

Research

FTSE
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International investment and the US dollar

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Executive summary

- Many US-based investors seek diversification benefits by investing in international equities. Unhedged international investing however, adds foreign exchange (FX) risk in the form of an embedded currency basket, which contains long positions in foreign currencies coupled with a 100% short position in the US dollar (USD).
- While financial theory argues the long-term payoff to currency exposure should be zero, currency fluctuations can have a significant effect on investment returns and volatility over short and even medium-term investment time horizons.
- Unhedged foreign investment embodies an expectation that the value of the USD will fall; a 100% hedged approach implicitly assumes the dollar will strengthen. A 50% hedged approach in contrast, represents a neutral view on the future direction of the USD; a neutral position is 50% long and 50% short.
- In 2015 FTSE Russell launched a series of international equity indexes for the USD-based investor that are 50% USD hedged to help investors evaluate their currency exposures and their hedging strategies when investing in foreign equities. This paper updates the research on the behavior of these indexes through June 2017; the results are consistent with earlier published findings.

Over the 12-month period from June 2014 to June 2015, the US dollar (USD) rose significantly relative to other currencies. Improving indicators about the state of the US economy, actions by the European Central Bank to stimulate the Eurozone, as well as investor expectations that the US Federal Reserve would begin raising interest rates all contributed to this stark improvement in the market's valuation of the USD. For the 24-month period between June 2015 and June 2017, however, the USD path was essentially trendless--though volatile; the US Federal Reserve Trade Weighted US Dollar Index: Major Currencies ended at a level on June 30, 2017 almost exactly equal to the level observed at the end of June 2015.

For the US based investor, the behavior of the USD is of particular concern. When foreign investments are unhedged and the dollar increases in value, for example, international equity returns are reduced--sometimes dramatically. This is caused by the short position in the USD that is embedded in unhedged international investments. Other states of the US dollar can also affect realized international returns and risks¹ from a US investor perspective. FTSE Russell responded to the need for investors to analyze these positions with the launch in 2015 of a series of five international equity indexes that apply a 50% hedge to the USD.

FTSE Developed Europe 50% Hedged to USD Index

FTSE Developed ex North America 50% Hedged to USD Index

FTSE Emerging 50% Hedged to USD Index

FTSE Japan 50% Hedged to USD Index

FTSE Germany 50% Hedged to USD Index

¹ Risk as measured by volatility (standard deviation).

The currency exposures embedded in unhedged international investment.

Why are they important?

What are their characteristic exposures?

What investment assumptions are made by the hedged and unhedged investor?

Exchange rate movements can have a significant impact on the overall returns to investing outside of the domestic market. The returns to currency can reduce and at times eliminate the returns of foreign stocks. This would have been the real-life experience of a US investor in an unhedged fund or portfolio that tracked the FTSE Developed ex North America (NA) Index over 2014 and 2015, two calendar years during which the dollar rose significantly against most other developed currencies. The outcomes are reported in Table 1; currency losses for the unhedged US investor over these years would have been significant.

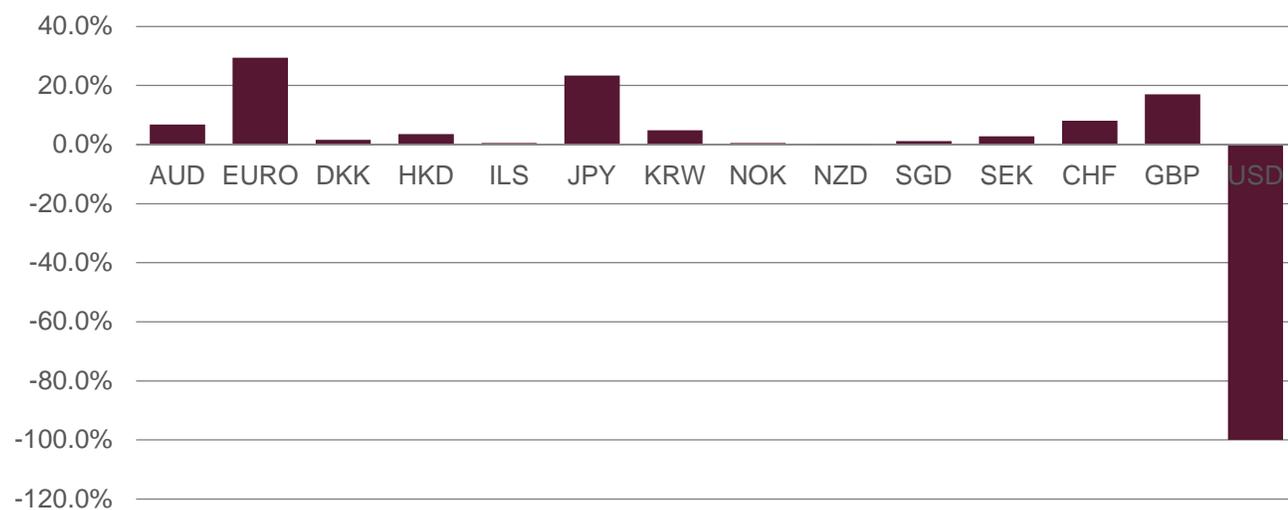
Table 1. Currency losses for the USD based investor in a portfolio tracking the FTSE Developed ex North America Index Calendar Years 2014 and 2015

	FTSE Developed ex North America Index 0% Hedged USD	FTSE Developed ex North America Index 100% Hedged USD	Impact of Currency on Unhedged Return
2014	-4.6%	5.6%	-10.3%
2015	0.0%	5.7%	-5.7%

Source: FTSE Russell. Data for the years 2014, 2015; data as of June 2017. Past performance is no guarantee of future results. Please see the end of this paper for important legal information.

