

JAMES A. GRAASKAMP COLLECTION OF TEACHING MATERIALS

II. CLASSES AT THE UNIVERSITY OF WISCONSIN--MADISON

- O. Business 935: Seminar--Urban Land Economics (MBA and MS)
  - 4. Problem Set Derived from the Ellwood Analysis

Ellwood Problems - 935

Fall, 1972  
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Due date October 16, 1972

- I. Construct an overall rate and provide arithmetic proof for the following case assumptions:
  - a. 75% mortgage at 6% annual interest, 25 year term, level monthly installments.
  - b. A projection period of 10 years
  - c. 10% depreciation
  - d. An equity yield rate of 9%
  - e. An annual net income before debt service of \$75,500
- II. Test of Appraisal for Market Attractiveness:

An apartment house has a gross rent roll of \$62,500 per year. Comparable sales indicate a multiplier of 6.4.

Value by comparison;       $\$62,500 \times 6.4$       \$400,000

Average expenses and allowances are budgeted at \$28,900 per year in a 10 year projection leaving net average income at \$33,600 per year.

Mortgage money is available up to 75% of appraisal at 6% interest with 25 year amortization.

Test the \$400,000 valuation for market attractiveness by calculating 10 year value changes which would produce equity yields ranging from 8% to 16%.

- III. A super market lease providing a net annual income of \$24,000 will expire in 13 years, mortgage money is available at 70% of appraised value on an 9% annual constant basis with interest at 7%. Allow for 20% property value decline in 13 years and appraise to yield 12% on equity.
- IV. Compute the overall capitalization rate for a 12% equity yield in the following situation:

First mortgage at 50% of value at 6 1/4% interest to be amortized in 20 years.

Second mortgage at 25% of value before discount at 8% interest to be amortized in 12 years. This mortgage will be subject to a 15% discount or 15 points at the outset. Allow for 15% depreciation and a 10 year projection.
- V. A property is purchased subject to a 20 year net lease which will fully amortize the investment at 7%. The lessee wants an option for an additional 20 years at a reduced rental. The lessor is willing to grant such an option at a price which will yield 8 1/4% investment yield with no allowance with residual value at the end of 40 years. Compute the extension in rent as a percentage of original investment.

I. Processing:

Basic Rate (see table):	.0689
Depreciation (.10 x .0658)	+ .0066
Overall Rate:	<u>.0755</u>

Then \$75,500 + .0755 = \$1,000,000

Arithmetical Proof:

Resale Price (@ 90% of present value after 10 yrs.):	\$900,000
Mortgage Balance (\$750,000 x .7624):	- 571,800
Equity Reversion:	<u>\$328,200</u>
Net Income:	\$75,500
Finance Charge (\$750,000 x .07740 (constant):	-58,050
Equity Net Income:	<u>\$17,450</u>
Stream: \$17,450 x 6.417658 (Present Worth of \$1 per annum for 10 yrs. @ 9%):	\$111,994
Reversion: \$328,200 x .422411 (Present Worth of \$1 deferred 10 yrs @ 9%):	+ 138,631
Total Equity Value:	<u>\$250,625</u>

II. Solution:

Indicated overall cap. rate;  $\frac{\$33,600}{\$400,000} = .0840$

Basic cap. rate from 75% mtg. Table @ 8%; .0658 @ 16%; .0898 ~~26.4%~~  
 O.A. Value decline to yield 8%;  $\frac{.0840 - .0658}{.0690} = \frac{.0182}{.0690} = \frac{26.4\%}{27.66\%}$

Value would have to decline; \$400,000 x .2766, \$110,640  
 O.A. Value increase to yield 16%;  $\frac{.0898 - .0840}{.0469} = \frac{.0058}{.0469} = 12.37\%$

Value would have to increase \$400,000 x .1237 - \$49,480

III.  $(f/(1-i)) (S_p - 1) = P$

Equity Yield, "Y"	.12000	$P = \frac{.09}{(.07-1)} (2.477763-1) \text{ p. 965}$
Plus $P \frac{1}{S_n}$	.01506	$P = .422196$
	<u>.013506</u>	$P \times \text{sinking fund } (.4222 \times .035677) \text{ p. 148}$
	- .0900	<u>.01506</u>

Mtge coefficient "C"	.04506
Equity yield "Y"	.12000
Less MC	.03154
Basic rate "r"	.08846
Plus $x2 \times .035677$	<u>.0071354</u>
	<u>.0955954</u>

$\frac{\$24,000}{.0956} = 25.1046$  251,046 or 250,000 rounded

IV.  $C = y - \frac{f-1/S_n}{1-k} CP-k$

M (1-k) = adjusted "M"	
OAR = Y - (M1C1 + M2(1-k)C2) + .15(.056984	
(.5 x .052175)	.00854760
[.026 + .25 (.85) (.03344)]	
	.00284240
	<u>.026</u>
	<u>.02884240</u>

