Strategic Currency Hedging in Emerging Markets

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We show that a diversified basket of emerging market currencies has a significant correlation to global equity markets, while a similar basket of developed market currencies does not. We consider exposure to developed and emerging market currencies separately, and derive the optimal hedge ratio for each within the classical mean-variance framework of asset allocation for a diversified portfolio of global equities and bonds. We find that a typical investor, with a 40 per cent/60 per cent split between bonds and equity, and 5 per cent of investments in emerging markets, should fully hedge emerging market currency exposure if the expected return to this currency basket is zero. However, we find that a small expected return to emerging market currencies changes the dynamics of the allocation, and results in emerging market currency being fully unhedged.

INTRODUCTION

Currency risk

In order to buy a foreign asset, an investor must buy enough foreign currency to make the purchase, and so has the same exposure to that currency as to the asset. Currency risk is significant, with the expected risk of any individual currency around 10 per cent. A diversified basket of developed market currencies has a risk of about 9 per cent.

We measure the risk of a diversified portfolio of international equities, where half the assets are in developed markets, and half are in emerging markets. The countries within those divisions are weighted according to their MSCI weights, and risk is measured using monthly returns to the portfolio from 1994 to 2009. We calculate the risk of the corresponding basket of currencies, and compare these numbers to the volatility of US Equity and an index of US bonds.

It is clear that even a very diversified basket of currencies has a significant risk associated with it. The level of this risk is comparable to that of a bond portfolio.

Despite this risk, it can be argued that there is no systematic return to a diversified basket of currencies over the long run. Therefore, an international investor must carefully consider a currency hedging strategy to deal with currency risk.

Hedging

While fully hedging currency exposure may decrease risk in an internationally diversified portfolio, there are transaction costs associated with executing such a hedge. An investor may be less likely to hedge if they have a high risk tolerance, if foreign assets make up a relatively small part of their portfolio, or if they have a high expectation for return to currency.

In order to estimate the optimal hedge ratio for a general portfolio, we must break down the return to a foreign asset like so:

$$r_i = r_i^{int} + (1 - hr)\, r_c - hr.tc$$

where,

r_i^{int} = return to asset in local currency

hr = currency hedge ratio (fraction of asset value hedged)

r_c = return to local currency

tc = transaction cost associated with hedging

We can then express the return to a portfolio as:

$$r_{PF} = \mathbf{w}'\mathbf{r} + (1 - hr) w^{int} r_c - hr.tc \qquad (1)$$

where,

$\mathbf{w}$ = vector of weights of assets in portfolio

$\mathbf{r}$ = vector of returns to assets in their local currency

w^{int} = total weight of international assets

and r_c is now the expected return to the basket of foreign currencies to which the portfolio is exposed.

A simple estimation of the optimal hedge ratio, hr, can be made by performing a mean-variance optimisation on the portfolio characterised by the returns above. The objective function to be maximised would be:

$$f(\mathbf{w}, hr) = E\{r_{PF}\} - \frac{A}{2} Var\{r_{PF}\}$$

where A is the risk aversion parameter.

The optimal value for hr can be calculated by observing that:

$$\left.\frac{\partial f}{\partial hr}\right|_{hr^*} = 0 \qquad (2)$$

where hr^* is the hedge ratio that maximises the objective function.

This approach yields some intuitive results when applied to a portfolio of developed market foreign assets. The returns to a basket of such currencies has a very small correlation with equity and bond markets, but its volatility of 9 per cent makes a considerable contribution to the portfolio risk.

Emerging market currencies

Emerging economies generally exhibit strong growth, and cash yields and inflation are generally higher than the global average. Emerging market currencies show different properties to their developed counterparts. They can be much more volatile, and have been subject to sharp devaluations. However, these currencies have generally appreciated against the dollar over the last 15 years, as the depreciation of the spot rate has not dominated the yield advantage, resulting in a real currency return, or positive return to forward contracts. The graph below shows returns due to forward premium and spot rate for an equally weighted basket of emerging market currencies.

