LECTURE 13

Futures and Forwards – An Overview

Example 1
To see how futures and forwards work and how they might be useful, consider the portfolio diversification problems facing a farmer growing a single crop, let us say wheat. The entire planting season's revenue depends critically on the highly volatile crop price. The farmer can't easily diversify his position because virtually his entire wealth is tied in the crop. The miller who must purchase wheat for processing faces a portfolio problem that is the mirror image of the farmer's. He is subject to profit uncertainty because of **unpredictable future cost of the wheat**.

Both parties can reduce this source of risk if they enter into a **forward contract** calling for the farmer to deliver the wheat when harvested at a price agreed upon now, regardless of the market price at harvest time. No money needs to change hands at this time. The forward contract is simply a deferred-delivery sale of some asset with the sales price to be paid or received for delivery of the commodity. **The forward contract protects each party from future price fluctuations.**

THE FUTURES MARKET FORMALIZE AND STANDARDIZE FORWARD CONTRACTING. Buyers and sellers do not have to rely on a chance matching of their interests; they can trade in centralized futures market (standardized contracts with size, grade of commodity, contract delivery dates) – this creates liquidity

- Future contracts (differ from forwards) call for daily settling up of any gains and loses on the contract – in contrast, the forward contracts, no money changes hands until delivery date.
- In centralized market, buyers and sellers can trade through brokers without personally searching for trading partners

Basics:

- **Futures Price** (agreed upon price of a commodity at delivery)
- Delivery date (maturity date)
- Grades (for agriculture commodity set different grades...i.e. No 2 hard winter wheat or No1 soft red wheat)
- Delivery is also specified (warehouse) – delivery rarely occurs – instead parties to the contract much more commonly close out their positions before contract matures (**reverse before maturity**), taking gains or losses in cash.
    - **Long Position** (purchasing the commodity on delivery date)
    - **Short position** (commits to delivery of the contract maturity)

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Futures Contracts

Metal & Petroleum Futures

	Open	High	Low	Settle	Chg	Open Interest
Copper-High (CMX)-25,000 lbs.; cents per lb.						
Sept	353.50	353.80	349.00	349.60	-1.75	1,658
Dec	352.05	355.55	349.45	350.45	-1.75	92,433
Gold (CMX)-100 troy oz.; $ per troy oz.						
Sept	1281.70	1282.00 ▲	1279.30	1279.00	3.40	151
Oct	1276.90	1283.70 ▲	1274.50	1279.30	3.40	30,517
Dec	1277.70	1285.20 ▲	1275.60	1280.80	3.30	398,926
Feb'11	1281.40	1286.70 ▲	1280.20	1282.50	3.30	27,782
April	1283.50	1288.20 ▲	1282.50	1284.00	3.30	17,149
Dec	1289.70	1293.50 ▲	1289.70	1290.40	3.30	15,548
Platinum (NYM)-50 troy oz.; $ per troy oz.						
Sept	...	...	...	1632.00	10.10	0
Oct	1619.90	1634.40	1617.00	1632.00	10.10	20,894
Silver (CMX)-5,000 troy oz.; cnts per troy oz.						
Sept	2090.0	2090.5	2074.0	2077.7	-1.3	903
Dec	2078.0	2100.0	2072.0	2080.3	-1.3	102,925
Crude Oil, Light Sweet (NYM)-1,000 bbls.; $ per bbl.						
Oct	73.59	75.45	73.32	74.86	1.20	65,538
Nov	74.82	76.77	74.58	76.19	1.27	350,380
Dec	76.67	78.34	76.16	77.80	1.13	219,057
Jan'11	78.12	79.62	77.49	79.09	1.01	80,101
Dec	83.17	84.34	82.42	83.87	0.79	124,486
Dec'12	85.18	86.37	84.76	85.97	0.57	81,422
Heating Oil No. 2 (NYM)-42,000 gal.; $ per gal.						
Oct	2.1052	2.1555	2.0907	2.1394	.0402	49,524
Nov	2.1159	2.1695	2.1072	2.1549	.0377	70,681
Gasoline-NY RBOB (NYM)-42,000 gal.; $ per gal.						
Oct	1.9175	1.9724	1.9151	1.9496	.0304	53,074
Nov	1.9180	1.9700	1.9138	1.9480	.0291	80,906
Natural Gas (NYM)-10,000 MMBtu.; $ per MMBtu.						
Oct	3.970	3.981	3.806	3.822	-.202	99,466
Nov	4.169	4.169	3.990	4.005	-.198	204,693
Dec	4.361	4.387	4.233	4.243	-.177	73,447
Jan'11	4.546	4.551 ▼	4.404	4.422	-.152	100,210
March	4.455	4.491 ▼	4.345	4.364	-.144	54,065
April	4.400	4.418 ▼	4.272	4.292	-.128	56,723

