

JAMES A. GRAASKAMP COLLECTION OF TEACHING MATERIALS

V. INDUSTRY SEMINARS AND SPEECHES - SHORT TERM

- I. Other Presentations In Which Either The Date And /  
Or Sponsoring Organization Is Missing
2. Appraisal Topics
  - w. "Market Comp Theory Compared to  
Regression", no date

## MARKET COMP THEORY COMPARED TO REGRESSION

### I. Common Requirements to be Determined

- A. Variables to survey
- B. Sales comparables available for analysis
- C. Variables which relate to value
- D. Rates of adjustment for difference in variable factors
- E. Comparable sales which are best related to subject property

### II. Prediction of Price Through Regression Analysis

$$V_p = b + X_s (A) + \dots X_{n,s} (A_n)$$

$$V_s = b_o + \sum_f A_f X_{f,s}$$

$$V_k = b_o + \sum_f A_f X_{f,k}$$

$$V_k^i = P_k + V_s - V_k$$

$$= P_k + A_1 X_{1s} - A_1 X_{1k} + A_2 X_{2s} - A_2 X_{2k}$$

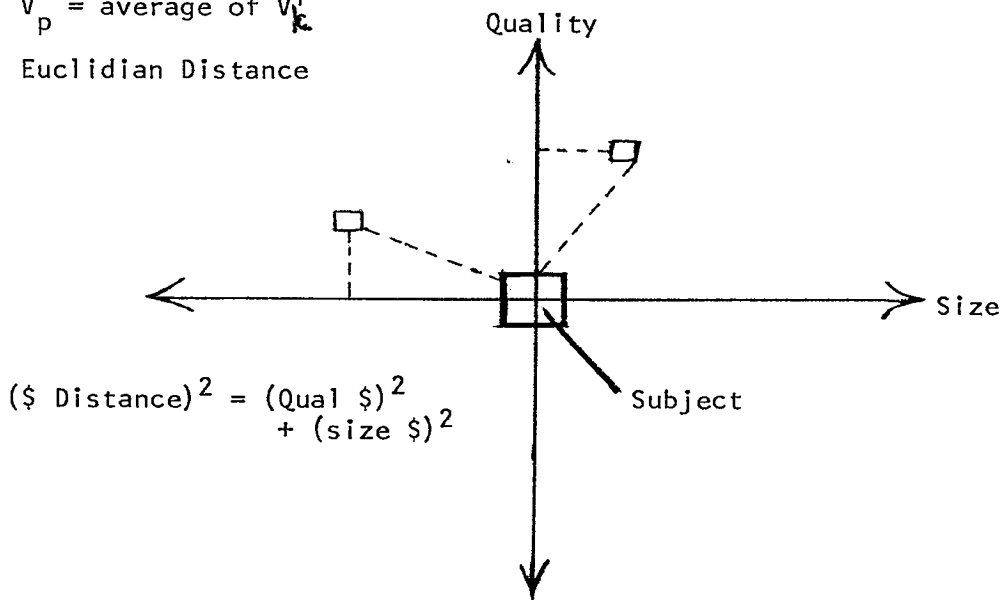
$$= P_k + A_1 (X_{1s} - X_{1k}) + A_2 (X_{2s} - X_{2k})$$

### III. Market Comparison

$$V_k = A_1 \times (X_s - X_k) + A_2 \times (X_{s2} - X_{k2})$$

$$V_p = \text{average of } V_k^i$$

### IV. Euclidian Distance



Scale requires conversion of factors to \$'s per unit

Market comp permits conversion with:

\$/unit

\$/as % of sale price/unit

\$'s/ transformation unit

~~95~~ Regression Appraisal

- I. Dilmore has suggested that regression analysis of sales is the most objective method of inferring price as the appraiser makes fewer subjective adjustments.
  - A. In some cases, regression will reduce the average error, in some cases it will identify useful value predictors, but almost always it increases the range of error. In general, it is more useful in organizing information for the appraisal process than in directly forecasting price.
  - B. Some of the areas in which it will prove useful are:
    1. Automatic identification of non-market transactions.
    2. Estimating cost to assemble a group of parcels at a low cost.
    3. Converting demand factors to potential market in dollars or households or customers.
    4. Establishing the value influence of adverse uses;
    5. Identification of compounding influence of certain attributes on value.
  - C. Regression will not generally provide a measure of an individual attribute's contribution to value.
- II. Simple lineal regression expresses a relationship between two variables while a multiple regression equation deals with three or more variables.