Why do we see this outcome when the USD strengthens? The unhedged index implicitly contains an embedded separate basket of currencies; for the FTSE Developed ex NA Index, this currency portfolio consists of a long position in foreign currencies, offset by a 100% short position in the USD. Figure 1 below depicts the currency basket embedded in the FTSE Developed ex NA Index as of June 30, 2017.

Figure 1. Embedded currency basket, FTSE Developed ex North America Index June 30, 2017

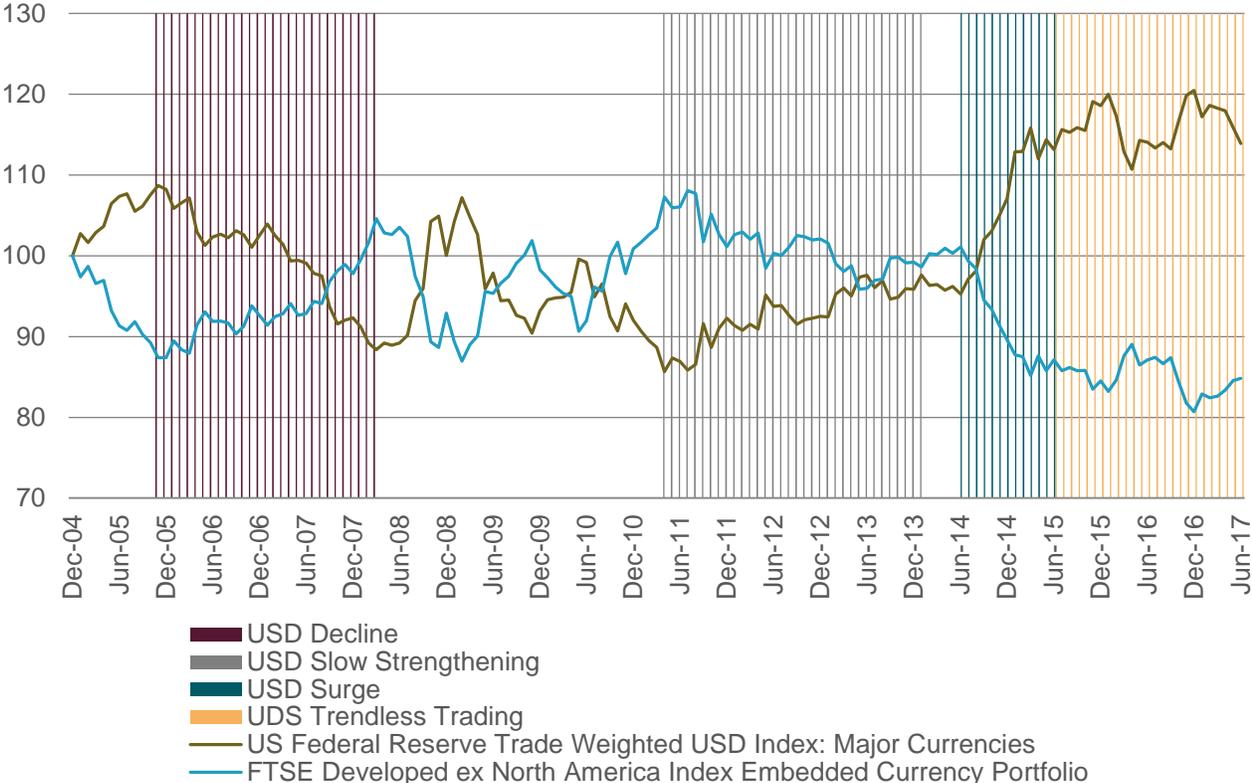


Source: FTSE Russell. Data as of June 30, 2017.

An investment that has a short exposure makes money and has a positive performance when the asset or underlying entity loses value. The opposite is also true; the short position will lose money when the underlying asset or position appreciates. We can see the history of this relationship in Figure 2, where we compare the values of the US Federal Reserve Trade Weighted USD Index: Major Currencies to the cumulative return of the currency basket embedded in the FTSE Developed ex NA Index (here we define the embedded currency basket return as the difference between the unhedged and the 100% hedged versions of the index). We highlight four important market states of the US dollar from Figure 2:

- USD decline from November 2005 to March 2008; note the increasing cumulative value of the embedded currency portfolio of the FTSE Developed ex NA Index over this period.
- USD gradual strengthening from April 2011 through January 2014; the embedded currency portfolio experienced a slow decline in value over this time period.
- USD rose significantly from June 2014 through June 2015; the currency portfolio embedded in the unhedged FTSE Developed ex NA Index precipitously lost value over this period.
- USD trendless trading: there were notable spikes and declines in the dollar over the 24 months between June 2015 and June 2017, yet the USD value ended this period at the same level as it began. The embedded currency portfolio incurred a slight loss over the period.