Agriculture Futures

	Open	High	Low	Settle	Chg	Open Interest
Corn (CBT)-5,000 bu.; cents per bu.						
Dec	513.25	523.75	507.50	508.25	-5.00	785,800
March'11	525.00	535.50 ▲	520.50	521.25	-4.50	279,792
Ethanol (CBT)-29,000 gal.; $ per gal.						
Oct	2.162	2.170 ▲	2.139	2.149	.002	385
Dec	1.990	1.995 ▲	1.970	1.976	-.002	1,940
Oats (CBT)-5,000 bu.; cents per bu.						
Dec	358.75	368.50 ▲	354.50	359.00	3.00	10,157
March'11	365.00	373.50 ▲	357.50	361.00	2.00	1,805
Soybeans (CBT)-5,000 bu.; cents per bu.						
Nov	1069.00	1099.50	1068.25	1084.50	15.50	302,912
Jan'11	1078.00	1109.50 ▲	1078.00	1094.50	16.25	104,274
Soybean Meal (CBT)-100 tons; $ per ton.						
Oct	303.60	313.10	303.30	306.10	1.40	23,428
Dec	306.90	317.40	306.90	310.20	1.70	128,070
Soybean Oil (CBT)-60,000 lbs.; cents per lb.						
Oct	41.91	42.86	41.91	42.65	.74	32,436
Dec	42.36	43.30	42.30	43.05	.75	173,488
Rough Rice (CBT)-2,000 cwt.; cents per cwt.						
Nov	1205.50	1237.00	1195.00	1225.50	17.50	13,202
Jan'11	1250.50	1261.00	1221.50	1252.50	18.50	2,140
Wheat (CBT)-5,000 bu.; cents per bu.						
Dec	738.50	757.00	729.00	731.75	-7.50	263,552
March'11	768.25	785.00	758.00	761.00	-7.25	78,983
Wheat (KC)-5,000 bu.; cents per bu.						
Dec	768.50	782.75	755.00	757.50	-10.75	106,001
March'11	781.00	795.00	768.50	770.50	-10.50	63,207
Wheat (MPLS)-5,000 bu.; cents per bu.						
Dec	773.50	790.00	764.00	767.00	-6.25	28,792
March'11	783.00	800.00	774.00	776.50	-6.50	17,774
Cattle-Feeder (CME)-50,000 lbs.; cents per lb.						
Sept	111.375	111.375	110.075	110.650	-1.175	2,260
Nov	111.850	111.850	110.750	110.950	-1.400	12,569
Cattle-Live (CME)-40,000 lbs.; cents per lb.						
Oct	99.050	99.050	98.100	98.150	-1.250	71,804
Dec	101.250	101.350	100.550	100.600	-1.350	149,787
Hogs-Lean (CME)-40,000 lbs.; cents per lb.						
Oct	77.800	78.775	77.500	78.525	.825	42,699
Dec	75.950	76.950	75.725	76.775	.825	95,685
Pork Bellies (CME)-40,000 lbs.; cents per lb.						
Feb	...	108.500	...	108.500	.500	10
Lumber (CME)-110,000 bd. ft., $ per 1,000 bd. ft.						
Nov	218.50	227.00	216.50	222.00	...	6,914
Jan'11	239.10	245.20	239.10	240.50	...	1,586
Milk (CME)-200,000 lbs., cents per lb.						
Sept	16.29	16.30	16.27	16.30	-.01	5,071
Oct	16.25	16.49 ▲	16.20	16.42	.24	5,191
Cocoa (ICE-US)-10 metric tons; $ per ton.						
Dec	2,737	2,769	2,695	2,716	-30	65,633
March'11	2,764	2,788	2,722	2,742	-31	28,924
Coffee (ICE-US)-37,500 lbs.; cents per lb.						
Sept	184.50	184.50	182.70	180.55	-7.30	97
Dec	190.00	190.75	180.95	181.95	-7.35	90,229
Sugar-World (ICE-US)-112,000 lbs.; cents per lb.						
Oct	24.88	25.60 ▲	24.17	24.29	-.32	95,729
March'11	23.40	23.95 ▲	22.93	23.08	-.17	275,909
Sugar-Domestic (ICE-US)-112,000 lbs.; cents per lb.						
Nov	37.30	38.85	37.30	38.83	-.17	1,354
Jan'11	37.00	37.00	35.50	36.68	-.32	2,867
Cotton (ICE-US)-50,000 lbs.; cents per lb.						
Oct	99.95	101.50 ▲	99.70	100.37	2.76	345
Dec	98.75	101.98 ▲	98.75	99.37	1.15	148,796
Orange Juice (ICE-US)-15,000 lbs.; cents per lb.						
Nov	149.60	151.00	149.00	150.40	.50	17,806
Jan'11	151.40	152.55	150.80	152.10	.50	6,334

