university of groningen / faculty of spatial sciences

Real Estate Development Exam

2022-2023

Examiner: Prof. dr.ir. AJ van der Vlist

Reviewers: Em Prof dr. E.F. Nozeman and dr. M. van Duijn

Note:

1. This exam consists of 7 questions with 70 points in total that counts for 60% of your final grade.
2. Read all questions (hardcopy) carefully and provide your answer in English (digital).
3. For calculation questions, you need to show the calculation steps, and you do not earn points if the calculation steps are missing, even if the result is correct.
4. Inconsistency in your answers will lead to fewer points, even if the answer is partly correct.
5. Only a standard calculator is allowed, no graphical calculator, no smartwatches. No devices are allowed that can connect to internet.
6. The exam will last for 2 hours.
7. Students can lodge an appeal against the results of an examination with the Central Portal for the Legal Protection of Student Rights (CLRS) within 6 weeks of the date on which the result was announced.
9. In case of questions, please raise your hand while remain seated.

QUESTION 1 – THEORY AND MECHANISMS IN RED

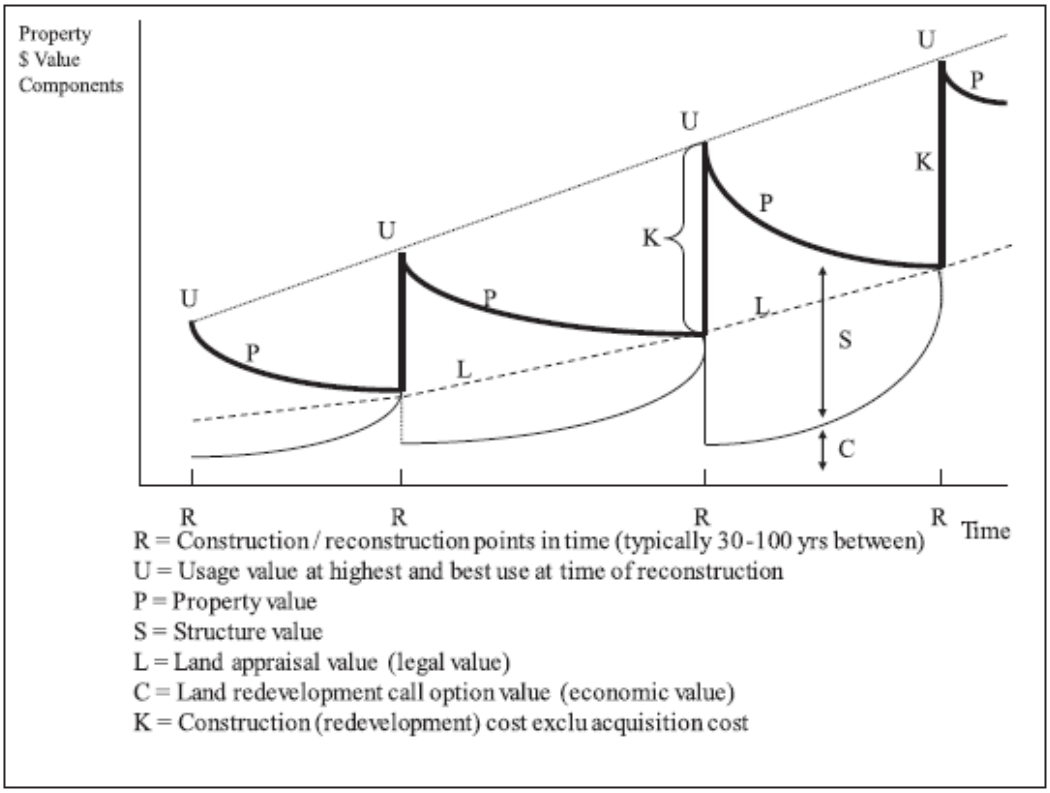
1A (10): In Class, we discussed the Real Options Theory. The Real Options Theory is also used in the conceptual investment model of Bokhari and Geltner (2016) (see below).

i) Explain the Real Options Theory,

ii) Use this to explain the patterns of C over time, and

iii) Explain why C can be lower than L.