Price equals  $a + bX + cY + \text{residual error}$

The object is to determine that set of coefficients and variables which will produce the lowest practicable residual error, which is often called the standard error of the estimate.

- A. The test of a regression equation is comparison of an estimated price to the actual observed price on a sample and then to predict a price on a similar property which was not included in the sample. Thus, there is a statistical test inherent in the sample and a pragmatic test for the utility of the application.
  1. If  $a$  is the only known coefficient it is the mean average value of the sample and the point where the mean line crosses the vertical axis.
  2.  $b$  introduces slope to the mean line which is parallel to the horizontal axis. These coefficients are determined with the least squares method and as a result extreme values in the scatter diagram will cause excess moment on the line because their squared values have so much influence. While prices do not have to be homogeneous, they must be more or less continuous along the line or the line is appropriate to fit only one segment of the data.

Notes on Mkt Comp & Fuzzy

Ratings	Points	Equiv Fuzzy Rtg	Rough age guideline absent remod, deterior
Excellent	26	1.00	0
Good	20	.75	5
Average	15	.60	10
Fair	13	.50	15
Poor	10	.40	20

Weights:

Office, restaurant

Eff Age	.20
Space Quality	.50
Marketability factors & amenities	.30
Sq ft bldg only--plus land	

Apartments

Eff Age	.20
Space Quality	.30
Amenities (pool, tenn, applia)	.20
Marketability & Location factors (D.T., emplyt ctrs, view)	.30

The sales were analyzed, using a procedure proposed by Dr. Richard U. Ratcliff, elaborated and implemented by Dr. James A. Graaskamp, with modifications by Gene Dilmore.

The comparison procedure is basically as follows: First, land value is calculated as of the sale date for each comparable property. The indicated land value is then deducted from the sale price, eliminating this major element from the price differentials. Then the remainder price, for improvements only, is reduced to price per square foot of net rentable area.

Next, the analyst acknowledges that many of the comparison factors to be considered, are qualitative in nature, and cannot, in the present state of the art, be precisely quantified. Therefore, a procedure is utilized which converts these subjective, or qualitative judgments to a quantitative basis:

In this step, the properties are assigned comparative quality points for the major property attributes. Points are in accordance with qualitative ratings, as follows:

<u>Rating</u>	<u>Points</u>
Excellent	26
Good	20
Average	15
Fair	13
Poor	10

The major categories of property attributes considered, and the relative weights assigned to each were as follows:

Effective Age	20%
Space Quality (Construction, Design, Finish)	50%
Marketability (Accessibility, linkages to clients & customers, amenities)	<u>30%</u>
	100%

Each assignment of quality points is given its appropriate weight, and the weighted quality points totaled. For example, a rating of Fair in regard to Age (13 points, x 20% weight); a rating of Fair in regard to space quality (13 points, x 50% weight); and a rating of Average in regard to Marketability Factors (15 points, x 30% weight) gives, for Sale #1, a total of 13.60 quality points.

Next, for each property, we divide the "Price Per Square Foot for Improvements" by the number of quality points, in order to reduce the comparisons to a common denominator. In the case of Sale #1, the price of improvements of \$33.86 per square foot, divided by 13.60 quality points, yields an indicator of a price of \$2.49 per quality point/per square foot. Note that these comparative ratings are thus independent of subject property, which is then assigned quality ratings in the same manner.

Finally, we examine the central tendency of these 13 indicators, for a value indication for subject improvements, and add subject land value for an indication of most probable selling price for the total property.

