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To Hedge or Not to Hedge: Foreign Currency Risk in the International Equity Markets

by

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An Honors Capstone

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TO HEDGE OR NOT TO HEDGE: FOREIGN CURRENCY RISK IN THE INTERNATIONAL EQUITY MARKETS

I. Introduction

Foreign exchange markets have a rich history going back thousands of years. Ever since early civilizations found the need to trade outside of their villages, foreign currency exchange rates have been established and used as a means of expanding economically beyond the regular realms of trade. The modern currency exchange system found its start after WWII with the Bretton Woods Accord, but it ultimately became the system we know today in 1973 when developed markets moved to a generalized floating rate system between major currencies[1]. This floating system has remained in place since 1973, with more and more currencies entering the world stage as their country's economy develops.

While the foreign currency exchange markets provide investors in the currencies with substantial returns in their own right, an additional benefit is in the role currency plays for the international investor. For example, an American who has dollars, but also buys British Pounds Sterling, now has access to not only the U.S. equity market, but also the U.K. equity market. In other words, foreign currencies give investors access to every major region in the world's capital markets and the diversification benefits that follow. This paper looks at investment in foreign equity markets, compares the hedged versus unhedged returns over different market conditions, and investigates the relative market and currency risk faced by U.S. investors.

[1] Jacob A. Frankel and Michael L. Mussa, The American Economic Review, Vol. 70, No. 2, Papers and Proceedings of the Ninety-Second Annual Meeting of the American Economic Association (May, 1980), pp. 374-381

II. Exchange Rates

Consider the following example that illustrates the effects of foreign exchange rate risk. Suppose an American investment firm is looking to diversify their client's portfolio internationally. After some research, they decide that they want to invest $10,000 in the Japanese equity market because of its strong outlook for the upcoming year. The firm buys Yen at a rate of ¥100/$ and invests all ¥1,000,000 in a Japanese stock. At the end of the year, the stock is up 7%, making the investment worth ¥1,070,000. At the end of the same year, suppose the Japanese Yen also appreciated to the point that the exchange rate was ¥90/$. When the firm converts their client's investment back to USD, they end up with:

$$\frac{¥1{,}070{,}000}{\frac{¥90}{\$}} = \$11{,}888.89$$

Which is a return in USD of:

$$\frac{\$11{,}888.89 - \$10{,}000}{\$10{,}000} 18.89\%$$

The return in USD is greater than the return in the local currency due to the appreciation of the local currency relative to the dollar. Conversely, suppose the Japanese Yen had depreciated to an exchange rate of ¥110/$. In this case, the firm would have seen the following loss:

$$\frac{¥1{,}070{,}000}{¥110/\$} = \$9{,}727.27$$

or a return of:

$$\frac{\$9{,}727.27 - \$10{,}000}{\$10{,}000} = -2.73\%$$

In this case, a positive equity return measured in the local currency turned into a negative return in USD because the exchange rate moved in the opposite direction.

This example also illustrates the added layer of return volatility arising from exchange rate risk. If the foreign currency appreciates relative to the USD, the investor will earn a higher return compared to the return in the local currency. However, if the foreign currency depreciates, the investor will earn a lower return. This can be seen in the following relationship:

$$R_{FX} \uparrow \;\Rightarrow\; R_{USD} \;>\; R_{foreign}$$

Or, as the return on the direct exchange rate increases, the return on a foreign investment in USD will be greater than the return in the local currency. It's a relatively simple concept to understand, but it is of great importance when interpreting the data gathered for this paper.