(50-200 words)



Answer:

1=Real Option theory: valuation of investment opportunities taking into account the flexibility to develop, or the right to build. The essence is 'to account for flexibility or 'right but no obligation to develop' Now what is also important is that you must have volatility in the market otherwise C is worthless.

C is option value of land to build

Asset value is S, either 2 states of the world: Su or Sd

Cu= max (Su - S; 0)

Cd= 0 as –by assumption- Sd<S

Value of the option using ROT is C = p Cu + (1-p) Cd

(in words is also correct)

2= When just built S is Su (U = highest and best use) and so C is 0. There is no better or higher highest and best use. Over Time, S declines due to deprecation. So the difference between Su en S becomes larger over time. And so C becomes larger. Note that the implicit assumption is that investors depreciate till P=L and not develop earlier because then the Option value is highest. In that case Cu = max (Su - L, 0).It is clear that Land does not depreciate. So the max option value is when current value P is L. (Value structure is 0).

3=L is the value of undeveloped land and varies with the growth of the city according to the Residual land value. L is appraisal value given Figure note. Now we just realized that C can be 0. This is when (Su - P) < K. Land will never be 0. This implies that C can be lower than L.

Grading: (1) correct 4 points, incomplete 2 points, incorrect 0 points.(2) correct 4 points, incomplete 2 points, incorrect 0 points (3) correct 2 points. Incomplete 1 point. Incorrect 0 points.

1B (10): Barras (2009) provides an in-depth treatment of Building Cycles.

i) Indicate the essence of Barras' conceptual framework,

ii) Explain the mechanisms in the framework, and

iii) Discuss in words how the framework can be used to understand the rent-vacancy relationship in relation to the structural vacancy rate.

(50-200 words)

Answer:

1.Essence of Barras is the relationship between the economic cycle, the property cycle and the credit cycle and the.

2.Mechansisms are as follows:

- Econ bc leads to fluctuations in demand for investment goods – after a number of years of operation capital goods must be replaced. These are lumpy goods and capital-intensive. If many firms invest in this then bc starts to arise.
- Fluctuations in Investments lead to fluctuations in demand for property space, this leads to higher rents (given stock) and higher asset values at given cap rates. So impetus for developments based on direct return considerations.
- The increase in property value sometimes lead to lower cap rates, and procyclical lending patterns. Then one starts to invest in RE because of indirect return considerations

3.

-the economic cycle in upswing will initially lead to lower vacancies (V-) but not higher rents (R0) (as V > Vstructural)

-(V-) continues to fall, and now V<Vstructural and so rents rise (R+) and at certain stage construction increases because credit is available,

-next V+ but V<Vstructural and rents starts to stabilize as new supply gradually comes available.

-(V+) continues to rise due to new construction (property cycle) and lower economic cyles (downturn) and now V>Vstructural and rents fall (R-)

Grading:

i)3 items mentioned. Correct. 4Q model is not Correct is 3 points

ii): correct is 3 points for each aspect of:

-why ec upturn arises. When not discussed, (-1)

-effect on demand for space. When not discussed (-1)

- why credit cycle happens. When not discussed (-1)

iii): 4 points for:

Notion of structural vacancy is not understood (-4). Rents and vacancy have a negative relationship (but this answer is incomplete as it depends on V< > V_str. incomplete (-2)). Correct notion must include relationship V-R inrelation to V <> V_str.

