Chapter Objective:

This chapter discusses exchange-traded currency futures contracts, options contracts, and options on currency futures.
Chapter Outline
(Material to be Covered in Class)

- Futures Contracts:
  - Preliminaries
  - Currency Futures Markets
  - Basic Currency Futures Relationships
  - Eurodollar Interest Rate Futures Contracts
- Options Contracts: NOT Exam Material
  - Preliminaries
  - Currency Options Markets
  - Currency Futures Options

Chapter Outline
(Suggested Background Reading)

- Basic Option Pricing Relationships at Expiry
- American Option Pricing Relationships
- European Option Pricing Relationships
- Binomial Option Pricing Model
- European Option Pricing Model
- Empirical Tests of Currency Option Models
### Futures Contracts: Preliminaries

- **A futures contract is *like* a forward contract:**
  - It specifies that a certain currency will be exchanged for another at a specified time in the future at prices specified today.

- **A futures is *different from* a forward contract:**
  - Futures are standardized contracts trading on organized exchanges, with daily resettlement through a clearinghouse (providing guarantees)
  - More importantly, positions can be closed (side bet?)
    - Right of offset $\leftrightarrow$ futures allows trading risk ($\neq$ commodity)

### Futures Contracts: Preliminaries

- **Standardizing Features:**
  - Contract size
  - Delivery month
  - Marking to market & Daily resettlement

- **Initial Margin**
  - As low as 2-3% of contract value on the CME
    - Margin is cut for spread positions, raised amid high volatility
  - cash in escrow account (or T-bills held in a street name) with the investor’s FCM (=broker)
Daily Resettlement

- With futures, we have daily resettlement of gains and losses rather than 1 big settlement at maturity
- Every trading day:
  - if the price goes down, the long pays the short
  - if the price goes up, the short pays the long
- After the daily resettlement, each party has a new contract at the new price with one-day-shorter maturity

“Performance Bond” Money

- Each day’s losses are subtracted from the investor’s account.
- Each day’s gains are added to the account.
- At initiation, both the long and the short post an initial performance bond or “margin”, say €3,333.
- Suppose the maintenance level is €2,500:
  - if this investor loses more than €833, then she can maintain her long position only by adding more funds;
  - if she fails to post the extra cash, then her position will be closed out (forced to offset with a short position).
Daily Resettlement: An Example

- Suppose you want to speculate on a rise in the ¥/€ exchange rate (specifically you think that the Euro will appreciate).

<table>
<thead>
<tr>
<th>Currency per Euro (€)</th>
<th>€ equivalent</th>
<th>Wed</th>
<th>Tue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan (yen)</td>
<td>0.007142857</td>
<td>0.007194245</td>
<td>140</td>
</tr>
<tr>
<td>1-month forward</td>
<td>0.006993007</td>
<td>0.007042254</td>
<td>143</td>
</tr>
<tr>
<td>3-months forward</td>
<td>0.006666667</td>
<td>0.006711409</td>
<td>150</td>
</tr>
<tr>
<td>6-months forward</td>
<td>0.00625</td>
<td>0.006289308</td>
<td>160</td>
</tr>
</tbody>
</table>

Currently €1 = ¥140. The 3-month forward price is €1=¥150.

Daily Resettlement: An Example

- Currently €1 = ¥140; if you believe in “forward parity”, it appears that the Euro is strengthening.
- If you short a ¥ futures (i.e., enter into a 3-month futures contract to sell ¥ at the rate of €1 = ¥150), then you will make money if the ¥ depreciates (i.e, if the € goes up). The contract size is ¥12,500,000.
- Your initial margin is 4% of the contract value:
  \[ \text{€3,333} = 0.04 \times ¥12,500,000 \times (€1/¥150) \]
Daily Resettlement: An Example

If tomorrow, the futures rate closes at €1 = ¥149, then your position’s value drops. (why?)
Your original agreement “was to sell ¥12,500,000 and receive €83,333.33” (sort of...)
But now ¥12,500,000 is worth €83,892.62
\[ €83,892.62 = ¥12,500,000 \times (€1/¥149) \]

You have lost €559.28 overnight.

