INSTITUTE OF ACTUARIAL & QUANTITATIVE STUDIES

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1 Valuation Methods for Different Investments

Market value

The **market value** of an asset varies constantly and can only be known with certainty at the date a transaction in the asset takes place. Even in an open market, an asset may be **quoted** at more than one figure at the same time.

However, for many traded securities it is an objective and easily obtained figure and is the starting point for asset valuation. Quoted securities have three prices associated with them:

- **Bid price** – the price at which the buyer is prepared to buy
- **Ask price or offer prices** – the price at which the seller is prepared to sell
- **Mid-market value** – the average of bid and offer price

In practice, the bid price should be assumed as the true market price as it gives a realistic valuation of the portfolio. Market prices are easily available, objective and can be easily understood by the common man.

1 Valuation Methods for Different Investments

There are certain **issues** that arise when using market prices:

- **Volatility** – in the short run, market values are **highly volatile** with **high fluctuations**, such that the changes in price may not always reflect the future expectations from the asset. Consequently, a particular asset may have extremely different market prices on different dates. For instance, gold valued at some price today, may have a way higher or lower market price the next day.

- **Achieving consistency** – this inconsistency in the market value of assets, makes valuing liabilities also difficult, unless they are valued in a manner which closely matches that of valuing assets. In this case like assets their values will also vary frequently.

- **No quoted price** – for quoted securities, determining market prices is quite straightforward, such as discounting of future dividends of equity. However, in the case of **unquoted investments** such as direct property investments or investments in start-ups.

1 Valuation Methods for Different Investments

Smoothed market value

Where market values are available, they can be **smoothed** by taking some form of **average** over a specified period to remove **daily fluctuations and reduce volatility**

Market values can be smoothed using several **methods** such as using a random walk, calculating a moving average or an exponential smoothing technique.

- A random walk smoothing assumes that future data points or future prices will be equal to the last available price data plus a random variable.
- A moving average method assumes that the value of an asset taken on a particular day is for instance the average of the market price over the previous two months
- An exponential smoothing technique works by taking a weighted average of the previous market values in a time series, with more weight given to the more recent values. The weight assigned to the previous value is determined by a smoothing factor, which is a parameter set by the user and it determines how the weight decreases as the time series moves further into the past

1 Valuation Methods for Different Investments

This method of valuing assets cannot be used for valuing liabilities, as the **appropriate discount rate** for the liability valuation is **indeterminate** and **requires judgement**. Judgement may be in terms of the length of the smoothing period, whether to use a one month or three-month period, the type of average to be used such as a simple average or a weighted average etc.

In practice the assessment becomes a view as to whether the asset is cheap or expensive in relation to its smoothed market value.

1 Valuation Methods for Different Investments

Fair value

There has been a shift towards market-based methods of valuation. Such as the fair valuation method.

A **fair value** is the amount at which an asset can be **traded**, or a **liability** settled between knowledgeable willing parties at arm's length, that is the buyer and seller both **freely agree on a price**.

Most of the times, an asset's fair value can be assumed to be its **market price**. As for assets which are not frequently traded, a **proxy fair value** may be used.

Fair value can be determined in the following manner:

- Using an indicative price from a market maker or dealer
- Using the assets most recent known price and adjusting it in line with a particular index
- Using a stochastic model

1 Valuation Methods for Different Investments

Discounted Cashflows

This method involves **discounting the expected future cashflows** from an investment using long term assumptions. It assumes that an asset's value is equal to the **present value** of the expected future income and capital from it. For instance, an equity value would be the present value of its expected future dividends, or the value of a property will be the expected rental income discounted to the present value.

An advantage of discounting cashflows method is that it can **easily** be used in **valuing liabilities**, where its consistency can be guaranteed if the same discounting rate is used for both assets and liabilities.
The success of this method largely depends on using an **appropriate discounting rate**. A suitable discounting rate can be established easily in the case of fixed interest bonds, but this is not always the case for other assets.

In case of high-risk assets, or those with poor marketability, a higher discounting rate is used, to place a lower value on its price. For example, the discounting rate used for corporate bonds will be higher than that used for government bonds because of poor marketability

1 Valuation Methods for Different Investments

Stochastic models

These are an extension of the discounted cashflow method in which the future cashflows and the interested rates are treated as **random variable**. For instance, cashflows can be assumed to follow an exponential distribution and interest rates a lognormal distribution.

