

Chapter 485

Appraisal Ratios (Old Version)

Introduction

An appraisal (or sales) ratio study measures the accuracy and equitability of mass appraisals by local government agencies. It compares the appraised value to the market value—measured by sales price—by creating the ratio of the two. These ratios, computed for each parcel that is sold, are compared across geographic areas (such as neighborhoods) to assess their level (central tendency) and uniformity (variation).

This topic is discussed in detail in Eckert (1990) and we refer you to that text for more details.

Data Structure

At the minimum, two values are necessary to construct a ratio—the numerator and the denominator. In this case, the numerator is the appraised price of the property and the denominator is the sales price of the property. Other information is usually necessary such as the sales date, a geographic location such as neighborhood, and a property class. Note that the appraised price may be the total of two or more variables such as the price of the land and the price of the structure (home or building).

The SalesRatio data is an example of such a dataset. This dataset contains 360 rows, of which a small portion are displayed here. The sales price of the property is given in dollars. The appraised value of the land is given in Land and that of the structure is given in Building. Three property classes are found on this database: 510, 511, and 512. Several neighborhoods are represented by an identification number.

SalesRatio dataset (subset)

SaleDate	SalePrice	PClass	Land	Building	Neighborhood	YearSold
51195	0	512	3110	39200	1720	95
62096	250	512	5910	27370	1720	96
21696	628	511	12630	43710	0	96
41696	1500	512	11000	54740	0	96
52595	1900	512	10890	17830	0	95
32295	2000	511	11000	73710	0	95
90496	2000	512	0	5800	708	96
52595	2100	512	10890	21110	0	95
53195	2500	511	4890	72800	1455	95
12496	3000	511	11540	70250	0	96

Procedure Options

This section describes the options available in this procedure.

Variables Tab

Specify the variables on which to run the analysis.

Variables

Appraisal Variables

The one or more variables listed here are summed to form the market valuation of the property. You might include land and building values. This value becomes the numerator of the sales ratio. It is assumed that all appraised values are current—that is, they represent the appraised value of the property today.

Sales Price Variables

These variables are summed to form the sales price. Usually, only one variable is specified. This value becomes the denominator of the sales ratio.

Since property sales may have occurred over several years, some adjustment of the sales price may be necessary. An automatic percentage increase adjustment is available in the Adjustment field below.

Break Variable

A separate line on the output report is created for each unique value of this variable. For example, you might want to compare the sales ratios by neighborhood.

Include Variable

This optional variable lets you restrict the analysis to certain rows of your database by listing the values to be included in the report. It works like a Filter variable.

For example, you might have several property types on your database and a variable that identifies the property type of each sale (row). Suppose you want to restrict the analysis to a few property classes. Specify the property class variable here and the values to be included in the Included Values option.

Included Values

These are the values of the Included Variable that are used in the analysis. Rows with values other than these are skipped. You may enter a single value or a comma-delimited list.

Min and Max Ratio

Min - Max Ratio Kept

The typical sales ratio database includes many records that are for specialized sales in which the listed sales price is not an accurate representation of the true market value of the parcel. An example would be sales among family members. Every effort should be taken to remove specialized sales from your database. However, this may not always be possible. This option lets you automatically omit records with sales ratios that are way out of bounds. The hope is that most of these are non-representative, specialized sales.

Specify a minimum and maximum ratio value here, using the metric defined by the Ratio Multiplier value. Only those properties with ratios in this range will be used. If the Ratio Multiplier is set to 100, typical values are Min Ratio equal to 50 and Max Ratio equal to 150. If the Ratio Multiplier is set to 1.0, typical values are Min Ratio equal to 0.5 and Max Ratio equal to 1.5.

Reports Tab

Select Reports

Count – Display COV x 100

These options let you indicate which items are displayed on the report. If more than five items are checked, you will need to put your printer into Landscape mode by selecting Printer Setup from the File Menu.

Star Items Based On Normality

This option causes certain items to be starred with an asterisk based on the results of the normality test. When checked and the normality test is rejected, the median, median confidence interval, and COD starred. When checked and the normality test is not rejected, the mean, mean confidence interval, and COV are starred.

Report Options

Normality Test Alpha

This option specifies the rejection probability for the normality test. If the normality test probability is less than this amount, reject the null hypothesis of normality. If the normality test probability is greater than this amount, there is not enough evidence in the data to reject the hypothesis of normality.

The possible range of this probability is 0.01 to 0.30. Most statisticians recommend testing normality at an alpha level higher than 0.05 such as 0.10, 0.15, or 0.20.

