

Issues in Currency Hedging

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Valuation

Minimum Risk Hedge Ratio

Optimal Hedge Ratio

Forward Rate Bias

Serial Dependence

Valuation

$$F = S \times (1+r_d) / (1+r_f)$$

$$S = 2.3000$$

$$r_d = 5.00\%$$

$$r_f = 8.00\%$$

$$F = 2.2361$$

Covered Forward Rate Arbitrage - forward rate is the center of distribution for futures spot rates

Current Spot Rate	2.3000	Spot Rate Increases To	Spot Rate Decreases To
Current Forward Rate	2.2361	2.4597	2.0125
Interest cost from borrowing \$2,300,000 at 5%		-\$115,000.00	-\$115,000.00
Gain or loss on principal from change in spot rate		\$159,722.22	-\$287,500.00
Interest received after change in spot rate		\$196,777.78	\$161,000.00
Gain or loss from short forward position (-1,080,000 x 2.2361)		-\$241,500.00	\$241,500.00
Net profit		\$0.00	\$0.00

Covered Interest Arbitrage -- current spot rate is the
Forward Rate Bias
 center of distribution for futures spot rates

	Current Spot Rate Current Forward Rate	2.3000 2.2361	Spot Rate Increases To	Spot Rate Decreases To
			2.5300	2.0700
Interest cost from borrowing \$2,300,000 at 5%			-\$115,000.00	-\$115,000.00
Gain or loss on principal from change in spot rate			\$230,000.00	-\$230,000.00
Interest received after change in spot rate			\$202,400.00	\$165,600.00
Gain or loss from short forward position (-1,080,000 x 2.2361)			-\$317,400.00	\$179,400.00
Net profit			\$0.00	\$0.00

Minimum Risk Hedge Ratio

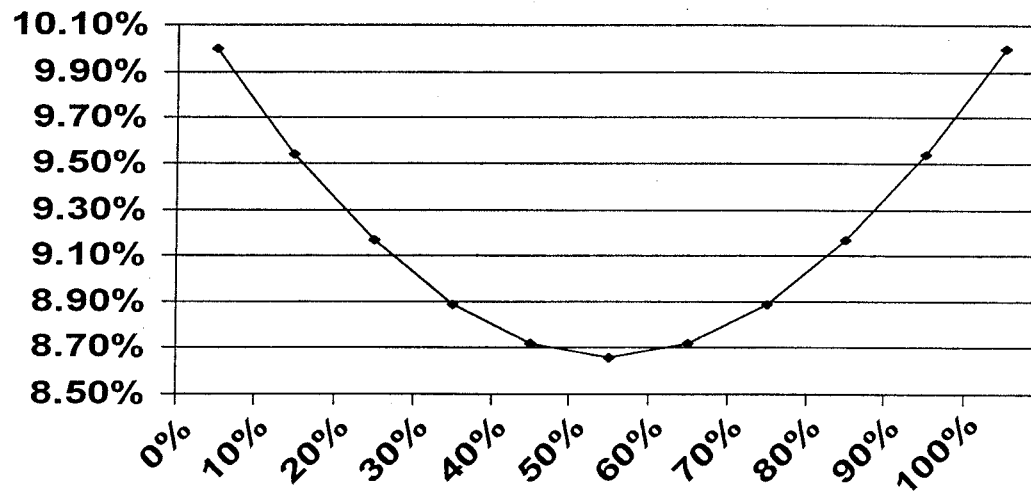
A Common retort to hedging currency exposure is:

The reason I chose to invest overseas in the first place was to diversify my portfolio. Part of that diversification arises from exposure to currencies. Therefore, why should I hedge that currency exposure?

The minimum risk exposure to a currency forward contract equals

$$- \text{Correlation} \times \frac{\text{Portfolio Standard Deviation}}{\text{Currency Standard Deviation}} = - \text{Beta}$$

Volatility



$$\begin{aligned} \theta &= .66 \\ \rho_P &= .10 \\ \rho_C &= .12 \end{aligned}$$