The result of a stochastic valuation is a **distribution of values** from which the expected value and other statistics can be determined. This method is particularly appropriate in complicated cases where **future cashflows** are **dependent** on the exercise of **embedded options**, such as the option to wind up in adverse financial circumstances.

A stochastic model is appropriate when :

- Valuing derivatives
- Gives a distribution of results instead of a single value
- Is consistent with liability valuation.

However, they are complicated for certain applications and their results are largely dependent on assumptions about the distribution of the random variables, making the model subjective

1 Valuation Methods for Different Investments

Arbitrage value

It is a means of obtaining a **proxy market value** and is calculated by replicating the investment with a combination of other investments and applying the condition that in an efficient market the values must be equal. This technique is widely used in the **valuation of derivatives**, but for other assets, it is impossible to apply as replicating assets is difficult.

Historic book value

Book value is the price originally paid for the asset and is often used for fixed assets in published accounts. This method is favourable as it is objective, well understood and is also used for accounting purposes. However, it is not appropriate for most assets as it is historical.

1 Valuation Methods for Different Investments

Written up or written down book value

Under this method the **original book value** is **adjusted** periodically for movements in value. For example, adjusting property values every five years or the current market value or discounted cashflows may be adjusted.

Despite the adjustments made to the book value, the value comes nowhere close to that of the market value. Like book value method this method too is unsuitable for most of the assets, and unlike book value uses a subjective approach for valuation and is inconsistent with liability valuation.

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2 Valuing Individual Investments- Market Value

When an asset is traded in an **open market**, and published prices are freely available then the **market value** becomes a **reference point** or **yardstick** of measure for all other valuations. If there is no market price, then other methods of determining the best proxy for market value should be used.

The type of valuation method adopted largely depends on these factors:

- The general **aim** and **objective** of investment
- **Reasons for valuing** a particular investment
- The **type of asset** being valued

Having established a **market value** or a **proxy market value** on the valuation date, an actuary may then adopt an alternate asset valuation method, that suits their purpose of valuation. The main aim is to adopt a method that can be used for valuing both assets and liabilities.

It is important to establish a relation between assets and liabilities to make sound investment decisions. Unlike assets, liabilities do not have any market value attached to them. Hence the need for alternate valuation method arises.

2 Valuing Individual Investments- Market Value

Valuation starts by using a market value for assets or a proxy market value, and to ensure **equivalence** between the valuation of **assets** and **liabilities**, a market consistent method is then used to value liabilities.

Earlier, assets were valued in a manner, that was made to fit them to a predetermined value of liability. However, this method was disregarded as it resulted in neither assets nor liabilities being valued using an observable data.

A market consistent method of valuing liabilities would be one where a market consistent discount rate is used for discounting liabilities, so the value of assets and liabilities will react to a similar manner to any changes in the external environment such as taxation, inflation etc.

3 Market Values Compared with Calculated Values

Modern finance theory suggests that where an efficient market exists, the resulting market value will reflect all the **publicly available information** and is the underlying economic value of the asset at a given point in time.

Market value is subject to considerable fluctuations and its use largely depends on **market sentiments**, **investor behaviour** and mindset, as a result of which the assets intrinsic or underlying value becomes obscure.

However, any other valuation method used to identify the intrinsic value of the asset will involve an investment call as to the direction the market in that asset will move. Both the **market value** and the **calculated values** can be used as filters for selecting shares for sale or purchase for further consideration.
In practice there are a lot of other factors such as risk profile of assets, investor's attitude towards risk, his preferences, duration of investment etc, apart from market values that are considered before making buying or selling decisions.

List some examples of such other factors that determine the purchase or sale of an asset other than its market price.

3 Market Values Compared with Calculated Values

The investor needs be made aware of the **implications** of using any other calculated value other than the market value.

For example, if a smoothed market value is used , where smoothing of values has been done to a great extent, investors need to be informed that they will not necessarily obtain the same value at the time of the sale.

A smoothed market value may show that the investor is solvent, however at the time of asset realisation at market value, they may be insufficient in matching the liabilities. There are several methods for asset valuation, none of them being better than the others. The appropriateness of the method largely depends on the purpose of valuation.

