CHARTA LEARNING · LESSON NOTES

Real estate investments

Level Two: alternative investments

1 What makes property different

- Every building is unique: no single price
- Large units: little diversification, so debt
- Heavy costs; a sale takes months
- Wear and tear: capital spending needed

IN THE LESSON

- Start with a story.
- Priya Rao is an analyst at a small fund, and she has spent her career with shares.
- A share is the same wherever you buy it, and it has a price all day.
- A building is not like that.
- Every building has its own place, its own age and its own tenants, so no two are identical, and there is no single market price.
- The value has to be estimated, usually by a valuer, which we call an appraisal.
- A building also costs a lot, so you cannot buy a little of many, and most buyers borrow.
- It costs money and time to buy, check and sell, and a sale can take months.
- And buildings wear out.

2 Feature and what it does to valuation

Feature of property → effect on valuation

Feature	Effect
Unique building	Value is estimated
High unit value, debt	Leverage
Costly, slow to sell	Illiquid
Wear and obsolescence	Capital spending

IN THE LESSON

- Here is the same list as a table, with what each feature does to valuation.
- Uniqueness means value is estimated, from an appraisal or a negotiated price.
- High unit values and debt mean the return on the owner's own money is magnified, up and down.
- Heavy costs and slow sales mean the asset is illiquid, so investors demand extra return for that.
- Physical wear and obsolescence mean part of the income must be spent back on the building, so rent received is not all profit.
- Finally, returns come from two places: the rent after running costs, and the change in the building's value.
- Keep these two sources in mind, because the next example uses both.

3 Example 1: the building, bought with debt

Price 25m, loan 15m at 4.5%, equity 10m

Income yield	1.5 ÷ 25	**6.0%**
Property return	6.0% + 2.0% growth	**8.0%**
Gain before interest	1.5 + 0.5	**2.0m**
Interest	15 × 4.5%	**0.675m**
Return on equity	(2.0 − 0.675) ÷ 10	**13.25%**

IN THE LESSON

- Example one.
- Priya looks at Ash Quay House.
- The price is twenty five million.
- In its first year, it is expected to produce one point five million of net operating income, which is rent after the costs of running the building.
- The value is expected to rise two per cent.
- The fund borrows fifteen million at four and a half per cent interest, and puts in ten million of its own.
- Start with the building alone.
- Income of one point five on twenty five is six per cent, and growth adds two, so the property returns eight per cent.
- Now the owner.
- Income plus value gain is two million.
- Interest is zero point six seven five.
- What is left, one point three two five, on ten million of equity, is thirteen point two five per cent.

4 Leverage in one line

Equity return = property return + (D ÷ E) × (property return − cost of debt)

Equity return	What the owner earns
Property return	8% in Example 1
Debt to equity	15 ÷ 10 = 1.5
Cost of debt	4.5% on the loan

IN THE LESSON

- There is a shortcut for what we just did.
- The return on the owner's equity equals the return on the property, plus the debt to equity ratio, times the gap between the property return and the cost of debt.
- Here the debt to equity ratio is fifteen over ten, which is one and a half.
- The gap is eight minus four and a half, so three and a half per cent.
- One and a half times three and a half is five and a quarter.
- Add that to eight, and you get thirteen point two five, the same answer.
- The message is simple.
- When the property earns more than the debt costs, borrowing adds to the return.
- When it earns less, borrowing takes away.

5 Example 2: the same building, a bad year

Same building, value falls 8%

Property return	6.0% − 8.0%	**−2.0%**
Gain before interest	1.5 − 2.0	**−0.5m**
Interest still owed	15 × 4.5%	**0.675m**
Loss to owner	−0.5 − 0.675	**−1.175m**
Return on equity	−1.175 ÷ 10	**−11.75%**

IN THE LESSON

- Example two is the same building in a bad year.
- Income is still one point five million, but the value falls eight per cent.
- Eight per cent of twenty five million is a drop of two million.
- The property return is six per cent income, less eight per cent, so minus two per cent.
- Now the owner.
- Income of one point five, less a two million fall, is a loss of half a million.
- Interest of zero point six seven five is still owed, so the total shortfall is one point one seven five million.
- On ten million of equity, that is minus eleven point seven five per cent.
- A fall of only two per cent in the property has become nearly twelve per cent for the owner.
- Use the shortcut and you get the same.

