

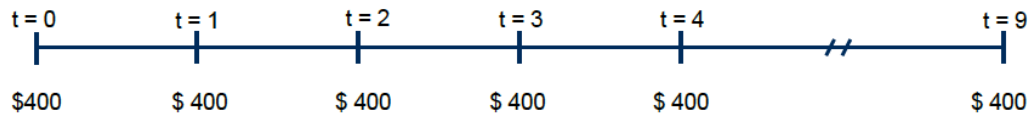
LECTURE 3 Examples:

Extended Examples

1. Annuity Due

- Annuity Due: An annuity for which the cash flows occur at the beginning of the period.
- Example: What is the PV of the following annuity due? Assume an interest rate of 10% per period.

› Timeline:

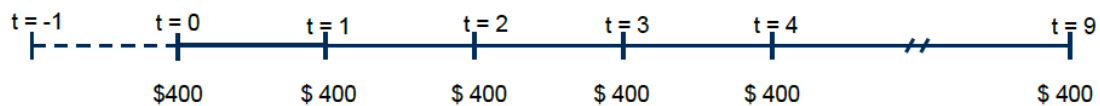


› These cash flows are equivalent to a 9 period annuity, with an extra payment at time 0.

$$\begin{aligned} PV_0 &= \frac{C_1}{r} \left(1 - \frac{1}{(1+r)^9} \right) + C_0 \\ &= \frac{\$400}{0.10} \left(1 - \frac{1}{(1+0.10)^9} \right) + \$400 = \$2,703.61 \end{aligned}$$

› Alternatively, use the annuity due formula:

$$\begin{aligned} PV_0 &= \frac{C_0}{r} \left(1 - \frac{1}{(1+r)^{10}} \right) \times (1+r) \\ &= \frac{\$400}{0.10} \left(1 - \frac{1}{(1+0.10)^{10}} \right) \times (1.10) = \$2,703.61 \end{aligned}$$



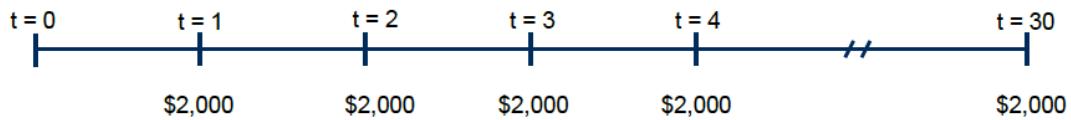
PV₋₁



2. Future Value of Annuity

- Example: You plan to deposit \$2000 into a retirement account that pays 8% interest per year. If your first deposit will be made one year from now, how large will your account be in 30 years?

› Timeline:



› Solution:

1. Find PV_0 (PV of annuity)

$$PV_0 = \frac{C_1}{r} \left(1 - \frac{1}{(1+r)^{30}} \right) = \frac{\$2,000}{0.08} \left(1 - \frac{1}{(1+0.08)^{30}} \right) = \$22,515.57$$

2. Find FV_{30} (single cash flow)

$$PV_0 = \frac{FV_n}{(1+r)^n}$$

$$FV_{30} = \$22,515.57 \times (1.08)^{30} = \$226,566.42$$

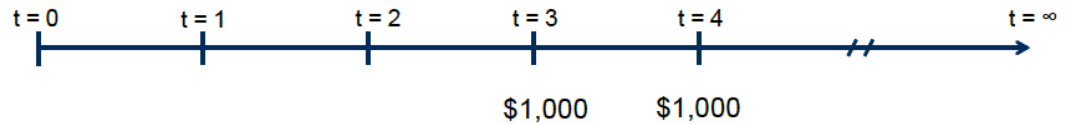
› Alternatively, use the future value of annuity formula:

$$\begin{aligned} FV_{30} &= C \left[\frac{(1+r)^{30} - 1}{r} \right] \\ &= \$2,000 \times \left(\frac{(1.08)^{30} - 1}{0.08} \right) \\ &= \$226,566.42 \end{aligned}$$

3. Delayed Perpetuity

- A perpetuity that begins at a date in the future
- Example: You plan to donate \$1000 to the university forever, begging 3 years from today. Assume an interest rate of 10%
- How much is your donation worth in Yr 2 and also today?

