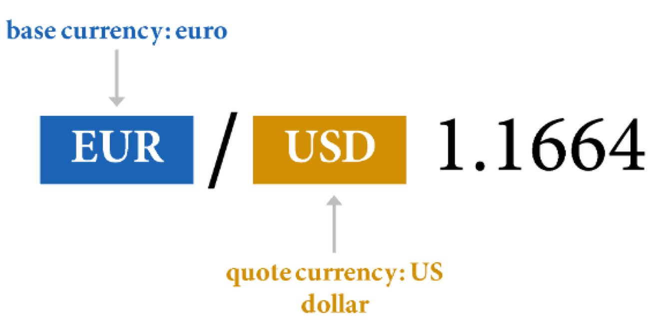
Derivatives I - FX

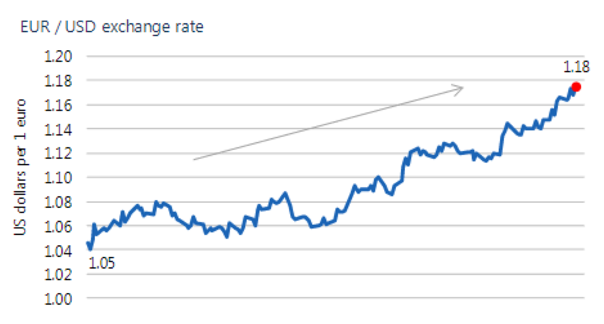
8/6/21 12:34 PM

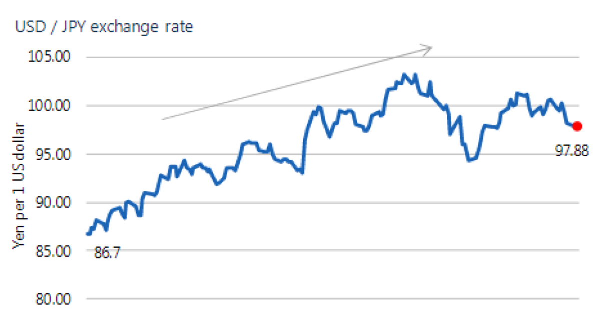
Anatomy of currency pair

- Base currency, quote currency
- 

- Direct currency quote: US dollar is the base currency
- Indirect currency quote: US dollar is the quoted currency
- Cross currency quote: currency pairs don't include US dollar

Appreciation and Depreciation





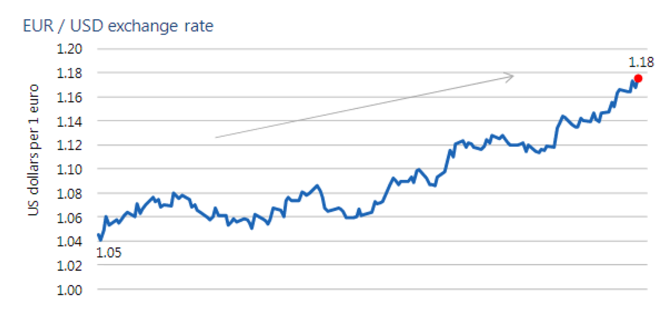
What happened to the euro?
- 1 euro was worth 1.05 US dollars
- 1 euro is worth 1.18 US dollars

The euro appreciated (the dollar depreciated)

What happened to the yen?
- 1 US dollar was worth 86.7 yen
- 1 US dollar is worth 97.88 yen

The yen depreciated (the dollar appreciated)

- *Calculating Spot Return*
  - As base currency:



What is the return of the Euro?

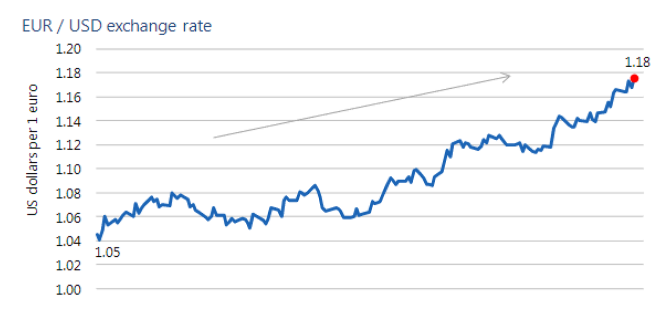
Starting point
EUR/USD = 1.05

Ending point
EUR/USD = 1.18

$\rightarrow \frac{1.18}{1.05} - 1 = 12.3\%$

The Euro appreciated 12.3% relative to the dollar

  - As quote currency:



How much did the dollar depreciate by?

