

## Chapter 7

# Statistics and Appraisal Standards

Mass appraisal is the systematic process used to value large quantities of properties as of a given date, using standard methodology. The process of valuing these properties must be uniform and the value level must be at 100 percent of RMV.

The principles and procedures used for mass appraisal are similar to those used for an individual appraisal. In mass appraisal, you work with a large volume of market data to develop value indicators. When applying these value indicators to appraise property, the process takes on the nature of direct comparison and produces accurate value estimates at a relatively low cost. Additionally, mass appraisal provides a means to establish and maintain valuation uniformity.

In Oregon, the three methods of mass valuation are:

- Physical reappraisal,
- Recalculation, and
- Ratio adjustment.

Physical reappraisal requires the use of benchmarks, market studies, and some level of inspection of the property to be appraised. (See Chapter 9, "Inspection level," pages 36 and 37.)

Recalculation requires market studies, developing adjustment tables, electronically stored property characteristics, and computer application of the adjustment tables to the property characteristics.

Ratio adjustment compares sale prices to RMV and applies an adjustment (if warranted) to bring the property to 100 percent of RMV. (See ORS 309.200 (1)(2)(3) and ORS 308.232).

### Uniformity and Equity of Real Market Value

One of the primary objectives of a mass appraisal program is to achieve uniform appraisals among properties of a similar type. This is accomplished by using proper valuation methods and procedures. However, since values can change rapidly within an area, it is often difficult to maintain equity and uniformity among all valuation areas or property classes. Annual sales ratio studies are a means to identify and measure the effects of market fluctuations.

Equity of RMV does not mean equal RMV. Equity of RMV is achieved through uniform valuation of properties within each property class in a market area or neighborhood. To ensure equity is maintained for all properties, the assessor must develop a program that identifies inequities and errors in the current assessment roll.

Reappraisal is the best method of correcting inequities, but it is not practical to reappraise each property every year. In areas with adequate sales, the most practical way to correct inequities in RMV are recalculation and ratio adjustment. Ratio studies work with traditional valuation and recalculation programs. Ratio studies can identify both the problem areas and the amount of adjustment required to correct inequities.

### **Physical Reappraisal**

Reappraisal typically refers to a three-step process used to value large groups of properties.

The general steps are:

- Conducting preappraisal studies;
- Inspecting the properties; and
- Applying the preappraisal study results to the properties being appraised.

The reappraisal process is discussed in Chapters 8 through 11.

### **Recalculation**

Recalculation is a method that is a hybrid of reappraisal and a ratio study. In recalculation, the results of the preappraisal studies are entered into tables in the computer. The studies are the same as those conducted for reappraisal. The tables are then applied to individual property characteristics already contained in the computer. This allows large numbers of properties to be valued with minimal staff involvement.

### **Ratio Study**

The sales data used in a ratio study are collected from real estate transfer documents recorded in county clerks' offices and, for manufactured structures, from copies of registration forms filed with the state. In some counties, residential sales data is obtained from multiple listing services. Necessary property identification, and statistical and ratio information are collected on all sales in the county. This information includes property location, name and address of buyer and seller, county identification number for the property, sales date, sales price, property class, condition codes, and current roll RMV.

A sales confirmation program verifies conditions of the sales transactions. Each transaction is given a condition code that identifies the type of sale and indicates if it is usable for ratio study purposes or should be rejected. Condition codes are defined in the Department of Revenue's *Assessor's Certified Ratio Study Procedures Manual*, 150-303-437.

Sales listings are created from usable sales. Sales listings relate adjusted sale prices to the RMV as of the prior January 1. Ratio indications for each sale (RMV divided by sales price) are listed in ascending order from lowest to highest to form an array. Data can be sorted in various ways to assist in determining the RMV level and equity of valuation for property classes.

Indicated ratios are reviewed to determine if the overall value level for each market area needs adjustment. If the RMV needs adjustment, then the indicated amount of adjustment is applied to each property in that market area. In this way each property value can be adjusted to achieve 100 percent of RMV.

When sales data is limited, a study of two or more years of sales may be necessary.