6 Leverage, drawn

Chart: Equity return vs Property return

- No debt
- With debt
- Good year 13.25%
- Bad year −11.75%
- Cost of debt 4.5%

IN THE LESSON

- Here is the picture, and it also shows the trap.
- Along the bottom is the return on the property.
- Up the side is the return on the owner's equity.
- The grey line is no borrowing, where the owner earns exactly what the property earns.
- The steeper green line is our fund, with one and a half of debt for every one of equity.
- Both lines cross where the property earns four and a half per cent, the cost of the loan.
- To the right of that, borrowing helps.
- To the left, it hurts, and it hurts faster.
- Our two examples sit on the green line, at thirteen point two five and minus eleven point seven five.
- So never set a borrowed equity return against an unborrowed property index without adjusting for the debt.

7 What creates demand for space

- Economic growth and employment: offices
- Retail sales and incomes: shops
- Trade and online shopping: warehouses
- Population and new households: apartments

IN THE LESSON

- Now to the second question: what makes property worth more or less?
- Think of a building as a machine that turns space into rent.
- So its value depends on how many people want the space, and what they will pay.
- That demand comes from the wider economy.
- When the economy grows, firms hire and incomes rise.
- More people in work means more demand for offices.
- Consumers with more income spend more in shops, so retail property benefits.
- Growing trade fills warehouses.
- A growing population, and more households forming as young people move out, fills apartments.
- Look for these five drivers when you read any vignette: growth, jobs, population, households and incomes.

8 From the economy to the value

Income side

Growth, jobs, incomes → Demand for space → Rents, occupancy, income

Rate side

Interest rates, required return → Cap rate moves → Value moves the other way

IN THE LESSON

- Here is the chain of cause and effect.
- Read the top row first.
- A stronger economy brings more jobs and higher incomes.
- That raises the demand for space.
- If the supply of new buildings is slow to arrive, rents and occupancy rise.
- Higher rents and fewer empty units lift net operating income.
- Value follows that income.
- The second row is the other force.
- Interest rates and the return investors require set the capitalisation rate, which we will meet properly soon.
- It is the rate used to turn income into value.
- When required returns rise, the cap rate rises, and value falls even if the rent is unchanged.
- Two forces, income and the cap rate, together set the value.

9 Value against the cap rate

Chart: Value (m) vs Cap rate (4% to 10%)

- 37.5 at 4%
- 25.0 at 6%
- 21.4 at 7%
- 18.75 at 8%

IN THE LESSON

- Let's draw the second force.
- Along the bottom is the cap rate, from four to ten per cent.
- Up the side is the value of a building with one point five million of next year's income.
- The curve falls steeply and then flattens.
- At a four per cent cap rate the building is worth thirty seven and a half million.
- At six per cent it is worth twenty five million, our building.
- At seven per cent it is worth about twenty one point four million, and at eight per cent eighteen point seven five.
- Notice the shape.
- A rise of one point in the cap rate hurts value more when rates start low.
- So low rates make property values very sensitive to small changes in required returns.

10 Example 3: rents rise, yet value falls

NOI 1.5m, cap rate 6% rises to 7%, rents +3%

Value at 6% cap rate	1.5 ÷ 0.06	**25.00m**
Cap rate rises to 7%	1.5 ÷ 0.07	**21.43m**
Rents rise 3%: new income	1.5 × 1.03	**1.545m**
Value at 7% cap rate	1.545 ÷ 0.07	**22.07m**
Change from start	22.07 ÷ 25 − 1	**−11.7%**

IN THE LESSON

- Example three.
- Priya's boss says, rents are rising three per cent, so values must rise too.
- Start with next year's income of one point five million at a six per cent cap rate: value twenty five million.
- Now the central bank raises rates, and investors want more, so the cap rate goes to seven per cent.
- With the same income, value is one point five over zero point zero seven, about twenty one point four three million.
- That is a fall of fourteen per cent.
- Now add the rent growth.
- Income rises three per cent, to one point five four five million.
- Divide by seven per cent and the value is about twenty two point zero seven million.
- Still down nearly twelve per cent.
- Income helped, but not enough.

