

FINC3012 NOTES

LECTURE 1: DERIVATIVE SECURITIES

OVERVIEW OF THE COURSE

1. Introduction
2. Mechanics of futures markets
3. Hedging strategies using futures
4. Determination of forward and futures prices
5. Swaps 1
6. Swaps 2
7. Mechanics of options markets
8. Trading strategies involving options
9. Binomial trees
10. Black-Scholes-Merton model
11. Currency & Future & Index Options and Delta
12. Exotics, Mishaps and Review

WHY DERIVATIVES?

- The Goldman strategy that's returned 105% in days
 - Simple strategy: buy call options before earnings announcement
- A very important hedging tool central to risk management in financial markets

INTRODUCTION TO DERIVATIVES

THE NATURE OF DERIVATIVES AND THEIR USE

- A derivative is an instrument whose price depends on, or is derived from, the price of another asset
- Examples of derivatives
 - Futures contracts
 - Forward contracts
 - Swaps
 - Options
- Derivatives are used to:
 - Hedge risks
 - Speculate
 - Lock in an arbitrage profit
 - Change the nature of a liability
 - Change the nature of an investment without incurring the costs of selling one portfolio and buying another

FUTURES CONTRACTS

- A futures contract is an agreement to buy or sell an asset at a certain time **in the future** for a certain price
 - Just a forward contract that has been standardised
 - Underlying asset is also called a spot asset
- By contrast, in a spot contract there is an agreement to buy or sell the asset **immediately** or within a very short period of time
- Exchanges trading futures
 - CBOT and CME (now CME Group)
 - NYSE Euronext
 - Eurex
 - BM&FBOVESPA (Sao Paulo, Brazil)
 - ASX
 - Many more (see list at end of book)
- Terminology
 - A **long** futures position is an agreement to **buy** the asset at a certain time in the future for a certain price

- A **short** futures position is an agreement to **sell** the asset at a certain time in the future for a certain price
- Futures price
 - The futures price is the price at which you agree to buy or sell
 - It is determined by supply and demand in the same way as a spot price
- Futures contracts
 - Agreement to:
 - Buy 100 oz of gold @ US\$1,050/oz in December
 - Sell £62,500 @ 1.5500 US\$/£ in March
 - Sell 1,000 bbl of oil @ US\$75/bbl in April
 - Buy 100 90-day bank bill futures contracts expiring in June
 - March: Trader takes a long position in a June futures contract on 90-day bank accepted bills at 95.00. This implies a yield of 5% per annum is to be used to value the futures contract
 - June: Trader must buy 90-day bank accepted bills with total face value of \$1,000,000 at a yield of 5% per annum
 - The futures price that would be paid for the bills is:
 - $$\text{Futures Price} = \frac{\$1,000,000}{1 + \frac{5}{100} \times \frac{90}{365}} = \$987,821.38$$

FUTURES EXCHANGES

THE AUSTRALIAN SECURITIES EXCHANGE

- Created in 2006 with the merger of the Australian Stock Exchange and the Sydney Futures Exchange
- Futures contracts were initially traded solely on the Sydney Futures Exchange (SFE) in 1960
- In the 1990s the Australian Stock Exchange replicated the individual share futures contract that was trading on the SFE
- This ceased with the creation of the Australian Securities Exchange
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- Futures contracts:
 - Gold futures
 - 90-day bank accepted bill futures contracts
 - Share price index futures contracts
 - Contracts for difference
 - Electricity futures contracts

OVERSEAS EXCHANGES

- CME Group (CME and CBOT) largest
 - Established in 1973 and 1848 to bring farmers and merchants together
 - First futures-type contract known as a to-arrive contract
 - Offers futures contracts on many different underlying assets
- In 1874 the Chicago Produce Exchange was established
- In 1898 the Chicago Butter and Egg Board was formed
- In 1919 it was renamed the Chicago Mercantile Exchange
- CME provides a futures market for many commodities

ELECTRONIC TRADING

- Traditionally, futures contracts have been traded using the open-outcry system where traders physically meet on the floor of the exchange
- Increasingly this is being replaced by electronic trading where a computer matches buyers and sellers
- The Australian Securities Exchange relies entirely on electronic trading

OVER-THE-COUNTER

- The over-the-counter (OTC) market is an important alternative to exchanges
- It is a telephone and computer-linked network of dealers who do not physically meet
- Trades are usually between financial institutions, corporate treasurers and fund managers

FORWARDS

- Forward contracts are similar to futures except that they trade in the over-the-counter market
- Futures are forward contracts but traded on the exchange
- Forward contracts are popular on currencies and interest rates
- Spot, forward margins quoted for the USD exchange rate and calculated forward rates, 10 January 2011; quote is number of USD per AUD