A basket of emerging market currencies is significantly less risky then the individual currencies, and appears to offer a systematic yield advantage.

Most importantly from a hedging perspective, the returns to a diverse basket of emerging market currencies has a significant correlation with global equity markets. Transaction costs associated with trading these currencies are significantly higher than in developed markets.

These differences suggest that the currency risk of emerging and developed markets should be treated independently from developed currency risk, and that there should be an optimal hedge ratio for each. To make this change to our formulation, we split up the currency returns and hedge ratios to get portfolio returns:

$$\begin{aligned} r_{PF} = \mathbf{w}'\mathbf{r} &+ (1 - hr^{dev}) w^{dev} r_c^{dev} - w^{dev} hr^{dev}.tc^{dev} \\ &+ (1 - hr^{em}) w^{em} r_c^{em} - w^{em} hr^{em}.tc^{em} \end{aligned} \qquad (3)$$

where,

hr^{dev} = hedge ratio for developed markets

hr^{em} = hedge ratio for emerging markets

Figure 1. **Annualised risk for equities, bonds and currency**

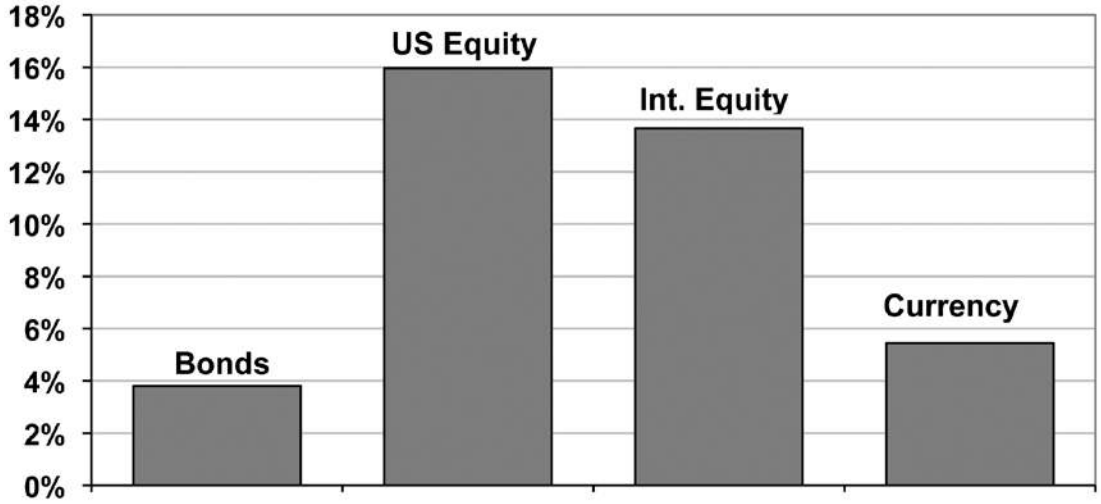
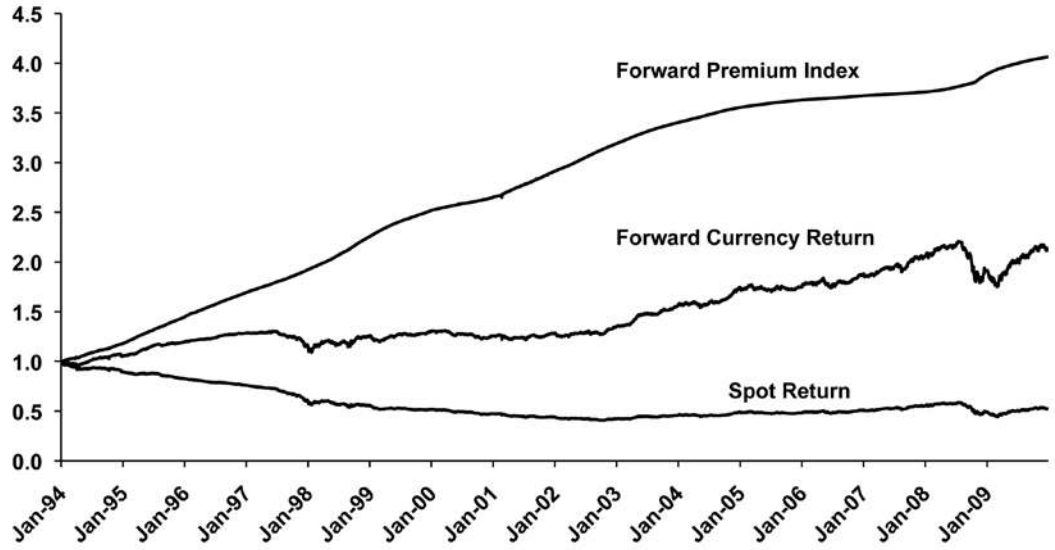