› Timeline:



1. Value in year 2 (PV of perpetuity):

$$PV_2 = \frac{C_3}{r} = \frac{\$1,000}{0.10} = \$10,000$$

2. Value today (PV of single cash flow):

$$PV_0 = \frac{PV_2}{(1+r)^2} = \frac{\$10,000}{(1.10)^2} = \$8,264.46$$

4. Two-Stage Model

- An investment makes payments annually. For the next 5 years, the payment is a constant \$360. In year 6, the investment pays \$400. The year 6 payment grows at a constant rate of 5% in perpetuity. What is the total present value of the investment's cash flows at a discount rate of 10%?

› See additional notes

$$\begin{aligned} PV_0 &= \frac{C_1}{r} \left(1 - \frac{1}{(1+r)^5} \right) + \frac{\frac{C_6}{r-g}}{(1+r)^5} \\ &= \frac{\$360}{0.10} \left(1 - \frac{1}{(1+0.10)^5} \right) + \frac{\frac{\$400}{0.10-0.05}}{(1+0.10)^5} \\ &= \$1,364.68 + \$4,967.37 \\ &= \$6,332 \end{aligned}$$

Interest Rates: APR, Effective and Periodic Rates

- Interest rates: Different Compounding Periods
 - There are many possible compounding periods that can be used depending on the nature of investments
 - Bonds generally pay interest semi-annually
 - Dividends on shares are often paid quarterly
 - Banks often pay interest on a daily basis

Interest Rates: APR and EAR

- **Key Concept:** The r used in your calculations must match the frequency of cash flows
 - If payments are made weekly, use a weekly rate
 - If payments are made monthly, use a monthly rate
 - If payments are made quarterly, use a quarterly rate
 - If payments are made annually, use an annual rate

APR, EAR and Periodic Rates

- Annual Percentage Rate (APR): this is the nominal, or quoted interest rate, which is quoted by financial institutions
 - E.g. 5% p.a. compounded monthly
- Periodic Rate: the interest rate per period
 - E.g. 0.5% per month, 2% per quarter
- Effective Rate: The rate of interest actually earned by investor
 - Effective Annual Rate (EAR): The total amount of interest that will be earned in one year

LECTURE 10

- **WHAT IS THE PURPOSE OF A MARKET?**
 - **POOLING RESOURCES FOR LARGE INVESTMENTS**
 - **TRANSFER RESOURCES THROUGH TIME AND SPACE**
 - **PROVIDE INFORMATION**
 - **TRANSFER RISKS**
 - **FACILITATE DIVERSIFICATION**
 - **CLEARING AND SETTLEMENT**
 - **MONITORING**
- **WHAT MAKES A QUALITY MARKET?**
 - **LIQUIDITY** – a liquid market is one in which a large amount of an asset can be traded without having a large impact on price
 - **TRADE OFF BETWEEN SELLING SOMETHING QUICKLY AND SELLING AT A GOOD PRICE**

