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 settlement through a clearinghouse (providing guarantees)
  - More importantly, positions can be closed (side bet?)
    - Right of offset <-> futures allows trading risk (≠ commodity)
- 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).

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

<table>
<thead>
<tr>
<th>Currency per Euro ($)</th>
<th>June equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan (yen)</td>
<td></td>
</tr>
<tr>
<td>0.007142857</td>
<td>0.007194245</td>
</tr>
<tr>
<td>1-month forward</td>
<td>0.006963007</td>
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<tr>
<td>3-months forward</td>
<td>0.006666667</td>
</tr>
<tr>
<td>6-months forward</td>
<td>0.0062889308</td>
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</tbody>
</table>

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 ¥ appreciates (i.e., if the € goes up). The contract size is ¥12,500,000.
- Your initial margin is 4% of the contract value:
  - €3,333 = 0.04 x ¥12,500,000 x (€1/¥150)

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 x (€1/¥149)

You have lost €559.28 overnight.
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
  - 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>OPEN</th>
<th>HIGH</th>
<th>LOW</th>
<th>SETTLE</th>
<th>CHG</th>
<th>LIFETIME OPEN</th>
<th>HIGH</th>
<th>LOW</th>
<th>INT</th>
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</thead>
<tbody>
<tr>
<td>Euro/US Dollar (CME)—€125,000; $ per €</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar</td>
<td>1.3136</td>
<td>1.3198</td>
<td>1.3112</td>
<td>-0.0025</td>
<td>1.3687</td>
<td>1.1363</td>
<td>159,822</td>
<td></td>
</tr>
<tr>
<td>Jun</td>
<td>1.3170</td>
<td>1.3193</td>
<td>1.3126</td>
<td>-0.0025</td>
<td>1.3699</td>
<td>1.1750</td>
<td>10,096</td>
<td></td>
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</table>

Expiry month
Opening price
Closing price
Daily Change
Highest and lowest prices over the life of the contract.
Number of open contracts

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

Basic Currency Futures Relationships

<table>
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<tr>
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<td>Mar</td>
<td>1.3136</td>
<td>1.3167</td>
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<td>-0.0025</td>
<td>1.3687</td>
<td>1.1363</td>
<td>159,822</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)
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:

\[ \text{Gains} = \left( 1.3112/\text{€} - 1.1363/\text{€} \right) \times 125,000 \]

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

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.

Recall our interest rate parity condition:

\[ 1 + i_d = \left( 1 + i_e \right) F(\$/\text{€}) \]

\[ 1 + i_e = S(\$/\text{€}) \]

Eurodollar futures prices are stated as an index number of three-month LIBOR calculated as \( F = 100 - \text{LIBOR} \).

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.
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.

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.

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.

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.

Option Premium = Intrinsic Value + 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>
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<tr>
<td>British pound</td>
<td>£31,250</td>
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<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.