OAR = .12 - .02884 + .0085476

OAR = .0997

$$C = Y - f + P$$

$$\frac{.12 - (.010825 \times 12)}{.129900} - \frac{2.21964-1}{2.603389-1} \times .056984$$

$$\frac{1.21964}{1.60339}$$

$$.7606$$

$$C = \frac{-.0099 + .04334}{.04334} \frac{.0099}{.03344} .0433420304$$

V.  $V [(1+i)S_n] = \text{Required Reversion}$

$V$  = Purchase Price

$(1+i)$  = The base; i.e., 1 plus effective yield rate or "Y" divided by  
n number of rent installments per year.

n = Number of rent installments in lease term

d = Periodic rent per dollar of purchase price

$S_n$  = Future worth of \$1 per period at rate "i" for "n" periods  
(Col. 2, compound interest table).

PP. 133-134

$V [(1+i)^n - d(1+i)s_-] = \text{Required Reversion}$

$$V = \frac{(1+.0825)^{240} - .007753}{12} \frac{(1+.0825)^{607.66}}{12}$$

$$V = 51.753 - .007753 \times 1.006875 \times 607.66$$

$$V = 51.753 - 6.1183766250$$

$$V = 45.635 \times .007753 \times 12$$

Rents equal .042457 of original investment

Alternative p. 429

$$.0820 = .4399$$

$$.0860 = .6211$$

$$.0040 = .1812$$

$$.4399 = 1/8 \times .1812 = .$$

$$.0226$$

$$.4625 \times .0925 = .042758$$

- #1 a) The Peabody Building has a gross income of \$850,000 this year, operating expenses of \$191,000 and taxes of 24% of effective gross income. Vacancies in the office building market are 6% currently and are expected to be reduced to 5½% next year. The land, if vacant, has an estimated value of \$900,000. The remaining economic life of the building is 25 years. The discount rate is 7½%, and the sinking fund rate is 4½%.

Determine the indicated value of the property using the building residual approach assuming

- 1) straight capitalization with straight line recapture
  - 2) straight capitalization with annuity recapture
- b) Now, assume that the Peabody Building was built in 1928, is 15 stories high and has four manual elevators in operation. How would this additional fact modify your appraisal?

- #2 Mr. Smith owns 20,000 ft.<sup>2</sup> of vacant land one mile north of the Milwaukee C.B.D., where the demand for both office space and apartments is strong. His first option is to build an office building which is described as follows:

- 1) 30 stories, land coverage 90%, building efficiency 81%
- 2) Average rental rate \$8.25 per ft.<sup>2</sup> MRA, operating expenses 48% of effective gross income.
- 3) Building cost <sup>28.00</sup>~~50.00~~ per ft.<sup>2</sup>, economic useful life 45 years

His second option is to build an apartment building which is described as follows:

- 1) 40 stories, land coverage 95%, building efficiency 86%
- 2) Average rental rate \$5.10/ft.<sup>2</sup> MRA, operating expenses 42% of effective gross income
- 3) Building cost <sup>23</sup>~~40~~.00/ft.<sup>2</sup>, economic useful life 40 years

Assume an 8% discount rate.

Using the traditional land residual approach to value, determine the highest and best use of the site.

- #3 A supermarket is leased to a national chain for 10 years at a rent which produces an average net annual income of \$21,000. Mortgage money is available up to 80% of value ~~at~~ 7% for a twenty-year term. What is the market value of the property if market equity yield rate is 10% and we may expect a 20% decline in value at the end of ~~two~~ years?

- #4 Assume net income of \$30,000 per year for an older apartment building. A bank is willing to make an 8%, 20 year loan for 80% of value. Assuming 15% depreciation over 10 years, what is the value of the investment property priced to yield 14% to equity?
- #5 Assume the same building as above. However, a real estate investment trust is willing to make a 9%, 25 year loan for 80% of value. With the 10 year forecast allowing for 15% depreciation, what is the maximum price the investor could pay to yield 18% on his equity?
- #6 Assume Charlie paid \$200,000 for a building with \$20,000 net income subject to \$120,000 mortgage at 7-3/4% with a 20 year term. He anticipated no depreciation over a 5 year forecast. What yield did he expect on his equity? If he wanted to improve his yield to equity 4% by refinancing with a new 20 year mortgage at 9% interest, how much would he have to borrow in a new loan?
- #7 Assume the buyer of the building above paid \$220,000 for it. How far could the price decline in 5 years and still give him an 8% return on his money if he could obtain \$180,000 at 9% for 20 years?
- #8 On the other hand, on the same deal as in #6, how far must resale price increase in 5 years to give him 20% on his equity? How much in 10 years?

~~ELLWOOD PROBLEM~~

- #9 Assume that an investor demands an equity yield of .100 and a given property is available for purchase in which the overall rate of return is estimated at .081. Assume that a mortgage ratio of 75% is available at 7½% for a 20 year term.

What depreciation can the property sustain to yield 10% for 10 years?

What depreciation can the property sustain to yield 9% for 10 years?