

How to Discredit Most Real Estate Appraisals in One Minute
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Real Estate Brokers have confidence but a real estate appraiser must have evidence especially when serving as an expert witness. Unfortunately, in most instances real estate appraisers make subjective, anecdotal, arbitrary, and unscientific “adjustments” to comparable sales market data without objective market-based support. Their valuation process relies on comparable building sales (Sales Comparison Approach), comparable rental rates (Income Capitalization Approach) and vacant land sales (Cost Approach). Using these three approaches without disciplined statistical valuation methodology, these appraisers arrive at guesstimates of value. Guesswork is no longer an acceptable methodology in our advanced technological world.

This paper will provide a simple mathematical test that can disprove most real estate appraisal reports in one minute. This test, *Verify Adjustments Tool*, is a freeware program that can be downloaded from the RealStat® website www.realstat.com.

Appraisers have little or no training in statistics and econometrics (regression analysis) and thus violate two simple rules in statistics:

1. Sample size is too small
2. Variance in the real estate market is not calculated

The term econometrics literally means economic measurement. It is the application of statistical analytical mathematical tools, mainly regression analysis, to the real world of economics. Its purpose is to:

1. Describe economic reality (via regression charts),
2. Test hypotheses about economic theory and significance of factors, and
3. Predict economic activity (estimate value of real estate).

Regression analysis is defined as:

“A method that examines the relationship between one or more independent variables (quantity) and a single dependent variable (price) by plotting points on a graph; used to identify and weight analytical factors and to make forecasts.”

Appraisal Institute. The Dictionary of Real Estate Appraisal, 3rd Edition
Appraisal Institute, 1993, Page 299.

Econometrics empowers real estate appraisers to describe accurately the relationship between sale price and the various factors that contribute to the value of real estate, test the significance of these factors, and apply the resultant econometric indicators to a credible estimate of value for a particular property. A scientific approach, it can be replicated to verify the appropriateness of the method used and to confirm the credibility of the estimated value.

Econometrics and regression analysis are superior tools compared to so-called “traditional” (guesswork) appraisal techniques as summarized here:

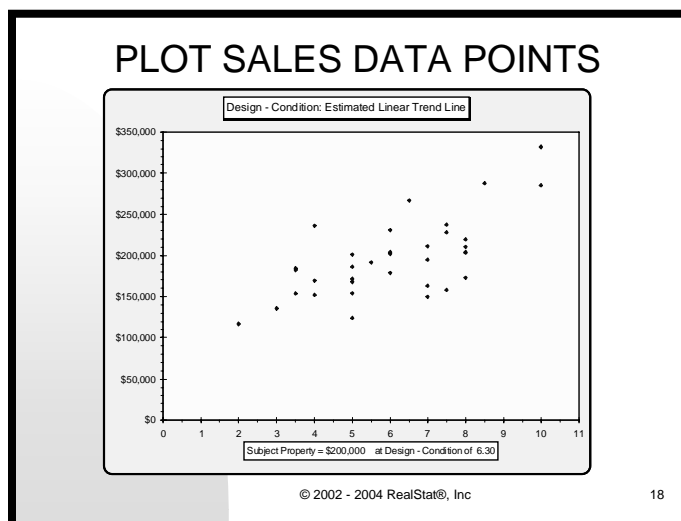
Methods:	Traditional	Regression
Nature of Analysis	Subjective	Objective
Quantification of Factors	No	Yes
Market Supported Adjustments	No	Yes
Hypothesis Testing	No	Yes
Charts With Trend Lines	No	Yes
Replication / Scientific Testing	No	Yes
Variance Calculation	No	Yes
“Paired Sales” Analysis	False Assumption: Perfect Market	NA

Regression analysis is superior with regard to the comparable sales data selection. The “traditional” methods contain a high potential for data bias, because the appraiser often engages in the highly questionable practice of “data mining” by selecting comparable sales to support a preconceived value conclusion. In contrast, regression relies on an unbiased random selection of comparable sales.

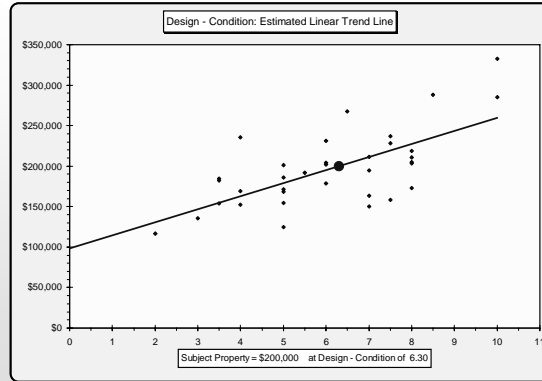
Comparable Data Selection Criteria		
	Traditional	Regression
Types of Use (Residential, Commercial, Industrial, etc.)	Similar	Similar
Property Features (Bedrooms, Bathrooms, Building Size, Ceiling Height, etc.)	Similar	Dissimilar
Data Diversity	Narrow	Wide
Data Bias Potential	High	Low