## **Appraisal Ratio Studies**

When the number of sales is insufficient to accurately estimate the RMV level of a class of properties in a market area or neighborhood, appraisal ratio studies may be conducted to supplement the sales data. A qualified appraiser needs to make the appraisals. The appraiser should appraise a random selection of properties that represent the property class and the market area being studied. The appraiser's value estimate is then used in the appraisal ratio study in place of a sale price.

An appraisal ratio study is compiled and analyzed in the same manner as a sales ratio study. Types of data that can be used in appraisal ratio studies are: gross income multipliers, construction cost indexes, and real estate trends.

## **Data Standards**

Analysis of assessment records allows the appraiser to establish and maintain accurate values. To make informed decisions, adequate information must be available. At a minimum, the following information should be maintained in the county's computer database for access by appraisers.

- Unique identification number
- Market, study, or adjustment area;

- Neighborhood;
- Sale price, date, deed type, etc.;
- Condition code;
- Map and tax lot;
- Zoning;
- Land class or type;
- Land size—square feet, front feet, acreage, etc.;
- Land features—view, topography, traffic, etc.;
- Land RMV;
- Improvement type;
- Improvement quality class;
- Improvement RMV;
- Year built;
- Square footage of each floor or unit;
- Foundation;
- Exterior walls;
- Roof;
- Number of bedrooms;
- Number of baths or number of plumbing fixtures;
- Type of heating system;
- Other interior features;
- Effective age;
- Percent good;
- Property MAV;
- Property AV;
- Date last inspected;
- Comments; and
- Appraiser's name or I.D.

For income properties, additional fields are required:

- Applied rates—capitalization rate, recapture rate, discount rate, overall rate;
- Income—gross income, net income; and
- Expenses applied.

In addition to the preceding fields, the computer should contain land value computations such as base unit land values and adjustments, and the improvement computations. You must be able to provide these for taxpayer inspection.

## **Statistics in Mass Appraisal**

Much of the mass appraisal program is dependent on the statistical analysis of sold properties and their current roll RMV. In order to discuss this topic it is necessary to have an understanding of statistical terms used in this section. The following terms are phrased so they closely resemble their use in mass appraisal.

**Absolute Deviation**—In an array of sales ratios, it is the absolute value difference between a sample point and one of the measures of central tendency. For assessment purposes, the median ratio is the central tendency used to calculate the absolute deviation.

**Array**—The list of a set of numbers or observations in either ascending or descending order.

**Average Absolute Deviation**—The average of the absolute deviations in an array.

**Bias**—A bias occurs if the expected value of a statistic is not equal to the population parameter being estimated. In assessment administration, valuation progressivity/regressivity are kinds of possible bias. Bias may also be caused when the sample only represents a small portion of the population. An example of bias is using sales of only lower-priced homes in a mixed area containing low-, medium-, and upper-value properties.

**Central Tendency**—The tendency of most kinds of data to cluster around some types of central value, such as median or mean.

**Coefficient of Dispersion (COD)**—The ratio of the average absolute deviation to the median, converted to a percentage. The lower the percentage, the greater the uniformity. COD is used as a measure of uniformity and to determine if the reliability and quality of the valuation data are deteriorating. Standards have been set around the COD that require an area to be reappraised once the data has been determined to be unreliable.

**Frequency distribution**—A tabulation of individual ratios, usually expressed in a graph format, determined by counting the ratios falling within uniform ratio spreads such as: 10, 20, or 30 percentage points.

**Homogeneous**—In assessment, used to describe a market area where the uses, property types, and quality classes are similar.

**Heterogeneous**—In assessment, used to describe an area or neighborhood in which the uses, and/or property types are diversified.

**Market Area**—Any given neighborhood, group of competing neighborhoods, or property types where, in the minds of potential purchasers, the properties are effectively competitive. To be considered a market area, an area must contain sufficient numbers of properties to ensure an adequate sales sample for analysis.

**Mean**—The total of the ratios in the array, divided by the number of ratios in the array. It is commonly referred to as the *average* of the sales ratios in the array.