The analysis is summarized in the following matrix:

Comparable Sales Analysis Matrix

<u>Sale #</u>	<u>Ident.</u>	<u>Price</u>	<u>Land</u>	<u>Improvements</u>	<u>Imps</u>	<u>Sq Ft</u>
1	Crnshw	800,000	220,500	579,500	\$33.86	
2	3700 4 Av	250,000	74,000	176,000	\$25.14	
3	1732 Ox	105,000	40,000	65,000	\$32.57	
4	1210 S 20	680,000	248,500	431,500	\$36.08	
5	201 Vulc	819,484	228,000	591,484	\$36.07	
6	3500 Mont	191,200	58,500	132,700	\$32.37	
7	3100 Ind	360,000	75,000	285,000	\$60.25	
8	2717 19 Pl	101,750	28,000	73,750	\$29.50	
9	11 Off Pk	265,000	147,000	118,000	\$32.78	
10	3499 Montg	265,000	63,000	202,000	\$29.71	
11	2720 S 19 St	100,000	24,500	75,500	\$28.49	
12	1200 S 17 St	250,000	105,000	145,000	\$33.72	
13	3928 Montcl	950,000	168,500	781,500	\$37.61	



Comparable Sales Analysis Matrix--Cont'd

<u>Sale #</u>	<u>Age</u>	<u>Sp Qual</u>	<u>Mktblty</u>	<u>Quality</u>	<u>Price Per</u>
	<u>Rating</u>	<u>Rating</u>	<u>Rating</u>	<u>Points</u>	<u>Point/SF</u>
1	13x.2	13x.5	15x.3	13.60	\$2.49
2	13x.2	13x.5	15x.3	13.60	\$1.85
3	10x.2	15x.5	20x.3	15.50	\$2.10
4	12x.2	15x.5	18x.3	15.30	\$2.36
5	10x.2	20x.5	15x.3	17.50	\$2.06
6	14x.2	15x.5	13x.3	14.20	\$2.28
7	20x.2	23x.5	23x.3	22.40	\$2.69
8	15x.2	13x.5	15x.3	14.00	\$2.11
9	13x.2	20x.5	20x.3	18.60	\$1.76
10	13x.2	15x.5	13x.3	14.00	\$2.12
11	15x.2	14x.5	13x.3	13.90	\$2.05
12	15x.2	15x.5	10x.3	13.50	\$2.50
13	15x.2	15x.5	20x.3	16.50	\$2.28
			Median		\$2.12
			Mean		\$2.20
			Standard Deviation		\$0.26

Most probable price for subject from this approach is indicated as follows:

Effective Age rating is assigned a Poor rating, of 8 points. Space Quality is assigned a Fair rating, at 13 points, and Marketability Factors are assigned a Fair rating, at 13 points. Therefore, 8 points x 20%, plus 13 points x 50%, plus 13 points x 30% = 12.00 points. Multiplying x \$2.20 per square foot per point = \$26.40 per sq. ft. x NRA of 11,640 sq. ft. = indicated value of improvements: (R) \$307,000

Plus Land	<u>\$225,000</u>
Probable Price Indication	\$532,000

A standard deviation for subject is computed as follows: standard deviation of \$0.26 x 12.00 points = \$3.12 x 11,640 sq. ft. = a standard deviation for subject, in dollars, of plus or minus (R) \$36,500.

Applying the standard deviation gives a 68% confidence interval of plus or minus one standard deviation, of:

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\$495,500 to \$568,500, with most probable figure of  
\$532,000

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The sales were analyzed, using a procedure proposed by Dr. Richard U. Ratcliff, elaborated and implemented by Dr. James A. Graaskamp, with modifications by Gene Dilmore.

The comparison procedure is basically as follows: First, the price is reduced to a price per square foot of improvements (including land).

Next, the analyst acknowledges that many of the comparison factors to be considered, are qualitative in nature, and cannot, in the present state of the art, be precisely quantified. Therefore, a procedure is utilized which converts these subjective, or qualitative judgments to a quantitative basis:

3 → Assorted pages re: same topic -- Market Comp using price/print score →

In this step, the properties are assigned comparative quality points for the major property attributes. Points are in accordance with qualitative ratings, as follows:

<u>Rating</u>	<u>Points</u>
Excellent	26
Good	20
Average	15
Fair	13
Poor	10

The major categories of property attributes considered, and the relative weights assigned to each were as follows:

Effective Age	20%
Space Quality (Construction, Design, Finish)	30%
Amenities (Pool, Tennis Ct, extra applia.)	20%
Marketability Factors (Accessibility to DT & emplmt ctrs, View, Location desirability)	<u>30%</u>
	100%

Each assignment of quality points is given its appropriate weight, and the weighted quality points totaled. For example, for Sale #1, a rating of Good in regard to Age (20 points, x 20% weight); a rating of Average in regard to space quality (15 points, x 30% weight); a rating of Average in regard to Amenities (15 points, x 20% weight), and a rating of Good in regard to Marketability Factors (20 points, x 30% weight) gives a total of 17.50 quality points.

