Real Estate Investment Appraisal

Some Background Reading
Concepts and Definitions of Value

INTRODUCTION

To give you an idea of the contexts in which you will be applying the mathematics of investment, this brief note sets out the main role of valuations (and valuers). This section provides an introduction to the property investment appraisal section. It will focus on the aims and goals of the property valuer in the appraisal of individual property investment assets.

VALUATION

Property owners and investors may require valuations of their property assets for a number of purposes.

- Sale/acquisition process.
- Performance measurement.
- Public accounts.
- Lending.
- Insurance.

Valuation is essentially an attempt to estimate market price, the exchange price in the market place. The precise definition of market value has changed. What exactly is this? Open Market Value was defined by the RICS in the UK (up to May 2003) as:

"the best price at which a property might reasonably be expected to be sold at the date of valuation assuming:

(a) a willing seller

(b) a reasonable period in which to negotiate the sale taking into account the nature of the property and the state of the market"
(c) that values remain static during that period

(d) that the property will be exposed to the market and

(e) no account will be taken of any additional bid by a purchaser with a special interest"

This has now changed. It has become Market Value defined as

“The estimated amount for which a property should exchange on the date of the valuation between a willing buyer and a willing seller in an arm’s-length transaction after property marketing wherein the parties has each acted knowledgeably, prudently and without compulsion”

This is the internationally accepted definition of market value and is included in the International Valuation Standards.

**Key Point**

Across the world, the main basis of the assessment of market value involves the estimation of how much a purchaser is likely to receive for his or her property interest at a specific date.

**VALUE, WORTH, PRICE AND VALUATION**

There is no single, accepted definition of these terms in the valuation context. In the investment literature there are terms such as exchange value, use value, and investment value - all looking at value in a different manner. Market Value is concerned with estimated exchange price. It is a single point estimate of what the price of an asset would be if it exchanged in the market place. This estimate may be incorrect for two reasons. The price may exchange quite legitimately at a different price according to the particular purchaser and seller involved (price could be drawn from a distribution). The valuer might have a different opinion of what that price would be than either the price itself or another valuer’s estimate of that price (a distribution of valuations). The courts have agreed that valuations can vary and not valuing a property at the correct value as determined by the court does not make the valuation incorrect.
The market value is therefore the valuer’s estimate of the price a purchaser needs to pay to obtain an interest in property (valuers value interests in property, not properties). It makes no claim to rationality, only objectivity in the sense that it can sometimes be observed in the market place (when a transaction takes place). A market could misprice assets. The price that needs to be paid in the market place may not be the same as the price that should be paid, either according to the generality of purchasers in the market or according to a specific purchaser or the seller.

The words price, worth and value can be defined loosely as:

*Price* is THE MONETARY RETURN ACHIEVED IN THE MARKET. ie what a buyer has paid?

*Valuation* is AN ATTEMPT TO PREDICT THE LIKELY SELLING PRICE IN THE MARKET.

*Worth* can be defined in either of two ways:

1. Worth to the individual.
2. Worth to the market.

Up to May 2003, the RICS Red Book had a definition of Calculation of Worth which was tied to the concept of worth to the individual.

“The provision of a written estimate of the net monetary worth at a stated date of the benefits and costs of ownership of a specified interest in property to the instructing party, and reflecting the purpose(s) specified by that party”

Basically, it suggests that the value of an asset is dependent upon the individual investor’s particular investment criteria, for example planned holding period, target rate of return, loan facilities, portfolio make-up, etc.

There are also some commentaries that suggest that there is worth to a section of the market; for example similar institutional investors should have similar aspirations and the price of an asset does not always reflect these accurately. During the module, these concepts need some thought and investigation so that the
question of the appraisal is well understood. The basis of valuation is the question, the method represents the best way to answer the question.

From May 2003 onwards, the RICS has discontinued its own definition of Calculation of Worth and adopted the international definition of Investment Value which is:

*The value of the property to a particular investor, or class of investors, for identified investment objectives.*

This subjective concept relates specific property to a specific investor, group of investor, or entity with identifiable investment objectives and/or criteria. It covers both the individual and the group.

In an ideal (an economist would say efficient or perfect world) all these would be the same. Buyers would purchase investments at prices that reflected the underlying value of their future returns and valuers would be able to predict selling price with complete accuracy. In terms of worth, market participants will have different views on the value that an asset has to them. Some will be prepared to buy at relatively high prices, whilst others will only be prepared to buy at low prices. Similar issues apply to vendors. The price at which buyers agree to buy and sellers agree to sell will depend on the nature of the trading environment.

