E&G, Ch. 23.

I. Introducing Forwards and Futures

A. Mechanics of Forwards and Futures.

1. Definitions:

Forward Contract - commitment by 2 parties to exchange a certain good for a specific price at a specified future time.
The price (F) is agreed upon initially,
but no cash changes hands until expiration.
Either or both parties may have to post margin.

Futures Contract - same as forward contract except that profits/losses are computed and settled (marked-to-market) on a daily basis, rather than only at expiration.
Financial Futures - a contract in which the good to be delivered is a financial instrument.
Futures Contracts are traded on Organized Exchanges that set standard terms for contracts, and facilitate trading.

FORWARDS	FUTURES
Traded between private parties (OTC)	Traded on exchange
Contracts not standardized	Standardized contracts
One specific delivery date	Many delivery dates
Settled at maturity	Marked-to-market daily
Delivery usually occurs	Rarely delivered

If you *buy a futures contract*,
agree to *buy* the asset at today's price (F)
sometime in the future. (long a contract; take delivery).

If you *sell a futures contract*,
agree to *sell* the asset at today's price (F)
sometime in the future. (short a contract; deliver).

2. **Institutional Features** of Futures Markets.

   a. **Role of Exchange**.

      i. Specifies the terms of the contract in detail.

      ii. Often places restrictions on trading.

      iii. Serves as clearing house to stand between buyer & seller
      - facilitates trading.

   b. **Margin** (collateral).

      i. Good faith deposit, to ensure fullfillmt of obligations.

      ii. Initial Margin - deposit when a position is first taken;
      Usually about 5-10% of total value of contract;
      Varies across markets, by size of contract and
      volatility in daily value of contract (F).

      iii. Maintenance Margin - minimum equity allowed;
      Usually 75-80% of initial margin;
      If losses reduce margin to this point, get margin call.
      If you don't meet margin call, broker will liquidate.
      If F moves in your favor, can skim off excess margin.

      iv. Effect of trading on margin is to leverage position.

      v. Two reasons for margin requirements:
      - Protect the integrity and reputation of Exchange and protect the middleman from customer default.
      - Regulators argue that higher margin requirements serve to reduce volatility caused by speculators.

   c. **Liquidity**.

      i. Open Interest - total number of outstanding contracts at a given point in time.

      ii. Volume - amount of trading activity in those contracts over some period of time.

d. Types of **Traders**.

   i. Commission brokers follow instructions of their clients, for a commission.

   ii. Locals trade for their own account.

e. Types of **Orders**.

   i. Market order – executed immediately at best price available.

   ii. Limit order – only execute at a certain price or one better.

   iii. Stop order (stop loss order) –
   - Execute immediately at best price available, once a trade occurs at the specified price or a ***worse*** price;
   - Becomes a market order once certain price is reached.
   - Used to limit losses if unfavorable price moves occur.

   iv. Stop limit order – combines stop order & limit order. Becomes a limit order once a bid or offer is made at a price at least as favorable as the stop price.

   v. Market-if-touched (MIT) order –
   - Execute immediately at best price available, once a trade occurs at the specified price or a ***better*** price.
   - Becomes a market order once certain price is reached.
   - Used to ensure profits are taken if sufficiently favorable price moves occur (thus differs from stop loss order).

   vi. Discretionary order – market order, but broker may delay execution at their discretion, to try & get better price.

   vii. Some orders specify time conditions.
   - Day order – expires at end of trading day. Unless otherwise stated, any order is a day order.
   - Time-of-day order – specifies particular time-of-day when order can be executed.
   - Open order – in effect until cancelled.
   - Fill-or-kill order – execute immediately or not at all.

f. **Regulation**.

i. CFTC (1974) – responsible for licensing futures exchanges.
New contracts & changes to existing contracts need CFTC approval.
To be approved, contract must have some useful economic purpose.
CFTC looks after public interest:
- ensure prices are communicated.
- ensure futures traders report outstanding positions, if above certain levels.
- license all individuals serving public in futures area.
- deal with complaints.

ii. National Futures Association (NFA, 1982)
Organization of participants in futures industry.
Purpose, prevent fraud & ensure market operates in public interest.
- requires members to pass exam (minimum competence).
- monitors trading
- deals with complaints.

