FIN 325 Corporate Finance

L16 (Applications): Multinational Topics — Exchange Rates

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Overview

- Management of a multinational corporation is not just a matter of choosing where to sell your goods.
- Overseas operations leave the firm exposed to exchange rate movements and foreign capital markets.
- Firms use **hedging** to reduce exposure to exchange rate risk.

Exchange rates (1)

- An **exchange rate** is the price of one country's currency in terms of another.
- Typically we'll see these quoted in terms of U.S. dollars.
- E.g. consider a quote of the form: EURO, 0.89, 1.13.
- Says that 1 USD buys 0.89 EUROS and 1 EURO buys 1.13 dollars.
- These numbers are the reciprocal of each other.

Exchange rates (2): let the good times roll...

Exchange rates (3)

- This is real money being wiped-out as the exchange rate depreciates!
- Consider my graduate school applications as an example.
- I applied to 25 economics PhD programs in the United States.
- The average application fee is around USD 100.
- When I applied the exchange rate was around 1 AUD = 0.89 USD.
- The process therefore cost around AUD 2,809 ($1/0.89 \times 25 \times 100$).
- If I'd applied a year earlier, the rate would have been more like 1 AUD = 1.05 USD.
- Instead the process would have cost AUD 2,381.
- Exchange rate movement cost me AUD 429, (around 43 bottles of Heineken at a bar in Melbourne).