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4 Bond Valuations

Discounted cashflow approach

Government or similar high-quality bonds can be valued by **discounting cashflows** at rates consistent with the **market spot rate yield curves**.
The market spot rate yield curve can be derived from zero coupon bonds or from government bonds. In developed countries, bonds may not necessarily suffer from default risk and low marketability, hence the yield can be assumed to be a risk free one.

Valuing bonds using option features

Many bonds have option features and are known as **callable** or **puttable** bonds
A **callable bond** is one where the bond issuer can choose to repay the bond at his discretion, and a **puttable bond** is one where the investor can demand the bonds repayment at his discretion.
Practically these bonds should be valued using an option pricing technique, but this is not always practiced.

Explain how the value of a callable bond compares with a similar bond without the call option.

5 Equity Valuation

Methods of valuation

Market value

Dividend discount model

Net asset value per share

Value added measures

Other equity valuation methods

5 Equity Valuation

Market value | Dividend discount model | Net asset value per share | Value added measures | Other equity valuation methods

Market value

The starting point for valuation of an individual equity is the **market value**, if there is a suitable market

Dividend discount models

Investors use this method for two purposes:

- To calculate the value of **unlisted shares** whose market value is not available,
- To check if the **market value is reasonable** and the shares aren't overpriced or underpriced.

The dividend discount model derives the value of the shares as the discounted value of the estimated future dividend stream. It is important to have appropriate assumptions.

5 Equity Valuation

Dividend discount models

A. General Model

The general model can be expressed as :

$$\boldsymbol{V = \sum D_t v(t)}$$

Where:
V is the value of the share
D_t is the gross amount of the t^{th} dividend payment
v(t) is the discount factor applied between time 0 and the time of the t^{th} dividend payment

Dividend discount models

B. Simplified Model

A simplified equation can be obtained by assuming:

- The dividends are payable annually with the next payment in one year's time
- That dividend grows at a constant rate ,g, per annum
- The required rate of return i, is independent of the time at which the payments are received
- i > g
- i and g are defined consistently i.e both include inflation or are net of inflation
- The dividend proceeds an be reinvested at i per annum
- No taxation or other expenses
- And like the general model, it is assumed that shares are held forever

With these assumptions the equation becomes:

$$\frac{D}{1+i} + D * \frac{1+g}{(1+i)^2} + D * \frac{(1+g)^2}{(1+i)^3} \dots$$

Where D is the dividend to be paid one year from now. We can simplify the model for the assessed value V of share as follows:

$$V = \frac{D}{1+i}\left(1 + \frac{(1+g)}{(1+i)} + \frac{(1+g)^2}{(1+i)^2} + \cdots\right)$$

$$= \frac{D}{1+i} * \frac{1}{1 - \frac{1+g}{1+i}}$$

$$= D * \frac{1}{(1+i) - (1+g)}$$

$$= \frac{D}{i-g}$$

5 Equity Valuation

Market value | Dividend discount model | Net asset value per share | Value added measures | Other equity valuation methods

Issues with using a simplified model

- The true value of **"I"** or the **rate of return** is unknown and assuming **"I"** to **remain constant** throughout the term is inappropriate, especially when the yield curve is volatile and is steeply sloping upwards or downwards. This can lead to equity being undervalued or overvalued.

  Thus, in order to calculate a value it is necessary to decide on an appropriate rate of return. This would often be calculated as the yield on long-term government bonds plus an appropriate addition for the riskiness of the income stream.

  Theoretically an investor would expect a **higher return from equity** than that achieved from government bonds to compensate for the:
  - Risk of **dividends** being reduced or not being paid and **loss of capital** at the time of company being wound up
  - The uncertainty of **returns** and **volatility** of share prices
  - Poor **marketability** and higher dealing **costs**

5 Equity Valuation

- We do not know the true value of the **growth rate**

  Using a constant growth rate is an **unrealistic assumption**. An alternative approach would be using dividends based on **profit forecasts** for the first few years, then apply a short-term rate of growth for a period until the growth rate settles down to a long-term average.

- The results derived are **sensitive** to the assumed rate of return and rate of growth.