The following equation breaks down returns to the U.S. investor in a foreign equity security. It shows that the USD return is equal to the return on the investment in the local currency multiplied by the return on the exchange rate, in this case the direct exchange rate.

$$(1 + USD\ Return) = (1 + Foreign\ Return)(1 + FX\ Return),$$

$$(1 + R_{USD}) = (1 + R_{FC})(1 + R_{FX}) \qquad \textbf{(1)}$$

$$where: R_{FX} = \left(\frac{E_1}{E_0}\right), and\ E = \frac{USD}{Foreign\ Currency}$$

Consider a real-life example from some of the data gathered for this thesis. Take, for example, Australia during the month of March in 1983. The return on the Australian equity market

calculated in Australian Dollars (AUD) was 3.24%. At the same time, the Australian Dollar saw a -9.36% return, relative to USD. According to equation (1), the USD return should be:

$$(1 + R_{USD}) = (1 + 0.0324) \times [1 + (-0.0936)]$$

$$R_{USD} = (1.0323 \times 0.9064) - 1$$

$$R_{USD} = -6.42\%$$

III. Hedging Foreign Exchange Risk

The previous example highlights the effects of volatility in the foreign exchange market on international equity investments. With this volatility in mind, many investors are fearful of the effects that these swings in the foreign exchange markets can have on their investments. Hedging is a simple way to mitigate, or eliminate, the effect of foreign exchange movements. As such, many investors choose to hedge their international investments against foreign currency risk. This can be done through a number of different ways, including the use of derivatives. When an investor hedges the foreign exchange risk, even though the currency must still be converted, the derivative position allows the effect of the exchange rate to be eliminated. The end result is a return in USD that is almost identical to the return in the local currency. In other words, hedging essentially eliminates the exchange rate variable $\left(\frac{E_1}{E_0}\right)$ in the equation (1).

IV. Data

The currencies chosen for this paper were picked for their regional diversity, and for their use in both developing and emerging markets. The currencies are:

Developed Markets	**Emerging Markets**
Australian Dollar (AUD)	Indian Rupee (INR)
Canadian Dollar (CAD)	Chinese Yuan (CNY)
British Pound Sterling (GBP)	South African Rand (ZAR)
Japanese Yen (JPY)	Brazilian Real (BLR)
Swiss Franc (CHF)	Russian Ruble (RUB)
Singapore Dollar (SGD)	
Euro (EUR)	

Foreign exchange data was available going back to 1975 for most of the developed country's currencies: AUD, CAD, GBP, JPY, CHF, EUR, and it was available for some former British Colonies (INR, and ZAR). Data for China (CNY) goes back to January of 1987, Singapore goes back to January of 1981, Brazil to January of 1992, and Russia to July of 1993. All currency data comes from a combination of Bank of England[2] records and Bloomberg[3] records.

All return data comes from MSCI Country indexes[4], gathered from Bloomberg. Hedged returns are represented by MSCI EOD Country Indexes, calculated in local currencies. Unhedged returns are represented by MSCI EOD Country Indexes, calculated in USD. In addition to returns for all of the countries with currencies listed above, the countries picked from the Eurozone are

[2] Exchange rate data, January 1975-December 2016, via Bank of England Statistical Interactive Database, accessed January 30, 2017. http://www.bankofengland.co.uk/boeapps/iadb/index.asp?Travel=NIxIRx&levels=2&XNotes=Y&A3790XNode3790.x=5&A3790XNode3790.y=3&Nodes=&SectionRequired=I&HideNums=-1&ExtraInfo=true#BM

[3] Exchange rate data, January 1975-December 2016, via Bloomberg LP, accessed January 30, 2017

[4] MSCI, "Bloomberg End of Day Country Indexes," via Bloomberg LP, accessed January 30, 2017, https://www.msci.com/country-indexes

France, Germany, and Italy. Data[5] on the economic cycles over the last forty-one years are gathered from the National Bureau of Economic Research.

V. Results

For each of the countries listed in the previous section, we compiled both the hedged and unhedged equity returns, as well as the return on each country's currency. Table 1 shows the average monthly hedged and unhedged returns over the span of time available for each currency. The last column gives the average monthly return on the country's currency. Recall that a positive return implies that the currency has appreciated in value relative to the USD.