Method DATA	Traditional Analysis BIASED	Regression Analysis UNBIASED
Selection	"Data Mining": Comparable sales selected to closely "match" the subject property	Random sample of sales from market transactions.
Analysis	Often a self fulfilling prophecy.	Regression analysis is independent of the subject property.
Adjustments	Guesswork to support a value.	Derived from market transactions and then applied to subject property.
USPAP Ethics Provision	Possibly Misleading Report	Meaningful Report

Regression analysis charts provide a visual image of the market. The following is a step-by-step presentation of regression data charting. The regression line is drawn through the mathematical center of the data points. The subject property is plotted along the regression line. It is the estimated most probable price and hence the market value. The vertical \pm price distance between the regression line and each data point is the price variance, the statistical residual. The total and the average of the \pm statistical residuals must always equal zero because the regression line is drawn through the mathematical center of the all the \pm data points.



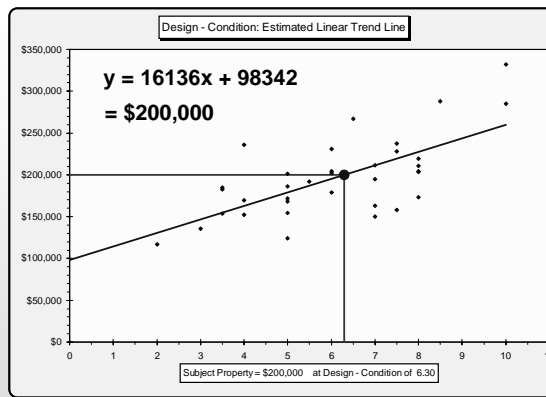
DRAW REGRESSION TREND LINE



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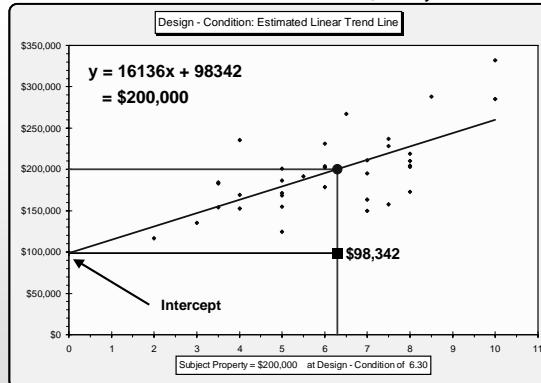
PLOT SUBJECT PROPERTY



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PLOT CONSTANT \$98,342



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The regression formula is composed of the “constant” and the slope of the regression line. The constant is that point where the regression line intercepts with the price vertical axis, in this case \$98,342. The slope increases at \$16,136 per each unit x 6.3 units = \$101,658. Adding the constant of \$98,382 plus the \$101,658 equals the estimated market value of \$200,000.

TEST 1: Sample Size

The sample size (number of comparable sales) must be large enough to calculate the adjustment factors. Appraisers usually violate this rule. This simple mathematical proof is as follows: Sample size “n” minus 1 for the constant minus the number of factors = Remaining Degrees of Freedom (DF) that must always result in a positive number.

SAMPLE SIZE FORMULA						
Sample Size "N" - 1 - Adjustment Factors = Degrees of Freedom						
Typical	"N" Sales	N - 1	-	# Adjustment Factors	=	Degrees of Freedom
Residential	3	2	-	7	=	-5
Commercial & Industrial	6	5	-	7	=	-2
	7	6	-	7	=	-2
	8	7	-	7	=	0
	9	8	-	7	=	+1
-						
Regression	35	34	-	7	=	+ 27
It is mathematically impossible to estimate value when the degrees of freedom are less than one (1).						
A smaller sample size with a positive degrees of freedom are permissible if the result achieves a statistically significant confidence level.						

TEST 2: Variance

Real estate is an imperfect marketplace and hence has a built-in variance. Two properties that are exactly alike in age, size, location, etc. that are sold on the same day will not sell for the same price because the real estate market is an imperfect market that contains an inherent price variance. This is precisely why the appraisal profession exists to calculate the price variance. An appraiser is not needed to estimate the market price of fungible commodity such as gold since one gram of gold is equal in price and interchangeable with any other gram of gold.

The following table lists the rules necessary for a measure of variance.

Variance – The Missing Adjustment

In The Real Estate Market It Is *Always* There

- The Variance Must be Calculated.
- Typically It Is 10% to 30%.
- The Statistical Residual is the Measure of Variance.
- The Sum of Residuals = 0.
- The Average of the Residuals = 0.
- The Residual Must Be Added to Calculate the Correct Value Estimate.

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Here is a typical example of an appraisal report for a single-family home. It relies on three comparable sales. The calculations look quite impressive. The appraiser made adjustments for eight factors (location, room count, gross living area, finished basement, heating & cooling, car garage, fireplace, and functional utility). Unfortunately, the sample size was too small indicating that the appraiser engaged in guesswork or simply made up the adjustments.

