

## SOLUTIONS FOR SESSION 2: PARITY CONDITIONS & ARBITRAGE

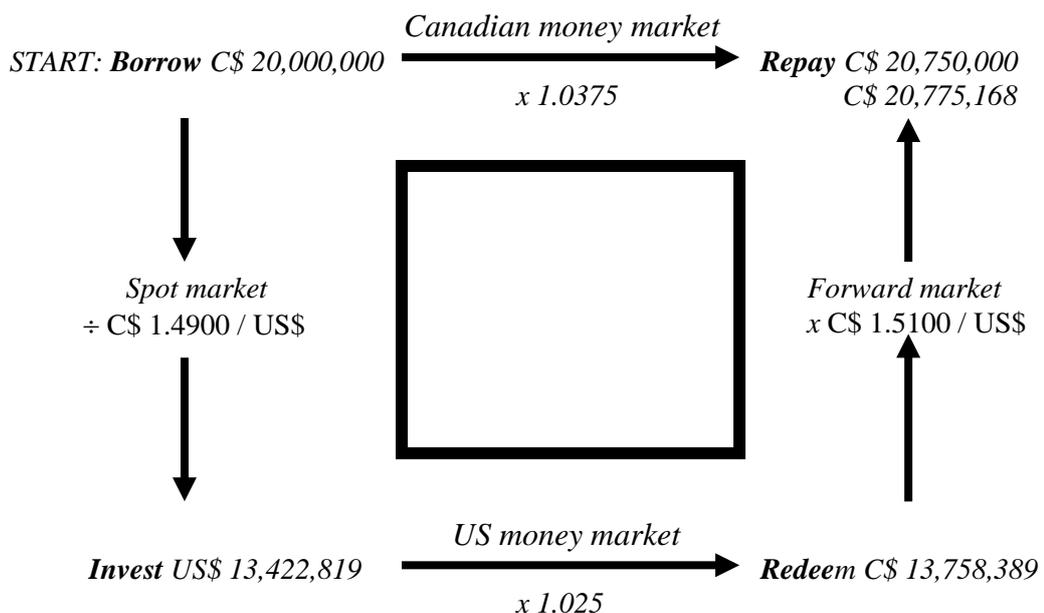
### 1. Covered Interest Arbitrage

Henri Jacque, an arbitrageur with Bank of Montreal, faces the following Canadian dollar/US dollar quotes:

Spot rate	C\$1.4900/\$
Six-month forward rate	C\$1.5100/\$
Six-month Canadian dollar interest rate (borrowing or investing)	7.50% p.a.
Six-month US dollar interest rate (borrowing or investing)	5.00% p.a.

Henri Jacque is authorized to borrow C\$20,000,000 or its US dollar equivalent. The ending profit, if any, should be realized in Canadian dollars. How can he complete covered interest arbitrage? What will be his profit?

### ANSWER: BOX ILLUSTRATION



$$\text{Arbitrage profit} = \text{C\$ } 20,775,168 - \text{C\$ } 20,750,000 = \text{C\$ } 25,168$$

*Note: annual interest rates have to be scaled down to conform to the sixth month maturity of the transactions.*

2. **Absolute and relative PPP**

Pinot Noir wine is produced in the states of California (US) and New South Wales (Australia). Equivalent bottles of Pinot Noir sell in the United States for US\$22 and in Australia for A\$34.

**ANSWERS:**

(a) *According to the theory of purchasing power parity, the US dollar/Australian dollar spot rate of exchange would be that which equates current prices of a comparable bottle of wine:*

$$\text{Spot rate} = \frac{P_{\text{wine in A\$}}}{P_{\text{wine in US\$}}} = \frac{\text{A\$ } 34}{\text{US\$ } 22} = \text{A\$ } 1.5455 / \text{US\$}$$

(b) *Suppose the price of Pinot Noir is expected to rise to \$27 over the next year, while the price of a comparable bottle of Australian wine is expected to rise to A\$44. What should be the spot US dollar/Australian dollar exchange rate one year from now?*

*If PPP holds the spot rate in one year will reflect relative prices one year from now. This would be:*

$$\text{Forward rate} = \frac{P_{\text{wine in A\$}}}{P_{\text{wine in US\$}}} = \frac{\text{A\$ } 44}{\text{US\$ } 27} = \text{A\$ } 1.6296 / \text{US\$}$$

### 3. London and New York

Money and foreign exchange markets in London and New York are very efficient. You have the following information:

	<u>London</u>	<u>New York</u>
Spot exchange rate	\$1.6000/£	£0.6250/\$
One-year treasury bill rate	5.00%	6.00%
Expected inflation rate	2.00%	Unknown

Assume parity conditions hold.

#### ANSWERS:

(a) To estimate inflation in the United States next year we use the **Fisher Effect**.

##### Precise Analysis:

Step 1: find the real rate of interest in the UK

$$(1 + i_{UK}) = (1 + r_{UK}) (1 + \pi_{UK})$$

$$(1 + r_{UK}) = (1 + i_{UK}) / (1 + \pi_{UK}) = (1.05) / (1.02) = 1.029412$$

$$r_{UK} = 1.029412 - 1 = 0.29412 \text{ ie } \underline{\underline{2.9412\%}}$$

Step 2: apply the UK real rate of interest to the US

$$(1 + \pi_{US}) = (1 + i_{US}) / (1 + r_{US}) = (1.06) / (1.029412) = 1.029714$$

$$\pi_{US} = 1.029714 - 1 = 0.29714$$

Thus the implicit estimated inflation rate in the US = 2.9714%

##### Approximate Analysis:

$$UK: \quad r_{UK} = i_{UK} - \pi_{UK} = .05 - .02 = .03, \text{ ie } 3\%$$

$$US: \quad \pi_{US} = i_{US} - r_{US} = .06 - .03 = .03, \text{ ie } 3\%$$

(b) To estimate today's one-year forward exchange rate between pounds and dollars **use interest rate parity**.

$$\frac{F}{S} = \left[ \frac{1 + i_{US}}{1 + i_{UK}} \right]$$

$$F = \$ 1.6000 / \text{£} \times \left[ \frac{1 + .0600}{1 + .0500} \right] = \$ 1.6152 / \text{£}$$

#### 4. Covered foreign investment opportunity

A UK company has excess cash of £1 million for a period of 3 months. A proposition is put that it should be invested in South Korean won due to the high South Korean interest rate.