Table 1. Hedged and Unhedged Equity Returns

Currency	Observations (months)	Average Monthly Hedged Return (%)	Average Monthly Unhedged Return (%)	Average Monthly Currency Return (%)
Developed Markets				
Australia AUD	503	0.76	0.74	-0.07
Canada CAD	503	0.68	0.68	-0.04
U.K. GBP	503	0.81	0.72	-0.09
Japan JPY	503	0.49	0.72	0.24
Switzerland CHF	503	0.63	0.84	0.24
Singapore SGD	348	0.52	0.66	0.11
Germany EUR	348	0.70	0.69	-0.02
France EUR	348	0.66	0.65	-0.02
Italy EUR	348	0.37	0.29	-0.02
Emerging Markets				
India INR	288	1.08	0.88	-0.28
China CNY	288	0.28	0.28	-0.04
South Africa ZAR	288	1.04	0.83	-0.43
Brazil BLR	340	4.33	1.17	3.50
Russia RUB	239	1.48	1.37	-0.85

[5] The National Bureau of Economic Research, "US Business Cycle Expansions and Contractions," http://www.nber.org/cycles/cyclesmain.html, (March 31, 2017)

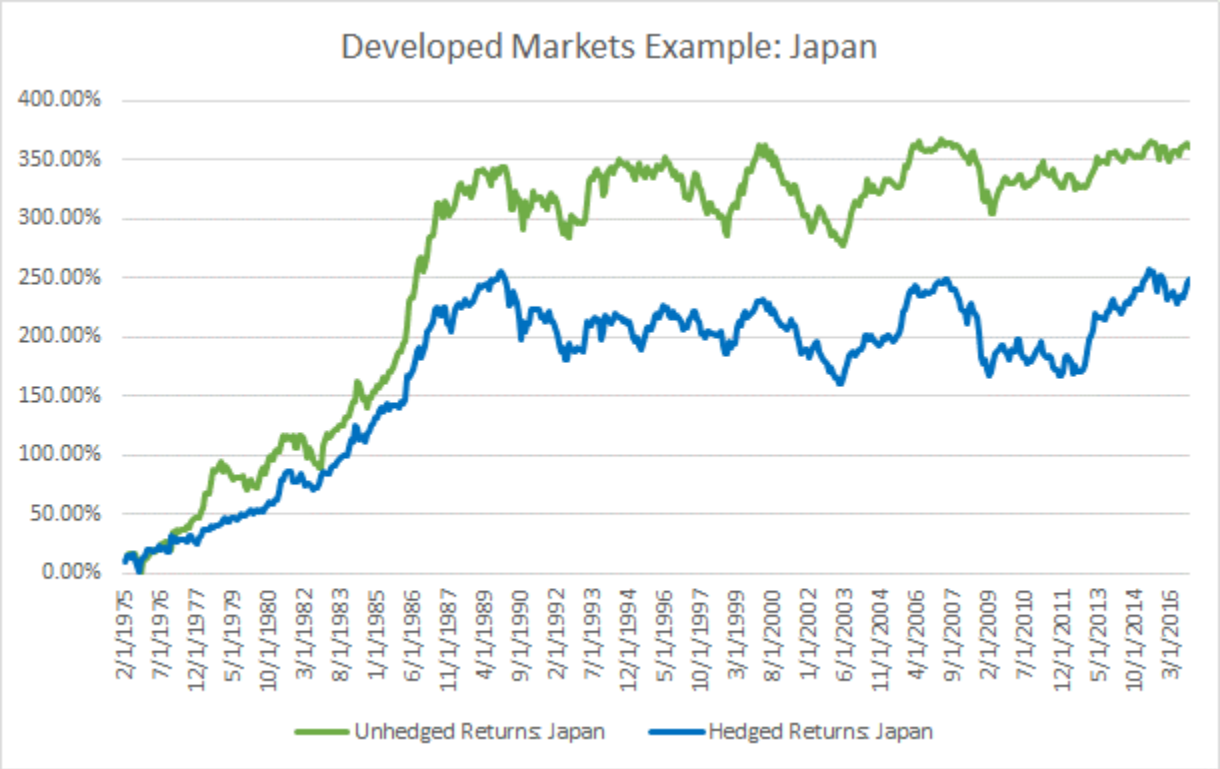
For the following countries: Australia, India, China, Canada, the U.K., South Africa, Germany, France, Italy, and Russia, on average the currency declined in value. In other words, the average monthly return on its currency was negative. Therefore, from equation (1) we would expect the unhedged return to be slightly less than the hedged return. This is true for all of the countries except China. For many years, China had a state-controlled, fixed exchange rate that was re-valued periodically rather than allowed to float in an open market. Hence, in many of the time periods, there was no positive or negative return on their exchange rate. Therefore, even though the average monthly currency return is slightly negative on an average basis, the hedged and unhedged equity returns are identical.

