

Lesson IX: Overview

1. Working within an international context:
exposures and risks
2. Hedging techniques



Working within an international context: exposures and risks



Risk vs Exposure



Risk relates to the **variability in the values** of assets and liabilities, due to unexpected events and occurrences.

Exposure is the **amount at risk**.

Different Risks and Exposures

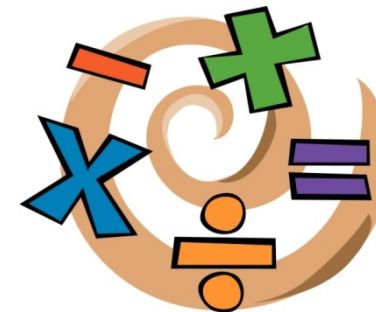
- 1. Foreign exchange risk and exposure**
- 2. Operating risk and exposure**
- 3. Country risk and exposure**



Foreign exchange exposure I

Foreign exchange exposure: sensitivity of changes in the real domestic currency value of assets and liabilities to changes in exchange rates.

$$Exposure = \frac{\Delta V_{(DC)}}{\Delta S_{(DC / FC)}}$$



Foreign exchange exposure II

$$\textit{Exposure} = \frac{\Delta V_{(DC)}}{\Delta S_{(DC / FC)}}$$



Measured in **monetary terms** (can you find the currency of measurement?)



Exposure on the same asset/liability varies depending on which currency is considered as domestic/foreign

Foreign exchange exposure III

1. Exposure on **contractual** assets and liabilities
2. Exposure on **non-contractual** assets and liabilities



Contractual assets and liabilities

Assets or payment obligations with a **fixed face and market values** (e.g. bank accounts/ deposits, accounts receivable/ payable...)



Exposure on contractual A&L

Suppose:

- €-denominated bank account = €1,000
- $S_{\$/\text{€}}$ from 1.1 $_{\$/\text{€}}$ to 1.2 $_{\$/\text{€}}$

$$\textit{Exposure} = \frac{\Delta V_{(DC)}}{\Delta S_{(DC / FC)}} = \frac{.1 \cdot 1,000}{.1} = \text{€}1,000$$

What if we dealt with a bank loan?



Terminology



Long (short) position: an investor is **long** (short) in a currency if she or he **gains** (loses) when the **spot value of the currency increases**, and **loses** (gains) when it **decreases**.

Non contractual assets and liabilities

Assets or payment obligations **without a fixed face and market values** (e.g. shares, foreign currency-denominated bonds...)



FX exposure on non contractual A/L I

Suppose:

- Shares (initial price)= €10
- The shares belong to a European company exporting to the USA
- $S_{\$/\text{€}}$ from $1.1_{\$/\text{€}}$ to $1.2_{\$/\text{€}}$ → the € appreciation harms the exporting company's competitiveness: the shares' price drops to €9.50



FX exposure on non contractual A/L II

$$Exposure = \frac{\Delta V_{(DC)}}{\Delta S_{(DC / FC)}} = \frac{(1.2 \cdot 9.5) - (1.1 \cdot 10)}{.1} = \frac{11.4 - 11}{.1} = \text{€4}$$

The € appreciation has increased the \$ value of the investment, **although** part of this benefit has been eroded due to the lower firm's competitiveness in int'l mkts.

Is the US investor long or short EUR? Why?

More on FX exposure and N-C A&L



Exposure depends on the extent to which the currency value and the asset value are **related**

Co-variation between the FX rate and the foreign currency value of assets

FC bonds & FX exposure I

Suppose:

- Bond (initial price)= €1000
- The ECB follows a policy of “**leaning against the wind**”
- $S_{\$/\text{€}}$ from $1.1_{\$/\text{€}}$ to $1.2_{\$/\text{€}}$ → after the € appreciation, the ECB lowers the interest rates, thus forcing bonds’ prices up to €1,050



FC bonds & FX exposure II

$$Exposure = \frac{\Delta V_{(DC)}}{\Delta S_{(DC / FC)}} = \frac{(1.2 \cdot 1,050) - (1.1 \cdot 1,000)}{.1} = \frac{1,260 - 1,100}{.1} = \text{€1,600}$$

The exposure is **larger** than the value of the bond



FC bonds & FX exposure III

Does an investor buying exclusively domestic currency – denominated bonds face any foreign exchange exposure? Why?



Foreign exchange risk

Exchange rate risk: standard deviation of domestic currency values of assets or liabilities attributable to **unanticipated** changes in exchange rate.

Exposure, Risk and CIRP

$$(1 + r_D)^n = \frac{F({}_nD / F)}{S(D / F)} (1 + r_F)^n$$

Assume that the foreign currency-denominated security is **held to maturity** (when the fwd contract also expires). Does this transaction bear any FX exposure/risk?



Exposure, Risk and PPP

Suppose that $\Delta S = \Delta P_D - \Delta P_F$ holds and assume a positive inflationary shock occurs in the foreign country. Will a domestic investor have to face any FX risk/ exposure on a real estate investment? Why?



One lesson to learn

It is possible to face **foreign exchange exposure on domestic assets** and NOT face exposure on **foreign assets**.



Operating exposure I

Operating exposure: effects of exchange rates on revenues, costs (and, consequently, profits).



Does a domestic firm with no direct business relationships abroad face operating risk?



Operating exposure II

Operating exposure is very difficult to eliminate.