Optimal Hedge Ratio

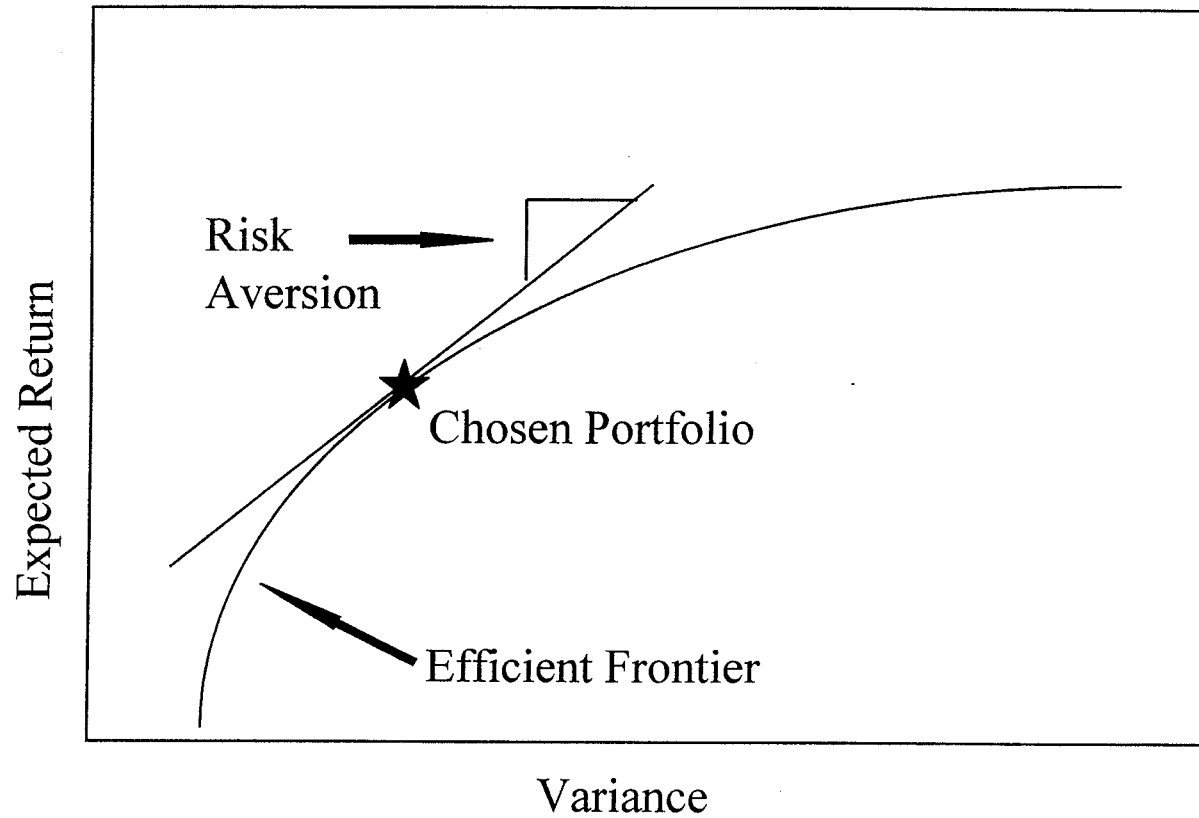
The optimal currency hedging policy does not minimize risk. It balances risk reduction with the cost of hedging by maximizing:

$$\text{Expected Return} - \text{Risk Aversion} \times \text{Standard Deviation}^2$$

Process

- Determine investor's risk aversion
- Estimate hedging costs and forward contract variances and covariances
- Solve for forward contract exposures that maximize the above quantity

Optimal Hedge Ratio



Optimal Hedge Ratio

- Whereas the composition of a portfolio implicitly answers the following question

How many units of expected return are you willing to give up in order to lower your portfolio's risk by one unit?

- A rational currency hedging policy answers the following question

How many units of currency hedging costs are you willing to incur in order to lower your portfolio's risk by one unit?

Forward Rate Bias

- Forward exchange rates have systematically over-predicted changes in the spot rates
- Therefore investors could have profited by purchasing discount currencies and selling premium currencies

Uncovered Interest Arbitrage -- forward rate is the
Forward Rate Bias
 center of distribution for future spot rates

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Forward Rate Bias

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Test of Forward Rate Bias -- Constant Beta

Panel Regression applied to AUD*, DEM, GBP, JPY / USD
1/75 - 12/97

$$\Delta S_{(t+1)} = \beta_0 + \beta_1(f_1 - S_1) + \mu_{(t+1)}$$

	Forward Tenor			
	1 month	3 month	6 month	12 month
Slope	-0.9367	-0.5639	-0.4014	-0.0814
t-statistics	-5.9	-4.53	-3.5	-2.2
* slope = 1				

* AUD starts 1/86