11 Example 4: does property hedge inflation?

Rent 1.0m today; prices rise 4% a year

Apartments after 3 renewals	1.0×1.04^3	**1.125m**
Office on fixed rent	unchanged	**1.000m**
Office rent in today's money	$1.0 \div 1.04^3$	**0.889m**
Real loss over 3 years	0.889 − 1	**−11.1%**

IN THE LESSON

- Example four, about inflation.
- Property is often called an inflation hedge, because rents can rise with prices.
- But it depends on the lease.
- Take two buildings that each pay one million of rent today.
- Building X is an office let to one tenant on a fixed rent for fifteen years.
- Building Y is an apartment block let on one year leases.
- Suppose prices rise four per cent a year.
- Y can raise rents at each renewal, so after three years it earns about one point one two five million.
- X still earns one million, which buys only about eighty nine per cent as much as before.
- So the fixed lease gives little protection until it is renewed.
- Building costs rise too, which raises the cost of replacing the building.

12 Role of property in a portfolio

- Steady income from rents
- Diversification: imperfect correlation with shares
- Partial inflation protection, only if rents reset
- Trap: always a hedge, rents up so value up

IN THE LESSON

- So why would a fund own property at all?
- There are three reasons.
- First, income.
- Rent is paid regularly, and for good buildings it is steady, so property gives cash as well as growth.
- Second, diversification.
- Property returns are imperfectly correlated with shares and bonds, since they depend on local space markets as well as on the stock market, so adding some can lower the risk of the whole portfolio.
- Third, partial inflation protection, but only where rents are indexed or reset often, as we just saw.
- The trap on the exam is to say property always protects against inflation, or that rising rents always mean rising values.
- Both ignore the lease and the cap rate.

13 Five property types, five lease styles

Type → how income is earned

Type	Lease style
Office, warehouse	Long leases
Retail	Base plus % of sales
Apartments	Short leases
Hotels	No leases at all

IN THE LESSON

- Now the third question: why do property types differ?
- The answer is mostly the tenant and the lease.
- Offices depend on jobs in office using industries and usually have long leases, so income is stable until a lease ends and a large space falls empty.
- Warehouses follow trade and online shopping, again often on long leases where the tenant pays the building costs, which we call net leases.
- Retail depends on shoppers, and leases may include percentage rent, which gives the owner a share of sales above a set level.
- Apartments have short leases, so rents reset fast, and demand follows population.
- Hotels have no leases at all.
- Their income changes every night.

14 How steady is the income?

- Warehouse
- Office
- Retail
- Apartments
- Hotels

IN THE LESSON

- Here are the types on a line, from steadiest income on the left to most volatile on the right.
- Warehouses on long net leases sit near the left, because the rent is fixed for years and the tenant pays the running costs.
- Offices come next.
- Their leases are long as well, but a single expiry can take out a big share of the rent.
- Retail is in the middle, because percentage rent ties income to store sales.
- Apartments are further right, because every lease is short, so income reacts quickly to the local economy.
- Hotels sit at the far right.
- With no leases, room rates and occupancy change every night with the economy, and the hotel also needs heavy running costs.
- Their income is the most volatile of all.

15 Example 5: percentage rent in a shop

Base 160,000; 5% of sales above 2.0m

Base rent	4,000 × 40	**160,000**
Sales above breakpoint	2.9m − 2.0m	**0.9m**
Percentage rent	5% × 900,000	**45,000**
Total rent, good year	160,000 + 45,000	**205,000**
Total rent, sales 1.8m	base only	**160,000**

IN THE LESSON

- Example five.
- A shop owner has let four thousand square feet to a clothing retailer.
- The base rent is forty per square foot a year, which is one hundred and sixty thousand.
- The lease also sets percentage rent of five per cent of sales above a breakpoint of two million.
- This year sales are two point nine million.
- Sales above the breakpoint are nine hundred thousand.
- Five per cent of that is forty five thousand.
- So total rent is two hundred and five thousand.
- In a bad year, sales fall to one point eight million, below the breakpoint, so the percentage rent is zero and the owner gets only the base.
- That is why retail income moves with consumer spending, but never falls below the base rent while the tenant stays.