Next, for each property, we divide the "Price Per Square Foot of Improvements" by the number of quality points, in order to reduce the comparisons to a common denominator. In the case of Sale #1, the price of \$24.69 per square foot of building, divided by 17.50 quality points, yields an indicator of a price of \$1.41 per quality point/per square foot. Note that these comparative ratings are thus independent of subject property, which is then assigned quality ratings in the same manner.

Finally, we examine the central tendency of these indicators, for a value indication for subject improvements, and add subject land value for an indication of most probable selling price for the total property.

The analysis is summarized in the following matrix:

Comparable Sales Analysis Matrix

<u>Sale #</u>	<u>Ident.</u>	<u>Price</u>	<u>Sq Ft Imps</u>	<u>Price Sq Ft</u>
1	1521 S 17 St	391,495	15,855	\$24.69
2	630 Idlwld	245,000	13,086	\$18.72
3	1504 S 14 Av	530,000	20,363	\$26.03
4	1512 S 13 Av	270,000	14,412	\$18.73
5	3512 Clairmnt	490,500	19,360	\$25.34
6	2905 Rhodes	700,000	30,640	\$22.85
7	3400 S 8 Av	653,000	28,704	\$22.75
8	2316 S 10 Ct	381,500	16,270	\$23.45
9	634 Idlwld	315,000	14,430	\$21.83
10	1316 S 33 St	214,000	9,000	\$23.78
11	1320 S 18 Av	761,250	33,324	\$22.84
12	1540 S 29 Ct	575,000	26,786	\$21.47

Comparable Sales Analysis Matrix--Cont'd

Sale #	Age	\$p Qual	Amenty	Mktblty	Quality	Price Per
	<u>Rating</u>	<u>Rating</u>	<u>Rating</u>	<u>Rating</u>	<u>Points</u>	<u>Point/SF</u>
1	20x.2	15x.3	15x.2	20x.3	17.50	\$1.41
2	13x.2	15x.3	15x.2	20x.3	16.10	\$1.16
3	20x.2	15x.3	15x.2	20x.3	17.50	\$1.49
4	13x.2	15x.3	15x.2	20x.3	16.10	\$1.16
5	10x.2	17x.3	15x.2	23x.3	17.00	\$1.49
6	13x.2	17x.3	20x.2	23x.3	18.60	\$1.23
7	12x.2	15x.3	20x.2	20x.3	16.90	\$1.35
8	10x.2	15x.3	20x.2	20x.3	16.50	\$1.42
9	15x.2	15x.3	15x.2	20x.3	16.50	\$1.32
10	13x.2	15x.3	15x.2	20x.3	16.10	\$1.48
11	13x.2	15x.3	15x.2	17x.3	15.20	\$1.41
12	13x.2	15x.3	20x.2	20x.3	17.10	\$1.34
				Median		\$1.38
				Mean		\$1.36
				Standard Deviation		\$0.12

Most probable price for subject from this approach is indicated as follows:

Comparable Sales Analysis Matrix

<u>Sale #</u>	<u>Ident.</u>	<u>Price</u>	<u>Sq Ft Imps</u>	<u>Price Sq Ft</u>
1	Jacksn Tr	1,472,074	60,720	\$24.24
2	Clubvw	277,500	15,424	\$17.99
3	Shadowwd	1,545,000	75,712	\$20.41
4	Warrior Rd	360,000	13,680	\$26.32

Comparable Sales Analysis Matrix--Cont'd

<u>Sale #</u>	<u>Age</u>	<u>Sp Qual</u>	<u>Amenity</u>	<u>Mktblty</u>	<u>Quality</u>	<u>Price Per</u>
	<u>Rating</u>	<u>Rating</u>	<u>Rating</u>	<u>Rating</u>	<u>Points</u>	<u>Point/SF</u>
1	20x.2	15x.3	15x.2	15x.3	16.00	\$1.52
2	15x.2	13x.3	13x.2	13x.3	13.40	\$1.34
3	15x.2	15x.3	20x.2	15x.3	16.00	\$1.28
4	20x.2	15x.3	13x.2	13x.3	15.00	\$1.75

Median \$1.43

Mean \$1.47

Standard Deviation \$0.21

Most probable price for subject from this approach is indicated as follows:



Subject is 16 years old. Effective Age rating is assigned a Fair rating, 13 points. Space Quality is assigned a Fair rating, 13 points. The Amenities factor is assigned a rating of Fair, or 13 points. Marketability factors are rated Average, with 15 points.

