

ACF305

International Financial and Risk
Management

Week 5 tutorial

Question 1

Suppose that you are quoted the following NZD/FC spot and forward rates:

	Spot bid-ask	3-mo. forward bid-ask	<i>p.a.</i> 3 month Euro-interest	6-mo.forward bid-ask	<i>p.a.</i> 6 month Euro-interest
NZD			5.65–5.90		5.47–5.82
USD	0.5791–0.5835	0.5821–0.5867	3.63–3.88	0.5839–0.5895	3.94–4.19
EUR	0.5120–0.5159	0.5103–0.5142	6.08–6.33	0.5101–0.5146	5.60–6.25
DKK	3.3890–3.4150	3.3350–3.4410	6.05–6.30	3.3720–3.4110	5.93–6.18
CAD	0.5973–0.6033	0.5987–0.6025	1.71–1.96	0.5023–0.5099	2.47–2.75
GBP	0.3924–0.3954	0.3933–0.3989	5.09–5.34	0.3929–0.3001	5.10–5.35

Question 1

- a) What are the three-month synthetic-forward NZD/USD bid-ask rates?
- b) What are the six-month synthetic-forward NZD/EUR bid-ask rates?
- c) What are the six-month synthetic-forward NZD/DKK bid-ask rates?
- d) What are the three-month synthetic-forward NZD/CAD bid-ask rates?
- e) In a–d, are there any arbitrage opportunities? What about least cost dealing at the synthetic rate?

Solution

0.5816–0.5868 are synthetic rates

0.5821–0.5867 are direct rates

We start with the bid rate, i.e., you sell FC 1 to obtain a certain amount of HC, at maturity. First, borrow against this FC 1 in the foreign money market, i.e., divide 1 by $(1+0.0388/4) = \text{USD } 0.9904$. Sell the USD for NZD in the spot market. As the bank needs to make a profit, you obviously get the worse rate, the bid rate. In practice, you multiply your USD 0.9904 by NZD/USD 0.5791 to obtain NZD 0.573537. You now invest the NZD 0.573537 in the New Zealand money market, i.e., you multiply 0.573537 by $(1+0.0565/4)$ to obtain NZD 0.5816 – the NZD/USD bid rate.

Solution

We now want to compute the NZD/USD ask rate. In case of the ask rate, you want to buy FC 1 for a certain amount of HC at maturity (in the future). The question is: how much HC x do we need to buy this FC 1? To find out, first calculate the present value of the HC x , which is $HC\ x/(1+0.059/4)$. You now want to convert this into FC in the spot market. To achieve this goal, you need to invert the spot quote. Recall: the inverse of the ask rate is the bid rate, and this is what we need here. Multiply $HC\ x/(1+0.059/4)$ by $1/0.5835$ and then invest this in the foreign money market at an interest rate of 3.63 p.a., which gives you $HC\ x/(1+0.059/4) * (1/0.5835) * (1+0.0363/4)$, which should be equal to FC 1. Solve for x , which gives you HC 0.5868 – the NZD/USD ask rate.

Solution

Or use formula (5.5) from Sercu (2009), p. 162:

$$\begin{aligned}\text{synthetic } [F_{t,T}^{bid}, F_{t,T}^{ask}] &= \left[S_t^{bid} \frac{1+r_{t,T}^{bid}}{1+r_{t,T}^{ask}}, S_t^{ask} \frac{1+r_{t,T}^{ask}}{1+r_{t,T}^{bid}} \right] \\ &= \left[0.5791 \frac{1+(0.0565/4)}{1+(0.0388/4)}, 0.5835 \frac{1+(0.0590/4)}{1+(0.0363/4)} \right] = [0.5816, 0.5868]\end{aligned}$$

(b) $0.5101 - 0.5165 = \text{NZD/EUR six-month}$

(c) $3.3773 - 3.4132 = \text{NZD/DDK six-month}$

(d) $0.6028 - 0.6096 = \text{NZD/CAD three-month}$

(e) NZD/USD: direct market dominates synthetic market in either direction, NZD/EUR: direct market dominates synthetic market in either direction, NZD/DKK: the synthetic market dominates the direct market for the bid rate, NZD/CAD: arbitrage opportunity

Question 2

Michael Milkem, an ambitious MBA student from Anchorage, Alaska, is looking for free lunches on the foreign exchange markets. Keeping his eyes glued to his Reuters screen until the wee hours, he spots the following quotes in Tokyo:

Exchange rate: Spot	NZD/USD	1.59–1.60	JPY/USD	100–101
	NZD/GBP	2.25–2.26	JPY/GBP	150–152
180 - day Forward	NZD/USD	1.615–1.626	JPY/USD	97.96–98.42
	NZD/GBP	2.265–2.274	JPY/GBP	146.93–149.19
Interest rates (simple, <i>p.a.</i>)				
180 days	USD	5%–5.25%	JPY	3%–3.25%
	NZD	8%–8.25%	GBP	7%–7.25%

Given the above quotes, can Michael find any arbitrage opportunities?

Solution

Use formula (5.5) from Sercu (2009), p. 162:

$$\text{synthetic } [F_{t,T}^{bid}, F_{t,T}^{ask}] = \left[S_t^{bid} \frac{1 + r_{t,T}^{bid}}{1 + r_{t,T}^{*ask}}, S_t^{ask} \frac{1 + r_{t,T}^{ask}}{1 + r_{t,T}^{*bid}} \right]$$

Synthetic 180-day forward rates:

$$\text{for NZD/USD: } = \left[1.59 \frac{1 + (0.08/2)}{1 + (0.0525/2)}, 1.60 \frac{1 + (0.0825/2)}{1 + (0.05/2)} \right] = [1.6113, 1.6254]$$

$$\text{for JPY/USD: } = \left[100 \frac{1 + (0.03/2)}{1 + (0.0525/2)}, 101 \frac{1 + (0.0325/2)}{1 + (0.05/2)} \right] = [98.9038, 100.1378]$$

$$\text{for NZD/GBP: } = \left[2.25 \frac{1 + (0.08/2)}{1 + (0.0725/2)}, 2.26 \frac{1 + (0.0825/2)}{1 + (0.07/2)} \right] = [2.2581, 2.2736]$$

$$\text{for JPY/GBP: } = \left[150 \frac{1 + (0.03/2)}{1 + (0.0725/2)}, 152 \frac{1 + (0.0325/2)}{1 + (0.07/2)} \right] = [146.9240, 149.2464]$$

Solution

There are opportunities for shopping around for the NZD/USD rate (buying USD synthetically) and the NZD/GBP rate (buying GBP synthetically), but Michael is interested in arbitrage opportunities (and not in the cheapest way to buy or sell foreign currency).

Michael finds an arbitrage opportunity for the JPY/USD rate: he will buy USD with JPY via the forward and sell USD synthetically in order to make a risk-free profit.

There is an arbitrage opportunity if

- the real bid forward price is above the synthetic ask forward price,
- or the real ask forward price is below the synthetic bid forward price.