Figure 2. **Index of currency returns and forward premium**



By following the same method as that outlined for the single foreign currency basket, we can work out the variance of the portfolio and maximise a mean-variance objective function with respect to hr^{dev} and hr^{em}, to obtain the optimal hedge ratios for developed and emerging markets separately.

The risk of such a portfolio depends on the variance of the underlying assets in their own currencies, but also on the covariance of the developed and emerging market currencies with the assets, the variance of the currencies themselves, and the covariance of the two currency baskets with each other. The final hedge ratios are co-dependent.

CALCULATION

For our analysis, we took a portfolio that is 40 per cent invested in domestic bonds, with the remaining 60 per cent invested in equities. We set 30 per cent of the portfolio to be domestic equity, 25 per cent to be international equity from developed markets, and 5 per cent to be a diversified selection of emerging market equity.

We estimated our parameters by measuring returns, variances and covariances over a 15 year period between 1994 and 2009.

The composition of the two foreign equity portions of the assets were weighted across countries in proportion to their MSCI weights. The local return to equities in each country was calculated using local equity indices. All correlations were calculated using monthly returns over the entire period.

We found the correlations of an equally weighted basket of currencies with an equally weighted basket of local equities to be:

Developed currency basket	**0.09**
Emerging currency basket	**0.57**

This result illustrates a key difference between the behaviour of emerging market currencies and that of developed market currencies. The significant correlation between an emerging economy's currency and its equity market gives a clue as to the role of capital flows due to foreign investment in the determination of the exchange rate. This observation suggests that it is necessary to consider emerging markets separately when formulating a currency hedging strategy.

We used the following expected returns, risks and correlations in our calculation of the optimal hedge ratios. Our analysis is from a US perspective. The assets have expected returns and risks:

Asset	Return	Risk	Mix
Domestic bonds	6%	5%	40%
Domestic equity	9%	15%	30%
Hedged international equity	9%	14%	25%
Hedged emerging equity	20%	20%	5%

They have correlations:

Asset	Correlations			
Domestic bonds	1			
Domestic equity	0.3	1		
Hedged international equity	0	0.7	1	
Hedged emerging equity	0	0.7	0.7	1

The risk of the developed market currency basket is 9.0 per cent, and the risk of the more diversified emerging market basket is 6.0 per cent. The expected return to these baskets is set to zero initially. The correlations with the assets are:

	Developed	Emerging
Domestic bonds	0.1	0
Domestic equity	0	**0.5**
Hedged international equity	0	0.6
Hedged emerging equity	0	0.4

The correlation between domestic equity and the emerging market currencies is the most influential parameter here. Domestic equity has a risk of 15 per cent, and makes up a large

proportion of the portfolio. Any currency with a strong correlation with this component will have a large contribution to the overall variance of the portfolio.