Confidence Coefficient

This option specifies the value of confidence coefficient for the confidence intervals of the mean and median. The possible range is from 0.800 to 0.999. The standard value is 0.95.

Ratio Multiplier

Sales Ratios are usually multiplied by 100 to scale them as a percentage. At other times, you may not wish to scale them. This option lets you specify the multiplier. Use 100 for percentages and 1 for regular ratios.

Variable Names

This option lets you select whether to display only variable names, variable labels, or both.

Value Labels

This option lets you select whether to display only values, value labels, or both. Use this option if you want the table to automatically attach labels to the values (like 1=Yes, 2=No, etc.). See the section on specifying *Value Labels* elsewhere in this manual.

Justification

This option specifies whether the data and labels in each column should be right or left justified.

Page Title

This option specifies a title that will be printed at the top of each page of the report.

Report Options – Decimal Places

Count - COD

These options let you specify the number of decimal places shown in the various items of the output report.

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Report Options – Setup the ruler for Outputting a Line of the Report

These options let you specify the tab settings across the table. The output ruler is also modified by the settings of Justification.

First Tab

Specifies the position of the first cell in inches. Note that the left-hand label always begins at 0.5 inches. Hence, the distance between this tab and 0.5 is the width provided for the row label information.

Right Border

Specifies the right border of the table. The number of tabs is determined based on *First Tab*, the *Tab Increment*, and this option. If you set this value too large, your table may not be printed correctly.

Column Width

Specifies the width of a column in inches. We recommend a value of 0.6 when a lot of items are to be displayed.

Sale Date Tab

Sale Date Specification

Sale Date Variable

This optional variable contains the dates on which the sale took place. These date values may be used to select a range of dates for the report. For example, you may want to include only sales that occurred after 1994. These dates may also be used to adjust the sales price using the Adjustment value.

The date values may be in any one of several date formats. The date format is specified in the Date Format option.

Date Format

Specify the format of the date variable. Note that Y is for year, M is for month, and D is for day. The date format used must match the format used in the Min Date and Max Date. All date values are converted to Julian dates (number of days since January 1, 0000), so there is no year 2000 conversion problem.

Speaking of year 2000 conversion, two-digit year dates are converted to Julian dates using the conversion rule that is set as a system option. If the conversion factor is 30, then year values of 30 or more are converted to 1930 (or more) and year values 29 and less are set to 2029 (or less). For example, the year part of the date 010101 is assumed to be 2001; the year part of the date 010129 is assumed to be 2029; and the year part of the date 010130 is assumed to be 2030.

Minimum - Maximum Date Kept

Specify either the minimum date, the maximum date, or both. The format must match that specified in the Date Format box above. Only properties in the date range specified here will be used. Leave this option blank if you do not want to make a selection based on date.

Optional Price Adjustment

Adjust Prices To This Date

This is the date to which all sales price values are adjusted. Often this is January of the current year. The format is YYYY-MM. For example, you might enter 1999-01 to adjust all sales values to January 1, 1999.

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Monthly Price Adjustment Factor

This is the monthly sales price adjustment factor. Each sales price is adjusted using the formula $\text{Adjusted Sales Price} = (\text{Actual Sales Price}) (1 + a m)$ where m is the number of months between the actual sale date and the adjusted date and a is the factor entered here.

For example, suppose that a sales took place in August of 1997 and that you have set the Current Date to 1998-07 and the Adjustment value to 0.001. Since there are twelve months between from August to July, the sales value would be adjusted up using the factor $(1 + 0.001 * 12)$ which is 1.012. That is, the sales price would be increased by 1.2 percent.

Example 1 – Sales Ratio Study

This section presents a tutorial of a sales ratio study conducted on the SalesRatio dataset. The analyst wants to limit the analysis to sales that occurred on or after January 1, 1994 and to property classes 510, 511, and 512.

You may follow along here by making the appropriate entries or load the completed template **Example 1** by clicking on Open Example Template from the File menu of the Appraisal Ratios (Retired 2016) window.

1 Open the SalesRatio dataset.

- From the **File** menu of the NCSS Data window, select **Open Example Data**.
- Click on the file **SalesRatio.NCSS**.
- Click **Open**.

2 Open the Appraisal Ratios (Retired 2016) window.

- Using the Analysis menu or the Procedure Navigator, find and select the **Appraisal Ratios (Retired 2016)** procedure.
- On the menus, select **File**, then **New Template**. This will fill the procedure with the default template.

