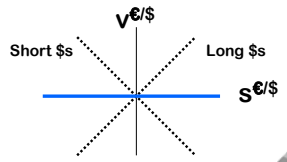
Chapter 6
Currency Futures & Futures Markets

A forward hedge of the dollar

Underlying position of a French exporter (long $s): +$40 million, -Goods

Sell $s forward at $F_t^{€/\$}$ (short $s and long €s): +€40 million, -$40 million

Net position: +€40 million



Currency futures contracts

- **Forwards are a pure credit instrument**
  - Forwards are a zero-sum game, and one party always has an incentive to default
- **The futures contract solution**
  - A futures exchange clearinghouse takes one side of every transaction (and makes sure that its exposures cancel one another)
  - Contracts are marked-to-market daily
  - Require initial and maintenance margins

Futures exchanges

- Financial futures exchanges are usually associated with a commodity futures exchange

Top 5 futures exchanges	2002 volume (million contracts)
Eurex - Eurex (Germany & Switzerland)	536.0
CME - Chicago Mercantile Exchange (U.S.)	444.5
CBOT - Chicago Board of Trade (U.K.)	276.3
Euronext - (Amsterdam, Brussels, Lisbon, Paris, London)	221.3
NYMEX - New York Mercantile Exchange (U.S.)	107.4
BM&F - Bolsa Mercadorias & de Futuros (Brazil)	95.9

Source: Futures Industry Association

Growth of derivatives trading

Forwards versus futures

	Forwards	Futures
Counterparty	Bank	CME Clearinghouse
Maturity	Negotiated	3rd week of the month (US)
Amount	Negotiated	Standard contract size
Fees	Bid-ask	Commissions
Collateral	Negotiated	Margin account
Settlement	At maturity	Most are settled early

Been there, done that...

- Futures contracts are similar to forward contracts
  - Futures contracts are like a bundle of consecutive one-day forward contracts
  - Daily settlement is the biggest difference between a forward and a futures contract
  - Futures and forwards are nearly identical in their ability to hedge risk

Hedging with forwards and futures

- Forward contracts can be tailored to match the underlying exposure

  Forward contracts thus can provide a perfect hedge of transaction exposure to currency risk
- Exchange-traded futures contracts are standardized

  They will not provide a perfect hedge if they do not match the underlying exposure's
  - currency
  - maturity
  - contract size

Interest rate parity revisited

- Some definitions

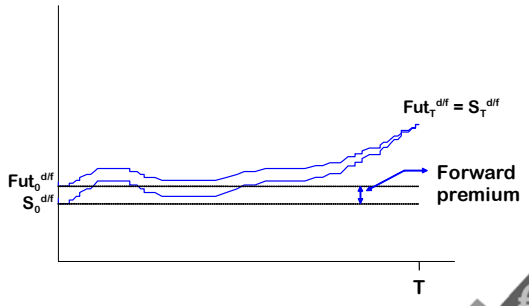
  $S_{t,T}^{d/f}$ = spot price at time t for expiry at time T

  $F_{t,T}^{d/f}$ = forward price at time t for expiry at time T

  $Fut_{t,T}^{d/f}$ = futures price at time t for expiry at time T
- Forward and futures prices are equal through interest rate parity

$$Fut_{t,T}^{d/f} = F_{t,T}^{d/f} = S_t^{d/f}\,[(1+i^d)/(1+i^f)]^{T-t}$$

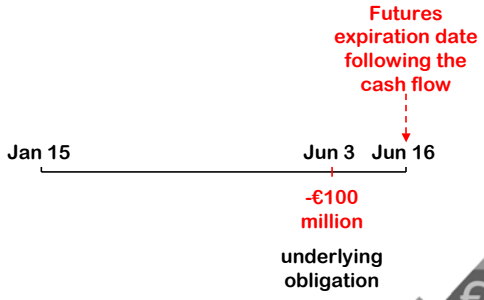
Spot and futures price convergence at expiration