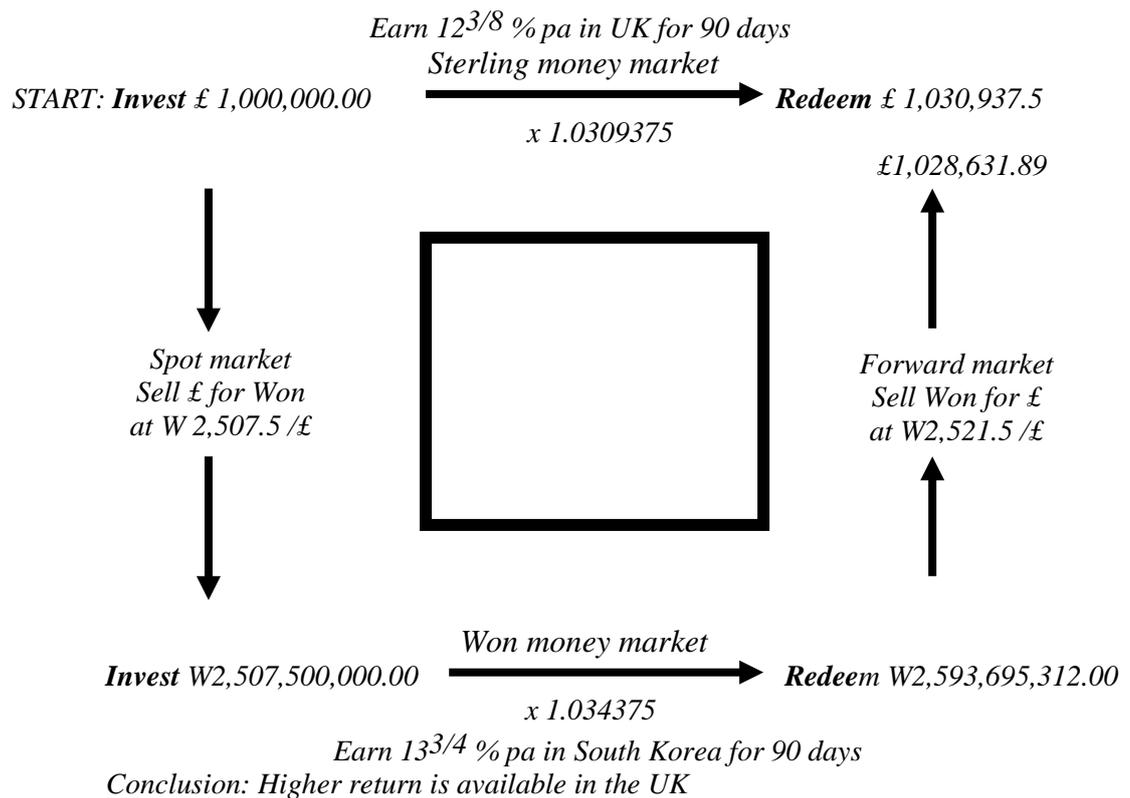
When the decision was made FX rates and interest rates are as follows:

Won/£ spot	2507 <sup>1</sup> / <sub>2</sub>	-	2508 <sup>1</sup> / <sub>2</sub>
Won/£ 3-month forward	9	-	13
Sterling 3-month interest	12 <sup>3</sup> / <sub>8</sub>	-	12 <sup>1</sup> / <sub>2</sub>
Won 3-month interest	13 <sup>3</sup> / <sub>4</sub>	-	14 <sup>1</sup> / <sub>4</sub>

Note: the South Korean won is the variable currency in the above quotes. Interest rates are quoted on an annualized basis.

What would you do, and why?

#### ANSWER: BOX ILLUSTRATION



NB: as the South Korean won has higher interest rates it must be trading at a forward discount

Won/£ spot	2507 <sup>1</sup> / <sub>2</sub>	-	2508 <sup>1</sup> / <sub>2</sub>
ADD Won discount	9	-	13
Outright Won/£ 3-month forward	<u>2516<sup>1</sup>/<sub>2</sub></u>		<u>2521<sup>1</sup>/<sub>2</sub></u>

**Alternative solution:**

Compare the exchange and interest 'agios':.

**EXCHANGE AGIO**

$$\frac{F-S}{S} \cdot \frac{12}{n} \cdot 100 = \frac{2,521.5 - 2,507.5}{2,507.5} \cdot 4 \cdot 100$$

= 2.23% discount on Won

=>  $i_{\text{Won}}$  should be 2.23%  
greater than  $i_{\text{£}}$

**INTEREST AGIO**

$$\frac{1.1375}{1.12375} = 1.0122$$

=>  $i_{\text{Won}} > i_{\text{£}}$  by 1.0122 - 1

= 0.0122 ie 1.22%

ie  $i_{\text{Won}}$  is not high enough

**Conclusion: Invest in £**