**Key Points**

Price is the actual realised price when a transaction takes place.

Market Valuation is an attempt to estimate the price at which an asset will sell at a given point in time.

Worth or Investment Value is the subjective process of estimating the value of an asset given the particular circumstances of viewpoints of individuals or relative to the market price.

It is commonly accepted that the three variables rarely coincide in the commercial property market.

**The Five Methods of Real Estate Valuation**
Although not covered in this module, it is important to be aware that there are five main categories or methods of real estate valuation. However, it is important to note that there are a number of variations (sub-categories) within each category. The purpose of this section is to make you aware that there are other approaches to valuation and to outline the basic methodology, usage and limitations of each approach. It is the income method that you shall spend most time studying over the next three years and in this module.

The five categories are generally termed the

- Income or investment method
- Residual method
- Comparison method
- Profits or accounts method
- Contractors or cost method.

They are generally used specifically for certain types of buildings. However, in some cases, they may be used as a ‘check’ on other methods. For instance in the US it is quite common for appraisers (as they are known in the US) to use three methods of appraisal when valuing commercial premises and then to ‘reconcile’ the (appraisals) valuations.

*The Income Approach*

There are a number of variations to the income approach. However, the investment method is essentially derived from share and bond valuation models. Essentially the value of an investment is viewed a product of its future income flow. Hence a share price is seen as the market’s view of the present value of the future dividend flow. Changes in the share price reflect changing market perceptions about the value of future (unknown) dividend flows. In turn the price of a bond reflects the market’s view of the present value of the future (known) coupon payments. Changes in the value of bonds will reflect changing market perceptions about the value of the right to receive future coupon payments.
Methodology

The value of a commercial property asset is viewed as the net present value of the right to receive future rental income. Note the introduction of term ‘net present value’.

In essence the income approach involves discounting future rental incomes to their present values and summatig.

The crucial variable affecting the value will be the rate at which future income streams are discounted.

Applications

It is used for rental income generating properties or properties that have the potential to generate rental incomes. In practice such properties are mainly in the industrial/warehousing, retail and office sectors.

Limitations

Given the role played by comparable evidence in this method, the quality of the valuation will depend on the quality of the market data. Hence the limitations of the comparison method will apply equally to the income approach.

The Residual Approach

The residual approach has been traditionally used for the valuation of land or buildings with redevelopment potential. As you shall see, it has been the subject of a great deal of criticism. In addition modern software allows more sophisticated methods to be used more widely.

At its most simple, the residual approach involves the basic calculation:

\[
Land \ Value = Development \ Value - (Development \ Cost + Profit)
\]

The basic rationale is that the amount that a developer will pay for a site is the difference between the cost of producing the product (building) (Including an
allowance for profit) and the value of the product (building) that they can put on the site.

**Limitations**

It is important to remember that the residual approach to land pricing emerged in a specific macro-economic and technological environment. In the inter war period, the economy was characterised by low inflation and relatively stable interest rates. Market conditions were not expected to change dramatically during the construction period. The residual approach’s popularity originated from several sources

(i) It is easy to use. Without a computer a cash flow approach will be time consuming.

(ii) It is quick - in the context of a non-PC environment

(iii) It is relatively easy to understand

The residual approach may still be appropriate for certain kinds of development scheme. However, because its underlying assumptions simplify the development process, problems of inaccuracy or mis-pricing are likely to occur where developments are complex.

The residual method of assessing the land value has been criticised by the Lands Tribunal as "far from a certain guide to values" and have suggested that "once valuers are let loose upon residual valuation, however honest the valuer however reasoned their arguments, they can prove almost anything".

With the result of the widespread use of computers and spreadsheet and the development of specialist software packages, residual appraisals are not used as much as they were in the past. A number of cash flow approaches have emerged which are able to examine the development variables in a much more logical fashion. They permit an explicit consideration of the timing of all expenditure and income involved in a development scheme. An alternative method of land pricing is the comparison approach. The Lands Tribunal has endorsed this method. This approach involves the analysis of land transactions. For instance, if land for
industrial use is selling at £600,000 per acre it is likely that you will have to pay this amount.

With current technology, there is no need to use a residual approach. However, it does provide a useful basis for checking that prices asked are feasible.