Maturity mismatches and basis risk

- If there is a **maturity mismatch**, futures contracts may not provide a perfect hedge
- The difference (i^d-i^f) is called the **basis**
  - The risk of change in the relation between futures and spot prices is called **basis risk**
  - When there is a maturity mismatch, basis risk makes a futures hedge slightly riskier than a forward hedge

An example of a delta hedge



A delta hedge

$$s_t^{d/f} = \alpha + \beta\, fut_t^{d/f} + e_t$$

$s_t^{d/f}$ = percentage change in the spot rate
$fut_t^{d/f}$ = percentage change in the futures price

- The hedge ratio is used to minimize the variance of the hedged position

N_{Fut}^* = (Amount in futures)/(Amount exposed)
= $-\beta$

- Hedge quality is measured by $(\rho_{s,fut})^2$

An example of a CME delta hedge

- It is now January 18. You need to hedge a €100 million obligation due on June 3.
  - The spot exchange rate is $S_0^{\$/€} = \$1.10/€$
  - A €100,000 CME euro futures contract expires on June 16
  - Based on $s_t^{\$/€} = \alpha + \beta\, fut_t^{\$/€} + e_t$, you estimate $\beta = 1.020$ with $r^2 = 0.95$.
  - How many CME futures contracts should you buy to minimize the risk of your hedged position?

The delta hedge solution

- The optimal hedge ratio for this delta hedge is given by

N_{Fut}^* = (amount in futures)/(amount exposed)
= $-\beta$

$\Rightarrow$(amount in futures) = $(-\beta)$(amount exposed)
= (-1.020)(-€100 million) = €102 million

or (€102 million) / (€100,000/contract)
= 1,020 contracts

Currency mismatches and cross hedges

$$s_t^{d/f_1} = \alpha + \beta\, s_t^{d/f_2} + e_t$$

- A cross hedge is used when there is a maturity match but a currency mismatch

s_t^{d/f_1} = percentage change in the currency f_1 of the underlying exposure

s_t^{d/f_2} = percentage change in the spot price of currency f_2 of the futures contract

An example of a CME cross hedge

- It is now January 18. You need to hedge a DKr 100 million obligation due on June 16.
  - Spot (cross) exchange rates are \$0.75/DKr, €0.75/DKr, and \$1.00/€.
  - A CME € futures contract expires on June 16 with a contract size of €100,000
  - Based on $s_t^{\$/DKr} = \alpha + \beta\, s_t^{\$/€} + e_t$, you estimate $\beta = 1.040$ with $r^2 = 0.89$.
  - How many CME futures contracts should you buy to minimize the risk of your hedged position?

The cross hedge solution

Optimal hedge ratio:

N_{Fut}^* = (amt in futures)/(amt exposed) = $-\beta$

$\Rightarrow$ (amt in futures) = $(-\beta)$(amt exposed)
= (-1.040)(-DKr100 million) = DKr104 million

or €78 million at (DKr104m) (€0.75/DKr)

or 780 contracts

The delta-cross hedge

Delta-cross hedge $s_t^{d/f_1} = \alpha + \beta\, fut_t^{d/f_2} + e_t$

- A delta-cross hedge is used when there is both a currency and a maturity mismatch
  - s_t^{d/f_1} = percentage change in the currency f_1 of the underlying exposure
  - fut_t^{d/f_2} = percentage change in the value of the futures contract on currency f_2

A classification of futures hedges

Hedge (hedge ratio estimation)		Currency: Exact match	Currency: Mismatch
Maturity	Exact match	Perfect hedge ($s_t^{d/f} = \alpha + \beta s_t^{d/f} + e_t$) (such that $\alpha=0$, $\beta=1$, and	Cross hedge ($s_t^{d/f_1} = \alpha + \beta s_t^{d/f_2} + e_t$)
	Mismatch	Delta hedge ($s_t^{d/f} = \alpha + \beta fut_t^{d/f} + e_t$)	Delta-cross hedge ($s_t^{d/f_1} = \alpha + \beta fut_t^{d/f_2} + e_t$)