In the other cases, in which the local currency strengthened against the dollar, the unhedged return is higher than the hedged return, as expected, in every case except Brazil. Because Brazil has seen very high levels of volatility in both its foreign exchange rate and equity returns, the averages are skewed by severe outliers in such a way that the relationship in equation (1) breaks down. The influence of such volatility, or lack thereof, will be discussed later in the paper.

Clearly, the immediate advantage or disadvantage of hedging depends on exchange rate movements in the short term. However, exchange rates are difficult to predict in the short term. Figures 1 and 2 provide graphical representation of the long-term benefits and disadvantages of choosing to hedge or not to hedge. In Figure 1, we see Japan's hedged and un-hedged returns over the span of forty-one years. In Japan's case, unhedged investors beginning in January of 1975 would have seen a 361.91% return, while investors hedged against the foreign exchange risk of the Japanese Yen would have seen a 248.75% return, or a difference of 113.16%. In this

case, clearly investors would have been better off not hedging the foreign exchange risk. As indicated in Table 1, the Japanese Yen tended to appreciate in value during the period. Recall in Equation 1 that the foreign exchange rate of a currency has the ability to boost or detract from a country's unhedged return. In this case, the average appreciation of the Japanese Yen boosted the currency's return.

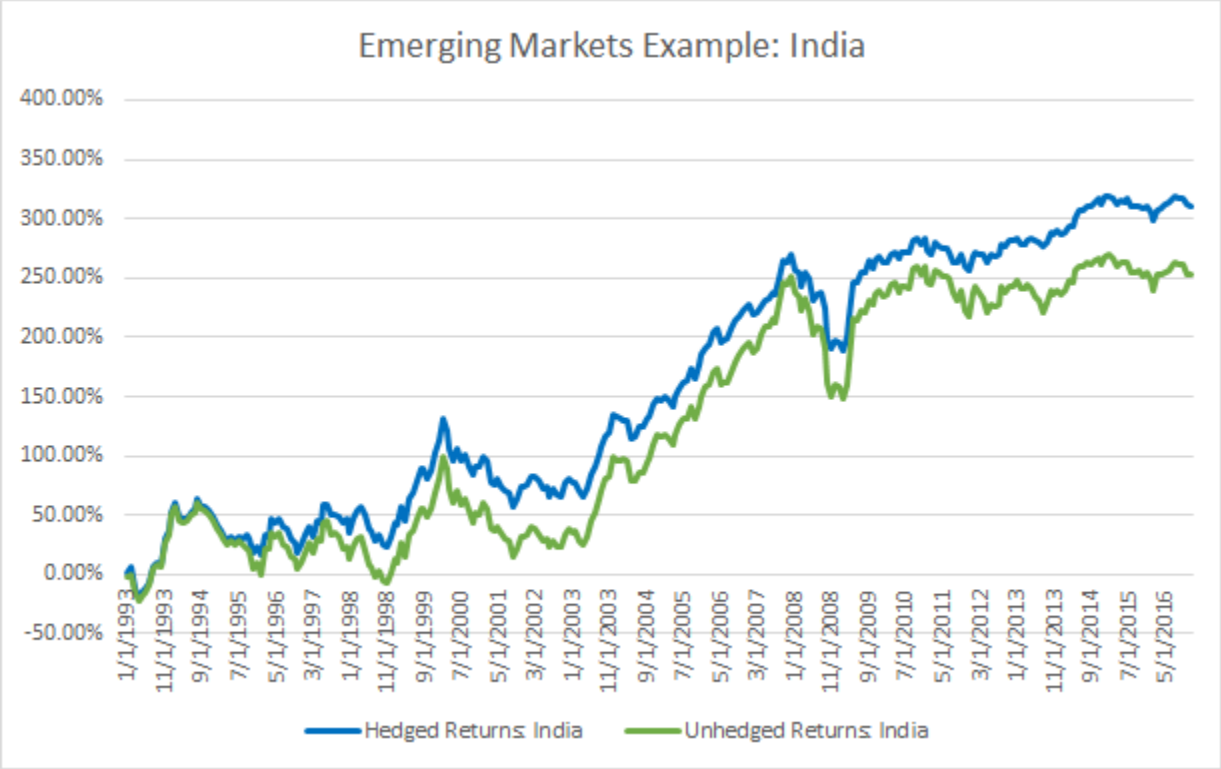
Figure 1. Hedged and unhedged returns for Japan, 1975-2016



