HW2

Thursday, September 21, 2023 12:39 PM

1. (5 points) Suppose the spot ask exchange rate, $S^a(\$|£)$, is \$1.90 = £1.00 and the spot bid exchange rate, $S^b(\$|£)$, is \$1.89 = £1.00. If you were to buy \$10,000,000 worth of British pounds and then sell them five minutes later, how much of your \$10,000,000 would be "eaten" by the bid-ask spread?

Gsk: $1.9/GBP
bid: $1.89/GBP

$10m/1.9 = 526315.90 GBP
526315.9 GBP x 1.89 = 9947368.42

10m - 9947368.42 = 52631.58

2. (15 points) Use the table below to answer question a-d.

	In U.S. $ (Direct quotations)	
	Bid	Ask
Canadian Dollar (CAD)	0.8653	0.8667
Euro (€)	1.4000	1.4200

A. What is the **bid** price of Canadian dollars in terms of euro **S^b(€/CAD)?**

Bid CAD/USD = .8653 CAD to buy USD/sell CAD
Ask EUR/USD = 1.42 EUR to sell USD/buy EUR

.8653/1.42 = .60937

B. What is the **ask** price of Canadian dollars in terms of euro **S^a(€/CAD)?**

Ask CAD/USD = .8667 to sell USD/buy CAD
Bid EUR/USD = 1.4 to buy USD/sell EUR

.8667/1.4 = .61907

C. What is the **bid** price of euro in terms of Canadian dollars **S^b(CAD/€)?**

Bid EUR/USD = 1.4 to buy USD/sell EUR
Gsk CAD/USD = .8667 to sell USD/buy CAD

1.4/.8667 = 1.61532

D. What is the **ask** price of euro in terms of Canadian dollars **S^a(CAD/€)?**

Ask EUR/USD = 1.42 to sell USD/buy EUR
Bid CAD/USD = .8653 to buy USD/sell CAD

1.42/.8653 = 1.64104

3. (10 points) Suppose you are a U.S.-based investor with $1,000,000 to invest. The dollar-euro exchange rate is quoted as $1.60 = €1.00 and the dollar-pound exchange rate is quoted at $2.00 = £1.00. If a bank quotes you a cross rate of £1.00 = €1.20. Are there any arbitrage opportunities? What transactions will you carry out? How much profit in $ can you make?

1.6 USD / 1 EUR
2 USD / 1 GBP

1.2 EUR / 1 GBP ← cross rate
1.25 EUR / 1 GBP ← no-arbitrage rate

EUR/GBP = EUR/USD · USD/GBP
x = 1/1.6 · 2 = 1.25 ← what rate should be

Opportunity for arbitrage ✓ b/c quoted = 1.2 ≠ actual = 1.25 GBP undervalued

- Buy EUR with USD: 1m USD → 1.6 USD/EUR = 625,000
- Buy GBP with EUR: 625k EUR → 1.2 EUR/GBP = 520,833.33
- Buy USD with GBP: 520,833.33 → 2 USD/GBP = 1,041,666.67

Profit: 1,041,666.67 − 1M = **41,666.67**

4. (15 points) Using the table below to answer question a-c

Country	In US $
UK Pound	2.0000
1-mos forward	2.0100
3-mos forward	2.0200
6-mos forward	2.0300
Euro	1.5000
1-mos forward	1.5100
3-mos forward	1.5200
6-mos forward	1.5300

A. What is the spot cross-exchange rate between pounds and euro **S(£/€)**?

$$GBP/EUR = \frac{GBP}{USD} \cdot \frac{USD}{EUR} = \frac{1}{2} \cdot \frac{1.5}{1} = \frac{1.5}{2} = .75$$

B. What is the 6-month forward cross-exchange rate between pounds and euro **F_6(£/€)**?

$$GBP/EUR = \frac{GBP}{USD} \cdot \frac{USD}{EUR} = \frac{1}{2.03} \cdot \frac{1.53}{1} = \frac{1.53}{2.03} = .7537$$

C. What is 3-month forward premium or discount (expressed as an annual percentage rate) for the U.K. pound versus U.S. dollars (assuming 90 days for the 3-month forward)?