- The €559.28 comes out of your €3,333.33 margin account, leaving €2,774.05
- This is short of the €3,355.70 required for a new position:
  \[ €3,355.70 = 0.04 \times ¥12,500,000 \times (€1/¥149) \]
- Your broker will let you slide until you run through your €2,500 maintenance margin. Then you must post additional funds (variation margin) or your position will be closed out (usually via reversing trade).
Currency Futures Markets

- The IMM division of the Chicago Mercantile Exchange (CME) is by far the largest.
- Others major players:
  - London International Financial Futures Exchange
    - EuroNext-LIFFE
  - Tokyo International Financial Futures Exchange (TIFFE)
  - ICE-NYBOT (ref. for contracts on € – see FT quotes)
- Currency futures markets are dwarfed by OTC
  - Though the growth rate has accelerated

The Chicago Mercantile Exchange

- Expiry cycle:
  - March, June, September, December (except small currencies)
- Delivery:
  - 3rd Wednesday of delivery month, CLS (since 03-06).
  - CME and SIMEX cross-clear
- Last trading day
  - Two business days before the delivery day
- CME hours
  - 7:20 a.m. to 2:00 p.m. CST ( = Chicago time)
  - Extended hours on Globex (Su-Th 5:00 p.m. to 4:00 p.m. CST on the next day – with only a short dinner break).
### Reading Currency Futures Quotes

<table>
<thead>
<tr>
<th></th>
<th>OPEN</th>
<th>HIGH</th>
<th>LOW</th>
<th>SETTLE</th>
<th>CHG</th>
<th>LIFETIME</th>
<th>OPEN</th>
<th>INT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar</td>
<td>1.3136</td>
<td>1.3167</td>
<td>1.3098</td>
<td>1.3112</td>
<td>-0.0025</td>
<td>1.3687</td>
<td>1.1363</td>
<td>159,822</td>
</tr>
<tr>
<td>Jun</td>
<td>1.3170</td>
<td>1.3193</td>
<td>1.3126</td>
<td>1.3140</td>
<td>-0.0025</td>
<td>1.3699</td>
<td>1.1750</td>
<td>10,096</td>
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- **Highest price that day**
- **Lowest price that day**
- **Closing price**
- **Daily Change**
- **Highest and lowest prices over the life of the contract.**

**Euro/US Dollar (CME)—€125,000; $ per €**

**Open Interest**

- *Open Interest* = number of contracts outstanding for a particular delivery month.

- Open interest is a proxy of demand for a contract
  - Some refer to open interest as the *depth* of the market
  - *Breadth* of the market = how many different contracts (expiry month, currency) are outstanding
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<tr>
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<td>1.3202</td>
<td>1.3225</td>
<td>1.3175</td>
<td>1.3182</td>
<td>-.0025</td>
<td>1.3711</td>
<td>1.1750</td>
<td>600</td>
<td></td>
<td></td>
</tr>
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Notice that open interest is greatest in the nearby contract, in this case the March, 2005 contract.

In general, OI decreases monotonically with the contract maturity *(exception: commodities)*

### Basic Currency Futures Relationships

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The holder of a long position is “committing” himself to pay $1.3112 per euro for €125,000—a $163,900 position.

As there are 159,822 such contracts outstanding, this represents a notional principal of over $26 billion.
Notice that if you had been smart or lucky enough to open a long position at the lifetime low of $1.1363, by now your gains would have been:

$$21,862.50 = (1.3112/€ - 1.1363/€) \times €125,000$$

Bear in mind that someone was unfortunate enough to take the short position at $1.1363!