**Median**—The exact middle ratio of an array. If the array contains an odd number of sales, it is the center of the array. If the array contains an even number of sales, it is the average of the two middle, or central, sales.

**Population**—All of the properties of a given property type within a specified market area.

**Price Related Differential (PRD)**—A measure of appraisal progressivity or regressivity. It is calculated by dividing the mean by the weighted mean.

**Progressivity**—Where high-valued properties are over-appraised relative to low-valued properties.

**Regressivity**—Where high-valued properties are under-appraised relative to low-valued properties.

**Sales Ratio**—To calculate the sales ratio, the RMV of a property is divided by the sale price of the same property.

**Sample**—A set of observations selected from a population and used to make inferences about population values. In assessment, the sample consists of the properties that sell (in fair-market transactions) within a specific market area during a specific time period.

**Uniformity**—The degree to which a single member of a property group reflects a RMV level consistent within the market area and property class.

**Weight**—A percentage value that represents the relative importance of each element's contribution to the total.

**Weighted Mean**—A measure of central tendency determined by dividing the sum total of the RMV by the sum total of the sale prices for a specified area. The mean, weighted mean, and median are referred to as measures of central tendency and are expressed as a percent. These three ratio indicators point toward adjustments that may be necessary within a property class and area, but do not provide a good indication of RMV uniformity.

### **Analysis of the Ratio Study**

Computing measures of central tendency is the first step in analyzing ratio conclusions. Three measures of central tendency must be used to measure the relationship between the current roll RMV and the sales price of property. Valuation level refers to the relationship between the RMV on the roll and the sales price of property.

Additional statistical measures for RMV uniformity are needed to illustrate how widely the values may vary from each of the ratio indicators.

Ratio studies are an excellent tool for establishing priorities for equalization operations, appraisal quality control, and preliminary analysis of market fluctuations. Whether properties are under- or over-valued, the appropriate correction for the inequities can be determined with ratio studies. If applying a percentage adjustment is the most practical correction for a class of properties in a specific area, the ratio conclusion from the sales ratio study will show the adjustment percentage amount required.

To maintain equity, it may be necessary to apply different adjustments to the land than to the improvements. The land value and improvement value components of each property represents a percentage of the total RMV. A weighting computation process is used to determine the correct adjustment for each component.

### **Population Testing**

Population testing is a type of statistical analysis used to determine if a sample is representative. A sample that is not representative of the population is biased. This may be due to a flaw in statistical technique, improper application of condition codes, inaccurate sample selection, or inconsistencies in the marketplace.

Although there are standard tests to determine if a sample is representative of the population, few work well in sales ratio analysis. To solve this problem, DOR has developed a test for sample bias that combines basic statistical and appraisal theory. The test is called Percent of Similarity.

To conduct this test, the neighborhood's property characteristics should be loaded on a computer with a spreadsheet program. The characteristics of the sales sample are compared to the characteristics of the entire neighborhood. If the characteristics are similar (at least 80 percent), the sample is useful for comparison. If the sample is less than 80 percent similar, it is biased and does not represent the population.

**Example:**

**Market Area Sales Sample**

<b>Characteristic</b>	<b>Market Area Average</b>	<b>Sales Sample Average</b>	<b>Calculation</b>	<b>Percent Similarity</b>
Percent Good	76%	72%	$72 \div 76$	95%
RMV	\$121,000	\$115,000	$115,000 \div 121,000$	95%
Quality Class	3.99	4.20	$3.99 \div 4.20$	95%
Square Footage	1,522	1,402	$1,402 \div 1,522$	92%

**Sample Similarity = 94.25%**

Averages for particular characteristics are listed under **Market Area Average** and **Sales Sample Average**. For example, the average quality class in a market area is determined by dividing the total numeric value of classes by the number of properties in the area. Percent of similarity is determined by dividing sales sample averages by market area averages for each characteristic.

The sales sample shows that 94.5 percent is the average similarity for all characteristics. This proves the sample has a low degree of bias and is representative of the market area. If the percent of similarity is less than 80 percent, the sample is not representative of the market area. If that were the case, the ratios developed from these sales should be given little weight. When the sample is not representative of the population, the analyst should review or expand the sales collection area, sales collection period, and characteristics for additional analysis.

