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Ratio Scale

Contributors: Deden Rukmana
Editors: Neil J. Salkind
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Ratio scale refers to the level of measurement in which the attributes composing variables are measured on specific numerical scores or values that have equal distances between attributes or points along the scale and are based on a “true zero” point. Among four levels of measurement, including nominal, ordinal, interval, and ratio scales, the ratio scale is the most precise.

Because attributes in a ratio scale have equal distances and a true zero point, statements about the ratio of attributes can be made. The score of zero in a ratio scale is not arbitrary, and it indicates the absence of whatever is being measured. Most variables in experimental sciences, particularly in behavioral sciences and natural sciences, are ratio-scale variables. One advantage of the ratio scale is that all mathematical operations are permitted for ratio-scale data.

True Zero Point

Variables measured at the ratio-scale level have equal distances between attributes and a true zero point. The score of zero in ratio-scale variables indicates the absence or complete lack of an attribute. The variable *number of vehicles owned in the past 5 years* is an example of a ratio-scale variable. A score of zero for this variable means the respondent owned no vehicles in the past 5 years.

Similarly, it is possible for respondents to have zero years of work experience, no children, a score of zero on a midterm exam, zero dollars in a savings account, or zero people living below the poverty line. These are all examples of ratio-scale variables.

The true zero point also makes a ratio-scale variable more precise than an interval-scale variable. The true zero point allows ratio scale variables to make statements about the ratio of attributes. It is possible to multiply and divide the attributes of a ratio-scale variable. For example, it is possible to say that four vehicles are twice as many as two vehicles in the variable *number of vehicles owned in the past 5 years.*

Similarly, for the variable *number of years of work experience*, those who have 3 years of work experience have half as many years of work experience as those who have 6 years of work experience. For the variable *amount in a savings account*, $1,500 is 3 times as much savings as $500 or one third as much savings as $4,500. In the variable *proportion of people living below the poverty line*, areas that have 3,000 people living below the poverty line have twice as many people living below the poverty line as areas that have 1,500 people living below the poverty line.

Mathematical operations

One advantage, and perhaps the most important advantage, of the ratio scale is suitability for all mathematical operations. Data measurement on the ratio scale permits all mathematical operations to be used, including addition, subtraction, multiplication, division, and square roots. The use of all mathematical operations in turn permits the use of most statistical techniques for data measured on the ratio scale. There are many statistical techniques that are not appropriate for data measured at the nominal-, ordinal-, or interval-scale level but that are appropriate for the ratio-scale level, such as correlation, regression, factor analysis, and time-series analysis.

The statistics for ratio-scale variables are more powerful and produce more information than statistics for nominal-, ordinal-, and interval-scale variables. For example, statistics for measuring dispersion are available for nominal-scale data (index of qualitative variation), ordinal-scale data (range and the interquartile range), and interval- and ratio-scale data (standard deviation). Among the statistics for measuring dispersion, standard deviation is the most powerful statistic for measuring data dispersion.

Dummy Variables

It is a common practice in statistics to convert nominal- or ordinal-scale variables to what are **[p. 1222 ↓]** called *dummy* variables so that they can be analyzed as if they were ratio-scale variables. In the simplest case, a dummy variable has two attributes, including 0 and 1. In experimental research design, a dummy variable is used to distinguish different treatment groups. A person is given a value of 0 if he or she is in the control group or a value of 1 if he or she is in the treatment group.

For example, the variable *gender* is a nominal-scale variable that has two attributes: female and male. Such a variable cannot be used in statistical techniques that are only appropriate for ratio-scale data unless the variable *gender* is converted into a dummy variable. In regression analysis, a nominal-scale variable such as *gender* can be used as an independent variable after being converted into a dummy variable. The attribute *female* could be coded as 1 and *male* could be coded as 0. After being converted into a dummy variable, the variable *gender* is no longer a nominal-scale variable and becomes the variable *femaleness.* The variable *femaleness* has a true zero point, and the attribute *male* has 0 *femaleness.* The variable *femaleness* could now be considered a ratio-scale variable and used as an independent variable in regression analysis.

Deden Rukmana

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See also

Further Readings

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