The correlation between developed and emerging currencies is 0.4. Transaction costs are estimated at 0.1 per cent for developed markets, and 0.2 per cent for emerging market currencies.

The risk aversion parameter, A, is estimated by assuming the asset weights are mean-variance optimal, and inferring a reasonable value for A by making a small perturbation to the asset allocation, and imposing the condition defined in equation (2). A typical investor of the type described here has a risk aversion of between 2 and 3.

RESULTS

Zero expected return case

Using the parameters detailed in the previous section, we calculate the optimal hedge ratios to be:

Optimal hedge ratio for developed markets	**20%**
Optimal hedge ratio for emerging markets	**100%**

As predicted, the high correlation between emerging market currencies and equity markets results in a large contribution to the variance of the portfolio, without any currency return to cancel out its effect in the objective function. In fact, varying the risk aversion parameter shows that it would take a very aggressive investor, or an investor very insensitive to risk (low A), to leave emerging market currency significantly unhedged.

This chart shows the behaviour of the optimal hedge ratios when we vary the risk aversion parameter. By the time the parameter reaches 1, the emerging market hedge ratio has already hit 100 per cent. The developed market hedge ratio increases gradually as the investor gets more risk averse. In our calculation, the risk aversion parameter is estimated to be 2.8.

This calculation shows that it is optimal to hedge out all emerging market currency exposure long before applying a significant hedge to the developed markets despite the more diversified emerging currency basket having less intrinsic risk. This is purely due to the strong correlation of this basket with the equity part of the assets. We can measure this effect by defining currency beta as:

$$\beta_c = \frac{\mathbf{w}'\Sigma_\mathbf{c}}{\sigma_c^2}$$

where $\Sigma_\mathbf{c}$ is the vector of covariances between the currency and the assets, and σ_c^2 is the variance of the currency. Our calculation yields the following currency betas:

$$\beta_c^{dev} = 0.02$$

$$\beta_c^{em} = 0.79$$

Sensitivity analysis

To test the sensitivity of the optimal hedge ratios to the parameters, we vary the asset allocations and the equity premium. We define the equity premium to be the expected excess return of domestic equities over bonds. Varying these parameters yields the following hedge ratios:

Equity premium hedge ratio

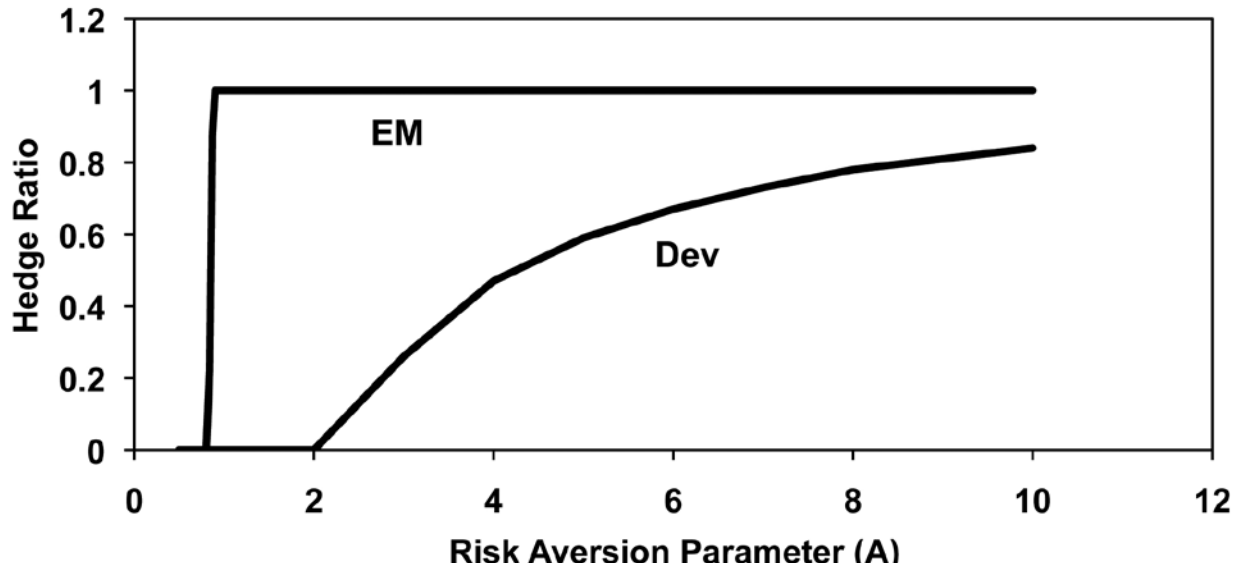
	Dev	EM
2%	0%	100%
3% *	**20%**	**100%**
4%	42%	100%