16 Example 6: a lease ends, office versus apartments

Office: rent 3.0m, costs 0.5m; anchor pays 60%

Income before	3.0 − 0.5	**2.5m**
Rent if anchor leaves	3.0 × 40%	**1.2m**
Income, empty year	1.2 − 0.5	**0.7m**
Fall in income	0.7 ÷ 2.5 − 1	**−72%**
Apartment rent lost, 100 flats	20 ÷ 12 ÷ 100	**1.7%**

IN THE LESSON

- Example six compares what happens when leases end.
- An office building has rent of three million a year and running costs of half a million, so net operating income is two point five million.
- One tenant pays sixty per cent of the rent, and its lease expires.
- The space stays empty for a year.
- Rent falls to one point two million, down sixty per cent.
- The costs remain, and income drops to zero point seven million.
- That is a fall of seventy two per cent.
- Now an apartment block of one hundred flats.
- Twenty tenants leave in a year, and each flat sits empty for one month.
- That is twenty twelfths of a flat year, so only about one point seven per cent of rent is lost, against sixty for the office.
- Long leases give stability, but they also bring lumpy risk.

17 One income, three cap rates

Value of 2.0m income (m)

Warehouse 5%	**40.0**
Office 6%	**33.3**
Hotel 8%	**25.0**

Made-up cap rates, to show the idea

IN THE LESSON

- Here is why one cap rate for every type is a mistake.
- Imagine three buildings, each with two million of next year's income.
- Investors accept a lower cap rate for steadier income.
- These rates are only made up for illustration.
- A warehouse on long leases might carry a five per cent cap rate.
- Two million over five per cent is forty million.
- An office might carry six per cent, which gives thirty three point three million.
- A hotel, with its volatile income, might carry eight per cent, giving twenty five million.
- Same income, but values differ by a lot, because the risk is not the same.
- Use the cap rate that fits the property type.

18 Mistakes so far

- 1. Appraised value read as a transaction price
- 2. Levered return versus unlevered benchmark
- 3. Rents up, so value up: ignores the cap rate
- 4. Fixed leases as an inflation hedge
- 5. One cap rate or risk view for every type

IN THE LESSON

- Before we move on, here are the common slips from the first three topics.
- One.
- Treating an appraised value as if it were a price paid.
- An appraisal is an estimate.
- Two.
- Comparing a borrowed equity return with an unborrowed property benchmark.
- Adjust for the debt first.
- Three.
- Saying rents up means values up.
- If the cap rate rises by more, value falls.
- Four.
- Saying all property hedges inflation.
- A fixed rent lease does not, until it is renewed.
- Five.
- Using one cap rate or one risk view for every type.
- A hotel, an office and a warehouse are different animals.
- Keep these five in mind as you read the vignettes.

19 Due diligence: check before you pay

Facts about income and the building

Leases and rent roll → Operating expense history → Physical and environmental

Facts about rights

Title and survey → Zoning, permitted use → Litigation

IN THE LESSON

- Now the fourth question.
- Before a buyer completes, they check the facts behind the valuation.
- We call this due diligence.
- Imagine buying a used car without opening the bonnet.
- Here it is a checklist, in two rows.
- First, the leases and the rent roll, which is the list of tenants, rents and expiry dates.
- Then the history of operating expenses, to see what the building really costs to run.
- Then the physical and environmental condition, such as the roof and any pollution.
- On the second row, title and survey, to confirm the seller owns what is being sold.
- Zoning and permitted use, to confirm what the land may legally be used for.
- And any litigation.
- A seller's brochure may assume a use the zoning does not allow, and that can wreck a valuation.

20 Three ways to value a building

- Cost: land + replacement cost − depreciation
- Sales comparison: adjusted recent sales
- Income, direct: next year's NOI ÷ cap rate
- Income, discounted cash flow: income + resale

IN THE LESSON

- With the facts checked, there are three approaches.
- The cost approach asks: what would it cost to rebuild?
- You take the land, add the replacement cost of the building, and subtract depreciation for age.
- It suits new or specialised buildings, where there are no comparable sales.
- The sales comparison approach looks at recent sales of similar buildings, and adjusts the price for differences in size, condition and location.
- It works where there are many sales.
- The income approach values the income stream.
- Within it, direct capitalisation divides one year of income by a cap rate, and a discounted cash flow model projects several years of income and a resale price, then discounts them.
- We will work each in turn.