“Residual FX exposure”

Country risk I

Country risk: possibility of losses due to country-specific economic, political and social events



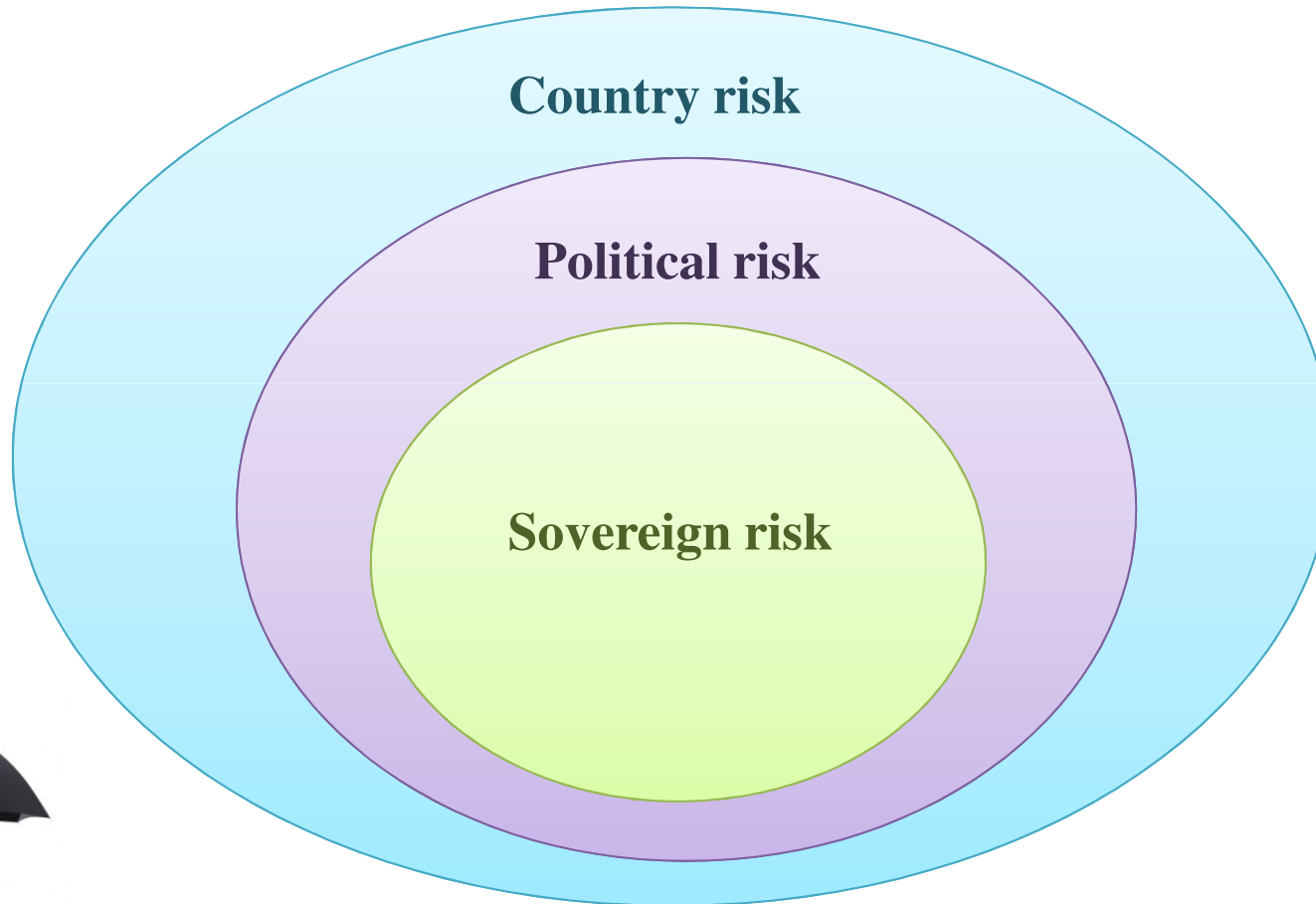
Uncertainty surrounding payments from abroad or assets held abroad due to the possibility of war, revolution, asset seizure, or other similar events.

Country risk II

- **Confiscation** (Government takeover **without** compensation);
- **Expropriation** (Government takeover with compensation);
- **Wars, revolutions;**
- **Changed legal environment** (restrictions on income repatriation, tax regimes...)



Digging a little deeper...I



Digging a little deeper...II

Sovereign risk: possibility of losses on claims to foreign governments or government agencies.

Political risk: additional possibility of losses on private claims (including FDIs).



Country Risk Assessment I

Country Risk Assessment



Ongoing, dynamic process, due to ever changing market conditions



Country Risk Assessment II

Major Assessment Approaches

Macroeconomic

GDP growth
Inflation trends
Public Debt
Public Deficit
Unemployment
Interest Rates
Exchange Rates
BoP

Analytical

Ratings
(S&P, Moody's,
Fitch...)

Market-Based

CDS prices
Sovereign Default
Spread dynamics

Ratings and Country Risk I

Rating

Synthetic evaluation of the **credit-worthiness** of a debtor



Lower ratings mean **higher default probability**

HIGHER RISK PREMIA



Final Yield = Risk Free + Risk Premium

Ratings and Country Risk II

| Country | Rating | Risk Premium |
|-------------|--------|--------------|
| Brazil | Baa2 | 2.63% |
| China | Aa3 | 1.05% |
| Germany | Aaa | 0.00% |
| Greece | Caa1 | 10.50% |
| Switzerland | Aaa | 0.00% |