Figure 2. Comparison of the cumulative growth of 100 units of the currency basket embedded in the FTSE ex North America Index (unhedged) and the value of the USD as measured by the US Federal Reserve Trade Weighted USD Index: Major currencies (beginning value reset to 100) January 2005 to June 2017



Sources: FTSE Russell and US Federal Reserve Bank. Data as of June 30, 2017. Past performance is no guarantee of future results. Returns prior to index launch dates reflect hypothetical historical performance. Please see the final page for important legal information.

Even though the unhedged international investor may not be consciously or knowingly predicting what the USD is going to do, they are implicitly assuming the USD will lose value. Over certain periods, for instance, during the calendar years 2014 and 2015 as we have shown, the unhedged investor that had a concentrated short position in the USD would have experienced significantly lower investment returns.

What about the investor who is 100% hedged? This investor is making an implicit assumption: that the dollar will rise. This bet is the mirror image—the other side—of the unhedged assumption. The performance statistics of the 100% hedged and the unhedged index reported in Table 2 demonstrate this. The hedged portfolio significantly underperformed the unhedged portfolio during the period of the dollar weakening, from November 2005 to March 2008—an average underperformance each year of 7.5% with a slightly increased level of volatility. Even during the recent trendless trading period, the hedged index posted higher returns compared to the unhedged, albeit the performance of the two indexes was not as differentiated as in the strongly trending market states.

Table 2. Performance statistics for the FTSE Developed ex North America Index, 100% hedged and 0% hedged to the USD over four market states

Falling Dollar Nov 2005 to March 2008	FTSE Developed ex North America Index 100% Hedged USD	FTSE Developed ex North America Index 0% Hedged USD
Sharpe Ratio	0.3	0.9
Annualized Return, %	7.6	15.1
Annualized StdDev, %	12.2	11.5
Max Drawdown Return, %	-19.3	-14.2
Gradually Strengthening Dollar April 2011 to January 2014	FTSE Developed ex North America Index 100% Hedged USD	FTSE Developed ex North America Index 0% Hedged USD
Sharpe Ratio	0.7	0.4
Annualized Return, %	8.1	5.9
Annualized StdDev, %	12.8	17.3
Max Drawdown Return, %	-18.4	-23.0
Sharply Strengthening Dollar June 2014 to June 2015	FTSE Developed ex North America Index 100% Hedged USD	FTSE Developed ex North America Index 0% Hedged USD
Sharpe Ratio	1.2	-0.2
Annualized Return, %	10.8	-2.5
Annualized StdDev, %	8.6	9.8
Max Drawdown Return, %	-4.4	-9.2
Trendless Trading June 2015 to June 2017	FTSE Developed ex North America Index 100% Hedged USD	FTSE Developed ex North America Index 0% Hedged USD
Sharpe Ratio	0.3	0.3
Annualized Return, %	4.0	3.5
Annualized StdDev, %	12.6	13.4
Max Drawdown Return, %	-15.5	-16.6

Source: FTSE Russell. Data as of June 30, 2017. Past performance is no guarantee of future results. Returns prior to index launch dates reflect hypothetical historical performance. Please see the end for important legal information.

How do international investors decide on their approach to hedging their currency exposure?

We have shown that currency exposure is an important determinant of performance in international investing, and decisions about whether to hedge and how much to hedge embody views, or forecasts, on the future performance of the domestic currency (here the USD) versus other major currencies. What else does an investor need to know to make an informed decision about currency? What insights are there from financial theory? From academic research?

Traditionally, discussions in relation to currency hedging have focused on the two extremes: the fully hedged portfolio which eliminates foreign exchange exposure and the unhedged portfolio which leaves currency exposure unmanaged. As we have shown above, these extremes may not be ideal for many investors. In this section we briefly summarize the arguments supporting the most common hedge ratios (here defined as how much or what percentage of the total currency exposure is to be hedged) from a survey of the academic literature.