21 Example 7: the cost approach

Land 4.0m, replacement cost 10.0m, depreciation 30%

Depreciation	10.0 × 30%	**3.0m**
Building after depreciation	10.0 − 3.0	**7.0m**
Land	given	**4.0m**
Value, cost approach	7.0 + 4.0	**11.0m**

IN THE LESSON

- Example seven.
- A newly built laboratory has no comparable sales, so Priya uses the cost approach.
- The land is worth four million.
- Building it again today would cost ten million.
- The building is a little worn, with depreciation of thirty per cent.
- Thirty per cent of ten million is three million, so the depreciated building is worth seven million.
- Add the land, and the value is eleven million.
- Notice we subtract depreciation only from the building, never from the land, since land does not wear out.
- The weak point of the method is that cost is not value.
- A building can cost a lot and still be worth less, if nobody wants that kind of space in that place.

22 Example 8: the sales comparison approach

Comparables per square metre; subject 3,000 square metres

Average price per square metre	(3,900 + 4,100 + 4,300) ÷ 3	**4,100**
Raw value	4,100 × 3,000	**12.3m**
Needs refurbishment	adjust −5%	**× 0.95**
Adjusted value	12.3 × 0.95	**11.685m**

IN THE LESSON

- Example eight.
- A shop building has three thousand square metres.
- Three similar buildings sold recently.
- Their prices per square metre were three thousand nine hundred, four thousand one hundred and four thousand three hundred.
- The average is four thousand one hundred.
- Multiply by three thousand square metres and the raw value is twelve point three million.
- But the subject needs refurbishment, which the comparables did not, so Priya adjusts down by five per cent.
- Twelve point three times zero point nine five is eleven point six eight five million.
- The skill in this method is in the adjustments.
- Each comparable differs in date, location, size and condition, and a careless adjustment gives a careless answer.

23 Direct capitalisation

Value = next year's NOI ÷ cap rate Cap rate = r − g

Property value	What the building is worth
Next year's NOI	Year one income, not last year's
Cap rate	Discount rate minus growth
Discount rate	Required return
Growth rate	Income growth, forever

IN THE LESSON

- Now the income approach in its simplest form.
- Value equals next year's net operating income, divided by the cap rate.
- The cap rate is roughly the discount rate minus the expected growth rate of income.
- Why?
- An income that grows forever is worth the first payment divided by the discount rate minus the growth, which is the same idea as a growing perpetuity.
- So with a discount rate of eight and a half per cent and growth of three per cent, the cap rate is five and a half per cent.
- Two warnings.
- The income is next year's, not last year's.
- And the divisor is the cap rate, not the discount rate.
- Both slips are favourites of the exam.

24 Example 9: direct capitalisation

NOI this year 2.4m, r = 8.5%, g = 3%

Cap rate	8.5% − 3.0%	**5.5%**
Next year's NOI	2.4 × 1.03	**2.472m**
Value	2.472 ÷ 0.055	**44.95m**
Trap: this year's NOI	2.4 ÷ 0.055	**43.64m**
Trap: discount rate	2.472 ÷ 0.085	**29.08m**

IN THE LESSON

- Example nine.
- A building earned net operating income of two point four million over the year just ended.
- Income is expected to grow three per cent a year for ever, and investors require eight and a half per cent.
- First, the cap rate: eight and a half minus three is five and a half per cent.
- Second, next year's income: two point four times one point zero three is two point four seven two million.
- Third, divide: two point four seven two over zero point zero five five gives forty four point nine five million.
- Now the traps.
- Dividing this year's income by the cap rate gives forty three point six four million, too low.
- Dividing by the discount rate gives only twenty nine point oh eight million, far too low.