	Bid Margin	Offer Margin	Bid Rate	Offer Rate
Spot			0.9934	0.9937
1-Month Forward	40.80	40.50	0.98932	0.98965
3-Month Forward	111.70	111.30	0.98223	0.98257
6-Month Forward	225.30	224.10	0.97087	0.97129

OPTIONS

- A **call** option gives the holder the right to **buy** an asset by a certain date for a certain price (the strike price)
- A **put** option gives the holder the right to **sell** an asset by a certain date for a certain price (the strike price)
- An American option can be exercised at any time during its life
- A European option can be exercised only at maturity
- Margin prices of options on BHP, 7 January 2011; $S = \$44.60$

Strike Price (\$)	Calls			Puts		
	24 FEB. 2011	24 MAR. 2011	28 APR. 2011	24 FEB. 2011	24 MAR. 2011	28 APR. 2011
43.500	2.530	2.780	3.185	0.660	1.095	1.430
44.000	2.155	2.430	2.890	0.760	1.265	1.610
44.500	1.840	2.150	2.555	0.940	1.455	1.810
45.000	1.520	1.835	2.260	1.135	1.675	2.030
45.500	1.240	1.570	2.010	1.365	1.910	2.270
46.000	1.010	1.310	1.755	1.630	2.180	2.525

- Options vs. futures/forwards
 - In a **futures/forward** contract the holder has an **obligation** to buy or sell the asset at a certain price
 - An **option** gives the holder the **right** to buy or sell the asset at a certain price (buyer pays premium for right)
- Exchanges trading options
 - Chicago Board Options Exchange
 - NYSE Euronext
 - Eurex (Europe)
 - ASX
 - Many more (see list at end of book)
- The over-the-counter market for options
 - Currently larger than the exchange-traded market
 - Advantage: contracts can be tailored to meet the particular needs of a corporate treasurer or fund manager

TYPES OF TRADERS

- Three broad categories of trader can be identified:
 - Hedgers (offset risk)
 - Speculators (thinks underlying price will rise/fall and takes a position to take advantage of that position)
 - Arbitrageurs (take advantage of mispriced underlying assets)

HEDGERS

- Hedge funds
 - Hedge funds are not subject to the same rules as mutual funds and cannot offer their securities publicly

- Mutual funds must:
 - Disclose investment policies
 - Make shares redeemable at any time
 - Limit use of leverage
 - Take no short positions
- **Hedging using forward contracts**
 - It is 10 January 2011. ImportCo, a company based in Australia, must pay USD 10 million on 10 April 2011, for goods purchased from a US supplier
 - ImportCo buys USD 10 million in the three-month forward market to lock in an exchange rate of 0.98257 for the USD it will pay
- **Hedging using options**
 - It is February. An investor who owns 5,000 CBA shares wants protection against a possible decline in the share price over the next five months
 - Current CBA share price is 51.21 and CBA July 50.00 put price is \$2.735
 - The investor buys fifty put option contracts for a total cost of \$13,675. This gives the investor the right to sell 5,000 shares for \$50.00 per share during the next five months
- 100 underlying shares in an option contract
- Value of CBA holding in five months

SPECULATORS

- **Speculation using futures**
 - An Australian speculator, who in February thinks that the Australian share market will strengthen over the next two months, is prepared to back that hunch to the tune of \$250,000
 - The speculator can purchase \$250,000 worth of units in an index fund in the hope that the units can be sold later at a higher price
 - Or take a long position in ASX SPI 200TM futures contracts
- **Speculation using options**
 - It is October and a speculator considers that a stock is likely to increase in value over the next two months and will invest \$2,000
 - The stock price is currently \$20 and a two-month call option with a \$22.50 strike price is currently selling for \$1 per share
 - What are the alternative strategies?
- Profit or loss from two alternative strategies for speculating on a stock currently worth \$20

ARBITRAGEURS

- Arbitrage involves locking in a riskless profit by simultaneously entering into transactions in two or more markets
- Suppose that a stock price is \$162 in Australia and £100 in London at a time when the exchange rate is \$1.6500 per pound. What is the arbitrage opportunity?
- Suppose that:
 - The spot price of gold is US\$1,000
 - The quoted 1-year futures price of gold is US\$1,100
 - The 1-year US\$ interest rate is 5% per annum
 - No income or storage costs for gold
- Is there an arbitrage opportunity?
- If the spot price of gold is S and the futures price for a contract deliverable in T years is F , then:
 - $F = S(1 + r)^T$
 - Where r is the 1-year (domestic currency) risk-free rate of interest