## Time Adjustment Studies

Time adjustment studies are used when sale prices are increasing or decreasing over time. Study results will indicate the percentage adjustment required to bring sales prices to current value indications. When there are few current-year sales, prior year's sales are used to supplement the sales sample.

There are various methods of conducting a time adjustment study. The most accurate method is to use double sales. A double sale is the resale of the same property within a specific time period.

If double sales are limited, an analysis of nearly identical or similar properties can be made. This is referred to as matched pair analysis. An important part of this analysis is to confirm that the property has not changed significantly since the last appraisal. Significant changes to the property invalidate the sale for this type of analysis.

Another method of computing a time adjustment is to use ratio trends. Analysis of ratio trends can be used to determine the percentage adjustment needed to reflect current market conditions. Detailed procedures for developing and analyzing ratio studies are in the *Assessor's Certified Ratio Study Procedures Manual*, 150-303-437.

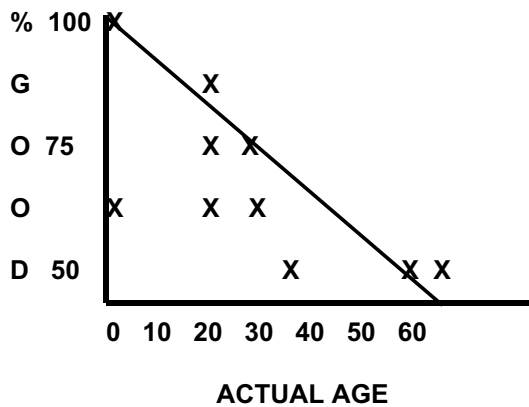
## Graphs

Graphs are commonly used in statistical analysis to provide a visual reference of data. The most common graphs display changes in value over time, differences in unit value due to economies in scale, and depreciation of improvements or personal property.

A typical graph has one horizontal and one vertical axis. The horizontal axis, or base, is referred to as the "X" axis and the vertical is the "Y" axis. Time or size is typically displayed on the "X" axis and other factors such as percent good or sale price on the "Y" axis. On a depreciation graph, percent good is placed on the "Y" axis and actual age or effective age (noted in years) is placed on the "X" axis with the lowest age and percent good appearing at the point where "X" and "Y" intercept. The points plotted on the graph are referred to as observations. Drawing a line through the center of the observations indicates the trend.

In the graph shown, the percent good is decreasing over time.

### Sample Depreciation Graph



### Stratification Studies

These studies look at different property characteristics in a sales sample to determine if a particular characteristic affects value. Sale ratios are stratified, or sorted, by a given characteristic. When ratios cluster around a characteristic, it may indicate the characteristic has an identifiable and measurable impact on value. If the characteristic is measurable, it can be adjusted to bring the affected properties to 100 percent of RMV.

An array containing class 3 and 4 dwellings may indicate a different conclusion than a study that looks at each dwelling class separately.

The following example looks at 35 sales from a ratio study area called ABC1. The sales in the left-hand column are arrayed in ascending ratio order, as found in a typical ratio study. The mean ratio from this sample is 93.83. The indication is that the study area would need to have the values increased by 1.066 ( $100 \div 93.83$ ) in order to be at 100 percent of RMV. The 1.066 adjustment is based on the assumption that all the properties are responding uniformly within market area ABC1. This is not always the case.

The column to the right has stratified the sales into their various quality classes. The indication when stratified is somewhat different. The quality class 3 properties indicate a 94 ratio and the quality class 4 properties indicate a 92 ratio.