NFA has shifted some responsibilities of CFTC to the industry.

iii. Other bodies with regulatory authority: SEC, Fed, Treasury.
Concerned about effect of futures markets on spot markets in stocks, T. Bills, T. Bonds, etc.
SEC has veto power over new futures contracts involving stocks or bonds.

iv. Trading irregularities, such as 'cornering the market.'
(Hunt brothers, silver, 1979; Sumitomo, copper, 1996).
Investor group takes big futures position, tries to corner supply, & squeeze short futures positions.
If # futures contracts outstanding > supply of spot, S & F ↑.
Regulators can deal with this – ↑ margin, ↓ position limits…
Abuse on floor of exchange:
- over-charging customers.
- front-running.

FBI sting, 1989, agents as moles in CME & CBOT.

g. **Hedge Accounting** for derivatives gains/losses.

IRS distinguishes between hedgers & speculators for taxes.

Hedgers - futures positions are part of "normal operations";
futures gains/losses treated as ordinary income.

Speculators - the rest; ... treated as capital gains/losses.

i. FAS #52 established accounting standards in U.S.
for foreign currency futures (early 1980's).

ii. FAS #80 established standards in U.S. for all other futures.

These statements required changes in mkt value be recognized
when they occur, unless the contract qualifies as a hedge.

If the contract qualifies as a hedge,
gains/losses from hedge can be deferred and recognized
in same period as gains/losses from item being hedged.

Example:
In Sept 2000 trader buys a March 2001 corn futures at F_0=\$1.50/bu.
At the turn of the year (Dec. 31, 2000), F_1=\$1.70/bu.
In Feb 2001 closes position at F_2=\$1.80/bu.
One contract is for the purchase of 5000 bushels.

If trader is *hedging* the expected purchase of corn in 2001,
the entire gain is realized in 2001 (this is hedge accounting):
2001 –- 5000x\$.30 = \$1500.
If trader is hedging purchase in 2001, effect of futures contract
is to ensure price paid in 2001 is close to \$1.50.
Hedge accounting reflects this price is paid in 2001.
Accounts in 2000 are unaffected by this futures trade.

If trader is *speculating*, accounting gains recognized as follows:
2000 –- 5000x\$.20 = \$1000;
2001 –- 5000x\$.10 = \$500.

Note: even though contract still open, gains realized at year-end.

In 1982 Congress stipulated all futures positions must be
marked-to-market at year-end for **speculators**.
Then 40% of gains/losses treated as short term, 60% as long term.

This change eliminated use of tax straddles as a loophole.

h. **Taxation**. Two key issues:

i. First consider the *nature* of taxable gain/loss
Capital gain/loss or Ordinary Income.

For corporate taxpayer:

Capital gains are taxed at same rate as ordinary income;

Ability to deduct losses is restricted.
Capital losses are deductible only to extent of capital gains.
Corporation may carry back capital loss for 3 years,
and may carry it forward up to 5 years.

For noncorporate taxpayer:

Short-term capital gains taxed at same rate as ordinary income;

Long-term capital gains taxed at lower rate.
(Taxpayer Relief Act of 1997 widened this rate differential.)

Capital losses are deductible to extent of capital gains plus
ordinary income up to $3000; can be carried forward indefinitely.

ii. Second consider the *timing* of income recognition.

For speculators, futures gains/losses must be marked-to-market
at year-end; then 40% treated as short-term & 60% as long-term.

Hedging transactions are exempt from this rule.

The definition of a hedge transaction for tax purposes is different
from that for accounting purposes.
Tax regulations define a hedging transaction as one entered into
in the normal course of business:

i. to reduce the risk of price changes or currency fluctuations
with respect to property held to produce ordinary income;
ii. to reduce risk of price changes or currency fluctuations
with respect to borrowings made by taxpayer.

For hedgers, gains/losses are realized in the same period
as gains/losses from the item being hedged.

B. Uses of Financial Futures.

Three important features of financial futures:

i. liquid,
ii. involve low transactions costs, and
iii. involve low margin requirements.

These features make financial futures attractive for several uses.

1. **Hedging** various forms of risk. Examples:

a. Farmer will wish to sell wheat in July;
can sell wheat futures to avoid risk of price decline.