1. The 100% hedged ratio (fully hedged). Andre Perold and Evan Schulman² make an argument for full hedging in an influential paper, based on the position that currency exposure can be removed without sacrificing return in the long run. They argue that currency hedging has a long-term expected return of zero, and thus investors can achieve substantial risk reduction at no loss of expected return. The USD appreciates some years and depreciates relative to foreign currencies in others. Proponents of 100% hedging strategies argue that unless participants have the ability to time these currency movements, they will be best served by a completely hedged approach. We have demonstrated however, that the fully hedged position is in fact implicitly taking a position on the USD over short- and even medium-term horizons. We also note that a 100% hedge does not always reduce index volatility relative to the unhedged index— during the period of the Falling Dollar, November 2005 to March 2008, the hedged index had a higher standard deviation and a higher maximum drawdown (Table 1).
2. The 0% hedged ratio (unhedged). 0% hedging leaves the investor with full currency exposure, so total returns, as we have seen, will include both asset and FX movements. Kenneth Froot³ makes an argument for unhedged portfolios on the basis that currency hedging does not reduce volatility for long horizons. Froot does concede that hedging can substantially reduce risk in the short-term, but shows that in the long run many fully hedged international investments actually have greater return variance than their unhedged counterparts. According to the theory of Purchasing Power Parity (PPP), currency returns are mean reverting over a long investment horizon and investors should maintain unhedged positions. The proponents of this approach contend that, considering the arguments above, the cost of hedging isn't worthwhile. Again, our examples above show that the unhedged position has very concentrated exposures to currency which can have and have had significant impacts on investment returns over reasonable investment horizons.
3. The somewhere between 0 and 100% hedge ratio. The preferences and priorities of investors can be quite different, further complicating the hedge ratio decision. Fortunately, investors are not forced to choose between fully hedged or unhedged. In fact, transaction costs aside, there are an infinite number of hedging ratios that can be implemented within an international portfolio. Fisher Black⁴ derives a formula for an optimal hedge ratio dependent upon the expected return of the market, the

² Perold, André, and Evan C. Schulman. "The Free Lunch in Currency Hedging: Implications for Investment Policy and Performance Standards." *Financial Analysts Journal* 44, no. 3 (May/June 1988).

³ Froot, K. (1993) "Currency Hedging over Long Horizons", *National Bureau of Economic Research*, Cambridge, MA.

⁴ Black, F. (1989) "Universal Hedging: Optimizing Currency Risk and Reward in International Equity Portfolios", *Financial Analysts Journal*, July- August.

market's volatility and the volatility of the exchange rate. Black concludes this optimal hedge ratio often falls between the two extremes of 0% and 100%, and changes through time based on the inputs.

4. The 50% hedge ratio. Studies have shown that a relatively simple alternative, a 50% hedge ratio, can provide substantial volatility reduction without having to give up the entire potential return from foreign currencies. Gardner and Wuilloud⁵ make an interesting case for the 50% hedging ratio by investigating the “regret” that results when a hedge implemented based on a mean-variance framework is outperformed by a simple alternative strategy. More broadly, regret results when investors are hedged and foreign currencies rise, and when unhedged and foreign currencies fall. The authors find that moving from the mean-variance optimal hedge ratio to a 50% strategy helps to avoid extreme regret without sacrificing much expected risk-adjusted return. The authors recognize that investors with a long time horizon experience less regret reduction than those with a shorter time horizon. Gorman, Qian and Surz⁶ also argue in favor of a 50% currency hedge. They make the following observations:

- currency impacts on both returns and volatility are too great to ignore;
- currency movements are too hard to predict and to time;
- the 50% hedged position represents neutrality (embodies no forecasts);
- the impact on returns and risk of a 50% hedged approach are non-linear in terms of volatility—in other words, generally over half the volatility improvement is realized with a 50% hedge ratio, and;
- this volatility reduction allows for larger allocations to international stocks within a portfolio's risk budget.

The 50% hedge ratio: further considerations and historical performance

Gorman, Qian and Surz's observations supporting a 50% currency hedge ratio for international investments merit a closer look. We have already demonstrated how much embedded currency exposures can impact the level and volatility of returns. We have reported return behavior that supports the contention that the 100% hedged as well as the 0% hedged positions embody a forecast of the performance of the home currency (here again the USD) relative to other currencies. Indeed, we find Gorman et al. persuasive in that any position other than a 50% hedge embodies a currency forecast; a 50% hedged portfolio represents a neutral stance on the domestic currency.

Currency fluctuations are very difficult to forecast and even more difficult to time, as Gorman, et al. stress. Although financial theory states that currencies will eventually converge to purchasing power parity (PPP) levels, empirically currency values can and do diverge for very long periods of time from their PPP values. Using a PPP based forecasting approach may in the very long run turn out to be correct, but investors may face more short-term consequences as they wait for PPP convergence to occur.

Central banks can have a significant impact on currency behavior as they influence exchange rates, the supply of money and short-term interest rates to manage their economies.

⁵ Gardner, G. and Wuilloud, T. (1994) “The Regret Syndrome in Currency Risk Management: A Closer Look”, *Russell Research Commentary*.

⁶ Gorman, S., Qian, E. and Surz, R. (2000) “International Benchmarks In Support of a 50% Hedge Ratio”, *Journal of Investing*, Vol. 9, No. 2.