Single Family House - Are The Adjustments Correct?			
	Sale # 1	Sale # 2	Sale #3
Sale Price	\$ 400,000	\$ 392,500	\$ 425,000
8 Adjustment Factors			
Location	\$ -	\$ (5,000)	\$ (5,000)
Room Count	\$ 5,000	\$ 5,000	\$ 5,000
Gross Living Area	\$ (14,000)	\$ 12,000	\$ (7,000)
Finished Basement	\$ 6,000	\$ 6,000	\$ -
Heating & Cooling	\$ 2,500	\$ -	\$ -
Car Garage	\$ (2,500)	\$ -	\$ 2,500
Fireplace	\$ (2,500)	\$ -	\$ -
Functional Utility	\$ -	\$ -	\$ (5,000)
Net Adjustments	\$ (5,500)	\$ 18,000	\$ (9,500)
Adjusted Sale Price	\$ 394,500	\$ 410,500	\$ 415,500
RESIDUAL	\$ 15,500	\$ (500)	\$ (5,500)
Estimated Value	\$ 410,000	\$ 410,000	\$ 410,000
Total of Residuals	\$ 9,500		
Average of Residuals	\$ 3,167		
Sample Size	\$ 3		
N-1	\$ 2		
Adjustment Factors	\$ 8		
Degrees of Freedom Left	\$ (6)		

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Let's see what went wrong.

Test No. 1

The sample size is too small. A sample size of three (3) sales minus 1 for the constant = 2 minus 8 adjustment factors = negative 6. It is mathematically impossible to derive eight adjustments from a sample of three sales.

Test No. 2

The variances (statistical residuals) were not calculated evidenced by the fact that the total and the average of the variances do not equal zero.

Sale No.	Sale Price	Net Adjustments	Adjusted Sale Price	Estimated Value	Variance / Residual
1	\$400,000	-\$5,500	\$394,500	\$410,000	\$15,500
2	\$392,500	\$18,000	\$410,500	\$410,000	-\$500
3	\$425,000	-\$9,500	\$415,500	\$410,000	-\$5,500
Total variance does not equal zero				Total =	\$9,500
Average variance does not equal zero				Average =	\$3,167

ADJUSTMENTS WRONG!

See "The Formula"

- Sample Size of 3 is Too Small
 (# Sales - 1) - # Factors = DF Left
 (3 - 1) = 2 - 8 = - 6
 (3 - 1) = 2 - 1 = + 1 Maximum
- Total of the Residuals (Variance) Not = Zero
- Average of the Residuals (Variance) Not = Zero

Use the "RealStat® Verify Adjustments Tool"

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As shown above, the maximum number of mathematically possible adjustments from a sample of three (3) sales is one (1) adjustment, so the appraiser's calculations are fatally flawed. Furthermore, the total and the average of the residuals do not equal zero. Thus, the value conclusion is based on guesswork unsupported with market derived adjustments, cannot be relied upon to produce a credible estimate of value, and consequently is in potential violation of the *Uniform Standards of Professional Appraisal Practice (USPAP) Standards Rule 1-1* that states:

USPAP 2006 Standards Rule 1-1

"In developing a real property appraisal, an appraiser must:

- (a) be aware of, understand, and correctly employ those recognized methods and techniques that are necessary to produce a credible appraisal;
- (b) not commit a substantial error of omission or commission that significantly affects an appraisal; and
- (c) not render appraisal services in a careless or negligent manner, such as by making a series of errors that, although individually might not significantly affect the results of an appraisal, in the aggregate affects the credibility of those results."

Source: The Appraisal Standards Board of
The Appraisal Foundation, Washington, DC
www.appraisalfoundation.org

SUMMARY

This paper illustrates the accuracy of econometric modeling as compared to “traditional” unscientific anecdotal guesswork methods used by a vast majority of real estate appraisers.

The regression analysis in this paper utilized RealStat® Econometric Software, a product developed and marketed by RealStat®, Inc.

The website www.realstat.com contains information regarding econometrics and you can download the freeware “Verify Adjustments Tool” featured in this paper.

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Eugene Pasymowski MAI is the president of RealStat® Valuation located in Chester Springs, Pennsylvania. He is an MAI designated member of the Appraisal Institute who specializes in the application of econometrics to the valuation of real estate. Mr. Pasymowski serves as an expert witness in state and federal court involving complex litigation concerning residential, commercial and industrial real estate. He conducts continuing education seminars on econometrics for the Appraisal Institute, Assessors Association of Pennsylvania, Greater Philadelphia Board of Realtors and other professional groups. He is the author of RealStat®, a Microsoft® Excel® based econometric software program that is specifically designed for the valuation of all types of real estate. The RealStat® website is www.realstat.com.

Mr. Pasymowski is the author of *Econometric Solutions for Real Estate Valuation* that received the “Best Paper Award” at the 23rd Pan Pacific Congress of Real Estate Appraisers, Valuers and Counselors in San Francisco in September 2006. Mr. Pasymowski’s paper was selected for the “Best Paper Award” by a panel of real estate experts and econometricians representing countries from the entire Pacific Ocean Rim including United States, Canada, Mexico Japan, Taiwan, Korea, Australia, New Zealand, Philippines, Indonesia, Singapore, and Malaysia.

Pan Pacific Congress 2006
<http://www.appraisalinstitute.org/ppc/default.asp>