Effectively locks into current (Forward) price of wheat.
Financial Futures hedging is analogous:

b. Treasurer will wish to issue bonds in near future;
Can reduce risk of interest rate increase before issue
by selling a T. Bond futures.

Effectively locks into current long term interest rates.

If rates rise, corporation must pay higher rates, but
short futures position will increase in value to offset.

i. Basis Risk - that the spot price of corporate bond
and futures price of T. bond may not move together.
Correlations are high; hedge is quite effective.

c. Treasurer has a receivable in Euro due in 3 mo;
Wishes lock into today's exchange rate & T. Bill rate.

Can sell Euro forward, and buy T. Bill futures.

If Treasurer delivers Euro and takes delivery of T. Bills,
the return is certain.

d. Investor near retirement; worried that stock market crash
might hurt the value of pension in equities.

Can sell stock index futures now, and hedge against
risk that market will decline before retirement.

2. **Changing Investment Policy**.

   a. Futures can be used to change various risk exposures. Futures have 3 advantages for accomplishing this:

      i. Transactions Costs are usually lower for futures than for the underlying assets;

      ii. Futures allow the firm's *selection* decision to be independent of the market exposure decision;

      iii. Profits & Losses on futures allow a direct measure of managers' ability to anticipate *timing* of opportunities;

      Use of futures separates performance due to *selection* from performance due to market *timing*.

   b. Changing market risk exposure of stock portfolio.

      To decrease the market beta of a stock portfolio,

      i. Can sell high-beta stocks & buy low-beta stocks, or

      ii. Can sell stock index futures, to reduce the portfolio's beta to any level desired.

   c. Changing interest rate risk exposure on bond portfolio.

      Duration - measure of sensitivity of a bond portfolio to changes in interest rates.

      Bond managers are interest rate forecasters (timers); If they feel interest rates will rise, then they wish to shorten duration of their portfolio so that the decline in bond values will be mitigated.

      To decrease the duration of a bond portfolio,

      i. Can sell long-term bonds & buy short-term bonds, or

      ii. Can sell T. Bond futures, to reduce the portfolio's duration to any level desired.

3. **Creating new products**.

   a. Alpha Fund - a 'zero beta' fund.
      If your firm has expertise in identifying undervalued assets, you can make your selections in some asset category or market, and then use futures to make the 'beta' of your combined portfolio of assets & futures = zero. The idea is to capture the selection abilities of your firm without being subject to any kind of market risk.

   b. Portfolio Insurance - futures can be used to replicate payoffs of stocks, bonds, puts, or calls. Possibilities are limitless.

II. Valuation of Forwards & Futures.

A. Notation:

P: Spot price of underlying asset today.

F: Forward price prevailing in market today.

F*: Theoretical Forward Price - what Forward price should be.

R: Riskfree rate per annum (for large banks, this is LIBOR).

1. Valuation depends on opportunity to arbitrage:
   buying/selling spot vs futures, if LOP is violated.

2. Shorting the spot asset is different from shorting futures.

   a. Shorting futures is just like going long futures.
   - The two positions are symmetric.
   - Each is simply a promise - to buy or sell at a price agreed upon today, but deliver sometime in the future.
   - Besides margin & marking-to-market, no cash changes hands today.

   b. Shorting spot - selling today something you don't own.
   - Today: borrow asset from someone else, and sell it.
   - Receive proceeds of the sale now.
   - This money is your asset; earns interest.
   - Your liability is fact that you owe the asset & all its benefits (like dividends) to the original owner.
   - Must maintain margin acct to protect against losses.
   - Later: buy the asset back, and give it back to owner.
   - If price has declined, make money.
   - If price has increased, lose.

B. Forward Prices for a security that provides no income.
(e.g. discount bonds, non-dividend paying stocks, gold, silver)

Example: T.Bill - sold at discount; pays $1,000,000 at maturity.

1. Suppose you wish to hold a 151-day T.Bill. Two alternatives:
   a. Direct purchase: Buy 151-day T.Bill at P (today's spot price).
   b. Indirect purchase using forwards:

      Buy forward contract (at F) that will deliver a 91-day T. Bill in 60 days, and
      Buy 60-day T. Bill that will pay F in 60 days.