Source: Damodaran, 2011



Greece: Ratings and Yields



Source: Bloomberg, 10 Yrs Avg Gvt Bond Yields

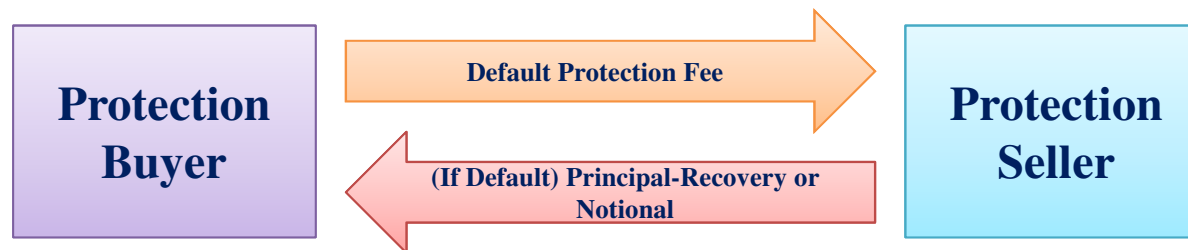
CDS and Country Risk

CDS

Derivative instrument that **insures against losses** stemming from a **credit event**



This contract **protects against the default** (credit event) of the issuer (**reference entity**). The **premium** the protection buyer pays to the protection seller is **determined by market forces** and depends on the **expected default risk** of the issuer.

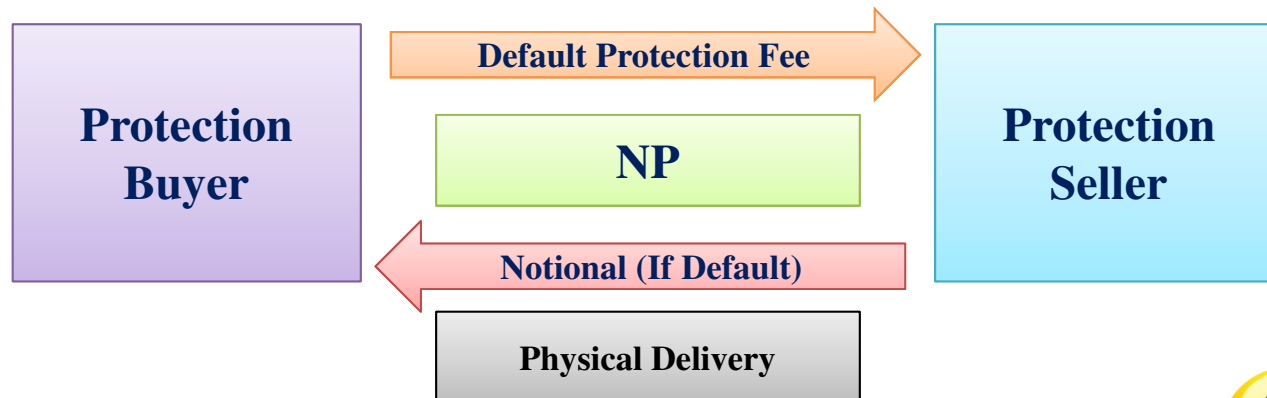
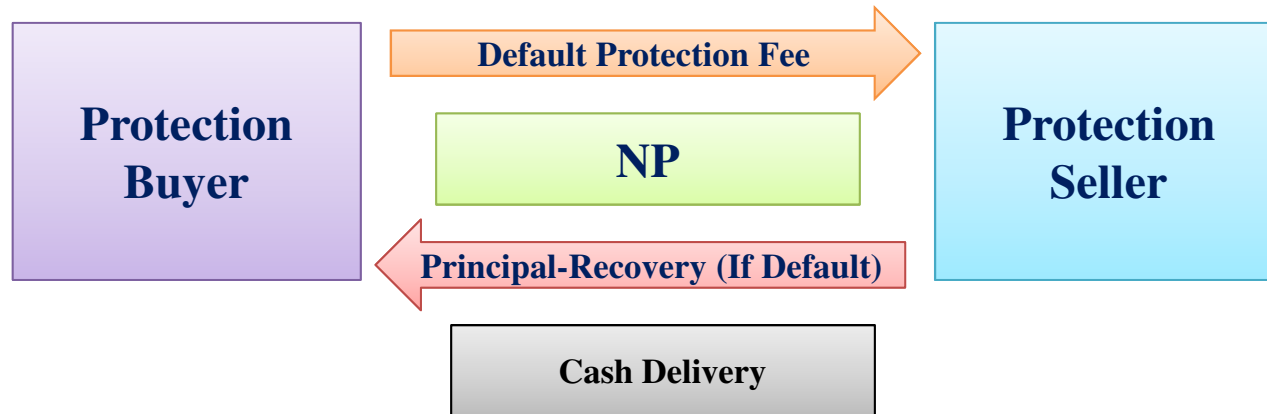