Conversely, in Figure 2, we see a case where the opposite is true. Hedged U.S. investors in India, over the time period from January of 1993 to December of 2016, would have seen a return of 310.61%, while unhedged investors would have seen a return of 253.31%, or a difference of 57.3% over the time period. Hence, hedged investors were better off over the time period. Again, looking back at Table 1, we can see that India's currency depreciated in value on

average. This depreciation in India's currency detracted from the unhedged investor's return potential.

Figure 2. Hedged and unhedged returns for India, 1993-2016



V. A. Economic Cycles

One alternative view of this data that should be of interest to most investors is how currencies perform during different stages of the economic or business cycle. Table 2 shows the peaks and troughs of the business cycles, beginning with a trough in March 1975 and continuing to December 31, 2016. According to the National Bureau of Economic Research[6], a recession is

[6] The National Bureau of Economic Research, "The NBER's Business Cycle Dating Committee" http://www.nber.org/cycles/recessions.html, (April 21, 2017)

defined as, “a period between a peak and a trough,” and an expansion is defined as, “a period between a trough and a peak.” So there are five recessions (contractions) in the time period since 1975. Counting the present expansionary period, there are six expansions. The duration of the contractions and expansions is shown in number of months.

Table 2. Business Cycles

Cycle	Peak Month	Trough Month	Contraction: Peak to Trough (months)	Expansion: Previous Trough to This Cycle’s Peak (months)
0	-	March 1975	-	-
1	January 1980	July 1980	6	58
2	July 1981	November 1982	16	12
3	July 1990	March 1991	8	92
4	March 2001	November 2001	8	120
5	December 2007	June 2009	18	73
6	Present Expansionary Period (Data ending December 31, 2016)		-	91

Tables 3 and 4 show average monthly returns during each type of cycle, expansionary and contractionary. The cycles are from the viewpoint of the U.S. economy, but it seems relevant to segment the international data this way, due to the nature of this paper’s perspective from that of a US investor. It also takes into account the exchange rates from USD to other currencies around the world, which relates the data to investors in the United States. The analysis is provided for currencies in developed markets from 1975 to the present.

Tables 3 and 4 illustrate just how dependent the developed world economy is on the United States. Table 3 presents the expansionary periods. In terms of equity returns, all five countries showed positive monthly returns on average in both the hedged and unhedged cases. In

other words, in expansion periods, equity returns in these five countries were positive regardless of hedge, so there was no downside to choosing a hedging strategy either way.