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If you had been smart or lucky enough to open a short position at the lifetime high of $1.3687 by now your gains would have been:

$$7,187.50 = (1.3687/€ - 1.3112/€) \times €125,000$$
Reading Currency Futures Quotes

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Recall our interest rate parity condition:

\[
\frac{1 + i_S}{1 + i_E} = \frac{F(\$/\欧元)}{S(\$/\欧元)}
\]

From June 15 to September 21, 2005 (the actual delivery dates of these contracts) we should expect higher interest rates in dollar denominated accounts: if we find a higher rate in a euro denominated account, we may have found an arbitrage.
Eurodollar Futures Contracts
(Futures on Interest Rate)

- Widely used futures contract for hedging short-term U.S. dollar interest rate risk.
- The underlying asset is a hypothetical $1,000,000 90-day Eurodollar deposit—the contract is cash settled.
- Traded on the CME and the Simex (Singapore International Monetary Exchange).
- The contract trades in the March, June, September and December cycle (+ additional near months).

Reading Eurodollar Futures Quotes

<table>
<thead>
<tr>
<th>EURODOLLAR (CME)—$1 million; pts of 100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>July</td>
</tr>
</tbody>
</table>

Eurodollar futures prices are stated as an index number of three-month LIBOR calculated as $F = 100 – LIBOR$.
The closing price for the July contract is 94.68 thus the implied yield is 5.32 percent = 100 − 94.68
The change was .01 percent of $1 million representing $100 on an annual basis. Since it is a 3-month contract one basis point corresponds to a $25 price change.
## Options Contracts: Preliminaries

The rest of this handout is NOT exam material

- An option gives the holder the right, *but not the obligation*, to buy or sell a given quantity of an asset in the future, at prices agreed upon today.

- **Calls vs. Puts**
  - Call options gives the holder the right, but not the obligation, to **buy** a given quantity of some asset at some time in the future, at prices agreed upon today.
  - Put options gives the holder the right, but not the obligation, to **sell** a given quantity of some asset at some time in the future, at prices agreed upon today.

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### European vs. American options

- European options can only be exercised on the expiration date.
- American options can be exercised at any time up to and including the expiration date.
- Since this option to exercise early generally has value, American options are usually worth more than European options, other things equal.
Options Contracts: Preliminaries

- **In-the-money**
  - The exercise price is less than the spot price of the underlying asset.

- **At-the-money**
  - The exercise price is equal to the spot price of the underlying asset.

- **Out-of-the-money**
  - The exercise price is more than the spot price of the underlying asset.

Options Contracts: Preliminaries

- **Intrinsic Value**
  - The difference between the exercise price of the option and the spot price of the underlying asset.

- **Speculative Value**
  - The difference between the option premium and the intrinsic value of the option.

\[
\text{Option Premium} = \text{Intrinsic Value} + \text{Speculative Value}
\]
Currency Options Markets

- PHLX
- HKFE
- 20-hour trading day.
- OTC volume is much bigger than exchange volume.
- Trading is in seven major currencies plus the euro against the U.S. dollar.

PHLX Currency Option Specifications

<table>
<thead>
<tr>
<th>Currency</th>
<th>Contract Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian dollar</td>
<td>AD50,000</td>
</tr>
<tr>
<td>British pound</td>
<td>£31,250</td>
</tr>
<tr>
<td>Canadian dollar</td>
<td>CD50,000</td>
</tr>
<tr>
<td>Euro</td>
<td>€62,500</td>
</tr>
<tr>
<td>Japanese yen</td>
<td>¥6,250,000</td>
</tr>
<tr>
<td>Swiss franc</td>
<td>SF62,500</td>
</tr>
</tbody>
</table>
Currency Futures Options

- Are an option on a currency futures contract.
- Exercise of a currency futures option results in a long position in the nearest futures for the holder of a call or the writer of a put.
- Exercise of a currency futures option results in a short in the nearest futures for the seller of a call or the buyer of a put.
- If the futures position is not offset prior to its expiration, foreign currency will change hands.

End Chapter Seven