**Topic 1 Solutions**

**THINGS TO NOTE:**

1.  I have set **more** questions than can be covered in a 2 hour session. The questions to be covered in the tutorial are indicated by an asterisk (*) in the file that *only* contains questions.

    The rest should be viewed as *extra* practice problems – we get requests for extra problems, and these are in response to those requests.

2.  Tutorial Solutions will be posted at the <u>end of the week</u>.

3.  I have also included exam questions from previous years that I have written. These are clearly marked as such in the "questions" file. These should give you an indication how I tend to write questions.

**Remember the following with exchange rate quotes:**

(1) the quote is always from the bank's perspective and

(2) the bank is buying/selling the currency in the denominator. For example, if given the following ¥/€ exchange rate, the bank is buying/selling €'s.

**NB:** Certain European currencies such as the French Franc (FRF), Deutsche Mark (DEM), Italian Lira (ITL), Belgian Franc (BEF) etc. were replaced by the Euro (EUR). While some of this week's tutorial questions use these currencies for tutorial questions, do **not** get hung up about currency names. In exams, we only care about whether you understand how exchange rate quotations work and not what they are called.

1. **The $:DEM exchange rate is DEM1 = $0.35, and the DEM:FRF exchange rate is 1FRF = DEM 0.31. What is the FRF:$ exchange rate?**

$/FRF = ($0.35/DEM) × (DEM 0.31/ FRF)

= $ 0.1085/FRF

Therefore, $FRF/_\$ = \dfrac{1}{\left(^\$/_{FRF}\right)} = 9.2166$

2. **A bank is quoting the following exchange rates with respect to the USD. DEM 2.3697-2.3725/USD and USD 1.5525-35/GBP. What DEM/GBP would the bank quote if asked? (\*)**

The **BUY** price for GBP [customer sells GBP for DEM]

= The customer sells GBP for USD at the <u>buy</u> price **&** sells USD for DEM at the <u>buy</u> price

= USD 1.5525/GBP * DEM 2.3697/USD = DEM 3.6789/GBP

The **SELL** price for GBP [customer buys GBP with DEM]

= The customer starts with DEM and converts it to USD **&** sells USD for GBP

= DEM 2.3725/USD × USD 1.5535/GBP = DEM 3.6857/GBP

Therefore, Bid-Ask quote is DEM 3.6789 – 3.6857/GBP


3. **A bank is currently quoting spot rates of DEM 4.2446-4.2456/USD and BEF 65.30-65.40/USD. What rate would the bank quote for the BEF/DEM exchange rate?** (BEF – Belgian Franc)


The **BUY** price for DEM (customer sells DEM for BEF)

= (BEF 65.30/USD)/(DEM 4.2456/USD)

= BEF 15.3806/DEM


The **SELL** price for DEM (customer buys DEM using BEF)

= (BEF 65.40/USD)/(DEM 4.2446/USD)

= BEF 15.4078/DEM

Bank's bid-ask price is BEF 15.3806 – 15.4078/DEM

**4. You are given the following foreign exchange quotations by a bank:**

|  | Yen = 1AUD | GBP = 1 AUD | USD = 1 AUD |
|---|---|---|---|
| Spot | 113.33/14.22 | 0.4876/85 | 0.6870/79 |
| 3 month | 106.22/09.02 | 0.4454/89 | 0.6770/84 |
| 6 month | 102.45/04.11 | 0.4211/95 | 0.6612/76 |

**(a)    How many Yen could 1 million GBP buy, spot?**

Sell 1 million GBP for AUD and receive

- GBP 1,000,000/(GBP 0.4885/AUD) = AUD 2,047,082.9

Sell AUD for Yen to receive

- AUD 2,047,082.9 × Yen 113.33/AUD = ¥ 231,995,906.19

**(b)    At what rate would the customer buy Yen 3 months forward?**

Buy Yen at ¥ 106.22 (the quote is ¥/AUD, the bank is buying/selling AUD. Here, the customer is buying ¥ in exchange for AUD.  Since the quote is from the bank's perspective, it will buy AUD at the bid/buy price.)

**(c)    At what rate would a client buy GBP for USD, 3 months forward?**

Sell USD at 0.6784/AUD and

Buy GBP at 0.4454/AUD

The rate is GBP 0.6565/USD (0.4454/0.6784)

**(d)    At what rate would the customer buy Yen and sell pounds, spot?**

Sell £ at 0.4885/AUD and

Buy ¥ at 113.33/AUD

1 £ = 113.33/0.4885 = ¥ 231.99/£

**(e)    How many USD could 10 million Yen buy, six months forward?**

Sell ¥ 10m to receive = ¥ 10,000,000/(¥ 104.11/AUD) = A$ 96,052.25

Sell AUD for USD = A$ 96,052.25 × (U$ 0.6612/$A) = U$ 63,509.75


**(f)    At what rate could a client buy Yen for GBP, six months forward?**

Buy ¥ (6mth forward rate) at ¥ 102.45/$A

Sell £ (6mth forward rate) at £ 0.4295/$A

1 £ = ¥ 102.45/(£0.4295/$A) = ¥ 238.53

**5.** **As a foreign exchange trader for Mitsubishi Bank, one of your customers would like a spot yen quote on Australian dollars. Current market rates are:**

$$Yen101.37 - 85/USD$$
$$AUD1.2924 - 44/USD$$

**What bid and ask rates would you quote for the Yen/AUD exchange rate?**

The cross-rate that we are after is the rate at which the bank (dealer) will buy/sell AUD in exchange for Yen (JPY).