*The Comparison Method*

In the UK the comparison method is used mainly for the rental valuation of commercial premises and the capital valuation of residential properties. However, it is often used as a ‘check’ on the other methods. Indeed, in contrast to the UK, in a global context it is probably the most widely used for the valuation of most types of commercial properties.

The underlying methodology is relatively simple.

Market data in the form of transactions involving comparable properties is analysed to provide evidence of the market value of the subject property.

However, given the heterogeneous nature of property, comparable evidence will require will often require adjustment to allow for differences between the subject property and the comparables.

The quality of the market evidence will obviously be a key determinant of the reliability of this method. The two key issues are relevance and recency. Is the market evidence relevant to the subject property? Is the market evidence relatively recent?

How do valuers adjust for differences between properties? In some cases there are general ‘rules of thumb’ which are applied to such differences. However generally it is for the valuer to make subjective adjustments.

*Limitations*

The main limitation of the comparison approach concerns the quality of the inputs. The method relies on market data. This is problematic in England and Wales where there is no public record of property transactions and there is a tradition of confidentiality about data. Moreover, in the commercial sector, transactions
(especially) sales may be rare. This is especially true in recessionary markets when liquidity can decrease.

At a more fundamental level, the method is essentially retrospective. Previous transactions tell us how market conditions were - not how they are. Hence there is a belief that valuers are biased in that they tend to undervalue in a rising market and overvalue in a falling market and miss the true peaks and troughs of the property market (Lagging and Smoothing).

<table>
<thead>
<tr>
<th>Rising market</th>
<th>Falling market</th>
</tr>
</thead>
</table>
| ![Diagram](image)

Undervaluation? Overvaluation?

The next major problem concerns the adjustment process. Firstly ‘rules of thumb’ may not reflect the actual effects of differences between properties. For instance it is a common practice to make a 5% adjustment to a rent to reflect a variation in repairing obligation. Comparable property was let at £100 per sq.m. on an IRI basis. How much is subject property on FRI basis? £95? In reality the extra burden to the tenant of responsibility for external repairs will depend on the condition and construction of the building. Secondly, subjective adjustment by valuers will mean that there is inconsistency in adjustment and as a result uncertainty in valuation.

*Contractors or Cost Method*

This method is typically used for buildings for which there are effectively no market but which still require a valuation. They will generally be held on a freehold basis and will have a specialised function. Most will tend to be purpose built to fit the requirements of the operator. As a result there is often no or a very limited market. They include:
Specialised operational property for instance power stations, other major utilities’ premises

Non-commercial or (partially commercial) local authority of government property eg. Schools, hospitals, leisure centres, police stations.

Unusual or unique properties for which there are no comparables and no profits generated eg. Churches, museums.

The contractors method is also the main method used in valuations for insurance purposes.

In the US the cost approach is used for the appraisal of all types of commercial property assets. There is a belief that the cost of replacing a building should not diverge from its exchange value.

The basic methodology of the cost approach is to calculate the cost of replacing the building including the land deducting an appropriate allowance for depreciation and obsolescence.

Review question What is the difference between obsolescence and depreciation?

Hence

\[ CB + CL - D = EV \]

\( CB = \) cost of building

\( CL = \) cost of land

\( D = \) depreciation allowance

\( EV = \) existing value

Example

\[
\begin{array}{lrl}
\text{Value of land} & \text{\pounds200,000} \\
\text{Cost of new building} & \text{\pounds500,000} \\
\text{Less depreciation(estimated at 15\% of CB)} & \text{-\pounds75,000} \\
\hline \\
\text{\pounds625,000} \\
\end{array}
\]
It is closely related to Depreciated Replacement Cost. This is defined in the 2003
RICS Red Book as:

*A method of valuation which provides a proxy for the market value
of specialised properties. It is an estimate of the market value for
the existing use of the land plus the current gross replacement (or
reproduction) cost of improvements less allowances for physical
deterioration and all relevant forms obsolescence and optimization.*

Limitations

For all valuation methods the quality of the output depends on the quality of the
inputs. It is generally viewed as the method of last resort in the UK. Whilst the
cost of rebuilding can be estimated with relative accuracy by using construction
costs data sources. The other inputs are more problematic.

Depreciation is very difficult to estimate and allowance will tend to be subjective.
Hence Mendel confirms most comments on the topic in suggesting that

“Although appraisal theory includes various techniques for estimating depreciation through analysis of comparable sales in the
market, for all practical purposes depreciation is extremely difficult
to identify in this way. Part of the problem is that the market does
not identify depreciation in any particular way….” (Mendel, 1997, p.
54).