1C (10): A recent article in the *Review of Financial Studies* entitled, "Does climate change affect real estate prices? Only if you believe in it," examines whether housing prices reflect belief differences about climate change. The authors examine two groups of agents, believers (agent *1*) and deniers (agent *2*) of sea-level rise (S'>S) in the future. The model's theoretical prediction is stated as follows:

$$P_1(S) - P_1(S') \geq P_2(S) - P_2(S'), \quad \text{for } S' > S.$$

Use the Stock-flow model to give an explanation for the price difference across the two groups in a steady-state housing market. (50-200 words)

Answer

The Stock-flow model states the following:

Demand =f(User costs, Population)
User costs =h(future nominal house price expectations, interest rate, maintenance costs) or as stated by Poterba

$$\omega = [\delta + \kappa + (1 - \theta)(i + \mu) - \pi_H]. \quad (1)$$

Short run S_t=D_t
Steady-state in the housing market means that in the long run S_t=S (so that the stock remains constant)

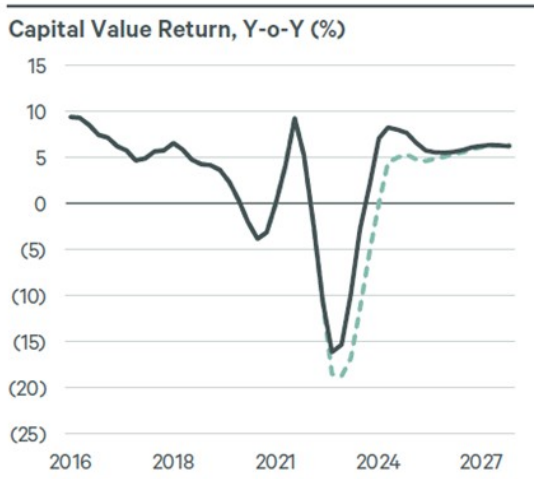
We note that
- Market demand is the aggregate of individual demand
- Two types of agents exist
- We have a context in which agents experience identical interest rates and property tax per $ of house prices
- Steady state with no increase in population or stock (no change in the tightening of the market)
- So agents must behave differently
- The only aspect that's that might differ are

So:
We find explanation in differential depreciation rates, or higher maintenance costs per $, or greater changes in nominal house price changes in the future. The latter is most likely.

Grading:
Stock flow model includes a discussion of Demand (1) user cost (1) supply (1) new construction (1) equil conditions (1).
Explanation refers to user cost, and must include discussion of expectations E(%p) for full (5) points. When referred to other aspects of user costs:
- maintenance increases (+), possible but holds for both groups (-2)
- depreciation becomes higher (+), possible but holds for both groups (-2)
When referred to price rather than price differences than (-3). Inconsistencies even when partly correct (max 2).

QUESTION 2 – MARKETS AND MECHANISMS

2A (10): CBRE Econometric Advisors (2023) report the following Commercial real estate forecasts. Explain the relationship between the forecasts (clearly indicating endogenous and exogenous variables in your argumentation). (50-200 words)



Note: Dashed line gives forecast scenario
Source: CBRE (2023) EA Quarterly: The full piciture. Chartbook. March 15, 2023. CBRE Econometric Advisors.

Answer:

Note that the figure on the left gives capital value returns. Now, please note that this is defined as 100%*(P_t – P_t-1) / P_t-1. So this is not the yield as most of you indicate. Yield will never become negative!

Discuss figure on right-hand side first: Nominal Rents rise and this is because of inflation, based on 4Q you would expect that given yields (exo) a rise in rents (exo) lead to a rise in asset values (endo). Asset values are not provided, but asset price changes (capital value returns are).

