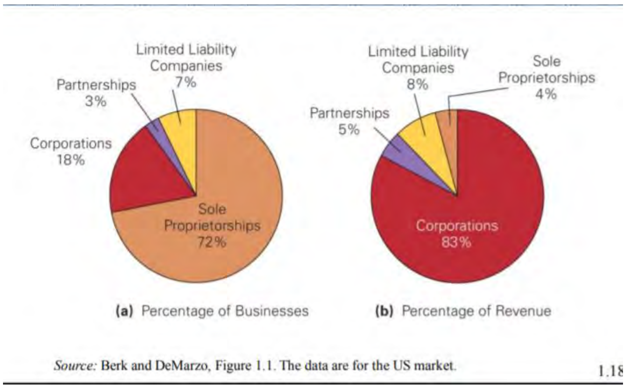
<u>Finance Lecture Notes</u>

Need Casio FX82 calculator (only one allowed)

Read financial press daily

Subject focusses on investment analysis and corporate finance



Main difference between sole proprietorship and corporations is that a sole proprietorship is purely operated by an individual rather than being beholden to shareholders. This is why:

- ❖ The main goal of management is to maximize the firm's market value of equity
  - ❖ Equity value = Present value of future expected cash flows
- ❖ Market value of equity = Share price × Number of shares
  - ❖ Maximizing the market value of equity is the same as maximizing the share price
- ❖ This maximizes the wealth of shareholders
  - ❖ Shareholder wealth = Present value of shareholders' future expected cash flows

In order to examine the goal of maximizing the market value of a firm's equity we need to understand three important concepts in Finance…

- ❖ The role of information and capital market efficiency
- ❖ The time value of money and interest rates
- ❖ Riskless arbitrage and the law of one price (more on this in future lectures)

❖ Capital market efficiency refers to the idea that the market prices we observe reflect all relevant information available at that point in time

The basic valuation principle states that if the value of benefits exceed the value of costs then the decision will increase the value of the firm

The correct approach takes the time value of money into account

- ❖ Value of the investment in year 1 (that is, the future value)…
  - ❖ Benefit in year 1 = $105,000
  - ❖ Cost in year 1 = 100000(1 + 0.08) = $108,000
  - ❖ Benefit – Cost = 105000 – 108000 = –$3,000 < 0
- ❖ Value of the investment today (that is, the present value)…
  - ❖ Benefit in year 0 = 105000/(1 + 0.08) = $97,222.22
  - ❖ Cost in year 0 = $100,000
  - ❖ Benefit – Cost = 97222.22 – 100000 = –$2,777.78 < 0
- ❖ Note: The net benefit above is referred to as the net present value

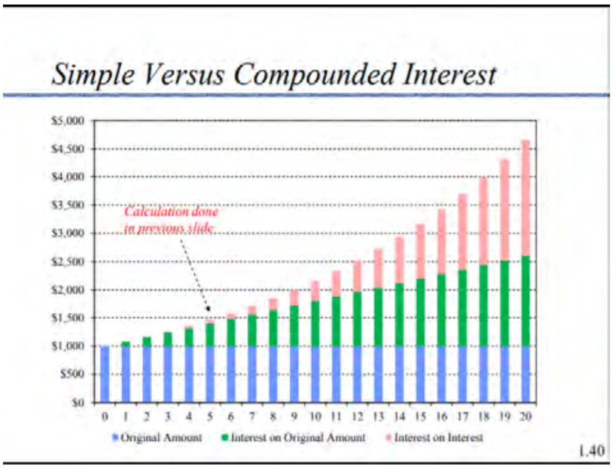
<u>Simple Interest</u>

Future value using simple interest,

$$FV_n = PV_0 \times (1 + n \times r)$$

❖ So, the present value today of a given future amount using simple interest is…
❖ PV0 = 1400/(1 + 5 × 0.08) = $1,000

<u>Compound Interest</u>



❖ Alternatively, we can do the calculation in a single step…
❖ Future value at the end of year 5 = 1000(1.08)5 = $1,469.33
❖ Note: $1,469.33 = $1,000 + $400 + $69.33 (see next slide)
❖ The amount of $69.33 is due to the compounding of interest ("interest on interest")

The future value (FVn) at r% p.a. of an amount (PV0) today is the dollar value to which it grows at the end of time period n

$$FV_n = PV_0 \times (1 + r)^n$$

Present value of a single cash flow works the same way as for simple interest:

$$PV_0 = FV_n \div (1 + r)^n$$

The values of 1/(1+r) gives the 'one-year discount factor', basically what 1 dollar will be worth a year from now.