Greece: Ratings and CDS

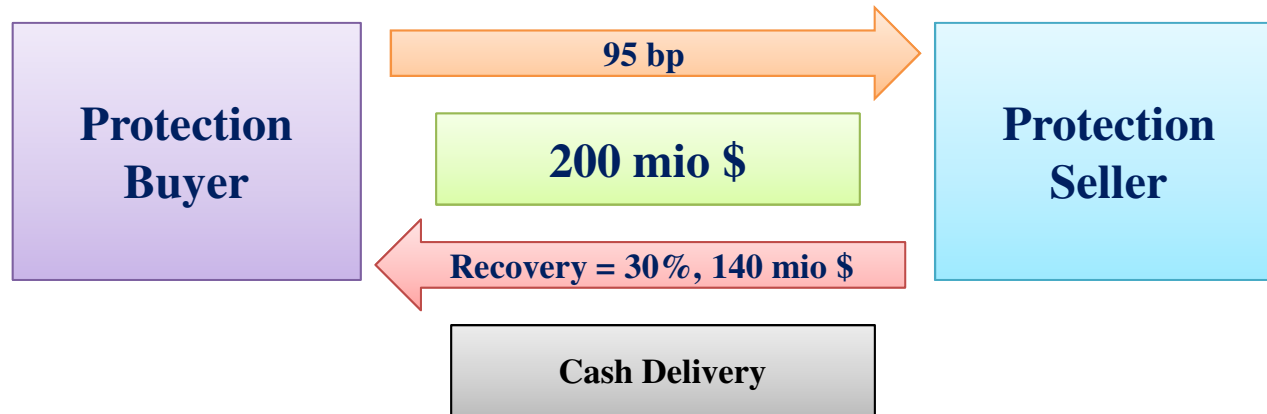


Source: Bloomberg, CDS on 10 Yrs Tenure

How does a CDS work?



An example



SDS and Country Risk

Sovereign Default Spread

(Yield on Govt Bonds)_{i,j} - (Yield on Govt Bonds)_{i,k}

With **i** = generic tenure (10 yrs, 30 yrs...)

j = Country under assessment

k = Country perceived as substantially risk-free (USA, Germany...)



Higher spreads mean higher risk

By the way, are
risk-free countries
truly riskless?



BTP-BUND spread



Source: <http://countryeconomy.com/>

A practical example

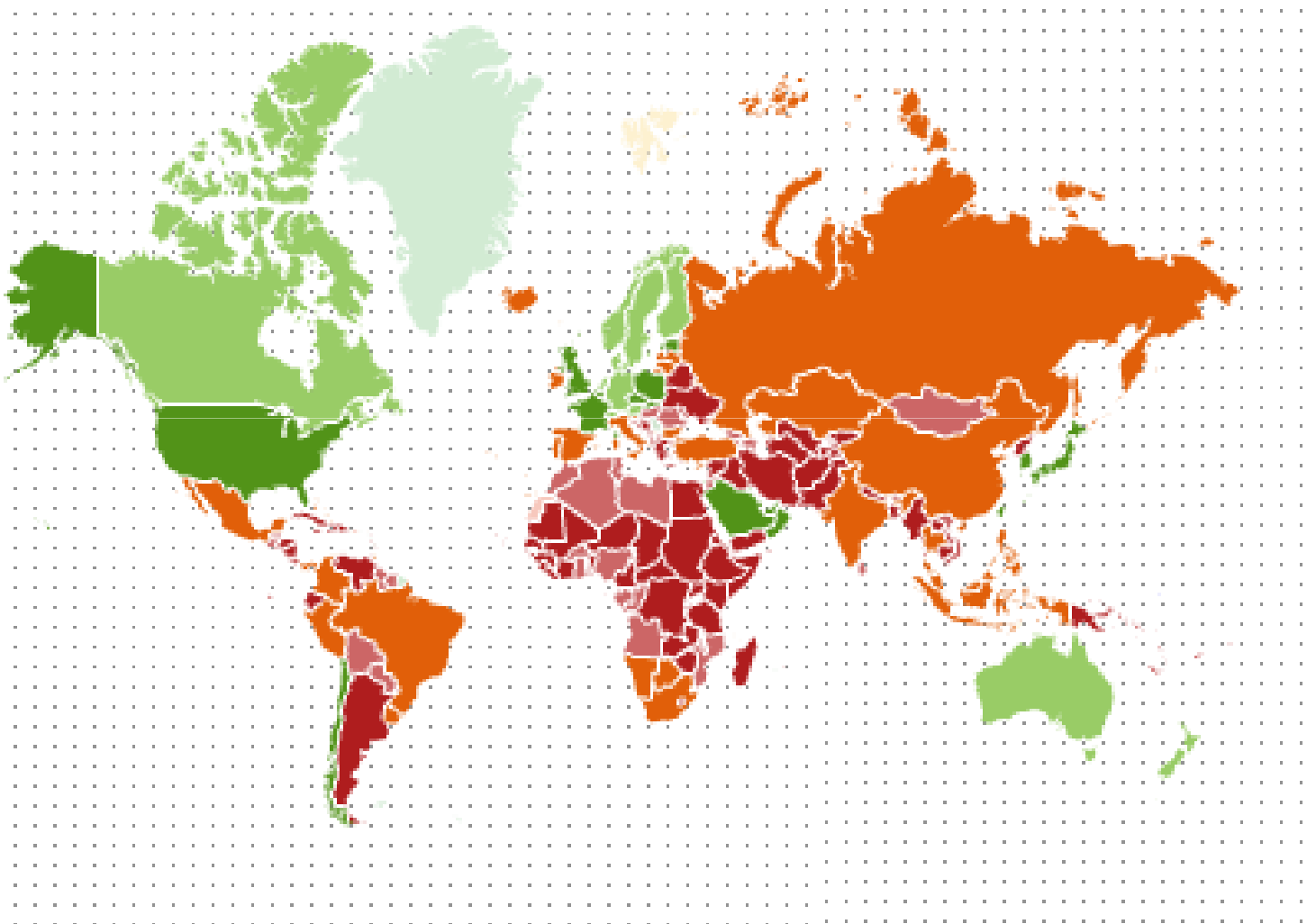
Euromoney's country risk rating scheme



Several specialists are asked to give their opinions on each country based on a few pre-selected factors (indicators):

- **Analytical indicators** (economic and political-risk evaluations);
- **Credit indicators** (measures of a country's credit worthiness - ability to service debt);
- **Market indicators** (measures of a country's access to bank loans, short term credits and bond mkts).

