

RATIO STUDIES

*This document is a summary of the ratio section of
Department of Revenue's Fundamentals of the Assessor's Office class.*

DEFINITIONS

Array	To list ratios in order of magnitude.
Average Absolute Deviation	Measures the difference, or average spread, between each ratio and the median ratio. Absolute indicates absolute value, in other words, the direction of the spread, whether above or below a measure of central tendency, is unimportant. It is the magnitude of the differences that is the significant aspect.
Coefficient of Dispersion	The most used measure of assessment uniformity in ratio studies. It is based on the average absolute deviation, but expresses it as a percentage. It is calculated by dividing the average absolute deviation by the median assessment/sale price ratio and then multiplying by 100 to convert the ratio to a percentage.
Mean	The average ratio, also known as the average, the arithmetic average, or the unweighted average. It is calculated by summing the ratios and dividing by the number of ratios.
Measures of Central Tendency	Measures which describe the typical level of appraisal by a single number or statistic. In ratio studies, three such measures of central tendency are the mean, the median, and the weighted mean.
Median	The median is the midpoint, or middle ratio, when the ratios are arrayed in order of magnitude. If the number of ratios is even, the two middle ratios are averaged to produce the median.
Ratio	The relative size of two quantities expressed as the quotient of one divided by the other.
Sales Ratio	The relationship between a parcel's assessed value and its estimated market value as represented by an open market, arms-length sale (an expert appraisal is sometimes used as a proxy for market value).
Stratification	The process of sorting the parcels into relatively homogeneous groups. It permits analysis of mass appraisal performance within and between property groups or categories. In ratio studies, stratification may be by land use categories, value categories, or both.
Weighted Mean	The weighted mean is an aggregate ratio found by first summing the assessed values for the entire sample; then summing the market values for the entire sample; and finally by dividing the total of the assessed values by the total of the market values.

PROPERTY TAX AND RATIO STUDIES

The assessment function is performed for the purpose of generating revenue through the property tax. The property tax is based on the taxable value of property. RCW 84.40.030 states that “all property shall be valued at one hundred percent of its true and fair value in money and assessed on the same basis unless specifically provided otherwise by law.” In Washington, statutes provide for the levying and collecting of property tax; however, the actual levying and collecting are done at the local level.

The property tax is an ad valorem tax, which means that a tax levy is apportioned among taxpayers according to the value of each taxpayer’s property. The property tax is the primary means by which local government pays for the services it provides, such as police and fire protection, schools, roads, parks, libraries, and the court system.

Two types of property tax levies support the state school system:

- the state school levy which is paid by all Washington property owners, and
- special levies which are approved by voters for a specific school district.

Special levy funds apply only to property within the taxing district which approved it and the funds remain in that particular taxing district.

If the property tax is to distribute fairly the tax burden for local government or other taxing bodies, mass appraisal must produce accurate appraisals and equitable assessments. The primary tool used to measure mass appraisal performance is the ratio study.

Ratio studies compare assessed values to market values. Market values are usually represented by individual market transactions or sales prices. Sales that do not represent open market, arms-length transfers should not be used in ratio studies.

Independent appraisals may be used to represent market values in a ratio study when valid sales data are insufficient. Ratios are calculated by dividing the assessed value of a property by the sale price. For example, a property assessed for \$120,000 which sells for \$150,000 has a ratio of .80, or 80 percent.

Ratio studies measure two primary aspects of mass appraisal accuracy: assessment level and assessment uniformity.

Assessment level refers to the overall, or typical, ratio at which properties are assessed. Measures of assessment level applicable to ratio studies include the median, the mean, and the weighted mean.

Assessment uniformity relates to the fair and equitable treatment of individual properties. Uniformity requires that (1) properties be assessed equitably within groups or categories (such as land use codes) and (2) that each of these categories be assessed at the same level, or ratio, or market value. In other words, assessment uniformity requires equity within groups and between groups.

MEASURES OF ASSESSMENT LEVEL

Measures of assessment level are calculated statistically by measures of central tendency, which describe the typical level of assessment by a single number or statistic. Three measures applicable to ratio studies are the median; the mean; and the weighted mean.

Each measure has advantages and disadvantages. Therefore, it is good practice to compute several or all of them in a ratio study. Wide differences among the measures might indicate undesirable patterns of appraisal performance.