Therefore, 13 points x 20%, plus 13 points x 30%, plus 13 points x 20%, plus 15 points x 30% = 13.60 points. Multiplying x \$1.47 per point per square foot = \$19.99 per sq. ft. x building area of 20,422 sq. ft. =

Probable Price Indication

(R) \$408,000

A standard deviation for subject is computed as follows: standard deviation of \$0.21 x 13.60 points = \$2.86 x 20,422 sq. ft. = a standard deviation for subject, in dollars, of plus or minus (R) \$58,300.

Applying the standard deviation gives a 68% confidence interval of plus or minus one standard deviation, of:

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\$349,700 to \$466,300, with most probable figure of

\$408,000

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FUZZY DECISION MAKING OUTPUT: Oakwood Apartments

NO. OF ALTERNATIVES: 5

NO. OF CRITERIA FOR THE DECISION: 4

RATINGS OF THE ALTERNATIVES

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Eff Age	RATING FOR 1	.75
Eff Age	RATING FOR 2	.60
Eff Age	RATING FOR 3	.60
Eff Age	RATING FOR 4	.75
Eff Age	RATING FOR Subject	.50
SpceQual	RATING FOR 1	.60
SpceQual	RATING FOR 2	.50
SpceQual	RATING FOR 3	.60
SpceQual	RATING FOR 4	.60
SpceQual	RATING FOR Subject	.50
Aments	RATING FOR 1	.60
Aments	RATING FOR 2	.50
Aments	RATING FOR 3	.75
Aments	RATING FOR 4	.50
Aments	RATING FOR Subject	.50
Mktblty	RATING FOR 1	.60
Mktblty	RATING FOR 2	.50
Mktblty	RATING FOR 3	.60
Mktblty	RATING FOR 4	.50
Mktblty	RATING FOR Subject	.60

RATINGS OF THE CRITERIA  
 \*\*\*\*\*

FOR EACH PAIR OF THE CRITERIA ENTER 1 OR 2 TO INDICATE WHICH IS MORE IMPORTANT, FOLLOWED BY A COMMA, FOLLOWED BY A NUMBER BETWEEN 1 AND 9 TO INDICATE HOW MUCH MORE IMPORTANT. DEFINITIONS FOR SOME OF THE VALUES ARE:

- 1 - EQUAL IMPORTANCE
- 3 - WEAK IMPORTANCE OF ONE OVER THE OTHER
- 5 - STRONG IMPORTANCE OF ONE OVER THE OTHER
- 7 - DEMONSTRATED IMPORTANCE OF ONE OVER THE OTHER
- 9 - ABSOLUTE IMPORTANCE OF ONE OVER THE OTHER

USE 2, 4, 6 & 8 WHEN THE DEGREE OF IMPORTANCE FALLS BETWEEN THE VALUES DEFINED ABOVE.

(1) Eff Age	--	(2) SpceQual	2	5
(1) Eff Age	--	(2) Aments	1 1	
(1) SpceQual	--	(2) Aments	1 5	
(1) Eff Age	--	(2) Mktblty	2	5
(1) SpceQual	--	(2) Mktblty	1	1
(1) Aments	--	(2) Mktblty	2	5

FDM PROGRAM OUTPUT  
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CONSISTENCY OF THE PAIRED MATRIX= 0

DECISION VALUES ...

1	- .426827
2	- .31498
3	- .426827
4	- .31498
Subject	- .31498

PRICE SQ FT PER RATING:

- 56.7911
- 57.1147
- 47.818
- 83.5608

MEAN = 61.3212  
 STD DEV = 15.4397

INDICATION FOR SUBJECT:

IMPROVEMENTS \$394,450  
 PLUS LAND \$0

            
 \$394,450