25 Example 10: discounted cash flow

NOI 2.0m, +3% a year, 3 years, terminal cap rate 6%, r = 8.5%

Resale at end of year 3	2.185 ÷ 0.06	**36.42m**
PV of year 1 income	2.0 ÷ 1.085	**1.84m**
PV of year 2 income	2.06 ÷ 1.085^2	**1.75m**
PV of year 3 income and sale	(2.12 + 36.42) ÷ 1.085^3	**30.18m**
Value, discounted cash flow	sum	**33.77m**

IN THE LESSON

- Example ten uses the other income method.
- Suppose income next year is two million, growing three per cent a year.
- Priya plans to hold for three years and sell at the end.
- The sale price is next year's, year four, income of two point one eight five million, divided by a terminal cap rate of six per cent.
- That gives a resale price of about thirty six point four two million.
- Now discount at eight and a half per cent.
- Year one income is worth one point eight four.
- Year two, one point seven five.
- Year three, the income plus the resale price, is worth about thirty point one eight.
- The total is about thirty three point seven seven million.
- The method is flexible, but it depends on the resale assumption.

26 Property indexes: three ways to build one

- Appraisal based: valuers revalue periodically
- Transaction based: repeat sales or hedonic
- Listed property companies: traded share prices
- Each type carries its own bias

IN THE LESSON

- Now the last question.
- Suppose Priya wants to know how the property market performed, or how risky it is.
- She needs an index.
- And a property index is hard to build, because buildings do not trade every day.
- There are three main types.
- The first is appraisal based.
- Valuers revalue a set of properties every period, and the index tracks the changes.
- The second is transaction based.
- It uses actual sales, either by comparing repeat sales of the same building, or with a regression that controls for building characteristics, called a hedonic model.
- The third is based on listed property companies, whose share prices come every second.
- Each type has its own bias, and the exam loves asking which.

27 Example 11: appraisal smoothing

Appraised = 0.5 × true + 0.5 × last appraised; start 4%

True returns, years 1 to 5	market	**12 −10 −6 14 10**
Year 1 appraised	0.5 × 12 + 0.5 × 4	**8.0%**
Year 2 appraised	0.5 × −10 + 0.5 × 8	**−1.0%**
Appraised, years 3 to 5	same rule	**−3.5, 5.25, 7.6**
Std dev, true vs appraised	sample	**11.1% vs 5.2%**

IN THE LESSON

- Example eleven shows how appraisals smooth returns.
- Valuers do not start from scratch.
- They anchor on last period's value.
- Suppose that each appraised return is half of the true market return, plus half of last period's appraised return.
- The true market returns over five years are twelve, minus ten, minus six, fourteen and ten per cent.
- Start with a prior appraised return of four per cent.
- The first appraised return is half of twelve plus half of four, which is eight per cent.
- The next is half of minus ten plus half of eight, which is minus one.
- Carrying on gives minus three point five, five point two five and seven point six per cent.
- The real market swung by about eleven points.
- The appraised series moved by only about five.

28 Unsmoothing the appraisal series

True return = (appraised − weight × last appraised) ÷ (1 − weight)

True return	The return to recover
Appraised return	From the index
Last appraised return	Previous period's
Smoothing weight	Half in the example

IN THE LESSON

- A common fix is to unsmooth the series.
- If the appraised return is a mix of the true return and last period's appraised return, we can reverse that.
- The true return equals the appraised return, minus the smoothing weight times last period's appraised return, all divided by one minus the weight.
- Check it on year two.
- The appraised return is minus one, last period's was eight, and the weight is a half.
- Minus one minus four is minus five, divided by a half gives minus ten, the true return.
- It works exactly here.
- In practice the weight is estimated, so unsmoothing only removes part of the problem.
- It tends to raise the measured volatility, and the correlation with shares.

29 Example 12: a flattering Sharpe ratio

Return 7%, risk-free 2%, appraised vs true risk

Excess return	7% − 2%	**5%**
Sharpe, appraised risk 5.2%	5 ÷ 5.2	**0.96**
Sharpe, true risk 11.1%	5 ÷ 11.1	**0.45**
Flattering by	0.96 ÷ 0.45	**2.1 times**

IN THE LESSON

- Example twelve.
- A colleague says an appraisal index is wonderful.
- It averaged seven per cent a year, with a risk free rate of two per cent and a standard deviation of five point two per cent.
- Its Sharpe ratio, which is the return above the risk free rate, per unit of risk, is five over five point two, about zero point nine six.
- Compare shares, the colleague says, which look much worse.
- But the standard deviation is understated, because the series is smoothed.
- Suppose the true volatility is eleven point one per cent, as in our five years.
- The Sharpe ratio is five over eleven point one, about zero point four five.
- Half as attractive.
- Low volatility and low correlation from an appraisal index should not be taken at face value.