**Bid Price** for AUD is given by:

AUD 1.2944 = Yen 101.37
AUD = Yen 78.31

**Ask price** for AUD is given by:

AUD 1.2924 = Yen 101.85
AUD = Yen 78.81

**Bid – Ask Price** = Yen 78.31 – 78.81/AUD

**6. Given the following information, what are the NZD/SGD currency against bid-ask quotations.**

|  | **American terms** | | | **European terms** | |
|---|---|---|---|---|---|
|  | **Bid** | **Ask** |  | **Bid** | **Ask** |
| **USD/NZD** | 0.4660 | 0.4667 | **NZD/USD** | 2.1427 | 2.1459 |
| **USD/SGD** | 0.5705 | 0.5710 | **SGD/USD** | 1.7513 | 1.7528 |

**Note:** American terms is direct quote from the perspective of the USD i.e., USD/FC.

The cross-rate that we are after is the rate at which the bank will buy/sell SGD in exchange for NZD.

The quote is calculated using the two currencies exchange rate relative to the USD.

Cross rate (NZD/SGD) → (USD/SGD)/(USD/NZD)

Buy/Bid for SGD: Bank sells USD in exchange for SGD (0.5705) and then sells NZD in exchange for USD (0.4667)

Sell/Ask for SGD: Bank buys NZD in exchange for USD (0.4660) and then sells SGD in exchange for USD (0.5710)

      **NZD/SGD:**    1.2224 – 1.2253 (rounded to 4 decimal places)

**7. The Euro quote is Euro 1.0242/$1 (from Dresdner Bank) and the CHF 1.5030/$ (from Credit Suisse). UBS is quoting Euro/CHF at 0.6750/CHF. Show how you can make a triangular arbitrage by trading at these prices. Assume that you have $5,000,000 with which to conduct the arbitrage. What happens if you initially sell $ for CHF? What Euro/CHF price will eliminate triangular arbitrage?**

The **synthetic cross-rate** is 0.6814 Euro/CHF (1.0242/1.5030) while the **actual cross rate** is 0.6750 Euro/CHF, i.e., the Euro is overvalued (fewer euros are required to buy 1 CHF)

1. Sell $5,000,000 for Euro @ Euro 1.0242/$ to Dresdner. This will yield Euro 5,121,000 ($5,000,000 × 1.0242).

2. Sell Euros for CHF at Euro 0.6750/CHF. This action will yield CHF 7,586,667 (5121000/0.6750).

3. Resell CHF for US$ at CHF 1.5030/$. This results in $5,047,682. The arbitrage profit is $47,682.

The Euro/CHF cross rate should be 0.6814. At this rate triangular arbitrage opportunities will not exist.

Profit is a function of the purchase of CHF at too low a rate in comparison to the equilibrium rate.

**8.** The following exchange rates are available to you. (You can buy or sell at the stated rates.)

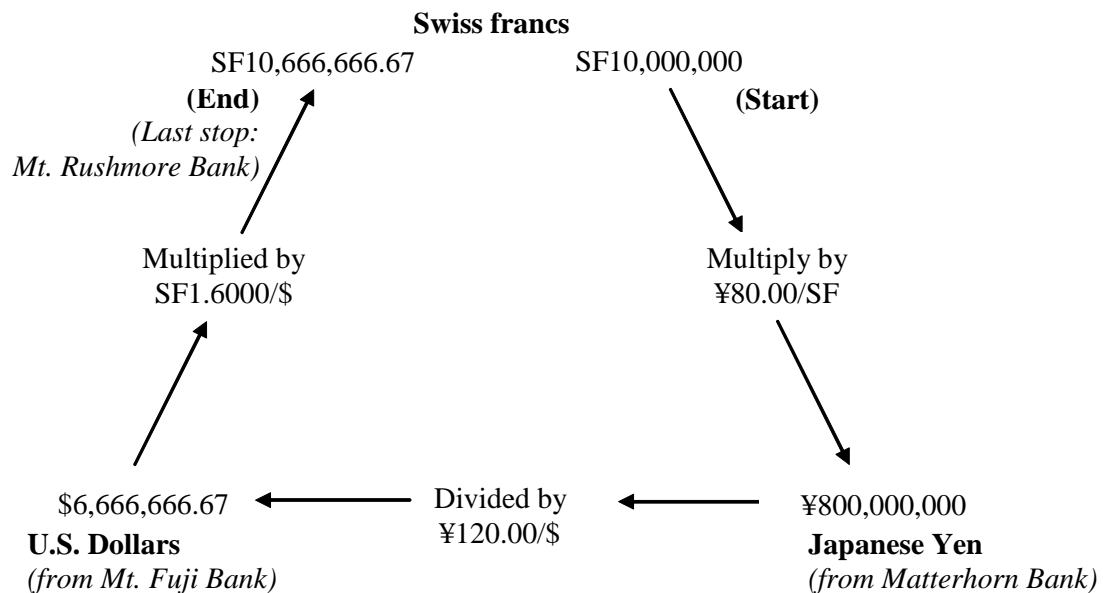| | |
|---|---|
| Mt. Fuji Bank | ¥120.00/$ |
| Mt. Rushmore Bank | CHF1.6000/$ |
| Matterhorn Bank | ¥80.00/CHF |