EM allocation hedge ratio

	Dev	EM
0%	35%	
5% *	**20%**	**100%**
10%	0%	100%

* Base Case

Figure 3. Optimal hedge ratios



The emerging market hedge ratio is not sensitive to either of these parameters. The developed market hedge ratio increases with the equity premium because increasing the return to equities while leaving the asset allocation fixed results in a higher estimation of the risk aversion parameter. Equities now have a better risk / reward profile than before, and so appear safer. The investor seems to have chosen a safer portfolio, and therefore is more risk averse then before, and more likely to hedge currency risk.

The developed market hedge decreases as more assets are allocated to emerging markets because reducing the allocation to developed markets decreases the impact of developed currency risk on the overall risk of the portfolio. Hedging is less worthwhile given the transaction costs incurred.

Positive expected return case

For our analysis so far, we have made the assumption that a basket of currencies has no expected return over a long period of time. Over the last 15 years, however, a diversified basket of emerging market currencies has appreciated against the US dollar. Although emerging markets tend to have high interest rates, the spot rates of these currencies have not depreciated enough to counteract the interest rate differential, and so there has been a relatively consistent return to owning these currencies. This is the basis of the popular "carry" trade.

If an investor has a strong view that emerging market currencies have an expected return of 1 per cent per annum, then the resulting hedge ratios become:

Optimal hedge ratio for developed markets	**25%**
Optimal hedge ratio for emerging markets	**0%**

Introducing a small return to the currency basket results in emerging market currency risk being entirely unhedged. The developed market currency hedge has increased slightly, as the two ratios are inversely related; taking on more risk in emerging markets means some risk must be taken away from the developed market currency exposure. Increasing the asset allocation to emerging markets does not result in a hedge being placed for emerging market currencies.

In order to understand this change in hedging strategy, we need to change the way we think about currency risk. Up until now, we have thought that currency risk is assumed involuntarily when a decision is taken to buy a foreign asset, and that this risk has no systematic return associated with it. A hedging strategy decision, therefore, is based on balancing the positive effect of reducing portfolio risk by implementing a currency hedge, and the negative effect of the transaction costs it generates.

If currency has a positive expected return, we must now take into account the positive effect that holding this risk has on the expected portfolio returns. The currency becomes an asset, and therefore its weight in the portfolio depends on its expected return, its risk and its correlation with the other assets. Emerging market currencies have a correlation of around 0.5 with global equity markets, and no significant correlation with bonds. Given the correlation between equity markets is 0.7, the currencies now look like an attractive addition to a diversified portfolio, rather than an unrewarded source of risk.

CONCLUSION

It is clear that when deciding on a currency hedging strategy, developed market currencies should be considered separately to emerging market currencies, as their behaviour and characteristics are different. Whatever an individual in-vestor's asset allocation or target risks might be, it is extremely important to carefully consider a view on the future expected return to emerging market currencies. For a non-specialist, a zero expected return assumption is reasonable, and results in a significantly hedged emerging currency risk. For an investor who is bullish, emerging market currencies may prove a valuable addition to a diversified portfolio. ●

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