World Risk Average 2014 I



World Risk Average 2014 II



World risk average

| | | |
|-----------------------|--------------|------------------|
| Score | 42.86 | ↑ +0.24 ▲ |
| Economic assessment | 45.18 | +0.39 ▲ |
| Political assessment | 46.12 | +0.07 ▲ |
| Structural assessment | 40.19 | +0.25 ▲ |
| Access to capital | 40.30 | 0.00 ▶ |
| Credit ratings | 31.48 | -0.02 ▼ |
| Debt indicators | 42.61 | +0.76 ▲ |



Country movers

| | ↑ Less risk | ↓ More risk |
|------------|-------------|-------------|
| Cape Verde | 30.91 | +14.31 ▲ |
| Libya | 36.01 | +10.00 ▲ |
| Gabon | 45.88 | +6.49 ▲ |
| Latvia | 55.82 | +6.17 ▲ |
| Namibia | 54.11 | +6.11 ▲ |

Country movers

| | ↑ Less risk | ↓ More risk |
|---------------|-------------|-------------|
| Barbados | 47.23 | -5.86 ▼ |
| Rwanda | 27.11 | -5.12 ▼ |
| New Caledonia | 1.80 | -3.92 ▼ |
| Sweden | 83.11 | -2.76 ▼ |
| Croatia | 49.31 | -2.72 ▼ |

Top Ten 2014

| Rank | Country | Overall score |
|------|------------------------------------|---------------|
| 1 | <u>Norway</u> | 90.86 |
| 2 | <u>Switzerland</u> | 88.69 |
| 3 | <u>Singapore</u> | 87.91 |
| 4 | <u>Luxembourg</u> | 85.71 |
| 5 | <u>Sweden</u> | 84.11 |
| 6 | <u>Denmark</u> | 83.41 |
| 7 | <u>Finland</u> | 82.77 |
| 8 | <u>Netherlands</u> | 82.69 |
| 9 | <u>Canada</u> | 81.96 |
| 10 | <u>Australia</u> | 81.72 |



Risk and Exposure: ST vs LT

Risk and exposure are **different** in the short/long run



As time goes by, markets provide some “natural” forms of hedge:

- **Parity relationships** hold **better** in the **long term**;
- **Overshooting** reactions tend to be gradually **reabsorbed**;
- **Economic policies** (purposely implemented to counteract FX fluctuations) become **fully effective**

How to survive the short run?

Hedging techniques

Hedge

Hedge (cover): to take steps to **isolate** assets, liabilities, or **income streams** from the consequences of changes in one or more **pre-identified risk factors**



Hedging against FX risk

There are **several** available **hedging mechanisms**.

Widespread solutions:

1. Forwards (Lesson II)
2. Futures (Lesson IV)
3. Options (Lesson IV)
4. Borrowing and lending (Lesson III)
5. Currency of invoicing, predictive accuracy of cash flows, selection of supplying country

Hedging via the forward market

Basic rationale: buying/selling a forward contract **eliminates the uncertainty** about future exchange rate dynamics

The costs of forward hedging I

Let's define

$$\text{Expected cost of hedging} = F_{D/F} - E[(S_{D/F})]$$



Under the **risk neutrality - zero transaction costs** asspts, it must be

$$F_{D/F} = E[(S_{D/F})]$$

so that Expected cost of hedging = 0

The costs of forward hedging II

Relaxing the **risk neutrality** asspt



$$F_{D/F} - E[S_{D/F}] \neq 0$$



Risk premium

The costs of forward hedging III

Relaxing the zero transaction costs asspt



$$F_{D/F} - E[S_{D/F}] \neq 0$$

The bid-ask spreads on forward exchange are larger than those on spot exchange transactions.



This depends on the risk of unexpected FX rates fluctuations that might affect a (still) uncovered fwd position a bank has taken in the fulfillment of its market making obligations → such a risk is higher in fwd mkts, due to their thinness

The costs of forward hedging IV

What about settlement risk?



The benefits of forward hedging

- Even assuming there is a risk premium to be paid for hedging, the **expected cost** of hedging is **matched** by the benefit of **eliminating uncertainty**;
- **Transaction costs** are generally quite **small**;
- Hedging tends to **reduce bankruptcy costs** as well as **refinancing costs**;
- Hedging helps **reduce the volatility of receipts, payments and profits.**

Hedging via the futures market

Basic rationale: futures hedging works very much the same as forward hedging apart from the daily marking-to-market procedure

The costs of futures hedging I

Basically related to the **marking-to-market risk**



Interest rates earned on the margin account may vary during the contract's life, so that there is no exact match with a forward contract's payoff profile

The costs of futures hedging II

Dealing with the **marking-to-market** risk



Suppose you have to buy 1mio £ sometime into the future and assume further that $E[S_{\$/\pounds}] = 1.5_{\$/\pounds}$. At maturity:

| Forward | Futures |
|--|--|
| Assuming $S_{\$/\pounds}$ turns out to be $1.7_{\$/\pounds}$, you pay only 1.5 mio \$, thus realizing a 0.2 mio \$ gain | Assuming $S_{\$/\pounds}$ turns out to be $1.7_{\$/\pounds}$, you still have to pay 1.7 mio \$ to purchase GBP. However, considering the (approximate) 0.2 mio \$ gain on the margin account, you end up paying roughly 1.5 mio\$ → marking to mkt risk |

How does futures hedging work? I

A US firm exports extensively to the UK and it is hence vulnerable to fluctuations in the \$/£ exchange rate.



The American company fears that next quarter the pound will depreciate (from 1.50 \$/£ to 1.40 \$/£), thus bringing about a significant profit reduction (estimate: - 200,000\$).