<u>Key Rules</u>

❖ Rule 1: You can only compare or combine cash flows at the same point in time
❖ Rule 2: To move cash flows forward in time you must compound them
❖ Rule 3: To move cash flows back in time you must discount them
❖ Rule 4: The interest rate used to compound or discount cash flows must match the periodicity of those cash flows (more on this in week 3)

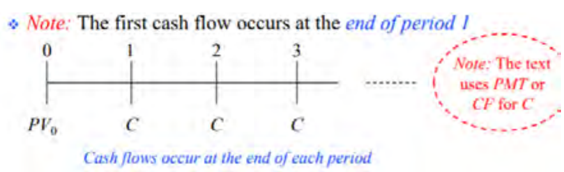
❖ A series of cash flows can be valued using the value additivity principle which states…

❖ The present (future) value of a series of cash flows is equal to the sum of the present (future) values of each cash flow

❖ The net present value of an investment resulting in a series of cash flows is defined as the present value of the cash inflows (benefits) minus the present value of the cash outflows (costs)

❖ NPV = PV(Cash inflows) – PV(Cash outflows), will be the same result regardless of working forwards to future values or backwards to present values.

❖ A perpetuity is an equal, periodic cash flow that goes on forever



$$PV_0 = \left(\frac{C}{r}\right)$$

❖ In general, the present value of a perpetuity deferred to the end of time n+1 is…

$$PV_0 = \left(\frac{C}{r}\right)\left(\frac{1}{(1+r)^n}\right)$$

Note: n rather than n+1

❖ An ordinary annuity is a series of equal, periodic cash flows occurring at the end of each period and lasting for n periods

❖ The present value of an ordinary annuity over n time periods is the difference between an ordinary perpetuity (starting at the end of period 1) and a deferred perpetuity (starting at the end of period n + 1).

$$PV_0(OA) = \left(\frac{C}{r}\right) \times \left(1 - \frac{1}{(1+r)^n}\right)$$

❖ This formula can be manipulated to provide the present value of a deferred annuity.

$$PV_0(DA) = \left(\frac{C}{r}\right) \times \left(1 - \frac{1}{(1+r)^n}\right) \div (1+r)^{n-1}$$

❖ The future value of an ordinary annuity can be obtained by compounding the present value above to the end of time period n as follows.

$$FV_n(OA) = \left(\frac{C}{r}\right) \times ((1+r)^n - 1)$$

❖ Unlike an ordinary annuity, an annuity due is a series of equal, periodic cash flows occurring at the beginning of each period

❖ The beginning of period n is the same as the end of period (n – 1). The overall effect is to move the annuity back one period on our standard (that is, end-of-period) time line

$$PV_0(AD) = \left(\frac{C}{r}\right) \times \left(1 - \frac{1}{(1+r)^n}\right) \times (1+r)$$

$$FV_n(AD) = \left(\frac{C}{r}\right) \times ((1+r)^n - 1) \times (1+r)$$

❖ A growing perpetuity is a series of periodic cash flows occurring at the end of each period and growing at a constant rate forever.

Cash flows occur at the end of each period

❖ A *constant* growth rate (g) in cash flows implies… *Note: n–1, not n!*

$$C_2 = C_1(1+g),\ C_3 = C_1(1+g)^2, \ldots, C_n = C_1(1+g)^{n-1}$$

❖ The present value of a growing perpetuity:

❖ N.B. It is possible for g < 0 (negative growth in cash flows), also future values of perpetuities obviously don't exist

$$PV_0(GP) = \left(\frac{C_1}{r-g}\right)$$

❖ The present value of a growing ordinary annuity over n time periods is…

$$PV_0(GA) = \left(\frac{C_1}{r-g}\right) \times \left(1 - \left(\frac{1+g}{1+r}\right)^n\right)$$

❖ The future value of a growing ordinary annuity at the end of n time periods is simply the present value compounded over that time horizon

$$FV_n(GA) = \left(\frac{C_1}{r-g}\right) \times \left(1 - \left(\frac{1+g}{1+r}\right)^n\right) \times (1+r)^n$$

❖ N.B. r<g is possible with this formula, r=g is also possible but not with this formula since the PV would be undefined

Valuation of Debt Securities

❖ The typical bank loan involves borrowing a sum of money with the promise to make regular payments to pay off the loan over a pre-determined time horizon. The interest rate payable can be fixed or variable. In Australia, the broad categories of bank loans are…