## Market Area ABC1 Sales Ratio Review

<u>Combined Property</u>					<u>Stratified Property</u>				
Sale No.	Quality Class	Total RMV	Sale Price	Sale Ratio	Sale No.	Quality Class	Total RMV	Sale Price	Sale Ratio
1	142	\$132,345	\$170,000	78	2	131	\$113,750	\$129,500	88
2	131	113,750	129,500	88	4	131	173,290	194,000	89
3	141	207,435	233,000	89	6	131	131,115	146,324	90
4	131	173,290	194,000	89	9	131	196,925	213,390	92
5	142	298,015	330,244	90	10	131	131,905	142,662	92
6	131	131,115	146,324	90	17	131	138,690	147,330	94
7	132	153,645	170,000	90	18	131	136,930	144,340	95
8	132	158,720	176,995	90	22	131	125,915	130,750	96
9	131	196,925	213,390	92	23	131	126,485	131,208	96
10	131	131,905	142,662	92	25	131	135,425	141,000	96
11	132	177,830	194,242	92	26	131	133,735	138,810	96
12	141	183,810	198,000	93	27	131	169,945	175,393	97
13	141	167,235	180,180	93	28	131	117,780	120,873	97
14	141	225,720	240,500	94	30	131	175,870	182,000	97
15	142	233,604	248,390	94	33	131	162,890	167,000	98
16	132	163,680	174,840	94	34	131	126,460	127,100	99
17	131	138,690	147,330	94	35	131	173,290	172,311	101
18	131	136,930	144,340	95	7	132	153,645	170,000	90
19	132	146,275	153,400	95	8	132	158,720	176,995	90
20	141	152,865	160,500	95	11	132	177,830	194,242	92
21	132	170,905	178,961	95	16	132	163,680	174,840	94
22	131	125,915	130,750	96	19	132	146,275	153,400	95
23	131	126,485	131,208	96	21	132	170,905	178,961	95
24	132	157,045	163,840	96	24	132	157,045	163,840	96
25	131	135,425	141,000	96	29	132	145,165	149,725	97
26	131	133,735	138,810	96			<b>Class 3 Mean</b>		<b>94.48</b>
27	131	169,945	175,393	97					
28	131	117,780	120,873	97	3	141	207,435	233,000	89
29	132	145,165	149,725	97	12	141	183,810	198,000	93
30	131	175,870	182,000	97	13	141	167,235	180,180	93
31	141	158,035	161,825	98	14	141	225,720	240,500	94
32	141	146,575	149,900	98	20	141	152,865	160,500	95
33	131	162,890	167,000	98	31	141	158,035	161,825	98
34	131	126,460	127,100	99	32	141	146,575	149,900	98
35	131	173,290	172,311	101	1	142	132,345	170,000	78
		<b>Combined Mean</b>		<b>93.83</b>	5	142	298,015	330,244	90
					15	142	233,604	248,390	94
							<b>Class 4 Mean</b>		<b>92.2</b>

After reviewing the stratified results in the example market area shown on the previous page, it would be appropriate to review several more areas of class 3 and class 4 properties. If the stratification in the majority of the market areas indicates that different adjustments by quality class are warranted, then there are several possible ways to achieve a 100 percent ratio.

In the following example, the summarized results of area ABC1 and six additional market areas are arrayed for comparison.

### Summary of Ratios Stratified by Quality Class and Market Area

Area	Class 3 Ratio	Class 4 Ratio	Combined Mean Ratio
ABC1	0.94	0.92	0.94
E001	0.90	1.04	0.95
NWS3	0.99	0.92	0.94
B005	0.99	0.91	0.97
NWN6	1.02	0.94	0.98
OOO6	0.97	0.87	0.96
BOO1	0.98	0.95	0.96

In the example above, overall sales of class 3 dwellings produced ratios higher than sales of class 4 dwellings. This is statistical evidence that the market is reacting differently to these dwelling classes. Both the combined and stratified ratios can be used to adjust RMV to arrive at a valuation level of 100 percent. Stratified ratios may be used to make adjustments to improve equity and uniformity. This adjustment will decrease the COD while the combined adjustment will increase the COD.

### Valuation Standards

Valuation standards are used to measure the results of county valuation programs. The minimum standards and the statistical measurements used to evaluate results are:

**Real Market Value (RMV)**—Oregon Revised Statute 308.232 requires property to be appraised at 100 percent of its RMV. The ratio study is the primary tool used to test RMV. Ratios less than 100 percent indicate that the RMV is below market. If the ratio is greater than 100 percent, the RMV is above market. Adjustments to the RMVs on the roll are made as required to bring values to current market conditions.