LECTURE 2: MECHANICS OF FUTURES MARKETS

OVERVIEW OF A FUTURES CONTRACT

- Available on a wide range of assets
 - They can be financial (stock indices) or commodities (such as oil)
- Exchange traded
- Specifications need to be defined
- Settled daily
- Can be closed out

OPENING AND CLOSING FUTURES POSITIONS

- A futures contract is an agreement to buy or sell an asset for a certain price at a certain time in the future
- Closing a position involves entering into an opposite trade to the original one that opened the position
 - For example, an investor who buys five July corn futures contracts on 6 May can close out the position on 20 June by selling five July corn futures contracts

SPECIFICATIONS OF A FUTURES CONTRACT

- What can be delivered (the asset)
- The contract size (how much of the asset)
- Where it can be delivered
- When it can be delivered (usually cash, settle or physical delivery)
- The exchange decides the contract and terms of delivery

THE ASSET

- When asset is a commodity, it is important that the exchange stipulate the grades of the commodity that are acceptable
 - The price received depends on the grade chosen
- Financial assets in futures contracts are generally well-defined and unambiguous
- The stock index futures listed on the ASX are:
 - ASX SPI 200™ Index Futures
 - S&P/ASX 200 A-REIT Index Futures
 - S&P/ASX 2004 Index Futures
 - S&P/ASX 50 Index Futures
- Specifications of Treasury notes and bonds on the ASX are also comprehensive

CONTRACT SIZE

- The amount of the asset that has to be delivered under one contract has to be specified
- The value of what is delivered under a futures contract on an agricultural product may vary in the range of \$40,000 to \$50,000
- For some financial futures the value is much higher
 - The ASX 90-day bank accepted bill futures contract has a face value of AUD 1,000,000

DELIVERY MONTHS

- The precise period during the month when delivery can be made must be specified
- The delivery months vary from contract to contract and are chosen to meet the needs of market participants
- The last day on which trading can take place also must be specified

DELIVERY ARRANGEMENTS

- The place where delivery will be made must be specified
- The period during which delivery can be made is defined and varies from contract to contract

CASH SETTLEMENT

- Some financial futures are settled in cash because it is inconvenient or impossible to deliver the underlying asset
- Final settlement price is equal to the spot price of the underlying asset at either the opening or close of trading on that day

PRICE QUOTES

- The exchange defines how prices will be quoted
- The ASX quotes the short-term interest rate and bond futures in yield per cent per annum
- For quotation purposes, the yield is deducted from an index of 100

PRICE LIMITS AND POSITION LIMITS

- For most contracts, daily price movement limits are specified
- A limit move is a move in either direction equal to the daily price limit
- Position limits are the maximum number of contracts that a speculator may hold
- Under the ASX trading rules, the position limits are imposed through the Capital Based Position Limits (CBPL), which restricts the initial margin liabilities

A FUTURES CONTRACT S&P 500

- The settlement price is the price just before the final bell each day
- Settlement price is used for the daily settlement process
- Volume of trading is the total number of trades in one day
- Open position (open interest) is the total number of contracts outstanding
- Open interest is equal to the number of long positions or number of short positions

CONVERGENCE OF FUTURES PRICE TO SPOT PRICE

- When the delivery period is reached, the futures price equals, or is very close to, the spot price
- If the futures price is above the spot price, traders then have an arbitrage opportunity
- As they exploit this arbitrage opportunity, the futures price will fall
- If the futures price is below the spot price companies will find it attractive to buy a futures contract and then wait for delivery to be made
- As they do so, the futures price will tend to rise
- Carrying cost is the cost of holding the underlying
- Relationship between futures price and spot price
 - (a) futures price above spot price
 - (b) futures price below spot price

MARGINS

- The operation of margins
 - A margin is cash or marketable securities deposited by an investor with his or her broker
 - The balance in the margin account is adjusted to reflect daily settlement
 - Margins minimise the possibility of a loss through a default on a contract
- The clearing house acts as an intermediary between traders of futures contracts requiring traders to maintain a margin in case of potential default
 - The clearing house is a function of the exchange and acts as a neutral third party to facilitate the trade
 - The only profit it makes is through fees charged for physical delivery
 - Provides less risk with regards to a trade
 - The clearing house works out the trader's profit or loss each day and any amount required to maintain the margin
- December 2020 have price of 3474.80
- One contract $\$250 \times 3474.80 = \$868,700$
- Exchanges can make the initial margin and maintenance margin as different or the same
- Initial margin is the amount required by the exchange to initiate a futures position
 - The exchange sets the margin amount but your broker may be required to collect additional funds for deposit
- Maintenance margin is the minimum amount that must be maintained at any given time in your account
 - If the funds in your account drop below this level, you may receive a margin call requiring you to add funds immediately to bring the account back up to the initial margin level