The accurate estimation of land value is also a problem.

*The Profits Method*

The Profits or Accounts Method is typically used for the valuation of commercial
property assets in which the operational business and the premises are inextricably
linked. The most common types include public houses, hotels, restaurants,
cinemas, petrol filling stations and other types of leisure premises.

The basic approach is to calculate a rent that is then capitalised at a rate which is
obtained from market comparables. The rent is taken to be a function of the
earning capacity of the business. The formula is
Gross Profit – (Net profit + Tenant allowance) = Rent

Where

Gross Profit = Gross earnings less purchases

Net profit = Gross profit less operating expenses

Tenant allowance = Amount to cover tenant’s wages, interest on capital investment and risk allowance

Freehold Value = Rent/Capitalisation factor

Obviously, it will be important that details of these variables are available. Normally the valuer will rely on the trading accounts produced over a period of years. See textbooks for examples of the method.

Limitations

The main limitation of the profits method is its retrospective nature. By relying on historic accounts, it involves an implicit assumption that previous trading figures reflect current trading conditions. This may not be the case and may result in valuation inaccuracy.

It requires a judgement concerning whether the premises are trading in a ‘normal’ manner. Otherwise there is a danger that poorly managed premises will be undervalued and excellently managed premises will be overvalued. Again this introduces subjectivity into the process.

The accuracy of the profits method has been the topic of some controversy, particularly in the hotel and public house sector. It is often supplemented by a comparison approach.

For an hotel – price per bedroom
For a cinema – price per seat
For a public house – price per sq. m.
For hotels, a DCF approach is often used as an alternative.
PROPERTY AND THE PROPERTY MARKET: SOME BASICS

INTRODUCTION

The aim of this section is to introduce some basic terms and concepts used in the UK real estate sector and the main actors in the sector. This section examines:-

- some key terms and concepts;
- property types and professions; and
- the interaction between planning and the development process
- the role of lease structures

LAND AND PROPERTY: TERMS AND CHARACTERISTICS

There are two main types of legal interests in land.

Freehold (Feuhold in Scotland) - This is the legal interest in land which is held by the owner of the land.

Leasehold - This is the interest in land or property held by the tenant who lets the property from the landlord (who is usually the freeholder).

Leaseholders can be occupiers or investors and therefore properties can have multiple interests; freeholders, leaseholders, sub-leaseholders, etc and varying numbers of each (including joint ownership of individual interests) The appraisal questions can therefore be many and varied. In the course we shall develop typical freehold and investment and occupational leasehold interests.

Occupational leases are vital to the value of investment property. Up to 1990, the typical lease term for better quality commercial property was a standard term of 20-25 years with upwardly only rent reviews to Market Rental Value (termed MRV/ERV/CRV) every five years on a full repairing and insuring lease. Since then, there has been much more diversity of lease terms with 10-15 years the average for the better quality commercial property but a wider range around this average. Despite Government pressure for change, the upwards-only rent review has survived and this has significant implications for the appraisal of property interests. In many cases appraisal is a combination of the lease value plus a
property residual value after the lease terminates and therefore the nature of lease terms and occupational tenants has significant effects on the value of UK property.

There are also much longer term leases for building/development purposes. For example, many local authority city centre shopping schemes involve long term leases of the ground for 125 or even 999 years let to developers. Assuming that the lease includes the appropriate terms, the local authority is able retain more control of the future of the site. The developer lets to the occupational tenants and thereby has an investment leasehold interest.

Given the importance of leases to value, restructuring leases can have significant value implications and can enhance the value of all the interests in the property. We are therefore going to spend quite a lot of time talking about leases and tenants as well as land and buildings.

**PROPERTY TYPES**

Figure 1 provides a classification of the various sub-sectors of the commercial property investment universe.

Figure1
Commercial Property Market Sectors

<table>
<thead>
<tr>
<th>Office</th>
<th>Retail</th>
<th>Industrial</th>
<th>Leisure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Town centre</td>
<td>Shopping centre</td>
<td>Manufacturing</td>
<td>Public house</td>
</tr>
<tr>
<td>Business Park</td>
<td>Town centre</td>
<td>Distribution</td>
<td>Cinema</td>
</tr>
<tr>
<td>Serviced offices</td>
<td>Out-of-town</td>
<td>Hi-tech</td>
<td>Hotels</td>
</tr>
<tr>
<td></td>
<td>Retail warehouse</td>
<td></td>
<td>Theme park</td>
</tr>
</tbody>
</table>

Prime? Secondary? Tertiary?
STATE INTERVENTION AND THE PROPERTY INVESTMENT PROCESS

The introduction of government legislation can affect the value of property investments. The legislation can affect buildings (health and safety), leases (Landlord and Tenant Acts) or Planning.