- **INFORMATIONAL EFFICIENCY** – PRICES ACT AS SIGNALS IN DIRECTING SCARCE RESOURCES TO THEIR MOST EFFICIENT USERS.
 - IF PRICES ARE WRONG [TECH BOOM] INVESTMENT IS DISTORTED
- **INTEGRITY** – THE PERCEIVED FAIRNESS OF MARKETS
 - MOST REGULATORS HAVE MANDATES TO *ENSURE FAIR AND EFFICIENT MARKETS*
 - VIOLATIONS: INSIDER TRADING, MARKET MANIPULATION, BROKER-CLIENT CONFLICTS
- **PROCESS OF TRADING SHARES**
 1. INVESTOR CONTACTS A STOCKBROKER, WHO OPEN AN ACCOUNT FOR THE INVESTOR TO DEPOSIT FUNDS INTO
 2. INVESTOR PLACES AN ORDER WITH THE STOCKBROKER BY PHONE OR INTERNET [OR TRADE INITIATED BY AN ALGORITHM]
 - a. MOST EQUITY MARKETS ALLOW FOR TWO MAIN TYPES OF ORDERS
 - b. **LIMIT ORDER**
 - c. **MARKET ORDER**
 3. THE STOCKBROKER ATTEMPTS TO EXECUTE THE ORDER VIA A COUNTERPARTY
 4. SETTLEMENT TAKES PLACE, WHERE THE OWNERSHIP OF SHARES IS TRANSFERRED IN EXCHANGE FOR A TRANSFER OF CASH
- **MARKET PARTICIPANTS**
 - The major participants involved in share trading are:
 - The securities exchange, which provides the facilities for trading and acts as a self-regulatory body
 - The buying and selling parties, which could be individuals, institutions or fund managers
 - The broker, who provides trading services
- **Brokers** – either a conduit to the market or act as an agent to client
 - **Carry out:**
 - Agency trading – business transacted on behalf of clients
 - Principal trading – BUSINESS TRANSACTED ON THE BROKER'S OWN ACCOUNT [*TWO TYPES*]
 - **Facilitation** – the broker takes the opposite side of a trade to a client to complete a transaction
 - **House trading** – THE BROKER BUYS AND SELLS SHARES FOR THEIR OWN INVESTMENT PURPOSES.
- **FUND MANAGERS** – ORGANISATIONS THAT INVEST FUNDS [CASH] ON BEHALF OF THEIR CLIENTS
 - **TWO TYPES OF FUND MANAGERS**
 - **WHOLESALE** – TYPICALLY INVEST SUPERANNUATION CONTRIBUTIONS SOURCES FROM COMPANIES
 - **RETAIL** – OBTAIN CASH BY ISSUING SAVINGS POLICIES OR SELLING 'UNITS' [SIMILAR TO SHARES] DIRECT TO THE PUBLIC

- **INVESTORS ARE CHARGED INVESTMENT MANAGEMENT FEES TO COVER EXPENSES INCURRED IN THE INVESTMENT PROCESS.**
- **MAIN TYPES OF FUNDS ARE**
 - **ACTIVE – FUNDS ARE USED TO OUTPERFORM THE MARKET INDEX, BY BUYING AND SELLING SECURITIES IN AN ATTEMPT TO REALISE CAPITAL GAINS ARISING FROM MOVEMENTS IN SHARE PRICES**
 - **PASSIVE – FUNDS ARE USED TO EARN A RETURN SIMILAR TO THE MARKET INDEX, BY ADOPTING A *BUY AND HOLD* STRATEGY.**
- **TYPES OF ORDERS**
 - **LIMIT ORDER – AN ORDER THAT SPECIFIES A DIRECTION, QUANTITY AND ACCEPTABLE PRICE. E.G. 100 SHARES AT \$10 PER SHARE**
 - **EACH NEW LIMIT ORDER THAT ENTERS THE MARKET IS COMPARED TO THE EXISTING LIMIT ORDERS TO SEE IF THERE IS A MATCH. IF THERE IS A MATCH, TRADE OCCURS, IF NOT, IT ENTERS THE LIMIT ORDER BOOK.**
 - **MARKET MIGHT HAVE MULTIPLE LIMIT ORDER BOOKS, MANAGED BY BROKERS OR ENTITIES.**
 - **WHEN TRADING OCCURS ON A SINGLE LIMIT ORDER BOOK THE MARKET IS SAID TO BE ORGANISED AS A CONSOLIDATED LIMIT ORDER BOOK (**CLOB**).**
 - **SEQUENCING OF ORDERS IN THE LIMIT ORDER BOOK IS USUALLY GOVERNED BY PRICE THEN TIME.**
 - **HIGHEST BUY AND LOWEST SELL, AND THEN BY TIME.**
 - **MARKET ORDER – AN ORDER TO PURCHASE OR SELL SECURITIES AT THE BEST AVAILABLE PRICE IN THE MARKET**
 - **IF THE ORDER INVOLVES A LARGER QUANTITY THAN IS AVAILABLE AT THE BEST PRICE, THE ORDER MIGHT BE AT MULTIPLE PRICES. THIS IS KNOWN AS THE WALKING BOOK.**
 - **MARKET IMPACT COST – DIFFERENCE IN THE AVERAGE TRADE PRICE ($\text{PRICE} \times \text{QTY} / \text{QTY}$) AND BEST AVAILABLE PRICE**
 - **Limit orders**
 - **Supply liquidity by providing an option to trade**
 - Pros: Can achieve better execution price
 - Cons: Order may not execute at all; price may move away from the order and the order has to be revised to a less favourable price; waiting time
 - **Market orders**
 - **Consume liquidity by exercising option to trade**
 - Pros: Immediacy, avoids the non-execution risk of limit orders
 - Cons: By crossing the spread, you pay more for the execution