Table 3. Average returns during expansionary periods (trough to peak)

Currency	Number of Observations	Average Monthly Hedged Return (%)	Average Monthly Currency Return (%)	Average Monthly Unhedged Return (%)
Australia AUD	445	0.9933	-0.0457	0.9888
Canada CAD		0.8502	-0.0268	0.8477
U.K. GBP		0.8733	-0.0590	0.8037
Japan JPY		0.7093	0.2030	0.8988
Switzerland CHF		0.8597	0.2238	1.0509

In terms of currency returns, Australia, Canada, and the U.K.'s currencies weakened against the dollar, while Japan and Switzerland's currencies strengthened against the U.S. Dollar. Hedging would have benefitted investors in Australia, Canada, and the U.K., while it was more beneficial for investors in Japan and Switzerland not to hedge. This can be further confirmed in Japan's case by Figure 1. Given Switzerland's higher currency appreciation and higher hedged return, it would have been even more beneficial than investors in Japan not to hedge for foreign exchange risk in investments in Switzerland. In totality, it is interesting that to see that both cases had strong positive returns, so in some sense, it does not matter which hedging strategy (to hedge or not) is chosen.

Table 4 shows the average monthly equity returns during contractionary periods of the economic cycle. While returns in both hedged and unhedged cases were negative for all five countries, average monthly currency movements went in the same direction during contractions as during expansions. Interestingly enough, the same recommendations made during expansionary periods can be made for contractionary periods, with the exception of Switzerland.

The Swiss Franc's unique status as a safe-haven currency, sometimes seen as an alternative to gold[7], likely propelled the currency's appreciation during recessionary periods, regardless of Switzerland's equity market's performance. Investors in the Australian, Canadian, U.K., and Swiss markets would have been better off hedging, while investors in Japan would have been better off not hedging, despite the world recessionary climate.

Table 4. Average returns during contractionary/recessionary periods (peak to trough)

Currency	Number of Observations	Average Monthly Hedged Return (%)	Average Monthly Currency Return (%)	Average Monthly Unhedged Return (%)
Australia AUD	56	-0.8228	-0.3459	-1.0640
Canada CAD		-0.3970	-0.2783	-0.5618
U.K. GBP		-0.0023	-0.5452	-0.5065
Japan JPY		-1.1826	0.2547	-0.9612
Switzerland CHF		-1.1647	0.0127	-1.1885

With these results in mind, it appears that the decision to hedge during periods of U.S. economic expansion makes very little difference. While hedging can result in a higher return in some instances, a complete picture and recommendation cannot be formed without a look at one further piece to this puzzle: volatility.

V. B. Volatility

Even though global equity markets have become more correlated over time, the empirical evidence supports the benefits of international diversification. However, at this point it is also clear that, in the unhedged case, an investment in foreign equities involves exposure to not just

[7] Clem Chambers, "A Gold Alternative? The Swiss Franc," *Forbes Intelligent Investing,* https://www.forbes.com/sites/investor/2014/06/23/a-gold-alternative-the-swiss-franc/#ce3b96e12931 (June 23, 2014)

the risk of the foreign equity markets, but also the risk of changes in the exchange rate. Examples in the Introduction indicate that currency effects can be quite large in the short run. But what about the effects in the long run? Is currency risk so large that it outweighs the benefits of equity diversification? In this section we investigate the relative contributions of equity risk and currency risk over the long term for each of the countries studied.