The right of occupying business tenants to renew leases under the Landlord and Tenant Act 1954 and a number of changes to Stamp Duty in the last four years both impact directly on the appraisal. It is now 4% for properties with values in excess of £500,000. This increases the costs to purchasers. Given that investors price property by discounting projected net cash flows at a target rate of return, the increase in stamp duty effectively increases costs, lowers cash flows and produces lower bid/valuations.

COMMERCIAL PROPERTY – INVESTMENT QUALITIES

A number of points have already been made about property which affect its investment characteristics. In comparison with other homes for investment funds such as Government and Corporate Bonds and the UK and overseas share markets;

1. Property is relatively illiquid. This can be attributed to a number of factors:

   (a) It is lumpy. It is not usual to sell small pieces of a property investment. Therefore the investor must make a substantial capital outlay in order to enter the market. This is often termed the lotting problem

   (b) It has high transaction costs. It costs approximately 5.75% of the transaction price to buy commercial property. These are substantial costs relative to gilts and shares.

   (c) There is no central market place. Property is traded in a series of geographical sub-markets. The absence of a central market place means that marketing is required before sale.
(d) Property markets are thin. There is a relatively small number of potential buyers for each property put on the market and the market thins even further in downturns/weak selling markets.

(e) Property is also characterised by lengthy transfer procedures. It often takes months to undertake the legal work necessary to transfer a property.

(f) Related to the above, most property transactions take place by private treaty. This requires negotiations which may be protracted.

There are other factors that differentiate it from the other asset classes.

2 There is imperfect information in the property market. Few countries possess a publicly available register of property transactions - leasehold or freehold. The result is that information is a relatively scarce. In the UK there is a tradition of confidentiality about transactions. Moreover, in recessionary markets, there tend to be fewer sales and lettings. This again may result in a lack of comparable evidence for the valuer. This is significant given the role that such evidence plays in the valuation process.

3 The property sector is heterogeneous. Each property will be unique given the inherent exclusiveness of its location. In addition, properties will differ in terms of construction, lease terms and quality of covenant (financial strength of the tenant). This is in contrast to the bond or equity markets where a share in a major company is identical to all the other shares in that company. This further enhances the problem of valuing properties where direct comparables are required since every property is different.

4 Supply is relatively inelastic. It takes a long time to create new investment products. This can produce market disequilibrium.

5 Property is a physical asset and prone to obsolescence and depreciation. These two concepts explain the rationale for redevelopment. Redevelopment will tend to occur when the value of redeveloped land or premises exceeds the existing use value.
Background Reading


Introducing Appraisal Mathematics

Introduction

This section introduces the basic mathematical principles and techniques underpinning investment appraisal. Its aim is to provide some revision to the basic financial mathematics and formulae which are necessary for the purposes of performing market valuations and investment analyses. These concepts provide the foundation for the techniques and approaches which will be discussed in the course.

Compound Interest

The basis of compound interest concerns the accumulation of interest on an original capital sum invested and the interest on the accumulated interest. In property it is termed the amount of £1. It is best illustrated by example. How much will £100 be worth after 1 year if invested at a rate of 5%?

\[
= (1 + 0.05)^1 \times £100
= £100 \times 1.05
= £105
\]

How much will £100 accumulate to after 2 years invested at 5% per annum.

After the first year the capital sum produced is £105

\[
= (1 + 0.05)^1 \times £100
\]

After the second year the sum produced is £110.25

\[
£105 \times (1 + 0.05)^1
= £110.25
\]

OR

\[
£100 \times (1.05)^2
= £110.25
\]

How much will £100 invested at 8% per annum accumulate to after 4 years?

\[
= (1 + i)^n \times £100
= (1 + 0.08)^4 \times £100
= 1.3605 \times £100
\]
Discounting and the Time Value of Money

The basis of investment appraisal lies in the maxim that money in the future is worth less than money today. This is because money in the future will lose some of its purchasing power due to inflation and there is an opportunity cost. It would also be possible to invest money today and receive an investment return. The further money is to be received in the future, the less valuable it becomes. The inherent value in an investment lies in its future returns.