Interest Rate Futures

	Open	High	Low	Settle	Chg	Open Interest
Treasury Bonds (CBT)-$100,000; pts 32nds of 100%						
Sept	131-310	132-040	131-140	132-010	16.0	11,816
Dec	130-050	130-230	129-310	130-200	17.0	641,629
Treasury Notes (CBT)-$100,000; pts 32nds of 100%						
Sept	125-150	125-185	125-050	125-165	9.0	29,460
Dec	124-055	124-150	124-010	124-130	8.5	1,596,898
5 Yr. Treasury Notes (CBT)-$100,000; pts 32nds of 100%						
Sept	120-235	120-285	120-210	120-267	3.2	17,550
Dec	119-292	120-010	119-252	119-315	2.2	867,122
2 Yr. Treasury Notes (CBT)-$200,000; pts 32nds of 100%						
Sept	109-245	109-252	109-242	109-250	.5	4,231
Dec	109-187	109-200	109-177	109-190	.5	699,036
30 Day Federal Funds (CBT)-$5,000,000; 100 - daily avg.						
Sept	99.808	99.810	99.805	99.808	.001	56,524
Nov	99.810	99.815	99.810	99.810	...	89,093
1 Month Libor (CME)-$3,000,000; pts of 100%						
Oct	99.7275	99.7325	99.7275	99.7300	...	6,915
Nov	99.7200	99.7225	99.7200	99.7200	.0025	12,405
Eurodollar (CME)-$1,000,000; pts of 100%						
Oct	99.6700	99.6800 ▲	99.6625	99.6750	.0075	75,254
Dec	99.5950	99.6150	99.5850	99.6050	.0150	1,079,506
March'11	99.5250	99.5400	99.5150	99.5300	.0050	1,131,489

Ex 5. →

Ex. 4 →

Ex 2 →

Example 2

Corn – 5,000 bushels
Price: cents per bushel
Expiration dates: December and March 2011

The Dec 2010 maturity corn contract open during the day at a future price of 513.25 per bushel. The highest during the day was 523.75 and lowest 507.50 and the settlement price were 508.25 or 5 cents lower than the opening price. The open interest or the number of outstanding contracts was 785,800.

The trader holding the long position, that is, the person who will purchase the good, profits from price increases at maturity. Suppose that when the contract matures in December, the price of corn turns out to be 518.25 per bushel. The long position trader who entered the contract at the futures price of 508.25 cents 9/20/2010 – earns a profit of 10 cents per bushel. The eventual price is 10 cents higher than the originally agreed-upon futures price. As each contract calls for delivery of 5,000 bushels – the profit to the long position equals $5,000 x .10 = $500 per contract. The short position loses 10 cents per bushel. The short position's loss equals the long position's gain.

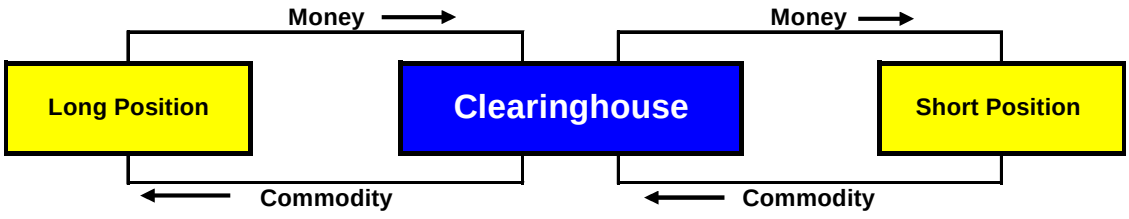
Profit for long = Spot price at maturity – Original futures price
Profit to short = Original futures price – Spot price at maturity.

Existing Contracts

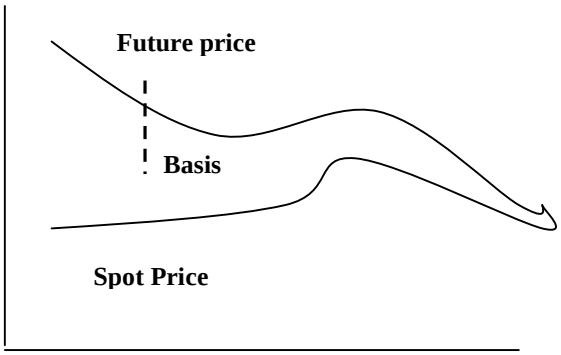
- Agriculture Futures
- Metals and Minerals
- Foreign Currencies
- Financial Futures (fixed Income and Equity indices)

History / Mechanics

- 10 years ago: "trading pit" for each contract – voice and hands
- Electronic platform –
  - Europe with Eurex
  - CBOT / BME – Globex
- Clearinghouse – once it's agreed – seller and buyer settle through the clearinghouse – provides liquidity



- **Marking to Market** (The daily settlement of obligations on futures positions)
- **Original Margin:** Each trader establishes a margin account (both Long and short trader) – backed by treasury bills/cash to make sure the cash is there. i.e. if the initial margin for corn is 10%, the trader must post (looking at the WSJ prices) 50.825 cents x 5,000 = $2,541.25 per contract on the margin account.
- **Maintenance margin / maintenance Margin**: On a daily basis they debit/credit the account to maintain 5% cushion (this margin could be different than the original margin).
- **Convergence property:** The convergence of futures prices and spot prices at the maturity of the futures contract – As a maturity contract calls for immediately delivery, the futures price on that day must equal the spot price.