Median

The median is the midpoint, or middle ratio, when the ratios are arrayed (or listed) in order of magnitude, from the lowest to the highest. The median divides the ratios into two equal groups. If the number of ratios is an even number, the two middle ratios are averaged to produce the median. In ratio studies the median has several advantages. It is easy to compute and interpret. It is also the base from which the coefficient of dispersion, the primary measure of assessment uniformity, is calculated.

Mean

The mean is the average ratio (also known as the arithmetic average, or the unweighted average). It is found by summing the ratios and then dividing the total by the number of ratios. Like the median, the mean is easy to compute and explain and is a valid measure of assessment level.

Weighted Mean

The weighted mean is an aggregate ratio determined by the following steps:

- Sum the assessed values for the entire sample.
- Sum the market values (sales prices and appraisals) for the entire sample.
- Divide the total of the assessed values by the total of the market values.

The weighted mean weights each ratio in proportion to its sale price, whereas the mean and the median give equal weight to each sale price. Because of this weighting feature, the weighted mean is the appropriate measure of central tendency for estimating the total dollar value of a population of parcels. The state ratios for real and personal properties are calculated utilizing the weighted mean.

MEASURES OF ASSESSMENT UNIFORMITY

As mentioned earlier, the quality of mass appraisal also requires measuring uniformity: uniformity within groups and uniformity between groups or properties.

Six measures of assessment uniformity can be used. They include:

- range
- average absolute deviation
- coefficient of dispersion
- standard deviation
- coefficient of variation
- price related differential

One of these measures, the **average absolute deviation**, measures the average spread between each ratio and the median ratio. The term absolute indicates absolute value, whether above or below the median.

The steps in calculating the average absolute deviation are as follows:

- Subtract the median ratio from each ratio.
- Sum the absolute values of the computed differences
- Divide this sum by the number of ratios.

The **coefficient of dispersion (COD)** is the most used measure of uniformity in ratio studies, and the only other one we will be discussing today. It is based on the average absolute deviation, but expresses it as a percentage. The COD is a measure of assessment uniformity that is independent of the level of assessment and permits direct comparisons between property groups.

The COD is calculated by dividing the average absolute deviation by the median assessment/sale price ratio and multiplying by 100 to convert the ratio to a percentage.

Low CODs (15.0 or less) tend to indicate good assessment uniformity. CODs of less than 5.0 are rare except in an area of extremely homogeneous property groups (such as condominium units all located within the same complex). Another circumstance which might reflect low CODs is when both the Assessor's office and the independent appraisals utilize the same appraisal manuals and procedures.

Table 2-3. Ratio study uniformity standards indicating acceptable general quality * ¹

General Property Class	Jurisdiction Size /Profile /Market Activity	COD Range
Residential improved (single family dwellings, condominiums, manuf. Housing, 2-4 family units)	Very large jurisdictions / densely populated / newer properties / active markets	5.0 to 10.0
	Large to mid-sized jurisdictions / older & newer properties / less active markets	5.0 to 15.0
	Rural or small jurisdictions / older properties / depressed market areas	5.0 to 20.0
Income-producing properties (commercial, industrial, apartments,)	Very large jurisdictions / densely populated / newer properties / active markets	5.0 to 15.0
	Large to mid-sized jurisdictions / older & newer properties / less active markets	5.0 to 20.0
	Rural or small jurisdictions / older properties / depressed market areas	5.0 to 25.0
Residential vacant land	Very large jurisdictions / rapid development / active markets	5.0 to 15.0
	Large to mid-sized jurisdictions / slower development / less active markets	5.0 to 20.0
	Rural or small jurisdictions / little development / depressed markets	5.0 to 25.0
Other (non-agricultural) vacant land	Very large jurisdictions / rapid development / active markets	5.0 to 20.0
	Large to mid-sized jurisdictions / slower development / less active markets	5.0 to 25.0
	Rural or small jurisdictions / little development / depressed markets	5.0 to 30.0

These types of property are provided for general guidance only and may not represent jurisdictional requirements.

**The COD performance recommendations are based upon representative and adequate sample sizes, with outliers trimmed and a 95% level of confidence.*

**Appraisal level recommendation for each type of property shown should be between 0.90 and 1.10.*

**PRD's for each type of property should be between 0.98 and 1.03 to demonstrate vertical equity.*

PRD standards are not absolute and may be less meaningful when samples are small or when wide variation in prices exist. In such cases, statistical tests of vertical equity hypotheses should be substituted.

**COD's lower than 5.0 may indicate sales chasing or non-representative samples.*

¹ *Standard on Ratio Studies*, The International Association of Assessing Officers, 2010, pp. 33.