns.

Figure 9 is a theoretical illustration of the impact of foreign currencies on portfolio volatility given two inputs: currency volatility, and equity-currency correlation. The figure assumes 15% equity volatility. Where the figure is unshaded, foreign currency exposure increased volatility by the percentage shown. For example, assuming no correlation between equity and currency returns and FX volatility of 10% (close to historical averages, as discussed earlier in this paper), leaving currency exposure unhedged would result in a 20% increase in portfolio volatility. Blue shading designates when currency exposure reduces volatility.

Figure 9: The relative volatility increase from currency exposure

Correlation of equity and currency returns	Standard deviation of currency returns							
	4	6	8	10	12	14	16	18
1	27%	40%	53%	67%	80%	93%	107%	120%
0.9	25%	37%	50%	63%	75%	88%	101%	114%
0.8	22%	34%	46%	58%	71%	83%	96%	109%
0.7	20%	31%	43%	54%	66%	78%	91%	103%
0.6	18%	28%	39%	50%	61%	73%	85%	97%
0.5	16%	25%	35%	45%	56%	67%	79%	91%
0.4	13%	22%	31%	41%	51%	62%	73%	84%
0.3	11%	18%	27%	36%	46%	56%	67%	78%
0.2	9%	15%	22%	31%	40%	50%	60%	71%
0.1	6%	11%	18%	26%	34%	43%	53%	64%
0	3%	8%	13%	20%	28%	37%	46%	56%
–0.1	1%	4%	9%	15%	22%	30%	39%	48%
–0.2	–2%	0%	3%	9%	15%	22%	31%	40%
–0.3	–5%	–4%	–2%	2%	8%	15%	22%	31%
–0.4	–7%	–8%	–7%	–5%	0%	6%	13%	22%
–0.5	–10%	–13%	–13%	–12%	–8%	–3%	3%	11%
–0.6	–13%	–18%	–20%	–20%	–18%	–13%	–7%	0%
–0.7	–16%	–23%	–27%	–29%	–28%	–25%	–20%	–13%
–0.8	–20%	–28%	–34%	–39%	–40%	–39%	–34%	–28%
–0.9	–23%	–34%	–43%	–51%	–55%	–56%	–53%	–47%
–1	–27%	–40%	–53%	–67%	–80%	–93%	–93%	–80%

This hypothetical example does not represent any particular investment.

We find that equity-currency correlation must be meaningfully negative for currencies to potentially provide diversification benefits. Correlation of 0 is not enough. As FX volatility increases, the correlation threshold becomes more negative. The average correlation was approximately zero across time periods historically (Figure 6), which indicates that portfolio variance-minimizing investors must have a very high conviction view that equity-currency correlations will be meaningfully negative in order to justify maintaining currency exposure.

Conclusion

Our theoretical and empirical analysis of equity and currency risk leads us to the observation that currency risk is typically uncompensated in international equity portfolios, given our previously described assumptions. Confirming standard theory, we found evidence that equities have positive risk premia, but found no such evidence for currencies. Turning to volatility, we found that currencies have meaningful standalone risk and that equity-currency correlation is an important determinant of overall portfolio volatility. Equity-currency correlation can range widely depending on the sample period and time horizon, but must be nontrivially negative for currency risk to help reduce total portfolio variance. We found that currency returns added to the variance of broad international equities in most historical environments.

Using our tested data and assumptions, we believe that hedging the currency risk of a portfolio of international equities can be expected to lower portfolio volatility without impacting expected returns. For investors determining their strategic asset allocation, we think zero exposure to foreign currencies should be considered the "new neutral," instead of fully unhedged exposure. If an investor takes fully hedged exposure as their baseline asset allocation, they should consider deviating from a fully hedged position if they have a strong tactical conviction for the return of a particular currency.