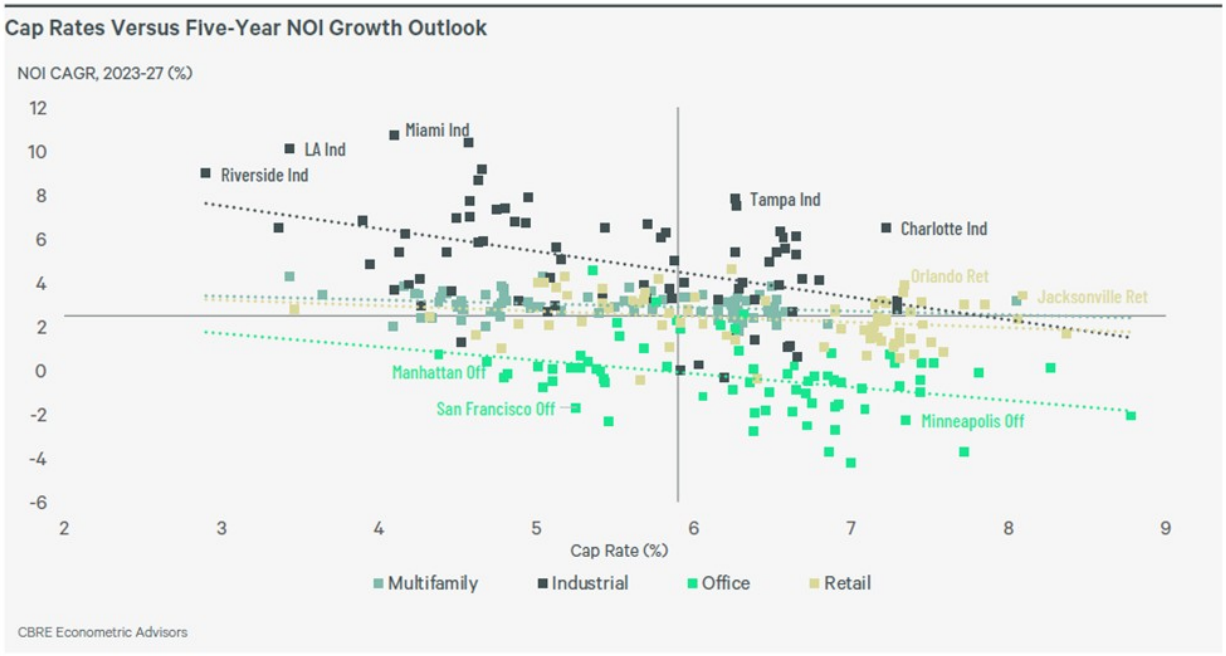
Now we discuss the figure on left-hand side: Asset prices however become lower as reflected in the negative capital value return rates.

The relationship between the 2 figures can only be answered using a conceptual framework because the two figures cannot be related automatically. Or stated differently: looking at the rental growth we cannot immediately explain the capital value return. Now, per 4Q-model the only correct answer is that the cap rates rise because of rising inflation and so the ultimate rent increase (exo) is washed out because of a stronger increase in cap rates (exo), and does not lead to a change in asset value (endo).

Grading:

If capital value return is interpreted as yield (max 5). In case of inconsistent remarks in terms of exo and endogenous variables (max 3). If no relationship between the two graphs is discussed then (-3), if cap rate is not related to inflation (-2). Note that capital value return can never be the yield as yields are never negative.

2B (10): CBRE reports the relationship between the current cap rate to the NOI growth outlook by metropolitan areas in the USA for different segments. Interpret the relationship and indicate which segment is priced relatively efficient? (50 – 200 words)



Answer:
Relationship:
The Gordon Fisher model for RE yield structures postulates that expected rental growth (here Five-Year NOI growth outlook) leads to lower cap rates, so one expects a downward sloping curve here.

Now note that -contrary to CBRE EA- we would be in favor of making Five-Year NOI growth on the x-axis and Cap rate on the y-axis in order to highlight the mechanism and causal relationship more clearly. This leads easily to a misinterpretation.

Efficiency:
You need to define efficient markets in some way, otherwise you cannot use it in your explanations. Here we use efficient as ' reflecting underlying fundamentals.' That is: cap rates reflect the underlying drivers including risk free interest rates, risk premium, expected inflation, and expected future rental growth. Now, note that all cities are in the USA so interest rates are identical, so these will not explain variation across cities. Other factors like the risk premium is unknown and cannot provide additional explanation but may explain inefficiency. What is known is NOI growth. What you see is that the industrial cap rates reflect NOI forecasts strongest and are thus relatively efficient.