MARGINS AND DAILY SETTLEMENT

- An investor takes a long position in one December 2010 ASX SPI 200 futures contract on October 20
 - Contract size is AUD 115,900
 - Futures price is 4,636.0 index points
 - Margin requirement is AUD 3,250/contract
 - Maintenance margin is equal to the initial margin (AUD 3,250)
- Operation of margins for a long position in the ASX SPI 200™
 - Index Futures contract

Day	Futures price (index point)	Daily gain (loss) (AUD)	Cumulative gain (loss) (AUD)	Margin account balance (AUD)	Margin call (AUD)
	4636.0			3250	
20 October	4632.0	(100)	(100)	3150	100
21 October	4630.0	(50)	(150)	3200	50
22 October	4649.0	475	325	3725	
25 October	4719.0	1750	2075	5475	
26 October	4689.0	(750)	1325	4725	
27 October	4643.0	(1150)	175	3575	

- The balance in a margin account may earn interest
- Futures contracts are settled daily
- Closing out a futures position involves entering into an offsetting trade
 - Since the contracts are made with the clearing house it is not necessary to offset with the same trader
- Most contracts are closed out before maturity

CLEARINGHOUSE

THE CLEARINGHOUSE AND CLEARING MARGINS

- The clearinghouse keeps track of all the transactions that take place so that it can calculate the daily net position of each of its members
- Brokers are required to maintain margin accounts with clearinghouse members and clearinghouse members are required to maintain a margin account with the clearinghouse

COLLATERALISATION IN OTC MARKETS

- It is becoming increasingly common for contracts to be collateralised in OTC markets
- Counterparties then post margins with each other to reflect changes in the value of the contract
- Regulators are now insisting that clearinghouses be used for some OTC contracts

TRADERS AND ORDERS

TYPES OF TRADER AND TYPES OF ORDER

- Two types of trader:
 - Futures commission merchants (FCMs)
 - Locals
- Traders, whether locals or the clients of FCMs, can be hedgers, speculators or arbitrageurs
- Open outcry market generally have brokers trading on behalf of clients whereas locals trade on the own account usually buying and selling small amounts

ORDERS

- Market order
- Limit order
- Stop order (stop-loss order) – if the position moves by a certain extent against you it will minimise risk exposure
- Stop-limit order

- Market-if-touched order (MIT)
- Discretionary order (market-not-held order)
- Time-of-day order
- Open order (good-till-cancelled order)
- Fill-or-kill order

REGULATION

- Regulation is designed to protect the public interest
- Regulators try to prevent questionable trading practices by either individuals on the floor of the exchange or outside groups
 - Also to protect other markets
- In the US: Commodity Futures Trading Commission (CFTC) and the National Futures Association (NFA)
- In Australia: Australian Securities and Investments Commission (ASIC) and the ASX Compliance

ACCOUNTING AND TAX

- It is logical to recognise hedging profits (losses) at the same time as the losses (profits) on the item being hedged
- It is logical to recognise profits and losses from speculation as they are incurred
- Roughly speaking, this is what the accounting and tax treatment of futures in the US and many other countries attempts to achieve
- The Australian Standard Board issued:
 - AASB 139, derivatives to be included on the balance sheet at fair value
 - AASB 132 and AASB 7, more disclosure requirements
- AASB 7, 132 and 139 are in agreement with the International Accounting Standards Board

FORWARD CONTRACTS

- A forward contract is an OTC agreement to buy or sell an asset at a certain time in the future for a certain price
- There is no daily settlement
- At the end of the life of the contract one party buys the asset for the agreed price from the other party

FORWARD CONTRACTS VS. FUTURES CONTRACTS

- **Forward**
 - Private contract between two parties
 - Not standardised
 - Usually one specified delivery date (held until expiry)
 - Settled at end of contract
 - Delivery or final cash settlement usually take place
 - Some credit risk
- **Futures**
 - Traded on an exchange
 - Standardised
 - Range of delivery dates
 - Settled daily
 - Contract is usually closed out prior to maturity
 - Virtually no credit risk

FOREIGN EXCHANGE QUOTES

- Futures exchange rates are quoted as the number of USD per unit of the foreign currency
- Forward exchange rates are quoted in the same way as spot exchange rates
 - GBP, EUR, AUD and NZD are USD per unit of foreign currency
 - Other currencies (e.g. CAD and JPY) are quoted as units of the foreign currency per USD