Introduction to Futures

BUSI 722: Data-Driven Finance II

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- A forward contract is a contract to deliver something and to be paid at a later date.
- A futures contract is like a forward contract, but it is traded on an exchange. Main exchanges are the Chicago Mercantile Exchange (CME) and the Intercontinental Exchange (ICE).
- Like options, a clearinghouse steps between buyers and sellers and becomes the counterparty to both sides.
- Unlike options, the buyer does not pay the seller when a futures contract is traded.
- Both have to post collateral (margin) to ensure they can uphold their future obligations. Generally less than 10% of the contract value.

Types of futures

- Agricultural (corn, wheat, ...)
- Energy (crude, natural gas, ...)
- Metals (gold, silver, ...)
- Currencies (euro, yen, ...)
- Financials (S&P 500, Treasury bonds, ...)

Examples of contracts

- CME gold: 100 troy ounces
- CME natural gas: 10,000 MMBtu delivered to Henry Hub, LA
- CME gasoline: 42,000 gallons delivered to NY harbor
- CME heating oil (ULSD) : 42,000 gallons delivered to NY harbor
- CME WTI Crude: 1,000 barrels delivered to Cushing, OK

Exiting through trade

- Like options, positions are usually cancelled by making offsetting trades.
- Example: buy a contract at 70. Later sell when price is at 80.
    - Deliver/receive obligations cancel.
    - Buy at 70 and sell at 80 produces a cash gain of 10.

Daily Settlement (marking to market)

- Gains and losses are realized daily.
- Why? To protect the clearinghouse.
- Any default will be for no more than the loss on a single day, because cash was transferred to cover prior losses.

Example

- Suppose you bought 1 CME WTI contract for Dec, 2022 delivery on Jan 2, 2020.
- You bought it at 51.80.
- The contract closed (settled) that day at 51.97.
- You made 1,000 barrels $\times$ 0.17/barrel = 170 on Jan 2. You receive that money at the end of the day.
- You are now obligated to pay 51.97 upon delivery in December.
- Deducting the 0.17 cash you already received, the net price is still 51.80.

The settlement prices for subsequent days were

Jan 3	51.72
Jan 6	51.81
Jan 7	52.13
Jan 8	51.31

Suppose you sold 1 contract on Jan 9 at 51.50.

Here are the daily cash flows per barrel

Day	**Price**	**Gain/Loss**
Jan 2	51.80	
Jan 2	51.97	+ 0.17
Jan 3	51.72	- 0.25
Jan 6	51.81	+ 0.09
Jan 7	52.13	+ 0.32
Jan 8	51.31	- 0.82
Jan 9	51.50	+0.19
TOTAL		- 0.30

Cash settled contracts

- Some contracts (mostly financials) do not have delivery provisions. Instead, the gain/loss on the last day is calculated from the market price of the underlying.
- Example: S&P 500 contract is cash settled based on the prices of the 500 stocks (i.e., the S&P 500 index).

Convergence to spot

- Spot price means price for "immediate" delivery.
- Spot and futures are usually different.
  - Example: The price for a bushel of corn in six months is usually not quite the same as the price of a bushel of corn today.
- However, as the maturity date of the futures approaches, the futures price and spot price must converge.
  - Because trading a futures near its maturity is the same as trading spot.

Hedging with futures

- Example: grain processor will need to buy corn in December.
- Buys corn in January on futures market at 5.00 per bushel.
- If the spot price of corn is 4.00 per bushel in December,
    - Processor will probably sell the futures contract, taking a 1.00 loss
    - Buy corn spot at 4.00
    - Net cost is 5.00
- If the spot price of corn is 6.00 per bushel in December, then …

Hedging with futures vs options

- What option could the processor buy to cap the price of corn?
- Calculate the net cost, including the option premium. under various scenarios for the price of corn.

Options on futures

- You can buy an option on corn over the counter (directly from a grain trader) but not on an exchange. However, you can buy an option on corn futures on the CME. Same for energy, metals, ...
- Exercising a call option on a futures rolls you into a long futures contract. Exercising a put rolls you into a short futures contract.
- Example. You are long a call option on crude with a **strike of 70**. The crude **futures is at 80**.
    - You do not pay the strike to exercise.
    - Exercising gives you a long futures contract as if you bought the contract at 70.
    - It is immediately marked to market. So **you get 10 cash** from the marking to market. And, you have a contract to pay 80 for crude.
    - You could sell a futures contract in the market at 80. This will cancel the delivery/receipt obligations.

Hedging with futures or futures options

- A farmer wants to insure against the price of wheat falling.
- The futures price is 6.00 per bushel.
- A put on the futures with a strike of 6.00 has a premium of 1.00. The call expires at the same time as the futures.
- Compare the outcomes for (a) futures, (b) put on futures, and (c) no hedge if the spot price of wheat at the option/futures maturity is 4.00, 5.00, 6.00, 7.00, or 8.00 per bushel.