Currency Overlay - How much currency risk?

If we have a successful method for forecasting currencies from both a directional and risk perspective, how do we best use this to enhance the risk-adjusted return on a foreign asset by active currency management?

By investing in a foreign asset, we can get return from the foreign asset or from the foreign currency. If we don't expect to generate currency returns, then we are better off to passively hedge out the currency risk. On the other hand, if we expect to generate currency return, we can only do so by accepting currency risk.

Clearly there is a compromise between extra return and extra risk. The currency risk and the foreign asset risk are typically uncorrelated and so the combined risk will be less than the sum of the individual risks whereas the combined return will be equal to the sum of the individual returns. So even if the risk adjusted return on the active management of the foreign currency is not as good as the risk adjusted return on the foreign asset it may still make sense to have some active currency management because of how the risks combine.

This article asks two questions namely:
1) "How much"
What is the optimum combination of the foreign asset risk and foreign currency risk?

2) "Risk budget or fixed percentage"
Should we actively manage a fixed percentage of the foreign currency or allocate a risk budget to the active currency strategy?

For the purpose of deciding, we shall use the Sharpe ratio as a measure of risk-adjusted return. The Sharpe ratio, S, is defined as:

$$S = \frac{r}{\sigma}$$

where 'r' is the average annual return of the asset above the risk-free return and 'σ' is the average annual volatility of the asset. We seek to maximise this ratio. We need to find the optimum combination of these two asset classes, which yields the highest Sharpe ratio. The Sharpe ratio for this combination is given by the formula:

$$S = \frac{\left(r_1 + \lambda r_2\right)}{\sqrt{\sigma_1^2 + \left(\lambda \sigma_2\right)^2 + 2\lambda \sigma_1 \sigma_2 \rho}}$$

where

ρ	is the correlation between the foreign equity and the active currency strategy
λ	is the amount of the active currency strategy used
r_1	is the expected return on the foreign equity
r_2	is the expected return on the active currency strategy
σ_1	is the annualised risk of the foreign equity
σ_2	is the annualised risk of the active currency strategy against fully hedged

To find the optimum with respect to λ we set,

$$\frac{\partial S}{\partial \lambda} = 0$$

and we find that,

$$\lambda_{optimum} = \frac{(S_2 - S_1 \cdot \rho)}{(S_1 - S_2 \cdot \rho)} \cdot \frac{\sigma_1}{\sigma_2}$$

Since the correlation between the foreign asset and the active currency strategy is expected to be zero, we have:

$$\lambda_{optimum} = \frac{S_2}{S_1} \cdot \frac{\sigma_1}{\sigma_2}$$

Two observations:

1) The optimum amount of the active currency strategy to use is directly proportional to the ratio of its Sharpe to the Sharpe of the foreign asset. The better the active currency strategy the more we should use it.

2) It is also directly proportional to the ratio of the risk of the foreign asset to the risk of the active currency strategy. The riskier the foreign asset the more currency risk it can absorb.

A Simulated Example

Consider the position of a European investor who wishes to invest in the S&P 500 index, (the foreign asset) and measure currency risk as zero for a fully hedged strategy. Our active currency strategy is to selectively take off all or part of the currency hedge.

Below we consider the S&P 500 fully hedged back into Euros to be the benchmark and look at two active currency strategies[1] for taking the hedge off. One strategy is based on the idea of a 'risk budget' for the active currency strategy and the other is based on actively managing a 'fixed percentage' of the currency exposure. The period used is from 1st January 1990 to the 30th September 2000.

Factoring out past directional bias.

Suppose we are fully hedged back into Euros. In a period where the EURUSD spot rate moves up taking the hedge off can't be profitable whereas in a period where the EURUSD spot rate moves down taking the hedge off can be profitable. Clearly then the ability to make positive returns by selectively taking the hedge off is linked to the past directional bias of the currency pair.

Thus, to accurately calculate the contribution of the active currency strategy to the combined Sharpe ratio we take the average of the returns for the actual spot moves that happened and also simulate with the equal and opposite moves for the currency pair. The volatilities are also averaged.

Foreign Asset Fully hedged:

(a)   S&P500 Total Return Index + Currency Exposure Fully Hedged for a Euro client.
(b)   Same as (a) above but the EURUSD moves are taken to be exactly opposite.
(c)   Average of (a) and (b).