- The equation ignores the effect of **tax** on dividend and capital gains. Tax paying investors should use dividends net of any tax applied.

- The model assumes that the **frequency** of dividend payments is on a yearly basis, when dividends may be paid on a semi-annually or quarterly basis.

- The model is useless if **g > i**

5 Equity Valuation

Market value | Dividend discount model | Net asset value per share | Value added measures | Other equity valuation methods

Net asset value per share

A company with significant **tangible assets** such as property, gold, cash etc. can use this method such as a property investment company.

This method is however of no use for companies with **high intangible** assets such as patents, copyrights and other intellectual property rights.

This approach is suitable for investment trusts, as they have several holdings in other assets, although the investment trust itself is a company.

5 Equity Valuation

Value added measures

Shareholder value is an attempt to get at the intrinsic or underlying value of an investment rather than its **accounting value**.

As an alternative, economic value added looks at one year's results and deducts the cost of servicing the capital that supports those results.

The rationale behind **EVA** is that, if it is positive, then the company has grown in terms of adding or creating value for the shareholders. This is ultimately reflected in the share price. Thus, EVA can be used as a measure of company's performance.

EVA acts as a bridge between quoted share value and accounting values, to give a framework for executive compensation schemes designed to produce results that increase shareholder value.

Other equity valuation methods

Where companies are **not making profits** and a **net asset valuation approach is inappropriate**, other methods have to be employed if a calculated valuation is required of an individual share.

All of the above methods are based on one of the following assumptions:

- The company pays **dividends**
- The company has **tangible assets**
- It is making **profits**.

In reality this may not always be the case, for the company may be a **start up** and is yet not declaring dividends, or the company has insufficient assets such as a pharmaceutical company, or the company might be loss making for a temporary period.

These methods often involve determining a relevant and measurable key factor for the company's business. The relationship between this factor and the market price for other quoted companies is then used as a basis for valuation. The factor used will depend on the business of the company.

6 Property Valuation

As with all investments, the **true market value** is only known when there is a **transaction** that equates a willing buyer with a willing seller. This happens **frequently with stocks** and shares that are actively traded on regulated markets, but **real property changes** happen **infrequently**, because of its low **marketability**.

One can get an estimate of a property's value based on the value of **similar properties** that have been transacted recently. However, the uniqueness of each property, makes drawing similarities between two properties in terms of value difficult, and thus considerable skill is needed to assess property market values.
Such valuations must be regarded as a matter of the **valuer's opinion** rather than facts, i.e. property valuation is **highly subjective** in nature.

Property can be valued using an **explicit discounted cashflow approach**, but like equities it is now more common to use a market-consistent valuation of liabilities.
The cashflows discounted should be net of any outgoings and should make explicit allowances for expected rental increases.

6 Property Valuation

Property values tend to be **stepped** in nature unlike equity which falls or rises smoothly and gradually over time. Property **rental income** stands at a level value for a given term and then step changes to a new level at the next rent review.

Allowance needs to be made if the **passing rent** is different from the current open market rental value. If the rent a property is earning is less or more than the rent prevailing in the market for similar properties, then it needs to be adjusted for.

The current rent will always be reviewed at the **next rent review**. If the current rent is greater than the open market rental value, then it should be known whether the lease allows a **downward rental review or not**

6 Property Valuation

Discount cashflow formula

$$R_0 \ddot{a}^{12}_{\overline{n_1}} + R_1 v^{n_1} \ddot{a}^{12}_{\overline{n_2-n_1}} + R_2 v^{n_2} \ddot{a}^{12}_{\overline{n_3-n_2}} + \cdots @\ i\%$$

Where,
R_0 is the initial rent
n_1, n_2, n_3 etc are the timings of the rent reviews
R_1, R_2 etc are the rent levels set at the rent review times
i is the discount rate or the required rate of return
The discount rate to be used should depend on the riskiness of the investment and could be based on the yield on a bond of suitable term, plus margins for factors such as risk and lack of marketability

Outline the factors that should be considered in determining a suitable margin to use in the discount rate.

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7 Valuation of Options, Futures and Swaps

Options and futures are usually valued using techniques based on the principle of '**no arbitrage**'. The value taken is the cost of **closing out the contract** by buying an equal and opposite option or future on current terms.