Starting point
EUR/USD = 1.05

Ending point
EUR/USD = 1.18

$\rightarrow USD/EUR = \frac{1}{1.05}$, $USD/EUR = \frac{1}{1.18}$ $\rightarrow \frac{1.05}{1.18} - 1 = -11.0\%$

The dollar depreciated 11.0% relative to the euro

Carry trade

- Carry trade = borrow currency that has lower interest rate to buy currency that is paying higher interest rate
- Carry = interest rate differentials

- Calculate total FX market return

FX returns = carry + spot

Example
- US 1yr rates = 1%
- Brazil 1yr rates = 8%
- Spot = 3.00 USD/BRL
- 1yr fwd spot = 3.33 USD/BRL

Carry: 8% - 1% = 7%

Spot: $\frac{3.00}{3.33} - 1 = -10\%$

Total FX return: 7% + (-10%) = -3%

Risks to consider:
- FX risk
- Central bank risk
- Geopolitical risks

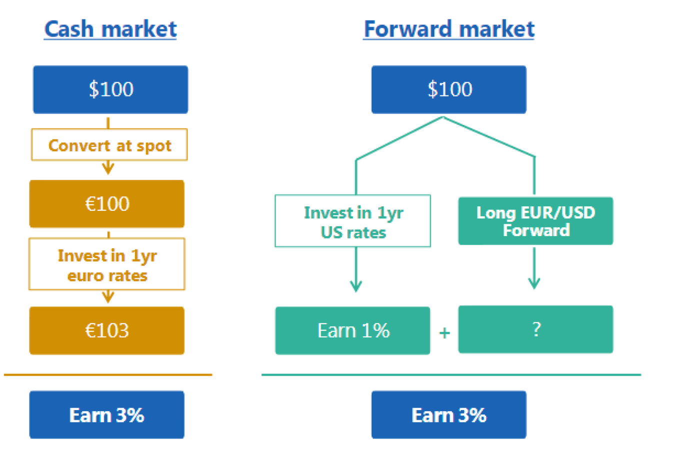
How to price a forward

You want exposure to eurozone rates and have $100 to invest. Assuming spot doesn't change, which would give a higher yield?

1. Covert to €100 and invest in Eurozone rates
2. Keep the $100 dollars and invest in US rates and go long a EUR/USD Forward

Assumptions:
- US 1yr rates = 1%
- Eurozone 1yr rates = 3%
- Spot = 1.00 EUR/USD
- Spot doesn't change

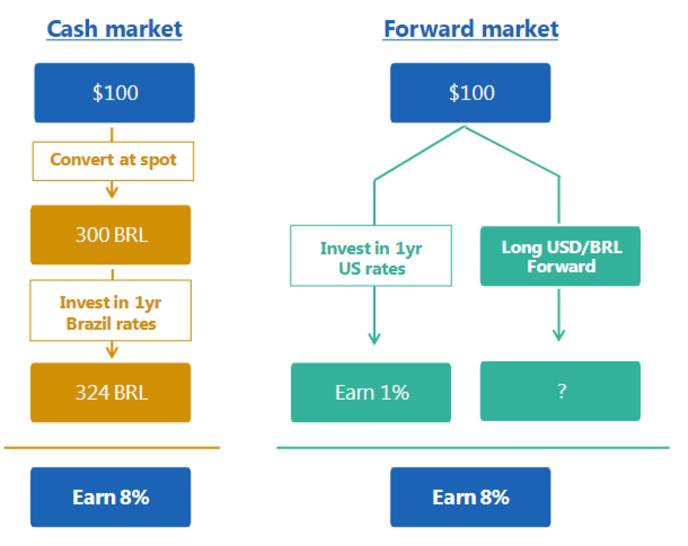
Conclusion:
- EUR/USD Forward is priced at 2% **discount**
- 1yr Forward = 0.98 EUR/USD
- You buy €100 for $98



What if you wanted exposure to Brazilian rates?