	Action	day 0	60 days	151 days
Direct:	Buy 151-day T. Bill:	P		$1,000,000
Indirect:	Buy forward contract:		-F	$1,000,000
	Buy 60-day T. Bill:	F/(1+R)	+F	
	Sum of Cash Flows:	F/(1+R)	0	$1,000,000

Produce identical cash flows; *should* have same cost today.

Pricing relationship: $F^*/(1+R) = P$; or $F^* = P(1+R)$.

Point: The forward offers something the spot purchase doesn't;
the use of your money ($P) during the life of the forward.

Thus, $F^* > P$ in this case – F *should* be > P.
Forward gives you something the spot purchase doesn't;
the use of your money during the next 60 days! Worth P(1+R).

To see if there is an arbitrage opportunity, compare actual F to F*.

B. Forward Prices on security that provides no income (cont).

2. Arbitrage forces: Suppose $F > F^* = P(1+R)$.

a. F is too high relative to P; Buy at P and sell at F.

today b. Borrow \$P & buy security. [Will owe \$P(1+R) at exp.]
Short a forward on the security at F.

exp. c. Exercise forward contract; deliver security for \$F.
Use part of proceeds to pay off the loan, \$P(1+R).
Keep the difference, [F - P(1+R)].

3. Arbitrage forces: Suppose $F < F^* = P(1+R)$.

a. F is too low relative to P; Sell at P and buy at F.

today b. Short the security, receive \$P. Invest proceeds at (1+R).
Buy a forward on the security at F.

exp. c. Proceeds worth \$P(1+R).
Use part of proceeds to exercise fwd contract (buy at \$F).
Deliver security to close out short sale.
Keep the difference, [P(1+R) - F].

4. Example: One-year Forward contract on non-dividend stock;
P = \$40; R = .05; What should F be (F*)?
F* = P(1+R) = \$40(1.05) = \$42.

a. Suppose F = \$43 (> F*=\$42).
today Borrow \$40 and buy the stock. (Will owe \$42 at exp.)
Short a forward on the stock.
exp. Exercise forward contract; deliver stock for \$43.
Use proceeds to pay off the loan, \$42.
Keep the difference, \$1.

b. Suppose F = \$41 (< F*=\$42).
today Short the stock, receive \$40. Invest proceeds at (1+R).
Buy a forward on the stock.
exp. Proceeds worth \$42.
Use proceeds to exercise forward contract; buy at \$41.
Deliver stock to close out short sale.
Keep the difference, \$1.

C. Forward prices on a security paying a known income - case 1.
(e.g. coupon-bearing bonds, dividend-paying stocks).

1. Example 1: T. Bond (pays coupons; at mat. pays face value).

** Assume that T. Bond *pays no coupon* during next 60 days.

Two alternatives:

a. Direct: Buy T. Bond at P (today's spot price).

b. Indirect: Buy forward contract (at F)
that will deliver a T. Bond in 60 days, and
buy a 60-day T. Bill that will pay F in 60 days.

Action	day 0	60 days	thereafter
Direct: Buy T. Bond:	P		coupons + face value
Indirect: Buy forward contract:		-F	coupons +
Buy 60-day T. Bill:	F/(1+R)	+F	face value
Sum of Cash Flows:	F/(1+R)	0	coupons + face value

Pricing relationship: $F^*/(1+R) = P$; or $F^* = P(1+R)$.

Same as B, since this T. Bond pays no income *during life of forward*.

C. Forward prices on a security paying a known income - case 2.

2. Example 2: T. Bond (pays coupons; at mat. pays face value).

** Now assume that T. Bond. *pays a coupon* during next 60 days.
Let I = PV(coupon).

Two alternatives:

a. Borrow $I, and use this to help buy the T. Bond.
Must put up $(P-I) today. Then the coupon pays off loan.

b. Buy forward contract (at F)
that will deliver a T. Bond in 60 days, and
buy a 60-day T. Bill that will pay F in 60 days.

	Action	day 0	60 days	thereafter
Direct:	Borrow $I and use to help buy T. Bond	P - I	coupon pays loan	remaining coupons + face value
Indirect:	Buy forward contract:		-F	remaining coupons + face value
	Buy 60-day T. Bill:	F/(1+R)	+F	
	Sum of Cash Flows:	F/(1+R)	0	remaining coupons + face value

Pricing relationship: $F^*/(1+R) = P - I$; or $F^* = (P - I)(1+R)$.