- ❖ Fixed rate loans (this is the focus in this subject)
- ❖ Variable rate loans

- ❖ Split rate loans
- ❖ Interest only loans
- ❖ Low doc loans

❖ The loan amortization schedule shows the interest paid, principal repaid and principal remaining over the loan's duration. It can be obtained as follows:

- The *loan amortization schedule* shows the interest paid, principal repaid and principal remaining over the loan's duration. It can be obtained as follows:
  - Interest paid = (Previous period's principal) × (Interest rate)
  - Principal repaid = Loan payment – Interest paid
  - Principal balance remaining = Previous period's principal – Principal repaid
- In year 1, we have…
  - Interest paid = 20000 × 0.10 = $2,000.00
  - Principal repaid = 6309.42 – 2000.00 = $4,309.42
  - Principal balance remaining = 20000.00 – 4309.62 = $15,690.58

Year	*Annual payment*	*Interest paid*[1]	*Principal repaid*[2]	*Principal remaining*[3]
0	–	–	–	$20,000.00
1	$6,309.42	$2,000.00	$4,309.42	$15,690.58 (i)
2	$6,309.42	$1,569.06 (ii)	$4,740.36	$10,950.22
3	$6,309.42	$1,095.02	$5,214.40 (iii)	$5,735.82
4	$6,309.42	$573.58	$5,735.84	$0.00
Totals	$25,237.66	$5,237.66	$20,000.00	

[1] Interest paid = Previous period's principal × Interest rate
[2] Principal repaid = Loan Payment – Interest paid
[3] Principal balance remaining = Previous period's principal – Principal repaid

❖ The effective annual interest rate (EAR or r_e) is the annualized rate that takes account of compounding within the year

- ❖ $r_e = (1 + \frac{r}{m})^m - 1$
- ❖ r is the annual percentage rate (APR) or the stated interest rate
- ❖ m is the compounding frequency: 1 for annual, 2 for semi-annual, 12 for monthly, and so on
- ❖ r/m is the per period interest rate taking into account the compounding frequency
- ❖ Note: Some markets use a 360 day year

❖ The effective annual rate with continuous compounding…

❖ $r_e = e^r - 1$

- Cash flows every two years; interest compounded quarterly requires first calculating the *effective annual* interest rate and then the *effective two-year* interest rate
  - Effective annual rate = $(1 + 0.12/4)^4 - 1 = 12.551\%$
  - Effective two-year rate = $(1 + 0.12551)^2 - 1 = 26.667\%$
- Cash flows every two years; interest compounded monthly requires first calculating the *effective annual* interest rate and then the *effective two-year* interest rate
  - Effective annual rate = $(1 + 0.12/12)^{12} - 1 = 12.6825\%$
  - Effective two-year rate = $(1 + 0.126825)^2 - 1 = 26.9734\%$

- *Recall Rule 4 from Week 1:* The interest rate used to compound or discount cash flows *must* match their periodicity
- Some examples (assume $r = 12\%$)…
- Annual cash flows; interest compounded annually, use 12%
- Monthly cash flows; interest compounded monthly, use 12/12 = 1%
- Quarterly cash flows; interest compounded quarterly, use 12/4 = 3%
- Annual cash flows; interest compounded quarterly requires calculating the *effective annual* interest rate
  - Effective annual rate, $r_e = (1 + 0.12/4)^4 - 1 = 12.551\%$

❖ The price of a security today is the present value of all future expected cash flows discounted at the "appropriate" required rate of return (or discount rate)

- ❖ Market price today, PV_0 = PV(Future expected cash flows)
- ❖ The valuation problem is to…
- ❖ Estimate the price; given the future cash flows and required rate of return, or
- ❖ Estimate the required rate of return; given the future cash flows and market price

- Short term debt instruments (or discount debt securities)
  - Mature within the year – typically in 90 and 180 days
  - Issuer has contractual obligation to make promised payment at maturity
  - *Examples:* Treasury Bills, Bank Bills, etc
- *Face (or maturity or par) value* is the dollar amount paid at maturity
  - Denoted as F_n (or FV_n)
- No other payments made to investors (that is, debtholders)
  - The interest (or return) earned by investors is implicit and equals the difference between the price paid (P_0) and face value (F_n)

- Long term debt instruments
- Mature after several years
- May or may not promise a regular interest (or coupon) payment
- Issuer has a contractual obligation to make *all* promised payments
- *Examples*
  - Treasury or Commonwealth bonds issued by the Commonwealth of Australia
  - Corporate bonds issued by companies