The problem is how to compare different incomes which are received at different points in the future. Is £500 next year better that £550 in two years time? How do we compare these two investment opportunities? A useful way of seeing the problem is in terms of different currencies. Let us say we are offered the choice between €1500, $2000 American dollars, $10,000 HK, 150,000 Japanese yen and £900 sterling. How do we decide which is the best? Obviously, we convert them to a common currency and decide which is the most valuable.

In the same way, if we are offered income at different points in the future, we convert them to a common currency. In this case the currency is called present value. Income in the future is discounted to its present value. The formula logically is the inverse of the compound interest formula (the amount of £1). It is conventionally termed the present value of £1. The formula is:

\[
PV \text{ of } £1 = \frac{1}{(1+i)^n} \text{ or } (1+i)^{-n}
\]

Let us return to the original example but instead ask the question how much are we prepared to pay for the right to receive £100 in one years time. The answer to this question will depend on our choice of discount rate. Let us say that we could obtain a 5% return risk free. Therefore, we are prepared to pay:

\[
= \frac{1}{(1+0.05)^1} \times £100 = 0.9524 \times £100 = £95.24
\]
Hence, if an investor requires a return of 5%, he or she would pay £95.24 for the right to receive £100 in one year. Returning to the example above, now it becomes apparent how we decide between £500 next year or £550 in two years time. Let us assume a 5% discount rate.

\[
\begin{align*}
1 & \quad \text{£500 next year} & 2 & \quad \text{£550 in two years time} \\
\text{PV} &= \frac{1}{(1+0.05)^1} \times \text{£500} & \text{PV} &= \frac{1}{(1+0.05)^2} \times \text{£550} \\
\text{PV} &= 0.9526 \times \text{£500} & \text{PV} &= 0.9070 \times \text{£550} \\
\text{PV} &= \text{£476.30} & \text{PV} &= \text{£498.85}
\end{align*}
\]

The £550 in two years time has the highest present value and this would be selected by a rational investor. However, if we change the discount rate to 15%, the decision changes.

\[
\begin{align*}
1 & \quad \text{£500 next year} & 2 & \quad \text{£550 in two years time} \\
\text{PV} &= \frac{1}{(1+0.15)^1} \times \text{£500} & \text{PV} &= \frac{1}{(1+0.15)^2} \times \text{£550} \\
\text{PV} &= 0.8696 \times \text{£500} & \text{PV} &= 0.7561 \times \text{£550} \\
\text{PV} &= \text{£434.78} & \text{PV} &= \text{£415.88}
\end{align*}
\]

In this case the decision changes to opting for the £500 next year. There are two further points to note. Firstly, there are dramatic reductions in present values as the discount rate increases. Secondly, this means that the farther in the future, the more the decrease in value becomes.

To put this rather abstract introduction to valuation mathematics into the property context, when buying a property for investment purposes, the investor is paying for the right to receive future rental income. Hence, a valuation can be seen as discounting a series of rental incomes to their present value and adding them together.

**Capitalising Future Rental Income**

When a valuer is appraising a property investment they are *capitalising* future incomes. Capitalisation has been defined as "the expression of future benefits in terms of their present worth" (Baum and Mackmin, 1981, p58).
As we will see, when carrying out a valuation, the valuer is giving a capital value to future rental income flows. How then do we capitalise the right to receive a fixed flow of income? Logically we use the present value formula.

\[ CV = \frac{RI}{1+i} + \frac{RI}{(1+i)^2} + \frac{RI}{(1+i)^3} + \ldots + \frac{RI}{(1+i)^n} \]

RI = Rental Income  
CV = Capital Value  
i = Discount Rate

However, for a fixed number of years this summates to:-

\[ CV = RI \times \frac{1}{i} \times \frac{1}{(1+i)^n} \]

This is termed the present value of £1 per annum. Again its use is best illustrated by example. What is the value of a rental income of £50,000 per annum receivable annually in arrears for the next four years at a discount rate of 10%? We could use a rather long winded approach and present value each individual element of the income.