**Coefficient of Dispersion (COD)**—This is the average absolute deviation to the median, converted to a percentage of a selected ratio. It is used to determine the reliability and uniformity of the RMV. A low percentage indicates a high degree of uniformity. A high percentage indicates a low degree of uniformity and may indicate the data is no longer reliable. Oregon Administrative Rule (OAR) 150-308.234 sets uniformity and equity standards for different classes of real property. The COD is calculated only from sales that are considered arm’s-length transactions. Some fair market sales are not considered usable if any of the following changes have occurred since the last appraisal:

- A new subdivision or partition;
- A major lot line adjustment;
- A change to the existing footprint on an improved property;
- The addition of a second floor;
- The addition of a major outbuilding;
- A major renovation or remodeling;
- A new dwelling; or
- A new commercial or industrial structure.

The following COD standards are set out in OAR 150.308.234

<b>Type of Property</b>	<b>Maximum COD</b>
Vacant land (100 & 400)	20
Manufactured Structures	25
Urban Residential	
Homogeneous	10
Nonhomogeneous	15
Rural Improved (101 & 401)	20
Apartments (701)	12
Income Property	
Larger Urban	15
Smaller Rural	20

**Price-Related Differential (PRD)**—The PRD measures the equity between high- and low-valued residential properties within a given market area or neighborhood. The PRD is calculated by dividing the mean ratio by the weighted mean ratio. As the PRD exceeds 1.00, the higher

valued properties are considered under appraised relative to the low-valued properties. As the PRD drops below 1.00, the high-valued properties are considered over-appraised compared to the low-valued properties.

The PRD should fall between .98 to 1.03 for residential property. Ratios within this range tend to display normal market disparity and do not display bias. Ratios outside of this range are evidence of bias in the sample and further verification is required.

**Trimming**—Trimming is the removal of sales from a sample because the sales are considered outliers or extreme ratios (those outside a predetermined range) and are not representative of the sample. The International Association of Assessing Officers' (IAAO) standards for trimming sales from an array requires that no more than five percent of the sales be trimmed and that half the trimmed sales come from each extreme. For example, if there are a total of 50 sales, 5 percent means only 2.5 sales may be eliminated. No more than one sale should be trimmed from each end of the array. All remaining sales must be left in the sample.

**Not Same As Appraised (NSAA)**—Voter approval of Measure 50 in 1997 eliminated the requirement for annual appraisal of one-sixth of the county, commonly referred to as reappraisal. Measure 50's passage also changed the appraisal priority to identification of all properties with significant changes that add or reduce RMV each year.

Counties can no longer rely on locating and valuing any missed changes every six years. One method for locating changed properties is to look at the sales ratios and field review sales outside a selected ratio range. This works well for locating properties that have sold and changed, but in the process has made the calculation of the COD unreliable as a test of uniformity for the population.

Reappraising sales will cause problems for the ratio study. According to the 1999 IAAO Standard on Ratio Studies:

“The objective of the ratio study is to determine appraisal performance for the population of properties. As long as sold and unsold parcels are appraised in the same manner, statistics calculated in a sales ratio study can be used to infer appraisal performance for unsold parcels. However, if parcels that sell are selectively reappraised based on their sales prices or some other criteria, the sales ratio study will not be valid. Accordingly, assessing officials must be diligent to ensure that sold and unsold parcels are treated equally.”

If sales are reappraised based on their selection from predetermined trim points, the COD will no longer be representative of the population. When this is the case, an additional study is needed to measure the reliability of the sample. A measure that gives an indication of reliability is referred to as the NSAA ratio. This ratio is calculated by dividing the number of NSAA sales by the total number of sales in the sample, which includes NSAA sales.

For example: under the 6-year reappraisal cycle, the NSAA ratio was 2 percent. Assuming no further reappraisal, the NSAA ratio increases to 6 percent in the first year. The new 6 percent ratio sets a baseline for the next year's study. If the ratio continues to increase annually, it is a strong indication the reliability of the data is deteriorating. Once the NSAA ratio reaches 15 percent, the area should be field reviewed to determine if reappraisal is necessary.