$F^3(USD/GBP) - S(USD/GBP) = 2.02 - 2 = .02$

P/D 3-month Forward = .02/2 (Part of year) = .01 $\left(\frac{360}{90}\right)$ = .04 = **4%**

5. (10 points) If the annual inflation rate is 2.5 percent in the United States and 4 percent in the U.K., and the pound depreciated against the dollar by 1.6 percent.

A. What is the real exchange rate (keep 4 decimal places)?

$$q = \frac{(1+\pi_{US})}{(1+e)(1+\pi_{GB})} = \frac{1+.025}{(1-.016)(1+.04)} = 1.0016$$

B. What implication can we make about the competitiveness of domestic products based on the real exchange rate calculated in part a?

Domestic products competitiveness weakens over time in this situation as the pounds value depreciates against the dollar given these inflation rates.

6. (5 points) As of today, the spot exchange rate is €1.00 = $1.60 and the rates of inflation expected to prevail for the next year in the U.S. is 2% and 3% in the euro zone. What is the one-year forward rate that should prevail?

$(F-S)/S = \pi_{\$} - \pi_{€}$

$F-S = (\pi_{\$} - \pi_{€})S$

$F = S(\pi_{\$} - \pi_{€}) + S = 1.6(.02-.03) + 1.6 = -.016 + 1.6 = 1.584$

$F_1 \approx 1.584$

7. (40 points) Suppose that the annual interest rate is 5% in the U.S. and 15.5% in the U.K. The spot exchange rate S($/£)= 1.25. Assume that the arbitrager can borrow up to $1,000,000 or £800,000.

$i_{\$} = .05 \quad i_{£} = .155 \quad S = 1.25$

A) If the one-year forward rate is F($/£)= 1.1494. What transactions will the arbitrager carry out? How much profit can the arbitrager make in terms of dollar? Discuss how IRP will be restored in this case.

$F = 1.1494 \qquad F_1 = S(1+i_{\$})/(1+i_{£}) = 1.25(1.05)/(1.155) = 1.3636... \neq F = 1.1494$ ← opportunity

GBP is undervalued, so: Borrow $1M @ $i_{\$} = .05$ ⇒ $1,050,000 is due @ maturity

$1m → GBP @ S=1.25 ⇒ you get 800,000 GBP
Lend 800K GBP @ $i_{£} = .155$ ⇒ you get 924,000 GBP
AND sell 924,000 GBP forward @ F=1.1494 ⇒ you get $1,062,045.6
Repay original $ loan and get profit = (1062045.6 − 1050000) = $12,045.6 ✓

IRP restored b/c $i_{\$}\uparrow$, $i_{£}\downarrow$, $S(\$/£)\uparrow$, $F(\$/£)\downarrow$
∴ Given enough transactions/volume, the IRP conditions will be restored.

B) If the one-year forward rate is F($/£)= 1.1236. What transactions will the arbitrager carry out? How much profit can the arbitrager make in terms of dollar? Discuss how IRP will be restored in this case.

$F = 1.1236 \neq F_1 = 1.3636$ ∴ opportunity

GBP is undervalued, so: Borrow 800,000 GBP @ $i_{£} = .155$ ⇒ 924,000 GBP is due @ maturity

800K GBP → USD @ S=1.25 ⇒ you get 1,000,000 USD
Lend 1m USD @ $i_{\$} = .05$ ⇒ you get 1,050,000 USD
AND sell 1,050,000 USD forward @ F=1.1236 ⇒ you get 934496.26 GBP
Repay original £ loan and get Profit = (934496.26 − 924000) = 10496.26 GBP

Profit in terms of dollars = 10496.26 GBP · 1.1236 = $11793.6 ✓

IRP restored b/c $i_{\$}\downarrow$, $i_{£}\uparrow$, $S(\$/£)\downarrow$, $F(\$/£)\uparrow$
∴ given enough transactions/volume, the IRP conditions will be restored