30 Hedonic regression output

Price (000). Example: 800 m², 20 years, centre = 3,410

Variable	Coefficient
Intercept	1,200
Area, per square metre	+2.5
Age, per year	−12
City centre (1 = yes)	+450

IN THE LESSON

- Now transaction based indexes.
- The repeat sales method uses only buildings that sold at least twice and measures the price change.
- It ignores new buildings, and buildings that sell only once.
- The hedonic method fits a regression of prices on characteristics, such as size, age and location.
- Here is some made up output, in thousands.
- A building starts at an intercept of twelve hundred.
- Each square metre adds two and a half.
- Each year of age takes away twelve.
- A city centre location adds four hundred and fifty.
- For eight hundred square metres, twenty years old, in the centre, the fitted price is twelve hundred, plus two thousand, minus two hundred and forty, plus four hundred and fifty.
- That is three thousand four hundred and ten.
- The index then compares quality adjusted prices over time.

31 Example 13: sample selection bias

No building changes in value; the mix of sales does

Whole stock average	(6 × 3,000 + 4 × 4,500) ÷ 10	**3,600**
Last year's sales	3 old, 1 modern	**3,375**
This year's sales	1 old, 3 modern	**4,125**
Apparent index change	4,125 ÷ 3,375 − 1	**+22.2%**

IN THE LESSON

- Example thirteen shows the main weakness of transaction indexes.
- Suppose a town has ten buildings.
- Six are old, worth three thousand each.
- Four are modern, worth four thousand five hundred each.
- The average is three thousand six hundred.
- Now prices do not change at all.
- But last year, three old buildings and one modern one happened to sell, so the average sale price was three thousand three hundred and seventy five.
- This year, one old and three modern sell, and the average is four thousand one hundred and twenty five.
- The index jumps twenty two per cent, though no building changed in value.
- The properties that sell may not represent the market.
- And when few sales occur, the index becomes noisy.

32 Recap: the formulas to remember

Equity return = Ra + (D÷E)(Ra − Rd)
Value = NOI_1 ÷ (r − g) True = (obs − φ × last) ÷ (1 − φ)

Equity return	Debt magnifies both ways
Property value	Next year's income
Cap rate	r − g, not r
True return	Appraisal series are smoothed
Sharpe ratio	Smoothing flatters it

IN THE LESSON

- Let's pull it together.
- Property is unique, costly, illiquid and usually bought with debt, so the equity return equals the property return, plus debt over equity times the gap to the cost of debt.
- Value drivers are demand for space, which sets income, and the cap rate, which turns income into value.
- Each type has its own leases and its own risk.
- Before buying, check leases, costs, condition, title, zoning and litigation.
- Then value by cost, by comparable sales, or by income: next year's income over the cap rate, where the cap rate is the discount rate less growth.
- Appraisal indexes lag and smooth.
- Transaction indexes suffer selection bias.
- Listed company indexes carry leverage and market mood.

33 Try three quick questions

1. Property return 8%, loan 4%, D/E = 1. Equity return?
   Answer: 8% + 1 × (8% − 4%) = 12%
2. NOI this year 3.0m, g = 2%, r = 7%. Value?
   Answer: 3.06 ÷ 0.05 = 61.2m
3. An appraisal index shows very low volatility. What to suspect?
   Answer: Smoothing: risk understated, Sharpe flattered.

IN THE LESSON

- Now try three quick questions.
- Pause after each one.
- Question one.
- A building returns eight per cent, the loan costs four per cent, and the debt to equity ratio is one.
- What is the equity return?
- Eight plus one times four is twelve per cent.
- Question two.
- Income this year was three million, growth is two per cent, and the required return is seven per cent.
- What is the value?
- Cap rate is five per cent, next year's income is three point zero six, so the value is sixty one point two million.
- Question three.
- An appraisal index shows a low standard deviation and low correlation with shares.
- What should you suspect?
- Smoothing, which understates risk.
- Well done.