	(a)	(b)	(c)
Annualised return above risk-free return.	12.05	11.74	11.9
Average annual volatility.	13.5	13.6	13.6
Sharpe Ratio.	0.89	0.86	0.87

Risk Budget 3%:

(d)   Active currency strategy with 'risk budget' of 3%. The overnight forecasted risk of any unhedged currency positions is not allowed to exceed 3%
(e)   Same as (d) with EURUSD moves taken to be exactly opposite.
(f)   Average of (d) and (e).

	(d)	(e)	(f)
Annualised return above risk-free return.	1.20	0.35	0.78
Average annual volatility.	2.27	1.97	2.13
Sharpe Ratio.	0.53	0.18	0.36

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[1] The active currency strategies used are simulations performed by an active currency specialist. The choice of currency manager is not the issue in question. Simulated performance is not a guide to future performance.

Fixed percentage:

(g)   Active Currency strategy selectively unhedging the foreign asset.
(h)   Same as (g) with EURUSD moves taken to be exactly opposite.
(i)   Average of (g) and (h).

	(g)	(h)	(i)
Annualised return above risk-free return.	3.34	0.71	2.03
Average annual volatility.	7.64	7.31	7.48
Sharpe Ratio.	0.44	0.10	0.27

Summary Returns and volatilities with directional bias factored out.

	FOREIGN ASSET FULLY HEDGED	RISK BUDGET	FIXED PERCENTAGE
Average annual return above risk-free return	11.90	0.775	2.03
Average annual volatility	13.6	2.13	7.48
Sharpe Ratio	0.87	0.36	0.27

Optimisation Calculations for risk budget method.

If we now find the optimum combination of the foreign asset with the 'risk budget' active currency strategy using the formula derived earlier we get,

$$\lambda_{optimum} = 2.66$$

This points to a strategy with a maximum tracking error of 3% x 2.66 = 7.98%. This prompts us to use a risk budget of 8%. We need to check this because the return and risk may not scale linearly up to 8%. The figures for a risk budget of 8% are presented below.

Risk Budget of 8%:

(j)   Active currency strategy with 'risk budget' of 8%. The overnight forecasted risk of any unhedged currency positions is not allowed to exceed 8%
(k)   Same as (j) with EURUSD moves taken to be exactly opposite.
(l)   Average of (j) and (k).

	(j)	(k)	(l)
Annualised return above risk-free return.	3.09	0.95	2.02
Average annual volatility.	5.99	5.19	5.60
Sharpe Ratio.	0.52	0.18	0.36

If we now find the optimum combination of the foreign asset with the 8% 'risk budget' active currency strategy using the formula derived earlier we get,

$$\lambda_{optimum} = 1.00$$

Therefore, the optimum amount for the 'risk budget' is indeed 8%. This seems intuitively correct because a 'risk budget' of 8% is high enough to allow most of the return but because of the cap on risk it manages to filter out the excess risk.

Optimisation Calculations for fixed percentage method

We now find the optimum combination of the foreign asset with the 'fixed percentage' active currency strategy using the formula derived earlier and get,

$$\lambda_{optimum} = 0.564.$$

So, if we are actively managing a fixed percentage it should be 56.4% of the value of the foreign asset.

Comparison of 'risk budget' and 'fixed percentage' strategies:

Using the optimum amount in each case results in the following Sharpe ratio for the foreign asset and the selected active currency strategy:

STRATEGY	RETURN	RISK	SHARPE RATIO
FOREIGN ASSET FULLY HEDGED	11.9	13.6	0.875
RISK BUDGET 8%:	11.90 + 2.02 = 13.92	$(13.6^2 + 5.60^2)^{0.5}$ = 14.70	0.947
FIXED PERCENTAGE:	11.90 + 0.564x2.03= 13.045	$(13.6^2 + (0.564x7.48)^2)^{0.5}$ = 14.24	0.916

Conclusion

The Sharpe ratio of the foreign investment can be improved by using an active currency strategy. The improvement is almost twice as good by using a 'risk budget' to limit the active strategy rather than applying a fixed percentage limit.

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Source: Alder Capital DAC unless otherwise stated. The data and calculations are not necessarily audited or independently verified.

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