The firm consequently decides to sell pounds in the futures market, so as to offset the exposure to exchange rate fluctuations...



How does futures hedging work? II

How many pounds does the company have to sell?

$$\frac{200,000\$}{(1.50 \frac{\$}{\pounds} - 1.40 \frac{\$}{\pounds})} = 2,000,000\pounds$$



Given that each pound futures contract on the CME calls for delivery of 62,500£, **how many contracts** should the company short (sell)?

$$\frac{2,000,000\pounds}{62,500\pounds} = 32$$

HEDGE RATIO



Hedging through options

Basic rationale: buying a call (put) option allows you to put a cap (floor) on the amount to be paid (received) in the future, while granting you a further chance of benefiting from the exchange rate ending up below (above) the strike price

The costs of option hedging

Options give their holder the possibility, **NOT**
the obligation, of buying or selling



Very desirable feature that generally implies a
higher purchasing cost if compared to
forward and futures

Watch out



The choice among options with different strike prices depends on whether the hedger wants to insure **only** against **very bad** outcomes for a cheap option premium (by using an out-of-the money option) **or** against **anything other than very good outcomes** (by using an in-the-money option).

Option hedging strategies I

Straddle

A **long (short) straddle** is obtained by **purchasing (selling)** both a **call and a put option** with identical strike price and maturity.



Option hedging strategies II

Assume that:

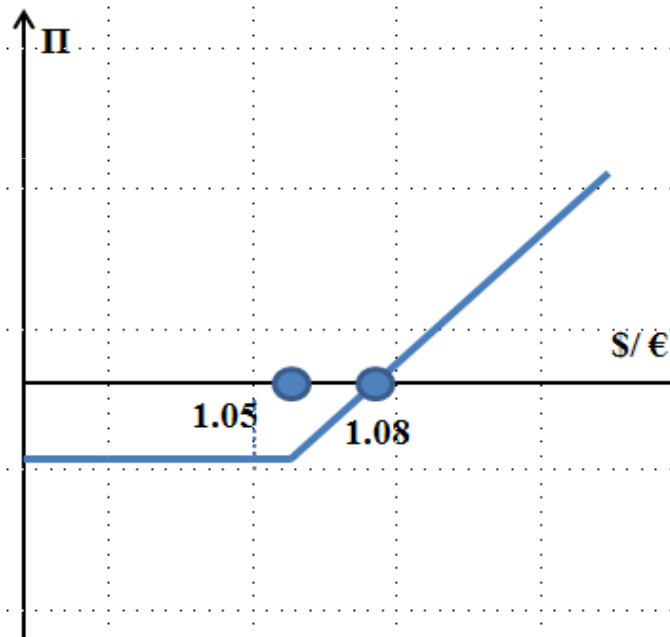
- Call Premium = \$.03
- Put Premium = \$.02
- Strike Price = \$/€ 1.05
- Each option contract represents € 62,500

Can you determine the payoff chart?