Definitions:
Correlation is a measure of how closely two variables move together over time. A 1.0 equals perfect correlation. A –1.0 equals total negative correlation. The MSCI Australia Index is designed to measure the performance of the large- and mid-cap segments of the Australia market in gross local terms. The MSCI Brazil Index tracks the performance of Brazilian stocks in gross local terms. The MSCI Germany Index tracks the performance of German stocks in gross local terms. The MSCI India Index tracks the performance of Indian stocks in gross local terms. The MSCI Japan Index is designed to measure the performance of the large- and mid-cap segments of the Japanese market in gross local terms. The MSCI Mexico Index tracks the performance of Mexican stocks in gross local terms. The MSCI South Africa Index is designed to measure the performance of the large and mid cap segments of the South African market in gross local terms. The MSCI South Korea Index tracks the performance of South Korean stocks in gross local terms. The MSCI Switzerland Index is designed to measure the performance of the large and mid cap segments of the Swiss market in gross local terms. The MSCI Taiwan Index is designed to measure the performance of the large and mid cap segments of the Taiwan market in gross local terms. The MSCI United Kingdom Index is designed to measure the performance of the large- and mid-cap segments of the UK market in gross local terms. The MSCI EAFE US Dollar Hedged Index is designed to provide exposure to equity securities in developed international stock markets, while at the same time mitigating exposure to fluctuations between the value of the U.S. dollar and selected non-U.S. currencies.

T-statistic is used to test hypotheses. It is a ratio of the departure of an estimated parameter from its notional value (total value of a leveraged position's assets) and its standard deviation (volatility). Standard deviation is a statistical measure of the degree in which an individual value in a probability distribution tends to vary from the average of the distribution.

Spot price is the current price a particular security can be bought or sold in the marketplace.
Variance is a measurement of the difference between a set of numbers in a data set.
VAR(RE): The variance of monthly equity returns.
VAR(RC): The variance of monthly currency returns.
Developed Market (DM) refers to a country with a highly industrialized economy and capital markets.

Emerging Market (EM) refers to a country with an economy consisting of low to middle per capita income.

Free-floating in terms of a currency's exchange rate refers to its ability to freely change based on activity in the foreign exchange market and the supply and demand of a particular currency relative to other currencies.

Standard theory is not in reference to a specific theory. Instead, in using the term 'standard theory' we are "confirming what everyone already assumes."

Risk premia refers to the expected excess return on a security. Excess return refers to the difference between an actual return of a security and that of a riskless security.

The opinions and forecasts expressed herein by the ETF strategists do not necessarily reflect those of DeAWM Distributors, are as of the date of this report and may not come to pass.

Deutsche X-trackers ETFs ("ETFs") are managed by DBX Advisors LLC or DBX Strategic Advisors LLC (the "Advisors"), and distributed by ALPS Distributors, Inc. ("ALPS"). The Advisors are subsidiaries of Deutsche Bank AG, and are not affiliated with ALPS.

Carefully consider the fund's investment objectives, risk factors, and charges and expenses before investing. This and other information can be found in the fund's prospectus, which may be obtained by calling 1-855-329-3837, or by viewing or downloading a prospectus from deutsche-etfs.com. Read the prospectus carefully before investing.

Investing involves risk, including possible loss of principal. Funds that invest in specific countries or geographic regions may be more volatile than investing in broadly diversified funds. A fund's use of forward currency contracts may not be successful in hedging currency exchange rates changes and could eliminate some or all of the benefit of an increase in the value of a foreign currency versus the U.S. dollar. Securities focusing on a single country may be more volatile. In addition to the normal risks associated with investing, international investments may involve risk of capital loss from unfavorable currency fluctuations, from differences in generally accepted accounting principles or from economic or political instability in other nations. Emerging markets involve heightened risks related to the same factors as well as increased volatility and lower trading volume. There are additional risks because of potential fluctuations in currency and interest rates. A fund's use of forward currency contracts may not be successful in hedging currency exchange rate changes and could eliminate some or all of the benefit of an increase in the value a foreign currency versus the U.S. dollar. Investing in derivatives entails special risks relating to liquidity, leverage and credit that may reduce returns and increase volatility.

Investment products: No bank guarantee | Not FDIC insured | May lose value

Nothing contained herein is investment advice nor shall it be relied upon as such. If an investment is made with any Deutsche Bank AG affiliate, it is acknowledged that we are not providing investment advice of any kind, nor are we acting in any fiduciary capacity.

Shares are not individually redeemable, and owners of Shares may acquire those Shares from the Fund, or tender such Shares for redemption to the Fund, in Creation Units only.

Deutsche Asset Management represents the asset management activities conducted by Deutsche Bank AG or any of its subsidiaries.