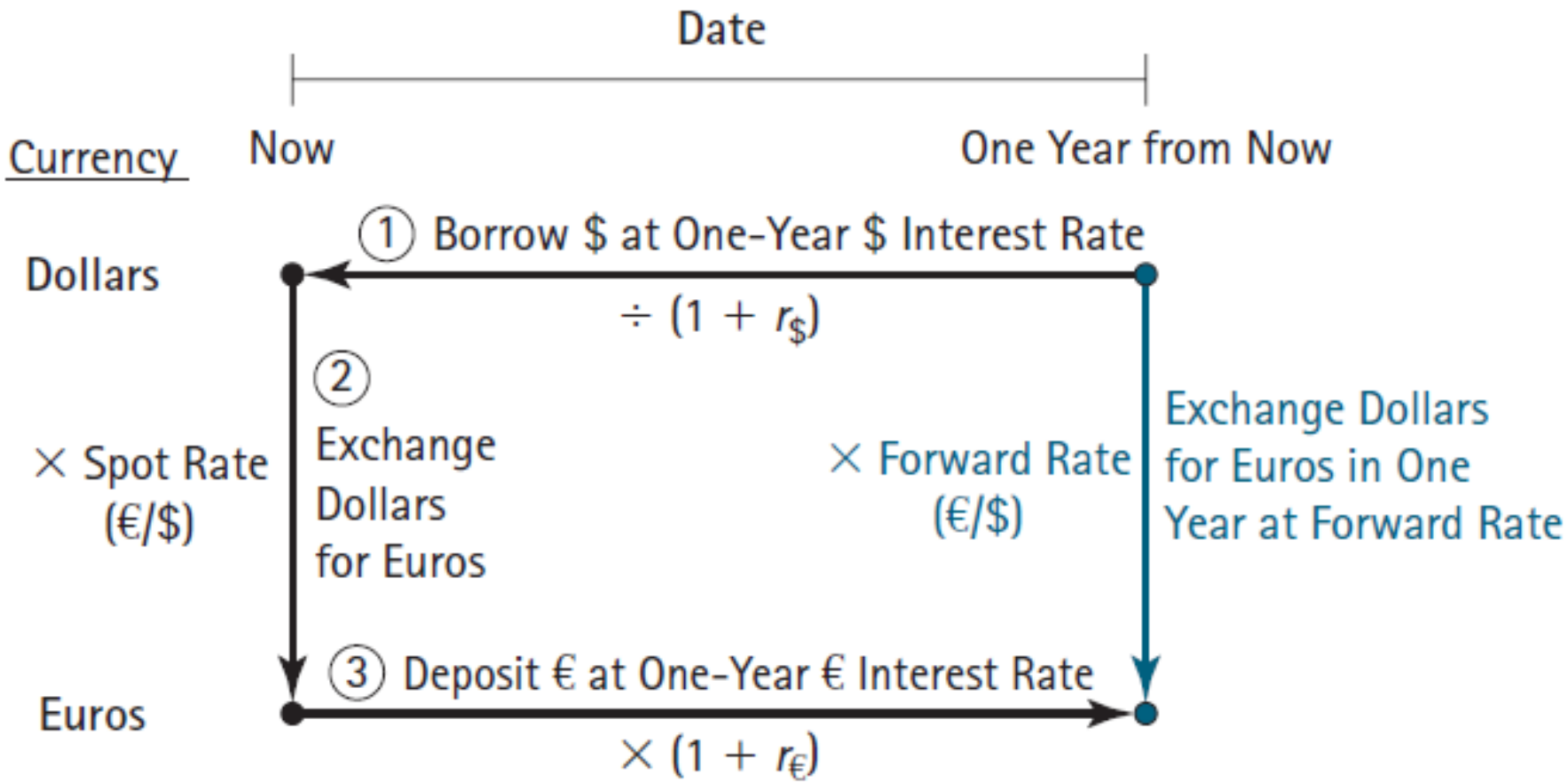
Hedging (1): forward contracts

- Firms only care about costs/revenues in terms of their own currency!
- Most common way of managing the risk is through **forward contracts**.
- A forward contract locks a **future** exchange rate in advance.
  - Contract specifies the rate, the date and the amount of currency to be exchanged.
- **Spot rate**: the prevailing exchange rate we can trade at **today**.
- **Forward rate**: an agreed upon rate at which an exchange will take place in the future.

Hedging (2): cash and carry

- **Cash and carry**: an alternative method to using forward contracts, which can yield the same outcome.
- The idea is to buy the currency today and to lock in the future cost by depositing it in a riskless account until a future date.
- The procedure for locking-in the EURO rate for one year's time involves the following three simultaneous trades:
  (1) Borrow USD today using a one-year loan at the USD interest rate.
  (2) Exchange the USD today for EUROs.
  (3) Deposit the EUROs today for one year at the EURO interest rate.
- After the year, you'll **receive** EUROs and **owe** USD.
- Emulates the effect of the forward contract.
  - EUROs will come out of the bank account at the end of the year like you wanted and there will be no need to turn to the spot market in the future.

Hedging (3): cash and carry



- Both methods **end up at the same place**.
- Cost in forward contract: **forward rate**.
- Cost in cash & carry: **repayment of USD loan**.

Hedging (4): interest rate parity

- **Interest rate partiy** is the relationship

$$F_T = S_0 \frac{(1 + r_{EURO})^T}{(1 + r_{USD})^T}$$

  where F_T (EURO/USD) is the forward rate for T periods ahead, S_0 is the current spot rate (EURO/USD) and r_j for $j \in \{USD, EURO\}$ is the interest rate in country j.

- Relationship arises due to the parallel between the forward contract method and cash and carry methods.