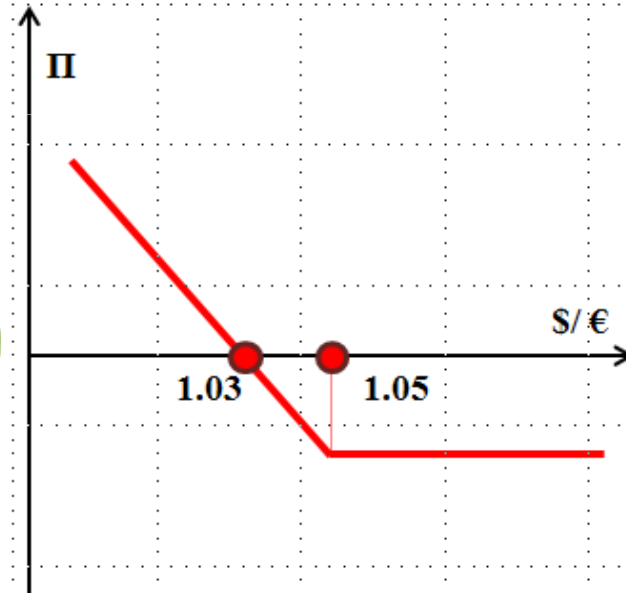


Option hedging strategies III

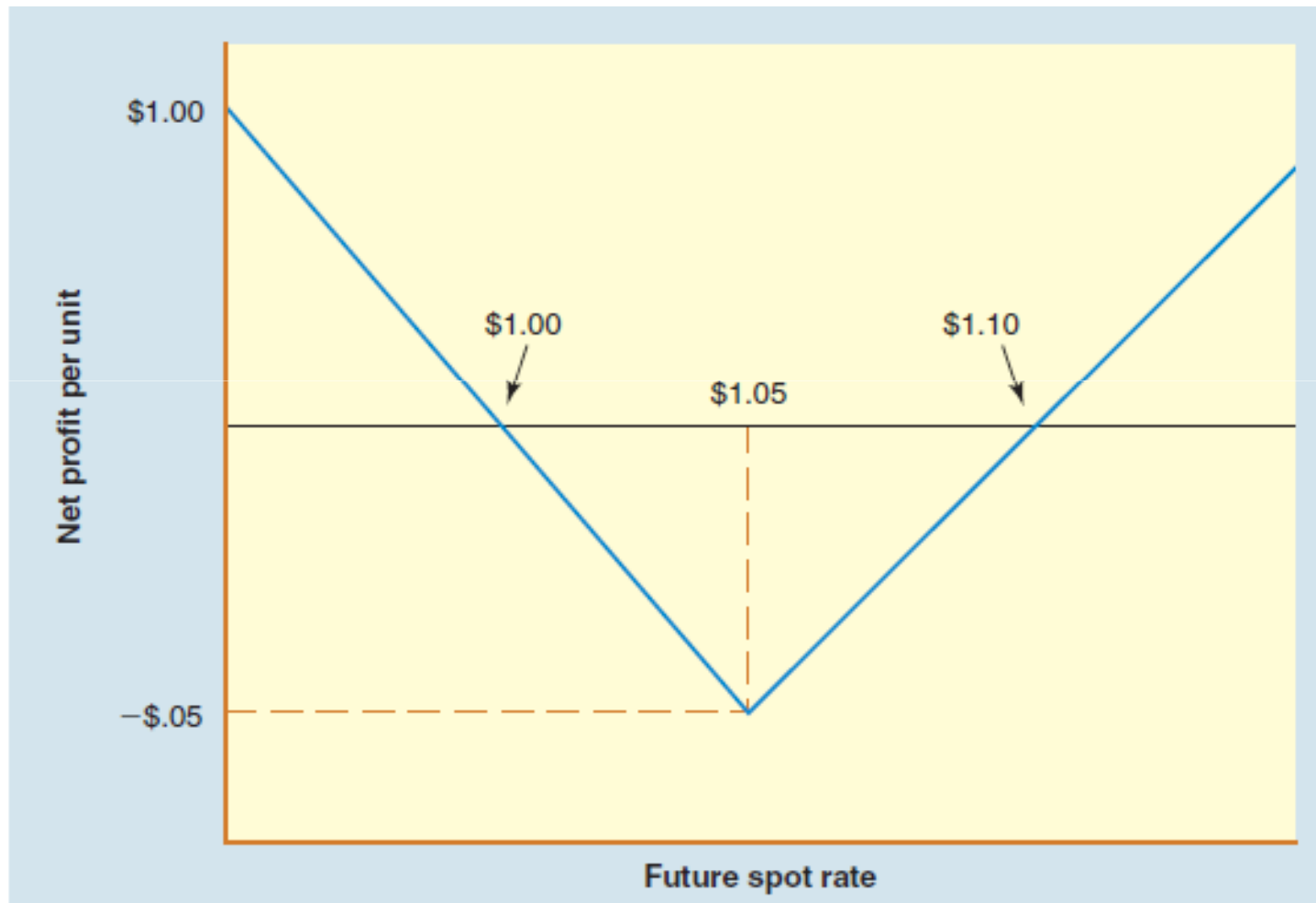
Call Payoff Diagram



Put Payoff Diagram



Option hedging strategies IV



Source: Madura, International Financial Management, 2007, Thomson South-Western

Option hedging strategies V

A long straddle allows you to hedge against **extreme** market movements.



Notice, though, that it is quite **expensive**, as it involves the simultaneous purchase of two separate options (option premia)



Strangle

A **long (short) strangle** is obtained by **purchasing (selling)** both a **call and a put option** with identical maturity, but different strike prices (most common type of strangle: $K_{\text{PUT}} < K_{\text{CALL}}$).



Option hedging strategies VII

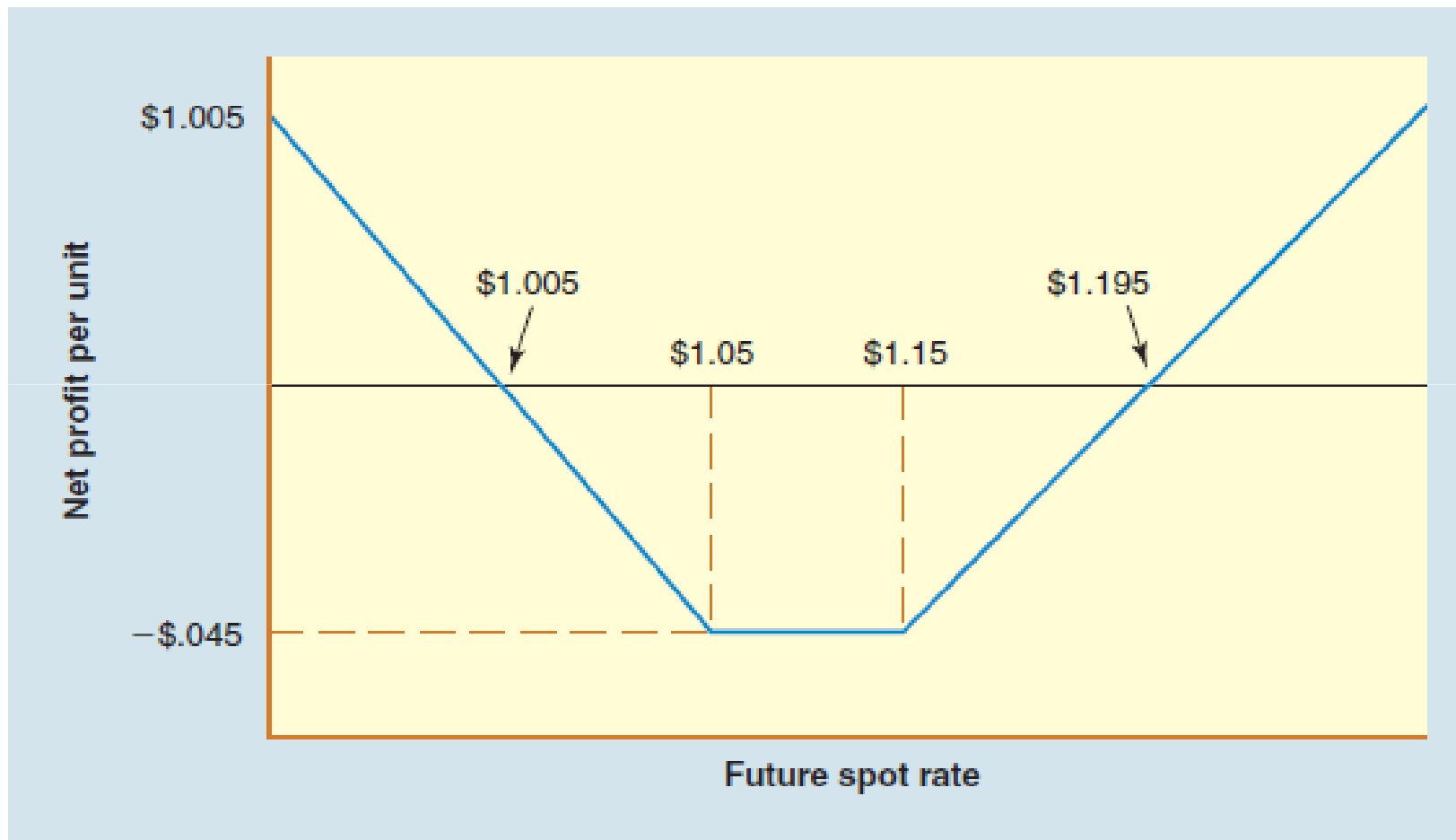
Assume that:

- Call Premium = \$.025
- Put Premium = \$.02
- Call Option Strike Price = \$/€ 1.15
- Put Option Strike Price = \$/€ 1.05
- Each option contract represents € 62,500

Can you determine the payoff chart?



Option hedging strategies VIII



Source: Madura, International Financial Management, 2007, Thomson South-Western

Option hedging strategies IX

A long strangle allows you to hedge against even more **extreme** market movements (if compared to a long straddle).

However, it is generally **cheaper** (could you explain why?)



Hedging via borrowing and lending

Basic rationale: if we combine the spot exchange rate with borrowing and lending, we can replicate a fwd's payoff profile (CIRP)

The costs of borrowing and lending

Hedging with borrowing and lending is generally more expensive than hedging with a forward contract



- Bid-ask spread on the spot FX rate
- Borrowing-investment spread on the interest rates

Hedging against country risk I

There are **no** precise hedging mechanisms to avoid country risk



Most of the available options are just strategic business choices that can help eliminate/reduce country exposure

Hedging against country risk II

- Keeping control of key corporate operations;
- Planned divestments;
- Joint Ventures;
- Local debt;
- Investment “insurances”



Hedging against country risk III

Keeping control of key corporate operations

Domestic investors try to maintain full control of crucial activities and, more generally, take steps to prevent key operations from being able to run without their cooperation

Planned divestments

The owner of an FDI can agree to turn over ownership and control to local people at a specific time in the future

Hedging against country risk IV

Joint Ventures

Shared ownership of an investment, instituted because of the need for a large amount of capital or to reduce the risk of confiscation or expropriation.

Local debt

The risk of expropriation or confiscation can be significantly reduced by borrowing within the country where the investment occurs → notice, however, that the higher the country risk, the less developed the domestic K mkts

Hedging against country risk V

Investment “insurances”

- Many countries will insure their companies that invest overseas against losses from political events (currency inconvertibility, expropriation, war, revolution...)
- CDS, to be conceived as **indicator** of the market's current perception of **sovereign risk**



To put it into practice I

- The treasurer of the XYZ company based in Country 1 is expecting a dividend payment of 10 mio Currency 2 from a subsidiary located in Country 2 in two months. His/her expectations of the future Currency 1/ Currency 2 spot rate are mixed and thus decides to hedge, with the aim of minimizing FX risk. The current exchange rate is Currency 1 0.63/Currency2. The two-month futures rate is at Currency 1 0.6279/Currency2. The two-month Country 2 interest rate is 7.5%. The two-month Country 1 T-Bill yields 5.5%. Puts on Currency 2 with maturity of two months and strike price of Currency 1 0.63/Currency2 are traded on the CME at Currency 1 0.0128. Compare the following choices offered to the Treasurer:



To put it into practice II

- I. Sell a futures on Currency 2 for delivery in two months for a total amount of 10 mio Currency 2.
 - II. Buy 80 put options on the CME with expiration in two months (Assume that 1 put option is for 125000 Currency 2).
 - III. Set up a forward contract with the firm's bank XYZ
-
- A. What is the respective cost of each strategy?
 - B. Which strategy would best fit the treasurer's mixed forecast for the future spot rate of Currency 2?

To put it into practice III

- Consider the following option strategy, involving the simultaneous sale of two different options (call and put, same maturity, same strike):

Call option premium: \$.01

Put option premium: \$.015

Strike: \$/£ 1.35

Each option calls for the delivery of £ 45,500

- a. Draw the payoff profile.
- b. Would you use the foregoing option strategy to hedge against small market movements? Why?



To put it into practice IV

- On 8th September 201X, in order to hedge your investment portfolio, you bought 2 futures contracts for 100,000 B each @ A/B 81.5. Assume that the daily settlement prices are shown in the table below:

| | 8 | 9 | 10 | 11 | 14 | 15 |
|-----|------|------|----|------|----|------|
| A/B | 81,7 | 81,6 | 81 | 81,3 | 81 | 80,9 |

- I. What are the daily cash flows from marking-to-market?
- II. If you deposit 70,000 A into your margin account, and your broker requires 50,000 A as maintenance margin, when will you receive a margin call and how much will you have to deposit?