Forecasting central bank actions in terms of content and timing is a very difficult task, with many significant market participants unaware of sudden central bank actions. A case in point here is the Swiss Central Bank removal of support for the exchange rate peg of the CHF (the Swiss Franc) to the Euro in January 2015—a policy reversal that stunned the world and roiled financial markets, especially foreign exchange.⁷

This occurred one week after the Swiss Central Bank had assured markets that the pegged rate would continue to be supported. Major banks and investment companies suffered significant losses because they could not predict that this action would occur when it did.⁸

Investors with conviction as to their ability to forecast currency may of course take positions reflecting those forecasts. But in the absence of such conviction—such ability—they may prefer an equal weighted or neutral approach to exposures. In the case of a home currency, as described above, some consider this is best represented by the 50% hedge ratio in international investment. In Table 3, we report key statistics for this neutral currency exposure as represented by the FTSE Developed ex North America 50% Hedged to USD Index.⁹ We compare the 50% hedged index returns to the 100% hedged and 0% hedged alternatives over our entire sample period (January 2005-June 2017) as well as for our four market states of a Falling Dollar, Gradually Strengthening Dollar, Sharply Strengthening Dollar, and Trendless Trading.

In the far right columns of Table 3, first we compute the difference between the outcomes of the 100% hedged and the 50% hedged indexes; second the difference between the outcomes of the 50% hedged and the 0% hedged indexes. Results vary across the different time periods of analysis and market states. The most consistent result we see in Table 3 is in line with the observations of Gorman, et al., in that the volatility improvement contributed by moving from a 0% hedged to a 50% hedged position was greater than 50%. Here, we reference the numbers highlighted in the chart. During the four periods where the volatility of the 100% hedged index was less than the 0% hedged (Total Period, Gradually Strengthening Dollar, Sharply Strengthening Dollar and the recent period of Trendless Trading) the reduction in volatility that would have been achieved via moving from a 0% hedged to a 50% hedged index was measurably larger than the volatility reduction moving from a 50% hedged to a 100% hedged strategy. It is striking that during the second period—the Falling Dollar—when the 100% hedged index exhibited more volatility than the unhedged, the volatility of the 50% hedged index was almost equal to the 0% hedged. Moving from the 0% hedged index to a 50% hedge ratio, there was an increase of 4 basis points (bp; 0.0 %) of volatility, but moving from 50% to a 100% hedge ratio added another 69 bp (0.7 %) of volatility (annualized standard deviation). Again, these results are all time period dependent, but do align with the results in Gorman et al.¹⁰

⁷ See, for example, K. Bishop, “Swiss franc soars, stocks tank as euro peg scrapped,” 2015, *CNBC: Currencies*, January 15.

⁸ See, for example, I. Iosebashvili, A. Ackerman and A. Wexler “Surge of Swiss Franc Triggers Hundreds of Millions in Losses,” *Wall Street Journal*, January 16 2015: <http://www.wsj.com/articles/swiss-franc-move-cripples-currency-brokers-1421371654>.

⁹ The FTSE Developed 50% Hedged to USD Indexes were launched on 23 July 2015. Performance has been backfilled to January 2015 based on transparent, consistent rules-based hedging methodology. Please see the Appendix for performance statistics for the FTSE Developed Europe 50% Hedged to USD Index and the FTSE Japan 50% Hedged to USD Index.

¹⁰ Case studies for Japan and Developed Europe are found in the appendix.

Table 3. Performance statistics for the FTSE Developed ex North America Index, 50% hedged, 100% hedged and 0% hedged to the USD over four market states as well as the total sample period

Total Period Jan 2005 to June 2017	FTSE Developed ex North America Index 100% Hedged USD	FTSE Developed ex North America 50% Hedged to USD Index	FTSE Developed ex North America Index 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.5	0.4	0.3	0.1	0.1
Annualized Return, %	7.1	6.4	5.4	0.8	0.9
Annualized StdDev, %	14.0	15.3	17.3	-1.4	-2.0
Max Drawdown Return, %	-50.0	-53.2	-56.4	3.2	3.2
Falling Dollar Nov 2005 to March 2008	FTSE Developed ex North America Index 100% Hedged USD	FTSE Developed ex North America 50% Hedged to USD Index	FTSE Developed ex North America Index 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.3	0.6	0.9	-0.3	-0.3
Annualized Return, %	7.6	11.3	15.1	-3.7	-3.8
Annualized StdDev, %	12.2	11.5	11.5	0.7	0.0
Max Drawdown Return, %	-19.3	-16.5	-14.2	-2.8	-2.3
Gradually Strengthening Dollar April 2011 to January 2014	FTSE Developed ex North America Index 100% Hedged USD	FTSE Developed ex North America 50% Hedged to USD Index	FTSE Developed ex North America Index 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.7	0.5	0.4	0.1	0.1
Annualized Return, %	8.1	7.0	5.9	1.1	1.2
Annualized StdDev, %	12.8	14.8	17.3	-2.0	-2.5
Max Drawdown Return, %	-18.4	-20.7	-23.0	2.3	2.3
Sharply Strengthening Dollar June 2014 to June 2015	FTSE Developed ex North America Index 100% hedged USD	FTSE Developed ex North America Index 50% Hedged to USD Index	FTSE Developed ex North America Index USD 0% Hedged	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	1.2	0.5	-0.2	0.7	0.7
Annualized Return, %	10.8	4.0	-2.5	6.8	6.5
Annualized StdDev, %	8.6	8.6	9.8	0.0	-1.2
Max Drawdown Return, %	-4.4	-3.6	-9.2	-0.8	5.6
Trendless Trading June 2015 to June 2017	FTSE Developed ex North America Index 100% Hedged USD	FTSE Developed ex North America 50% Hedged to USD Index	FTSE Developed ex North America Index 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.3	0.3	0.3	0.0	0.0
Annualized Return, %	4.0	3.8	3.5	0.2	0.3
Annualized StdDev, %	12.6	12.6	13.4	0.0	-0.8
Max Drawdown Return, %	-15.5	-16.0	-16.6	0.5	0.6