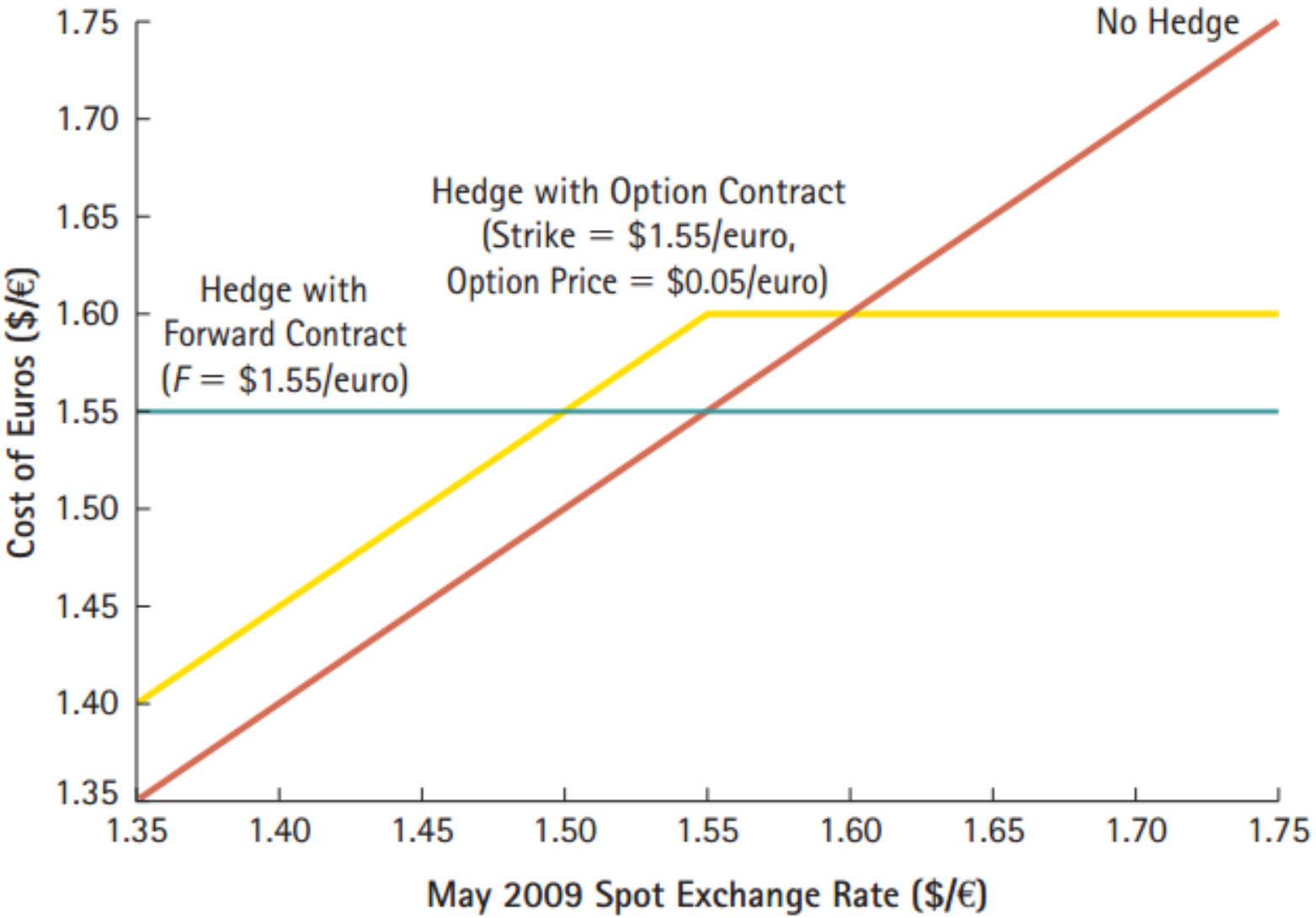
- Can be used to price forward contracts.

- Forward rate is an unbiased estimate of the **future spot rate**.

Hedging (5): options

- Just like stock options, **currency options** give the holder the right, but not the obligation to buy currency at a given exchange rate.
- Can be used to insure against the exchange rate moving beyond a certain level.
- Still receive all the benefits of a low exchange rate.
- You're not locked-in in the case of lower exchange rate cost — can be better than the forward contract.
- Need to pay the **price of the option** just to hold it though.

Hedging (6): summary



Absolute purchasing power parity (PPP) (1)

- How are prices of goods in different countries related to the exchange rate?

- **Absolute PPP** says that the price of a given good must be the same everywhere in the world after adjusting for the exchange rate.

$$p^{USA} e_{GBP/USD} = p^{UK}$$

  where p^j for $j \in \{USA, UK\}$ is the price of the good in country j and $e_{GBP/USD}$ is the amount of GBP received for one USD.

- E.g. if an iPod in Seattle costs USD 100 and 1 USD = 0.7 GBP then the price in the UK should be GBP 70.

- Relies on no arbitrage: we could buy in the cheaper country and import the good if this didn't hold.

Absolute purchasing power parity (PPP) (2)

- Requirements for absolute PPP to hold:
  - Zero transaction costs.
  - No barriers to trade (taxes, tariffs, etc).
  - No differences in the commodity between locations.
- Rarely holds in reality!
- Can we still say anything about the relationship between good prices and exchange rates?

Relative PPP

- **Relative PPP** provides information about what causes **changes** in exchange rates.
- Looks at **percentage changes** in variables rather than **levels**.
- Weaker in predictive power than absolute PPP.

$$\Delta e_{GBP/USD} = \pi^{UK} - \pi^{USA}$$

  where $\Delta e_{GBP/USD}$ gives the change in the exchange rate and π^j is the inflation rate.