<table>
<thead>
<tr>
<th>Year</th>
<th>Income</th>
<th>PV Factor @ 10%</th>
<th>Discounted Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>£50000</td>
<td>0.9091</td>
<td>£45454.54</td>
</tr>
<tr>
<td>2</td>
<td>£50000</td>
<td>0.8264</td>
<td>£41322.31</td>
</tr>
<tr>
<td>3</td>
<td>£50000</td>
<td>0.7513</td>
<td>£37565.74</td>
</tr>
<tr>
<td>4</td>
<td>£50000</td>
<td>0.6830</td>
<td>£34150.67</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>3.1698</td>
<td>£158493.26</td>
</tr>
</tbody>
</table>

Or we could use the formula.

\[ CV = RI \times \frac{1}{i} \times \frac{1}{(1+i)^n} \]

\[ = 3.1699 \times £50000 \]

\[ = £158495 \]

(differences due to rounding error)

In the UK the multiplier 3.1699 is sometimes referred to as the YP or Years Purchase factor. This is a term commonly used in property valuation. It refers to the number of years income it takes to recover the capital outlay. In this case a capital outlay of £158,495 is recovered in 3.1699 years.
What we have illustrated so far is how to discount an income for `n' years. What if the income is in perpetuity? The formula in this case is simple.

\[ YP \text{ in perpetuity} = \frac{1}{i} \]

where \( i \) = discount rate.

This is the same formula as the present value of £1 per annum. However, as \( n \) tends to infinity, the \( \frac{1}{(1+i)^n} \) tends to zero leaving \( \frac{1}{i} \). Hence how much should we pay for the right to receive £50,000 per annum in perpetuity assuming a discount rate of 10%?

\[
\begin{align*}
1/0.1 & \times £50000 \\
10 & \times £50000 \\
\text{=} & \text{ £500,000}
\end{align*}
\]

In this case all future income has been discounted at 10%. It is pointed out that the vast majority of an investment's return in present value terms is in the first 50 years. The right to receive £50,000 in 100 years discounted at 10% per annum is worth just over £3 in today terms. Before going on to look at the specific case of property investment and how property is valued, broader methods of investment appraisal are considered.

**Discounted Cash Flow – IRR, GPV and NPV**

The most common method of appraising investment opportunities is through the use of discounted cash flows which can be used to produce Gross Present Value, Net Present Value (NPV) and Internal Rate of Return (IRR). NPV and IRR are common methods of deciding between competing investment opportunities. What is provided in Figure1 is an example of a discounted cash flow. A discounted cash flow analysis involves the explicit tabulation of all income and outgoings and enables all assumptions about future costs and income to be illustrated. All cash flows are discounted back to present values at a discount rate. Definitions (taken from the glossary of terms in the RICS Information Paper on Calculation of Worth) of the three main output variables are outlined below

**Discounted Cash Flow (DCF)**  Technique used in investment and development appraisal whereby future inflows and outflows of cash associated with a particular project are expressed in present-day terms by discounting.

**Gross Present Value (GPV)**  The discounted or present value of a series of future cash flows where the initial outlay is NOT included as an outflow. The GPV is therefore the ‘Worth’ of the cash flow at the investor’s target rate of return.
Net Present Value (NPV)
The discounted or present value of a series of future cash flows where the initial outlay is included as an outflow. The NPV is therefore the surplus or deficit present valued monetary sum above or below the initial outlay (purchase price)

Internal Rate of Return (IRR)
The rate of interest (expressed as a percentage) at which all future cash flows (positive and negative) must be discounted in order that the net present value of those cash flows should be equal to zero.

A simple example is considered below in order to give the reader an understanding of the methodology.

An investor is offered the choice between two investment opportunities.

1) In return for an initial payment of £1000 the investor is offered the right to receive £100 annually in arrears for five years plus a lump sum of £1500 at the end of year 5.

2) In return for an initial payment of £11000 the investor is offered the right to receive £1000 annually in arrears for five years plus a lump sum of £15000 at the end of year 5.

Which is the best investment? This can be judged by calculating the NPV and IRR of the two alternative investment opportunities. Let us assume a target rate of return of 10%.

Figures 1 and 2 illustrate the income flow that is produced. NPV is calculated for both investment opportunities. It is clear that the investor should choose Investment 2 on the basis of the example outlined above.