Example 3 - Marking to Market and Future Contract Profits):
Assume the current futures price for silver for delivery five days from today is $12.10 per ounce. Suppose that over the next five days, the futures price evolves as follows:

Day		Futures Price	Profit (Loss) per Ounce	Daily Proceeds x 5,000 ounces / Contract		Cumulative
0	Today	$12.10				
1		12.20	$0.10	$ 500.00	Credit	$ 500.00
2		12.25	$0.05	$ 250.00	Credit	$ 750.00
3		12.18	($0.07)	$ (350.00)	Debit	$ 400.00
4		12.18	$0.00	$ -		$ 400.00
5	Delivery	12.21	$0.03	$ 150.00	Credit	$ 550.00
			Sum =	$ 550.00		

Cash Vs Actual Delivery

Cash Settlement: The cash value of the underlying asset (rather than the asset itself) is delivered to satisfy the contract (S&P index for example) – *delivering every stock from S&P will be impractical.*

FUTURES MARKET STRATEGIES –

Hedging & Speculation

Hedging and speculation are two polar uses for future markets. A speculation uses a futures contract to profit from movements in future prices, a hedger to protect against price movements.

Example 4

Consider an oil distribution planning to sell 100,000 barrels of oil in December that wishes to hedge against a possible decline in oil prices. Because each contract calls of 1,000 barrels, it would sell 100 contracts. Any decrease in prices would then generate a profit on the contracts that would offset the lower sales revenue from the oil.

Using the WSJ prices, suppose that the only three possible prices for oil December (stay at $77.80 and up/down $3 from there).

		Oil Prices in March, Pt		
		74.80	77.80	80.80
Revenue from oil sales	100,000	7,480,000	7,780,000	8,080,000
+ Profit on futures	100,000	300,000	0	(300,000)
Total Proceeds		7,780,000	7,780,000	7,780,000

Basis Risk and Hedging

The basis is the difference between the futures price and spot price.

The convergence property implies that

Sr – K = basis or K – Sr = 0

Basis Risk is the risk associated with imperfect hedging using futures. It could arise because of the difference between the asset whose price is to be hedged and the asset underlying the derivative, or because of a mismatch between the expiration date of the futures and the actual selling date of the asset.

Under these conditions, the spot price of the asset, and the futures price, do not converge on the expiration date of the future. The amount by which the two quantities differ measures the value of the basis risk. That is,

Basis = Spot price of hedged asset - Futures price of contract

Example 5 Speculating on the basis:
Investor holding 100 ounces of gold, who is short one gold futures contract. Suppose that gold today sells for $1,250 an ounce, and the futures price for December delivery is $1,280 an ounce (WSJ). Therefore, the basis is currently $30 ($1,280 - $1,250). Tomorrow, the spot price might increase to $1,260, while the futures price increases to $1,285, so the basis narrows to $35 ($1285 - $1,250). The investor's gains and losses are as follows:

Gain on holdings of gold (per ounce):	$1,260 – 1,250 = $10
Loss on gold futures position (per ounce):	$1,285 – 1,280 = $ 5

An investor gains $10 per ounce on the gold holdings, but loses $5 an ounce on the short futures position. The net gain is the decrease in the basis, or $5 an ounce.

Optimal Hedge Ratio:
The **Hedge Ratio** is the ratio of the size of the position taken in futures contracts to the size of the exposure

$$h = p^*(\sigma Sr / \sigma K)$$

Example 6:
A company knows that it will buy 1 million gallons of jet fuel in three months. The standard deviation of the change in the price per gallon of jet fuel over a 3-month period is calculated 0.032 (3.2%). The company chooses to hedge by buying futures contracts on heating oil. The standard deviation of the change in the futures price over 3-month period is 0.040 (4.0%) and the coefficient of correlation between the 3-month change in the price of jet fuel and 3-month change in the futures price is 0.8. The optimal hedge ratio is therefore:

0.8 x (0.032 / 0.040) = 0.64.

One heating oil futures contract is on 42,000 gallons. The company should therefore buy

0.64 x (1,000,000 / 42,000) = 15.2

Contracts (~15 contracts)