3 Specify the variables.

- On the Appraisal Ratios window, select the **Variables tab**.
- Set the **Appraisal Variables** box to **Land-Building**.
- Set the **Sales Price Variables** box to **SalePrice**.
- Double-click in the **Break Variable** text box. This will bring up the variable selection window.
- Set the **Break Variable** box to **Neighborhood**.
- Set the **Include Variable** box to **PClass**.
- Set the **Include Values** box to **510 511 512**.

4 Specify the dates.

- On the Appraisal Ratios window, select the **Sale Date tab**.
- Set the **Sale Date Variable** to **SaleDate**.
- Set the **Date Format** box to **MMDDYY**.
- Set the **Minimum Date Kept** to **010194**.

5 Run the procedure.

- From the Run menu, select **Run Procedure**. Alternatively, just click the green Run button.

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Ratio Section

Ratio Section						
Neighborhood	Count	Median	Mean	W Mean	PRD	COD
0	190	83.62	88.96	85.56	1.04	18.00
110	2	59.94	59.94	59.50	1.01	6.84
125	4	63.21	62.50	62.16	1.01	8.60
.
.
.
Total	275	83.76	88.71	85.39	1.04	18.37

This report gives various statistical values for each value of the break variable (which was Neighborhood in this example). Note the total line at the bottom of the report. This gives each statistical measure treating the whole database as a single group.

Neighborhood

This gives the value of the break variable. Note the total line at the bottom of the report.

Count

This is the number of rows included in the statistics reported on this line. The main use of this statistic is to be certain that a large enough sample was available to make the other statistics reliable. At a minimum, you would want at least thirty sales ratios included before you could have any faith in the accuracy and repeatability of the statistics.

Median

This is the median (middle) sales ratio. The individual sales ratios (R) are found using the formula

$$R = \frac{A}{S}$$

where A is the appraised value of the property and S is the sales price of the property. These values are ranked and the middle value is selected as the median.

The median is usually used as the measure of central tendency of sales ratios because of its resistance to distortion by outliers. Since outliers occur frequently in property sales databases, and since outliers often distort statistics that include them, their impact on the statistics must be realized and removed. Using the median is a good way to accomplish this.

The medians are scanned to determine if there are any groups (neighborhoods) that are way undervalued or way overvalued.

LCL and UCL Median

These are the confidence limits of the median sales ratio. These limits make no assumption of normality.

Mean

This is the averaged sales ratio. The individual sales ratios computed and averaged to calculate this value.

Unlike the median, the mean is easily distorted by outliers. For this reason, care should be exercised when using it. One possible use is to compare the mean with the median to determine if there were a lot of outliers present. The difference between the two is partially due to the presence of outliers.

LCL and UCL Mean

These are the confidence limits of the mean sales ratio.

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W Mean

The weighted mean is the ratio of the total appraised values for the entire sample and the total sales prices of the entire sample. Hence, the formula is

$$WM = \frac{\sum_{i=1}^n A_i}{\sum_{i=1}^n S_i}$$

The weighted mean weights each ratio by the sales price. Hence, high priced properties carry a larger weight than low priced properties. It is most appropriate for measuring the central tendency when you are most interested in total dollar value of the sample.

PRD

This is the price related differential. It measures the regressivity or progressivity of the assessments. Regressive appraisals occur when high-value properties are underappraised relative to low-value properties. Progressive appraisals occur when the opposite pattern occurs.

This statistic is the ratio of the mean and the weight mean. It is calculated using the formula

$$PRD = \frac{\sum_{i=1}^n \frac{A_i}{nS_i}}{WM}$$

A PRD greater than 1.0 indicates that high-value properties are underappraised, while a value less than 1.0 indicates that low-value properties are underappraised. As a general rule, except for computations involving small sample sizes, each PRD should be between 0.98 and 1.03.

COD

This is the coefficient of dispersion is usually used as the measure of uniformity in ratio studies. It is calculated using the formula

$$COD = \frac{\frac{100}{n} \sum_{i=1}^n \left| \frac{A_i}{S_i} - \text{Median} \left(\frac{A_i}{S_i} \right) \right|}{\text{Median} \left(\frac{A_i}{S_i} \right)}$$

COD values of 15.0 or less tend to be associated with good appraisal uniformity.

COV

This is the coefficient of variation. See the Descriptive Statistics chapter for details.

Std. Dev.

This is the standard deviation of the sales-ratio values. See the Descriptive Statistics chapter for details.

Normality Prob

This is the probability level of the Shapiro-Wilk test of normality. If this value is less than some cutoff value, often 0.05 or 0.10, the hypothesis that the sales ratios are normally distributed is rejected.