The Internal Rate of Return is most simply defined as the discount rate at which the Net Present Value equals zero. In Figure 1, the income streams have been discounted at 10% and 20%. At 10% the NPV is positive at 20% it is negative. Consequently, the IRR must fall somewhere in between 10% and 20%. A formula is presented below for calculating the Internal Rate of Return.
### Figure 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Out</th>
<th>In</th>
<th>Net</th>
<th>PV factor at 10%</th>
<th>Discounted sum</th>
</tr>
</thead>
<tbody>
<tr>
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<td>-1000</td>
<td>1.00</td>
<td>-1000.00</td>
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</tr>
<tr>
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<td>82.64</td>
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<tr>
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<td>100</td>
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<td>68.30</td>
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<tr>
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<td>1600</td>
<td>0.62</td>
<td>993.47</td>
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</tr>
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</table>

**IRR** 17.11%  310.46  
**NPV @ 10%** 310.46  
**NPV @ 20%** -98.12

### Figure 2

<table>
<thead>
<tr>
<th>Year</th>
<th>Out</th>
<th>In</th>
<th>Net</th>
<th>PV factor at 10%</th>
<th>Discounted sum</th>
</tr>
</thead>
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<tr>
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<td>16000</td>
<td>0.62</td>
<td>9934.74</td>
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</tbody>
</table>

**IRR** 14.53%  2104.61  
**NPV @ 10%** 2104.61  
**NPV @ 20%** -1981.22

The IRR can be calculated using graphical interpolation or the formula

\[
IRR = LR + \left[ HR - LR \times \left( \frac{NPV_{HR}}{NPV_{LR}} \right) \right]
\]

Where

- **IRR** = Internal Rate of Return
- **LR** = Lower rate
- **HR** = Higher rate
- **NPV_{HR}** = Net Present Value at higher rate
- **NPV_{LR}** = Net Present Value at lower rate

**NB – Negative signs are ignored.**

\[
IRR = 10\% + 10 \times \left[ \frac{310.46}{310.46 + 98.12} \right]
\]

\[
IRR = 10\% + 10 \times \left[ \frac{310.46}{408.58} \right]
\]
\[ IRR = 10 + 7.60 \]
\[ IRR = 17.60\% \]

\[ IRR = 10\% + \left[ 10 \times \left( \frac{2104.61}{2104.61 + 1981.22} \right) \right] \]

\[ IRR = 10\% + \left[ 10 \times \left( \frac{2104.61}{4085.83} \right) \right] \]
\[ IRR = 10 + 5.15 \]
\[ IRR = 15.15\% \]

You should note that the examples have been calculated using a personal computer and a spreadsheet. This is by far the easiest way to carry out this type of exercise. Most spreadsheet software will contain a NPV and IRR function. It is therefore rarely necessary to calculate these figures 'by hand'.

In the example above, interestingly Investment 1 offers the highest IRR of the two schemes. However, using the NPV criteria an investor would select Investment 2. There is an academic debate about the best criterion for investment appraisal (see Lumby 1988). Another issue is the fact that interpolation by formula is prone to inaccuracy. This is due to the assumption of linearity. This reinforces the case for calculating by spreadsheet.

When NPV and IRR produce conflicting decisions, there is often a problem of scale. How do we choose between large initial outlays with a large NPV and a low IRR and small initial outlays with a small NPV and a high IRR? Given the aim to maximise shareholders' wealth, the literature basically finds that NPV is accepted as the only criterion that is always consistent with this principle. NPV is the only technique that can be relied upon to give advice that will lead to the maximising of shareholders' wealth. However, there is an issue of independent and mutually exclusive investment opportunities.

- Independent investments are those that permit the manager to choose all or any. The general rule is that IRR works with single, independent investments
but can produce sub-optimal decisions when alternative investments are involved (which they usually are).

- Mutually exclusive projects are a set from which only one can be chosen. For mutually exclusive investments, in order to maximise wealth we should rank according to NPV.

An important principle is value-additivity. The value of a firm is the aggregate value of its assets or projects. The objective should be to maximise this value. Essentially using the IRR as a criterion can result in decisions which can fail to maximise the value of the firm.

The so-called ‘reinvestment problem’ is a commonly stated limitation of IRR. The NPV assumes that shareholders can reinvest at their target rate of return. So cash flows are being discounted at the target rate of return. A common criticism is that the IRR rule assumes that the shareholder can reinvest their money at the IRR for each project. However, this criticism is itself strongly criticised!

You can get multiple IRRs where you have a mixture of positive and negative cash flows. This is not really a large problem and can be avoided. But we need to be careful with IRRs.

For mutually exclusive it is also possible to perform ‘crossover analysis’ or ‘incremental cash flows’ when IRR/NPV fail to reconcile. This enables a calculation of the discount rate at which both investments have a zero NPV, this leads to more complex decision rules.

You can read up on this to your heart’s content (see below). But the consistent message is that assuming single period cash flows and correct specification of risk premia that NPV tends to produce wealth maximising decisions.