- In general, the less patient you are the more you pay for the trade
- **OTHER TYPES OF ORDER [SPECIALISED]**
 - **TIME-IN-FORCE** – SPECIFIES HOW LONG THE ORDER IS CONSIDERED TO BE ACTIVE
 - **IMMEDIATE-OR-CANCEL**: NEVER ENTERS THE LIMIT ORDER BOOK. IF IT CANNOT BE EXECUTED, IT LEAVES NO VISIBLE TRACE
 - **FILL OR KILL/ALL OR NOTHING**: THIS ORDER IS EXECUTED IN ITS ENTIRETY OR NOT AT ALL
 - **FILL AND KILL**: VALID ONLY FOR THE QUANTITY FILED AT SUBMISSION
 - **STOP LOSS**: A CONDITIONAL MARKET ORDER THAT IS TRIGGERED IF THE PRICE FALLS TO A PRE-SPECIFIED LEVEL.
 - **HIDDEN ORDERS** – ORDERS THAT DISPLAY NONE OF THE QUANTITY. THE HIDDEN ORDER IS AVAILABLE FOR EXECUTION AGAINST INCOMING ORDERS. THESE ORDERS USUALLY LOSE PRIORITY TO VISIBLE ORDERS TO ENCOURAGE TRANSPARENCY
 - **ICEBERG ORDERS** – ORDERS THAT DISPLAY A FRACTION OF THE QTY AND ONCE THIS EXECUTES, THE ORDER AUTOMATICALLY REPLENISHES THE VISIBLE POSTED VOLUME.
- **TYPES OF MARKET STRUCTURES**
 - **LIMIT ORDER VS DEALER MARKETS**
 - **LIMIT ORDER**: DOMINANT MARKET STRUCTURE FOR TRADING STOCKS
 - LIMIT ORDER BOOK MAINTAINS A LIST OF ALL UNEXECUTED LIMIT ORDERS
 - INVESTORS SUBMIT MARKET AND LIMIT ORDERS TO INTERACT WITH OTHER ORDERS EXISTING IN BOOK
 - **DEALER MARKETS** – QUOTE DRIVEN BECAUSE DEALER POST QUOTES THEN TRADERS DECIDE WHETHER TO TRADE, WHICH DIRECTION AND WHICH DEALER
 - INVESTORS CANNOT TRADE WITH EACH OTHER, ONLY THE DEALER
 - DEALERS COMPETE BASED ON THEIR QUOTES
 - OFTEN PHYSICALLY DISPERSED AND CONNECTED WITH TELEPHONE AND COMPUTER
 - *E.G. OVER THE COUNTER (OTC), FOREIGN EXCHANGE MARKETS, BONDS*
 - SOME EQUITY MARKETS ACT AS HYBRID MARKETS, WHICH HAVE DEALERS COMPETING WITH A LIMIT ORDER BOOK. *E.G. NYSE, NASDAQ.*
 - **UPDSTAIRS VS DOWNSTAIRS MARKETS**