Source: FTSE Russell. Data as of June 30, 2017. Past performance is no guarantee of future results. Returns shown prior to index launch dates reflect hypothetical historical performance. Please see the end for important legal information.

Conclusion

Unhedged international investing brings with it significant currency exposure, namely embedded long positions in foreign currencies coupled with a very large short position in the domestic currency, here the USD. Completely hedging currency exposures results in an implicit long position in the domestic currency. There may be no single hedge ratio that satisfies all investors because the heterogeneous outlooks and risk tolerances of investors can lead participants to implement vastly different strategies. Currency fluctuations are notoriously difficult to forecast, however, and some academics have supported a 50% hedge ratio, suggesting that it represents the neutral position; has been shown to minimize investor regret due to erroneous forecasts; and historically has exhibited attractive asymmetric risk characteristics. The FTSE 50% Hedged Index Series has been designed to assist investors in understanding and evaluating the currency exposures of their international equity investments.¹¹

¹¹ For details on FTSE Russell's currency hedging methodology, see our Guide to Calculations for the Global Equity Index Series: http://www.ftse.com/products/downloads/ftse_global_equity_index_series_guide_to_calc.pdf

Appendix 1: FTSE Japan

The Japanese yen has played an unusual role in the global currency market over our sample period of January 2005 through June 2017. Since the 1990s, Japanese interest rates have been very low, first hitting 0% in 1999 and occasionally moving below 0% since then.¹² Inflation has also been very low, also dipping into negative territory (deflation).¹³ During much of our total period, the Japanese yen has functioned as the funding or borrowing currency for the yen carry trade;¹⁴ during periods of market upheaval, the carry trade has collapsed as currency traders unwind their positions and investors seeking a safe-haven or “risk-off” currency buy the yen.

Shortly after beginning his second term in December 2012, Prime Minister Shinzō Abe launched an ambitious plan to bolster Japan’s economy and remedy nearly 20 years of stagnation in prices, interest rates and the economy. To generate modest inflation and make exports more competitive, the plan called for the intentional devaluing of the yen, achieved by printing more money. At the same time positive economic data out of the US spurred discussions and calls for the US Federal Reserve to end its stimulus program and potentially raise interest rates. The diverging policies of these two large central banks underpinned a period of a strengthening dollar, with a significant increase from June 2014 to June 2015 bringing the USD to a 13 year high versus the yen. Beginning in November 2015 through August 2016, however, the dollar fell sharply against the yen, a change influenced at least in part by the uncertainty about the strength of US economic growth and the delay of additional rate hikes by the Federal Reserve after their initial increase in December 2015.

Table A1 illustrates the impact the currency movement has had on the FTSE Japan Index from the perspective of a US based investor over four market states for the USD/JPN. Because of the special behavior of this currency relationship, our dates and states for the USD/JPN differ, however. We report statistics for our total period (January 2005-June 2017); a long period of a falling dollar (June 2007-January 2012); the dollar’s rise (September 2012 to June 2015); and the most recent precipitous decline in the dollar over the 8 months from November 2015 to August 2016.

The special circumstances of the yen are evident in the fact that in every state, including the total period, the 100% hedged index is the most volatile (highest standard deviation). In one state (Dollar Rise) the 50% hedged index is the least volatile, although very close to the unhedged. In all four market states as well as the total period, we observe the same asymmetrical volatility outcomes as with the FTSE Developed ex NA Index discussed in the body of the paper—moving from the most volatile index (here the hedged index) to a 50% hedged index reduced volatility more than 50%.

¹² “Lower and lower: Japanese banks grapple with ultra-low interest rates,” 2016, *The Economist: Finance and Economics*, December 24.

¹³ Kuroda, H., “The battle against deflations: The evolution of monetary policy and Japan’s experience,” 2016, *Bank of Japan: Speech at Columbia University*, April 13.

¹⁴ Yen carry trade: investors or traders borrow money in the Japanese market at very low rates and invest that money in assets expected to have greater returns or that offer greater interest rates, often other currencies.