Grading:
Relationship (7): what is asked is to interpret the relationship. A discussion of high and low is not sufficient. No interpretation (-5) NOI rather than Expected NOI growth, and incorrect causality (E-NOIg impacts cap rates, not the other way around) -4. Causality correct but incomplete and not fully discussed (-2)
Efficiency (3):described (1) defined (1) explanation (1). When definition and explanation is incorrect (-2)

QUESTION 3 - FINANCE IN RED

You, as real estate developer, learn that one of the real estate investors wants to buy a last-mile distribution center. The gross lettable area (GLA) is 5500 M2 on a parcel of 7000 M2. The investor forecasts a net rental cash flow of this distribution center to €60 per M2 of the net lettable area (NLA). Like all distribution centers, the exit value of the structure after 10 years is 0. IRR for the investor is 5.5%.

The city government is the active land owner and produces developable land. Note that, in these cases, developers cannot bargain over the land price as the city's land price is set fixed. The quoted price of developable land by the city is €225 per M2 . Your building cost is €500 per M2 of the gross lettable area. The ratio of net-to-gross lettable area is 0.7. The residual 'profit, risk premium and overhead cost' are quoted in percentage of building costs. A site survey indicates that the ground is free of contamination.

3A (10): Calculate the residual 'profit, risk and overhead cost' (and indicate calculation steps)

(3 points) HABU =
A=discounted sum NOI =
(60*5500*.7)/(1+0.055) + (60*5500*.7)/(1+0.055)^2+ (60*5500*.7)/(1+0.055)^3+ (60*5500*.7)/(1+0.055)^4 + (60*5500*.7)/(1+0.055)^5+ (60*5500*.7)/(1+0.055)^6+ (60*5500*.7)/(1+0.055)^7+ (60*5500*.7)/(1+0.055)^8+ (60*5500*.7)/(1+0.055)^9+ (60*5500*.7)/(1+0.055)^10
= 1,741,192

B= also correct (alternative but less precise given short lifetime (60*5500*.7)/0.55 = 231,000/0.055=4,200,000

(2 points) Land costs = 7,000 * 225 = 1,575,000

(2 points) Building costs = 500 * 5500 = 2,750,000

(3 points) residual p/r/o is quoted in % building costs, so (1+%pro) BWK

So A
(1+%pro) 2,750,000 = 1,741,192 – 1,575,000
(1+%pro) = 166,192 / 2,750, 000 =
%pro = 0.06 – 1 = -0.94 (so -94%) so at a huge loss

So B
(1+%pro) 2,750,000 = 4,200,000 – 1,575,000
(1+%pro) = 2,625,000 / 2,750, 000 = 0.95
%pro = 0.95 – 1 = -0.05 (so -5%) so at a loss

Grading: parts of habu incorrect (-2), land costs referred to as residual value or 5500 instead of 7000 (-2), building costs incorrect (-2). residual p/r/o method incorrect (-3) stated that operate at a loss (-2)

3B (10): The active land policy requires that the city takes on the production of developable land. The City's land production cost statement is shown below. Interest rate for the City is 7% per period. (We abstract from the fact whether the City receives internal or external financing).

Period#	1	2	3	4
Agricultural land costs	26,000	6,120	0	0
Research costs	225	51	52	53
Production costs of developable land	9,949	1,213	1,301	1,327
Other costs	1,550	1,666	1,358	2,175

Developable land sale revenues	0	0	18,207	38,000

Figures are all in euro's

Calculate the maximum financing necessary for the city government to produce developable land (and indicate calculation steps)

Answer:

Students must calculate the net cf per period and

Begin	0	-37,724	-49,414	
Net cashflow p period	-37,724	-9,050	15,497	34,445
Interest rate over period	0	(7% over -37,724)=2641		
End	-37,724	-49,414		

So max fin is 49,414 in period 2

Grading: if method is incorrect (max 5) interest rate computed incorrect (-2)

Scrap paper

Scrap paper