Assumptions:
- US 1yr rates = 1%
- Brazil 1yr rates = 8%
- Spot = 3.00 USD/BRL
- Spot doesn't change

Conclusion:
- USD/BRL Forward is priced at 7% **discount**
- 1yr Forward = 3.21 USD/BRL
- You buy 321 BRL for $100



Interest Rate Parity

- Equilibrium such that no arbitrage opportunity exists

$$Forward = Spot\frac{(1 + foreign\ interest\ rate)}{(1 + domestic\ interest\ rate)}$$

Quote currency

Base currency

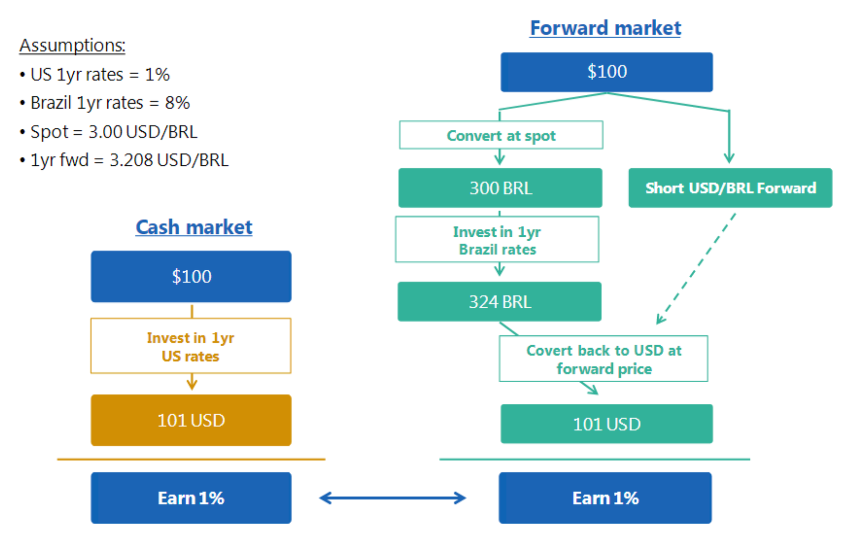
Example:

Assumptions:
- US 1yr rates = 1%
- Eurozone 1yr rates = 3%
- Spot = 1.00 EUR/USD

$$\text{1yr forward} = 1.00 * \frac{(1+.01)}{(1+.03)}$$

$$\text{1yr forward} = \mathbf{0.9806\ EUR/USD}$$

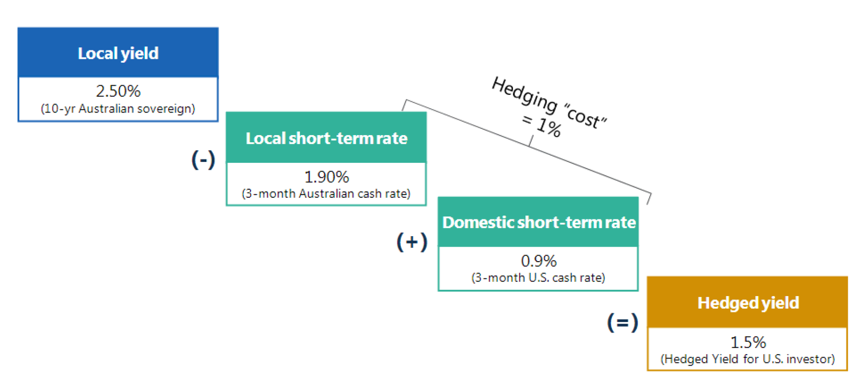
Assumptions:
- US 1yr rates = 1%
- Brazil 1yr rates = 8%
- Spot = 3.00 USD/BRL
- 1yr fwd = 3.208 USD/BRL