Table A1. Performance statistics for the FTSE Japan Index, 50% hedged, 100% hedged and 0% hedged to the USD over four market states as well as the total sample period

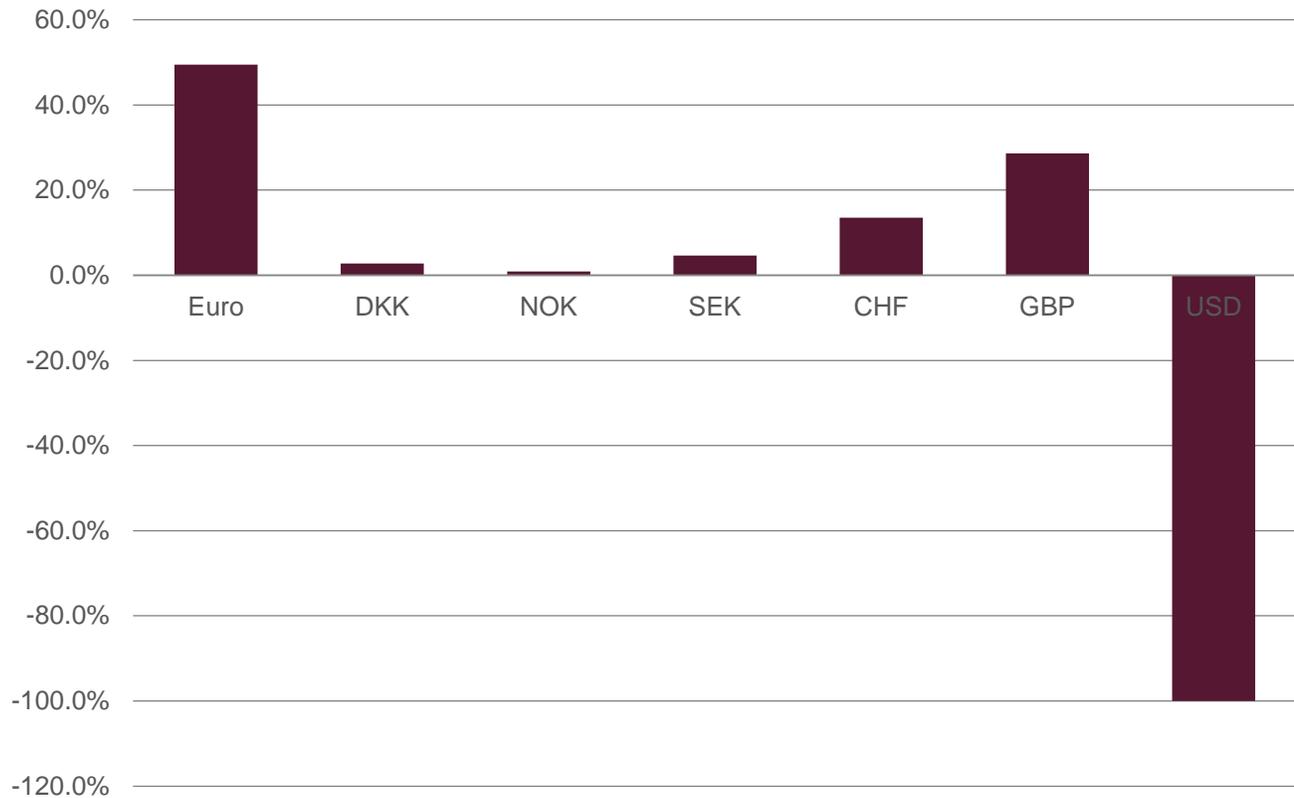
Total Period January 2005 to June 2017	FTSE Japan 100% Hedged USD	FTSE Japan 50% Hedged USD	FTSE Japan 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.3	0.3	0.2	0.0	0.1
Annualized Return, %	5.1	4.6	3.8	0.5	0.8
Annualized StdDev, %	18.8	16.3	14.9	2.5	1.4
Max Drawdown Return, %	-56.9	-51.3	-46.9	-5.6	-4.4
Falling Dollar June 2007 to January 2012	FTSE Japan 100% Hedged USD	FTSE Japan 50% Hedged USD	FTSE Japan 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	-0.7	-0.6	-0.4	-0.2	-0.2
Annualized Return, %	-15.4	-11.0	-6.6	-4.4	-4.4
Annualized StdDev, %	20.8	18.7	17.9	2.1	0.8
Max Drawdown Return, %	-56.5	-51.3	-46.0	-5.2	-5.3
Dollar Rise September 2012 to June 2015	FTSE Japan 100% Hedged USD	FTSE Japan 50% Hedged USD	FTSE Japan 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	2.2	1.9	1.4	0.3	0.5
Total	34.9	25.3	16.2	9.6	9.2
Total	14.6	12.5	11.4	2.1	1.1
Max Drawdown Return, %	-10.6	-9.2	-7.8	-1.4	-1.4
Sharply Strengthening Dollar June 2014 to June 2015	FTSE Japan 100% Hedged USD	FTSE Japan 50% Hedged USD	FTSE Japan 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	2.9	2.4	1.5	0.4	1.0
Annualized Return, %	34.7	24.1	14.2	10.6	10.0
Annualized StdDev, %	10.6	9.1	9.2	1.5	-0.1
Max Drawdown Return, %	-2.8	-2.1	-5.1	-0.7	3.0
Sharply Falling Dollar November 2015 to August 2016	FTSE Japan 100% Hedged USD	FTSE Japan 50% Hedged USD	FTSE Japan 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	-0.82	-0.47	0.08	-0.4	-0.6
Annualized Return, %	-14.80	-7.34	0.32	-7.5	-7.7
Annualized StdDev, %	21.10	17.08	15.26	4.0	1.8
Max Drawdown Return, %	-22.05	-14.85	-11.56	-7.2	-3.3

Source: FTSE Russell. Data as of June 30, 2017. Past performance is no guarantee of future results. Returns prior to index launch dates reflect hypothetical historical performance. Please see the end of this paper for important legal information.