The volatility of the USD returns can be decomposed into the two risk sources. Equation (1) can be rewritten as:

$$(1 + R_{USD}) = (1 + R_{FC})(1 + R_{FX}) \quad \textbf{(1)}$$

$$1 + R_{USD} = 1 + R_{FC} + R_{FX} + (R_{FC} \times R_{FX})$$

The higher order cross-product term is often dropped in order to simplify the expression to:

$$R_{USD} \approx R_{FC} + R_{FX}$$

The variance of the USD returns is then given by:

$$\sigma_{USD}^2 = \sigma_{FC}^2 + \sigma_{FX}^2 + 2[corr(R_{FC}, R_{FX})]\sigma_{FC}\sigma_{FX} \quad \textbf{(2)}$$

The difference between σ_{USD}^2 and σ_{FC}^2 in equation (2) is the contribution of the foreign currency risk, and it depends not only on the exchange rate volatility, but also the correlation between the exchange rate and local currency returns. Hence, the correlation is an important element in determining the contribution of currency risk. Specifically, currency risk should be lower in countries whose equity market is negatively correlated with its exchange rate.

Since the correlation coefficient is < 1, equation (2) can be significant to the following inequality:

$$\sigma_{USD} \leq \sigma_{FC} + \sigma_{FX} \quad \textbf{(3)}$$

Table 5 reports the risk (standard deviation) in the USD equity returns for each of the countries studied, and also decomposes the risk into the local currency equity risk, exchange risk, and correlation between the exchange rate and local currency returns. The results indicate that the foreign currency exchange risk is an important factor in USD returns.

Table 5. Standard Deviations

Currency	USD Standard Deviation	Local Currency Standard Deviation	FX Standard Deviation	% of USD Standard Deviation	Correlation
Australia	6.660	4.985	3.216	48.29	0.304
India	8.503	7.526	1.942	22.84	0.435
China	9.766	9.754	2.023	20.71	0.103
Canada	5.664	4.598	1.994	35.20	0.350
U.K.	5.672	4.871	2.959	52.17	-0.011
Japan	6.018	5.297	3.318	55.13	0.097
Switzerland	5.028	4.406	3.473	69.07	-0.213
Singapore	6.915	6.192	1.657	23.96	0.345
South Africa	7.685	5.411	4.265	55.50	0.214
Germany	6.544	5.968	2.970	45.39	-0.044
France	5.919	5.384	2.970	50.18	0.077
Italy	7.048	6.346	2.970	42.14	-0.083
Brazil	11.097	13.512	11.151	100.49	0.539
Russia	13.865	13.144	5.028	36.26	0.359

Across countries (excluding Brazil), the exchange risk accounts for about 20.71 to 69.07 percent of the USD equity return risk. The average percent is 42.80%. Therefore, on average, the exchange volatility accounts for almost half of the volatility in USD returns. This is in contrast to Solnik (2000) who suggests currency risk accounts for only about 15% of stock market risk worldwide. The Swiss Franc has the highest currency risk, accounting for about 69.07% of the USD equity return standard deviation. This is not surprising given Switzerland's low equity

market volatility and its currency's use as a safe-haven currency due to its consistent appreciation during economic expansions and contractions. It is also interesting to note that Switzerland has a negative correlation between its local currency return and its foreign exchange return. So, in fact, its exchange volatility is reduced because of this negative correlation. The Chinese Yuan has the smallest currency risk at 20.71%. As explained earlier, China's state-controlled, fixed exchange rate that showed no positive or negative return during many time periods lends itself to low volatility.

With these findings in mind, it can be surmised that foreign exchange volatility makes a much larger contribution to U.S. investor returns than previously thought.

VI. Conclusion

The objective of this paper was to consider investment in foreign equity markets, compare the hedged versus unhedged returns over different market conditions, and investigate the relative market and currency risk faced by U.S. investors. The results indicate that it generally makes no difference whether investors hedge their international investments during expansionary or recessionary periods. Investors will, on average, see positive returns during economic expansions and negative returns during economic contractions. Furthermore, foreign exchange volatility plays a much larger role in U.S. investor returns than previously thought. When examining whether to hedge or not to hedge, investors should choose the strategy that they are most comfortable with, because in the long term, it makes no difference.