Arbitrage is the process of simultaneously buying and selling an asset from different platforms, exchanges or locations to cash in on the price differences and make a risk-free profit.

Where the market is efficient, the **principle of no arbitrage** implies that all equivalent assets need to be priced identically, otherwise it would be possible to buy cheaper and sell the dearer asset, thereby making an immediate risk-free profit.

Consider two parties A and B who have agreed to enter into an interest rate swap, where A has agreed to exchange its fixed interest payments, with B's variable interest rate payments. A rise in interest rates, will lead to A receiving more money in return for its fixed rate payments, and a fall in interest rates, will result in A receiving less money for the same fixed rate.

The discounting factor and short-term interest rate estimates are drawn from the appropriate yield curve. Simply put a swap can be considered as a series of bonds put together, or a series of forward agreements. And just like a forward agreement, a swap can also be valued.

8 Placing a Value on a Portfolio of Investments

A straightforward approach of **valuing a portfolio of investments** is to **sum the market values** of the individual holdings, or if there is no active market, then a proxy market value.
It is now being preferred to use methods and bases for the valuation of liabilities that are consistent with the market value of assets.

Purpose of Valuation
The method and basis for any actuarial valuation will depend on the **purpose** of valuation and the type of liability.

- Valuation for Regulatory Purposes

For certain supervisory valuations, the actuarial **method** and **basis** will be set out in **regulations**. In other cases there will be less prescription.

- Discontinuance Valuation

Sometimes companies assume the need of **immediate winding up**, in which case assets need to be sold on a real time basis and their value will be based on an immediate realisable value.
This means looking at the **realisable market value** i.e. the bid value and comparing it with the liabilities on a discontinuance basis. Example a pensioner buying an immediate annuity from his pension fund.

8 Placing a Value on a Portfolio of Investments

- Ongoing Valuation

Valuing liabilities on the assumption that the fund is **ongoing**, then assets must also be valued on the assumption that the investments are valued on an ongoing basis.
If liabilities are considered as a stream of cashflows such as mortgage payments, then assets should be valued using a discounted cashflow approach

<u>Need for Consistency when valuing assets and liabilities</u>
It is important that the valuation of **assets** and **liabilities** is **consistent**.
To achieve consistency means that if assets are valued at market values, then liabilities should be valued at appropriate market-based discount rates.
Along with consistency in approach, assets and liabilities should also be valued using the same interest rate, which would represent the long term expected returns on the assets held to back liabilities.

8 Placing a Value on a Portfolio of Investments

Alternatively, the following could be done where:

- A single interest rate to be used for discounting all future liabilities, and this rate would reflect the average rate of returns expected from the entire portfolio of assets
- Match assets and liabilities in terms of their nature and duration, and then discount each liability type by the average return expected on the matching assets.

It is known that **returns** and **risk** are **directly proportionate**. Therefore, it can be argued that the use of a single discount rate to value all assets and liabilities is inappropriate and different discount rates should be used depending on the risks within the assets and liabilities to be valued and possibly other factors such as marketability and term

8 Allowing for the Variability of Asset Prices

People assume that an **asset's volatility** is a cause of concern when determining its market value. However, **stability** is also not always a desirable feature of asset valuation, and that people prefer **consistency** over stability.

Volatility of an asset is not a problem in itself as it reflects the true market scenario and investor behaviour towards assets

However, with respect to the ongoing valuation of a long-term fund, such as equity, property etc, comparing volatile asset values with a value of liabilities calculated using a stable interest rate is potentially misleading. This happens because with volatility, the riskiness of an asset increases or decreases, and so does the expected return on it.

The problem with market value of assets is not the volatility of valuation, but the **inconsistency** of asset and liability valuation basis.
In some situations, **stability** is considered a desirable feature of asset valuation, as an **unstable valuation** makes it harder to communicate and interpret results
One possible solution is to modify the method of asset valuing to make it more stable and consistent with liability valuation calculated using stable assumption.

Topics covered

- Valuation methods for different investments
- Valuing individual investments – market value
- Market values compared with calculated values
- Valuation
- Bond valuation
- Equity valuation
- Property valuation
- Valuation of options, futures and swaps
- Placing a value on a portfolio of investments
- Allowing for variability of asset prices