Appendix 2: FTSE Developed Europe

The FTSE Developed Europe Index contains a separate basket of currencies, which for a US based investor consists of a long position in foreign currencies, offset by a 100% short position in the USD. Figure A2 below depicts the currency basket embedded in the FTSE Developed Europe Index as of June 30, 2017.

Figure A2. Embedded currency basket FTSE Europe Index June 30, 2017 (US based investor perspective)



Source: FTSE Russell. Data as of June 30, 2017.

The greatest long exposures in this currency portfolio are to the Euro and the British Pound; the 100% short exposure is to the USD. Recent changes in the exchange rate between the US dollar and the Euro have been dominated by the diverging policies of their respective central banks, as the European Central Bank pursued a stimulus strategy but the US Federal Reserve has pursued a period of slow but steady increases in the US interest rate. The USD/GBP rates were dramatically affected by the Brexit vote in June of 2016 when the British currency fell against most major currencies, including the dollar. The first half of 2017 saw a rise in both currencies—the Euro and the GBP – versus the dollar.

In Table A2 we report statistics for the FTSE Developed Europe Index unhedged, 100% hedged and 50% hedged during four states of the US Dollar in our sample period as well as over the total period. In all cases, the unhedged index was the most volatile –as measured by standard deviation –of the three indexes; and in each state the volatility reduction achieved with moving from an unhedged to a 50% hedged approach would have been greater than 50%. The asymmetrical advantage in risk reduction with a 50% hedged approach that we documented in the body of the paper for the FTSE Developed ex North America Index over these periods was exhibited here as well.

Table A2. Performance statistics for the FTSE Developed Europe Index 50% hedged, 100% hedged and unhedged to the USD over four market states as well as the total sample period

Total Period January 2005 to June 2017	FTSE Developed Europe 100% Hedged USD	FTSE Developed Europe 50% Hedged USD	FTSE Developed Europe 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.5	0.4	0.3	0.10	0.10
Annualized Return, %	7.7	6.6	5.3	1.10	1.30
Annualized StdDev, %	14.2	16.2	19.0	-2.00	-2.80
Max Drawdown Return, %	-49.4	-54.2	-58.9	4.80	4.70
Falling Dollar Nov 2005 to March 2008	FTSE Developed Europe Index 100% Hedged USD	FTSE Developed Europe 50% Hedged to USD Index	FTSE Developed Europe 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.4	0.7	1.1	-0.4	-0.3
Annualized Return, %	8.5	13.3	18.1	-4.7	-4.8
Annualized StdDev, %	12.0	11.7	12.1	0.3	-0.5
Max Drawdown Return, %	-17.7	-15.2	-14.7	-2.5	-0.6
Gradually Strengthening Dollar April 2011 to January 2014	FTSE Developed Europe Index 100% Hedged USD	FTSE Developed Europe 50% Hedged to USD Index	FTSE Developed Europe 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.7	0.5	0.4	0.1	0.1
Annualized Return, %	8.3	7.8	7.1	0.5	0.7
Annualized StdDev, %	13.2	16.1	19.5	-2.8	-3.4
Max Drawdown Return, %	-20.3	-23.6	-26.9	3.3	3.3
Sharply Strengthening Dollar June 2014 to June 2015	FTSE Developed Europe Index 100% Hedged USD	FTSE Developed Europe 50% Hedged to USD Index	FTSE Developed Europe 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.6	0.0	-0.5	0.6	0.5
Annualized Return, %	5.9	-0.4	-6.5	6.3	6.1
Annualized StdDev, %	10.1	10.1	11.6	0.0	-1.4
Max Drawdown Return, %	-5.0	-6.1	-11.0	1.1	4.9
Trendless Trading June 2015 to June 2017	FTSE Developed Europe 100% Hedged USD	FTSE Developed Europe 50% Hedged USD	FTSE Developed Europe 0% Hedged USD	100% Hedged - 50% Hedged	50% Hedged - 0% Hedged
Sharpe Ratio	0.5	0.4	0.2	0.1	0.2
Annualized Return, %	5.3	4.1	2.7	1.2	1.4
Annualized StdDev, %	12.4	12.8	13.9	-0.4	-1.1
Max Drawdown Return, %	-12.7	-14.6	-16.5	1.9	1.9

Source: FTSE Russell, data as at June 30, 2017. Past performance is no guarantee of future results. Returns prior to index launch dates reflect hypothetical historical performance. Please see the end of this paper for important legal information.

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