- **UPSTAIRS MARKETS** – BROKER/DEALERS NEGOTIATE TRADES DIRECTLY WITH OTHER BROKER/DEALERS THEN REPORT THE TRADE TO EXCHANGE *BROKERS PHONE TO FIND COUNTERPARTIES*.
 - **OFTEN USED FOR LARGE BLOCK TRADES THAT WOULD OTHERWISE HAVE LARGE PRICE IMPACT ON THE MARKET**
 - **VERY OPAQUE PROCESS**
 - **TYPICALLY REPORTS TO THE EXCHANGE IMMEDIATELY AFTER THE TRADE IS COMPLETE**
 - **ALSO KNOWN AS OFF-EXCHANGE MARKET**
- **DOWNSTAIRS MARKET (ON EXCHANGE)** – REFERS TO LIMIT ORDER BOOK.
- **FLOOR/OPEN OUTCRY VS ELECTRONIC MARKETS**
 - **TRADES NEGOTIATED WITH SHOUTING HANDS AND SIGNALS**
 - **SOME MARKETS STILL HAVE A FLOOR, WHERE SOME TRANSACTIONS TAKE PLACE IN ADDITION TO AN ELECTRONIC PLATFORM *E.G. NYSE***
- **HIGH FREQUENCY TRADING**
 - High frequency trading (HFT) is a subset of algorithmic ('algo') trading. Algorithmic trading uses computer algorithms to decide on aspects of trade execution (e.g., timing, price, quantity and venue)
 - There are many definitions of HFT. Some characteristics of HFT include (ASIC, 2013):
 - It involves the use of sophisticated technological tools for pursuing a number of different strategies, ranging from market making to arbitrage;
 - It is a highly quantitative tool that employs algorithms along the whole investment chain: analysis of market data, deployment of appropriate trading strategies, minimisation of trading costs and execution of trades;
 - It is characterised by a high daily portfolio turnover and order-to-trade ratio (i.e. a large number of orders are cancelled in comparison to trades executed)
 - Positions are often held for as little as seconds or even fractions of a second;
 - It is mostly employed by proprietary trading firms or desks;
 - It is latency sensitive. The implementation and execution of successful HFT strategies depend crucially on the ability to be faster than competitors and to take advantage of services such as direct electronic access and co-location.
- **INFORMATION DISSEMINATION PROCEDURES**

- **STOCK EXCHANGES USUALLY MAINTAIN STRICT RULES REGARDING THE DISCLOSE OF INFORMATION TO MARKET PARTICIPANTS**
 - **ASX DISCLOSURE REQUIREMENTS**
 - **COMPANY “MATERIAL EFFECT” INFORMATION**
 - **MARKET SENSITIVE INFORMATION LEADS TO A TRADING HALT – IMMEDIATELY FOR 10 MINS**
 - **TAKEOVER ANNOUNCEMENTS – TRADING HALT – RADING TELY FOR 30 MINS**
- **TRADING HALT**
 - **DURING: NEW ORDERS CAN BE PLACED OR CANCELLED BUT OVERLAPPING ORDERS ARE NOT EXECUTED**
 - **AFTER: THE MARKET RESUMES TRADING AFTER A BRIEF OPENING PHASE, DETERMINING NEW PRICE**
- **SETTLEMENT PROCEDURES**
 - **THE PROCESS BY WHICH PAYMENT IS MADE BY THE BUYER TO THE SELLER AND SHARES (OWNERSHIP) ARE DELIVERED FROM THE SELLER TO THE BUYER.**
 - **USED TO INVOLVE THE TRANSFER OF SHARE CERTIFICATES**
 - **USUALLY CARRIED OUT BY A CLEARING HOUSE OWNED BY THE EXCHANGE**
 - **ON THE ASX, SETTLEMENT OCCURS IN T+3**
 - **TRADING DAY PLUS THREE WORKING DAYS.**