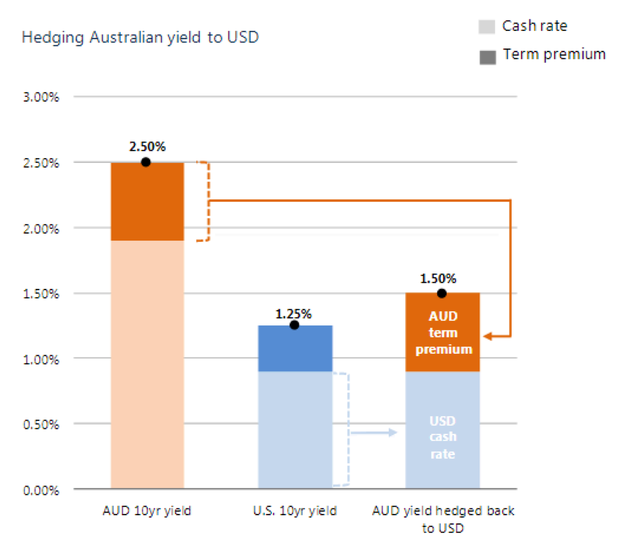


- Summary
  - The approximate % forward premium (or discount) is equal to the difference in interest rate
  - The currency with higher (lower) interest rate will be trading at a forward discount (premium)

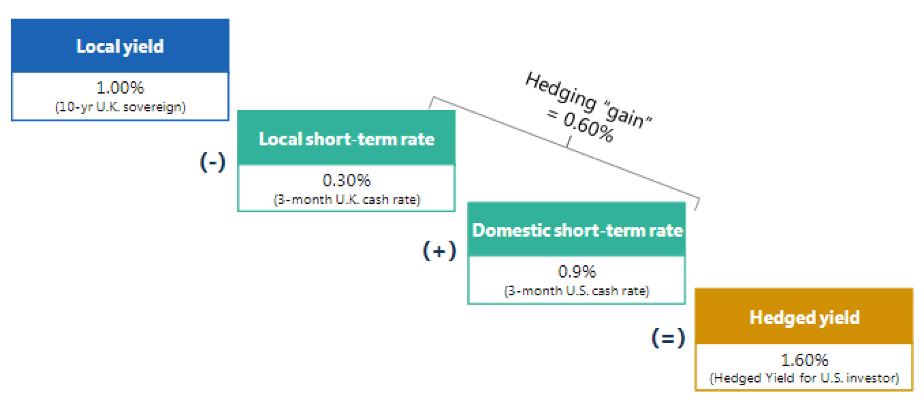
Currency Hedging

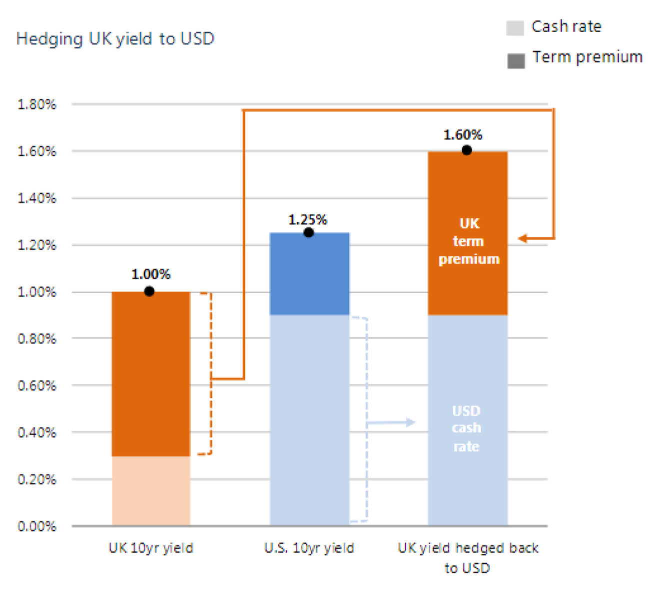
- Example 1:





- Example 2:





Key considerations

Reasons to be Unhedged	*Reasons to be Hedged*
• Express a negative view on the U.S. dollar • Match assets to liabilities denominated in foreign currencies • Diversify sources of FX returns	• **When you don't want to take currency risk** • Generally less volatility