- If inflation is higher in the UK than the USA then we'd expect the USD to appreciate relative to the GBP.
  - We can convert our currency from GBP to USD and buy the relatively cheaper goods in the US.
- This is the **first difference** of the absolute PPP relationship.

Valuation of overseas projects

- Two approaches you can use to place a value on potential overseas projects.

- **Home currency approach**:
  - **(i)** Estimate cash flows in foreign currency.
  - **(ii)** Estimate future spot rates using interest rate parity.
  - **(iii)** Convert future cash flows to USD.
  - **(iv)** Discount using U.S. cost of capital.

- **Foriegn currency approach**:
  - **(i)** Estimate cash flows in foreign currency.
  - **(ii)** Convert domestic cost of capital to foreign cost of capital using interest rate parity.
  - **(iii)** Discount using foreign cost of capital.
  - **(iv)** Convert NPV to USD using current spot rate.

Foreign cost of capital (1)

- If you want to discount the foreign cash flows, which discount rate is appropriate?
- Recall that the interest rate parity condition said (for $T = 1$)

$$F_1 = S_0 \frac{(1 + r_{EURO})}{(1 + r_{USD})} \tag{1}$$

where r_j is the riskless rate for country j.

- Using similar arguments, we can get a similar relationship for a firm's cost of capital

$$F_1 = S_0 \frac{(1 + r^*_{EURO})}{(1 + r^*_{USD})} \tag{2}$$

where r^*_j is the firm's cost of capital in country j.

Foreign cost of capital (2)

- We can combine equations (1) and (2) to get a relationship between the cost of capital and riskless rates

$$r^*_{EURO} = \frac{1 + r_{EURO}}{1 + r_{USD}}(1 + r^*_{USD}) - 1$$

- If you seek to discount cash flows denominated in EUROs, r^*_{EURO} is the appropriate rate to use.

Example

- Wald Incorporated, a U.S. company, is considering a project based in France.
- The project requires an upfront cost of 100m EUROs at $t = 0$.
- It will then generate 150m EUROs and 100m EUROs at $t = 1$ and $t = 2$ respectively.
- The current spot exchange rate is 1.15USD/EURO.
- The riskless rate in EUROs and USD are 2% and 1% respectively.
- The USD denominated cost of capital is 3%.
- Find the NPV of the project using both the Home and Foreign currency approaches.

Example solution (1)

- Using the Home currency approach first, we can estimate the future spot rates using the forward rates as follows

$$
\begin{aligned}
F_1^{-1} &= S_0^{-1} \frac{1 + r_{USD}}{1 + r_{EURO}} \\
&= 1.15 \frac{1.01}{1.02} \\
&= 1.14.
\end{aligned}
$$

$$
\begin{aligned}
F_2^{-1} &= S_0^{-1} \frac{(1 + r_{USD})^2}{(1 + r_{EURO})^2} \\
&= 1.15 \frac{(1.01)^2}{(1.02)^2} \\
&= 1.13.
\end{aligned}
$$

Example solution (2)

- Then we can find the NPV as follows

$$NPV = (-100m) \times (1.15) + \frac{150m \times 1.14}{1.03} + \frac{100m \times 1.13}{(1.03)^2}$$

$$= \$157.53$$

Example solution (3)

- Next we estimate the NPV using the Foreign currency approach.
- Find the cost of capital in EUROs as follows

$$\begin{aligned} r^*_{EURO} &= \frac{1 + r_{EURO}}{1 + r_{USD}}(1 + r^*_{USD}) - 1 \\ &= \frac{1.02}{1.01}(1.03) - 1 \\ &= 0.04. \end{aligned}$$

Example solution (4)

- Then to get the NPV, we discount the Foreign cash flows using r^*_{EURO} and then hit it with the current spot rate.

$$\begin{aligned} NPV &= \left[(-100m) + \frac{150m}{1.04} + \frac{100m}{1.04^2}\right] \times 1.15 \\ &= 157.19. \end{aligned}$$

- The difference in the numbers is due to **rounding error**.

Takeaways

- Multinational corporations face a great deal of risk in exchange rate movements.
- Forward contracts can be used to lock-in future conversion rates.
- Interest rate parity gives the relationship between the current spot rate, the forward rate and the riskless interest rates.
- Can discount using Home currency or Foreign currency approaches, both of which utilise the interest rate parity condition.
- Main friction is **imperfect capital markets** for this topic.