Assume you have an initial CHF10,000,000. Can you make a profit via triangular arbitrage? If so, show steps and calculate the amount of profit in Swiss francs.

**Past exam question (*)**

First, let's calculate the cross rate implied by the quotes given by Mt. Fuji Bank and Mt. Rushmore Bank: (¥120.00/$)/(CHF 1.6000/$) = ¥75.00/CHF.

Clearly, we get more yen from Matterhorn Bank than we do through the cross rate implied by the dollar quotes given by Mt. Fuji Bank and Mt. Rushmore Bank.

Therefore, our arbitrage will involve buying yen from Matterhorn Bank (by selling Swiss francs), and then selling those yen back to Mt. Fuji Bank (for dollars). Finally, we will sell our dollars to Mt. Rushmore Bank (buying Swiss francs). If we've done the arbitrage correctly, we will end up with more than CHF10,000,000. Let's try the arbitrage:

**Swiss francs**

SF10,666,666.67                    SF10,000,000
**(End)**                              **(Start)**
*(Last stop:*
*Mt. Rushmore Bank)*

Multiplied by                        Multiply by
SF1.6000/$                           ¥80.00/SF

$6,666,666.67    ←  Divided by  ←  ¥800,000,000
**U.S. Dollars**      ¥120.00/$        **Japanese Yen**
*(from Mt. Fuji Bank)*               *(from Matterhorn Bank)*

We've made a profit of CHF666,666.67.

## 9. Question from Lecture Slide #20

Find the arbitrage opportunity here if you start with €10,000,000:

| | |
|---|---|
| **Citibank:** | \$1.7395/£  or  £0.5749/\$ |
| **Barclays Bank:** | €0.8408/\$  or  \$1.1893/€ |

*Cross-rate:*

| | |
|---|---|
| **Dresdner Bank:** | €1.4381/£ or £0.6954/€ |

The first step is to check if the implied (or synthetic) quote is the SAME as the cross-rate that we see on our Bloomberg screens.

Implied Cross Rate: $\quad €/_£ = €/_\$ \times \$/_£$

$$= €0.8408/_\$ \times \$1.7395/_£ = €1.4626/_£ \ or \ £0.6837/_€$$

For arbitrage (or riskless) profits to NOT be possible, the quoted cross-rate should be EQUAL to the implied rate.

Here we notice that in the quoted cross-rate, the Euro buys more GBP (0.6954) that what the two exchange rates say that it should buy (0.6837). Hence, your strategy should be one where you are buying GBP with Euros.

STEP 1: Start with €10 million and buy GBP using the quoted exchange rate.
$$= €10,000,000 \times £0.6954/_€ = £6,954,000$$

STEP 2: Convert GBP into USD
$$= £6,954,000 \times \$1.7395/_£ = USD12,096,483$$

STEP 3: Last, we sell the USD for Euros
$$= USD12,096,483 \times €0.8408/_\$ = €10,170,722$$

If you are able to make these transactions ***simultaneously***, the profit you would have made is:
$$= €10,170,722 - €10,000,000 = €170,722$$

The instantaneous return of such a transaction is
$$= €10,170,722/_{€10,000,000} - 1 = 1.71\%$$

10. **Restate the following one-, three-, and six-month outright forward European term bid-ask quotes in forward points.**

| | |
|---|---|
| **Spot** | **1.3431-1.3436** |
| **One-month** | **1.3432-1.3442** |
| **Three-month** | **1.3448-1.3463** |
| **Six-month** | **1.3488-1.3508** |

Swap points are the *difference* between the <u>outright forward</u> rate and the <u>spot</u> rate.

Swap points are 01-06, 17-27 and 57-72 for one-, three- and six-months respectively.

11. **Compute the implied forward rate if a dealer was quoting the USD against the AUD at 0.7580/90 with 30 day forward margins of 40/30 points.**

To calculate the **outright** forward rate, the swap points are either added to or subtracted from the spot rate. A point is 0.0001.

In this case, the bid swap point > ask swap point indicating that the forward rate is at a DISCOUNT and the points must be subtracted from the spot price to get OUTRIGHT rate.

| | | |
|---|---|---|
| Spot | 0.7580 | 0.7590 |
| Swap points | <u>0.0040</u> | <u>0.0030</u> |
| **Outright rate** | **0.7540** | **0.7560** |

The forward rate is trading at a discount (i.e., forward rate is < spot rate)