3. Now two forces at work:

a. The forward offers something the spot purchase doesn't,
the use of your money during the life of the forward;
so (1+R) is pushing F* higher.

b. The spot purchase offers something the forward doesn't,
the first coupon; so I is pushing F* lower.

D. Stock Index Futures.

1. Examples of the spot asset - the stock index.

   a. S&P 500 - 400 industrials, 40 utilities,
   20 transportation companies, and 40 financial institutions.

   Companies amount to ≈ 80% of total mkt cap on NYSE.
   Two contracts traded on CME:
   One contract is on $250 x index;
   Other contract (mini-S&P) is on $50 x index.

   b. S&P Midcap 400 - composed of middle-sized companies.
   Futures traded on CME. One contract is on $500 x index.

   c. Nikkei 225 - largest stocks on TSE.
   Traded on CME. One contract is on $5 x index.

   d. NYSE Composite Index - all stocks listed on NYSE.
   Traded on NYFE. One contract is on $250 x index.

   e. MMI - 20 blue chips listed on NYSE.
   Traded on CBOT. One contract is on 500 x index.

   f. Nasdaq 100 - 100 Nasdaq stocks.
   Two contracts traded on CME:
   One is on 100 x index;
   Other (mini-Nasdaq) is on $20 x index.

   g. Goldman Sachs Commodity Index (GSCI) –
   commodity price index; traded on CME.
   One contract is on $250 x nearby index.

   h. Russell 2000 - 2000 small stocks in U.S.
   Traded on CME. One contract is on $500 x index.

   i. International - CAC-40; large European stocks
   - DAX-30; large German stocks.
   - FT-SE 100; large UK stocks.
   - DJ Euro Stoxx 50; large European stocks.

D. Stock Index Futures (continued)

2. Valuation. You wish to own the S&P 500 in one year.

   Treat as a security with known cash income (dividends).
   Two alternative ways to hold the S&P 500 in one year:

   a. Direct purchase, eliminating intermediate cash flows.

      Buy one round lot of all 500 stocks for $P.
      Let I = PV(expected stream of dividends).

      Borrow I, and use to help pay $P.
      As dividends arrive, use them to pay off loan.
      Must put up $(P - I) today.

   b. Indirect purchase: Buy futures & T. Bills for one yr.

      Buy forward contract on S&P 500.
      (promise to buy S&P500 at $F in one year)

      Buy T. Bill that will pay $F in one year.
      Must put up $F/(1+R) today.

   c. With both alternatives, will own S&P 500 in one year.
      Thus, initial cash flows must be the same.

      $$P - I = F/(1+R) \quad \text{or} \quad F = (P - I)(1+R).$$

3. Two forces at work:

   a. The forward offers something spot purchase doesn't, the use of your money during the life of the forward; so (1+R) is pushing F higher.

   b. The spot purchase offers something forward doesn't, dividends; so I is pushing F lower.

E. Foreign Currency Futures.

1. Valuation: Consider two alternative ways to hold riskless debt.

   i. U.S. riskless debt:
   $1 $\rightarrow$ $1(1+R) - $ in one year

   ii. Foreign riskless debt [3 steps]:
   a) $1 / S - FC today
   b) ($1 / S) x $(1+R_f)$ - FC in one year
   c) ($1 / S) x $(1+R_f)$ x F - $ in one year.

   iii. Both i. & ii. provide riskless cash flow in US$ in one year. Thus, final $ outcome must be identical.

   $$\$1(1+R) = [(\$1/S) \times (1+R_f)] \times F$$

   or $(1+R) = (F/S)(1+R_f)$

   or $F = [(1+R) / (1+R_f)] S.$ (Interest Rate Parity)

today		one year
	U.S. Riskless Debt	
$1	$\rightarrow$	1(1+R) $
		{[(1/S)(1+R_f)]F} $
(÷S) ↓		↑ (xF)
	Foreign Riskless Debt	
(1/S) FC	$\rightarrow$	[(1/S)(1+R_f)] FC