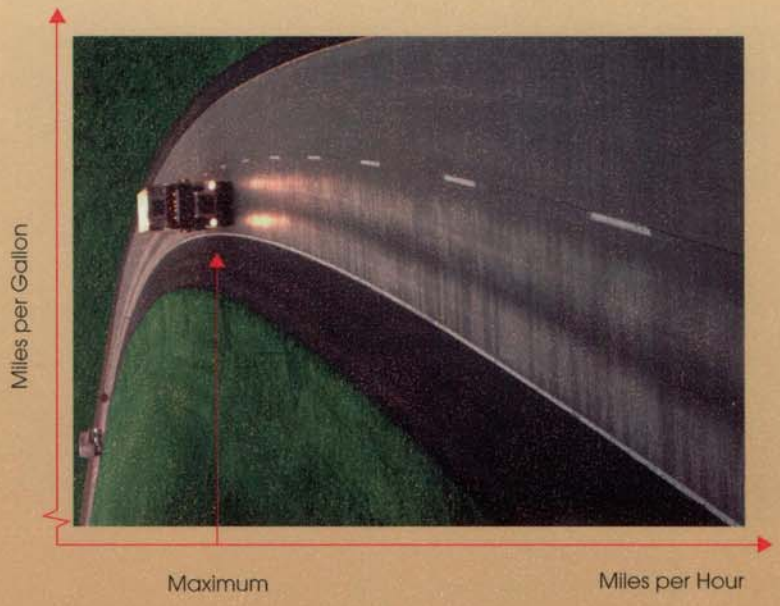
Graybill | Iyer

REGRESSION ANALYSIS

REGRESSION ANALYSIS

Concepts and Applications

With SAS or Minitab Lab Manual



Franklin A. Graybill Hariharan K. Iyer

Assumptions (A) for Multiple Linear Regression

Notation The $(k + 1)$-variable population $\{(Y, X_1, \ldots, X_k)\}$ is the study population.

(Population) Assumption 1 The mean $\mu_Y(x_1, \ldots, x_k)$ of the subpopulation of Y values with $X_1 = x_1, \ldots, X_k = x_k$ is

$$\mu_Y(x_1, \ldots, x_k) = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k$$

where $\beta_0, \beta_1, \ldots, \beta_k$ are unknown parameters and $x_1, \ldots, x_k$ belong to the set of allowable values (sometimes called the *domain*) of the predictor variables.

(Population) Assumption 2 The standard deviation of the Y values in the subpopulations with $X_1 = x_1, \ldots, X_k = x_k$ does not depend on the values $x_1, \ldots, x_k$ (i.e., the standard deviations are the same for each subpopulation determined by specified values of the predictor variables $X_1, \ldots, X_k$). This common standard deviation of all the subpopulations is denoted by $\sigma_{Y|x_1,\ldots,x_k}$. When there is no possibility of confusion, we use the simpler notation σ instead of the more complete notation $\sigma_{Y|x_1,\ldots,x_k}$.

(Population) Assumption 3 Each subpopulation of Y values, determined by specified values of $X_1, \ldots, X_k$ is a Gaussian population.

(Sample) Assumption 4 The sample data are obtained by simple random sampling or by sampling with preselected values of $X_1, \ldots, X_k$, discussed in Section 2.3. The number of items in the sample is n.

(Sample) Assumption 5 All sample values $y_i, x_{i1}, \ldots, x_{ik}$ for $i = 1, \ldots, n$ are observed without error (but read Section 3.10).

Assumptions (B) for Multiple Linear Regression

(Population) Assumption 1 The study population $\{(Y, X_1, \ldots, X_k)\}$ is a $(k + 1)$-variable Gaussian population.

(Sample) Assumption 2 The sample data are obtained by simple random sampling described in Section 2.3; i.e., a simple random sample of n items is selected from the population and the values of the variables $Y, X_1, \ldots, X_k$ are observed.

(Sample) Assumption 3 The sample values $y_i, x_{i1}, \ldots, x_{ik}$ for $i = 1, \ldots, n$ are measured without error.

Simple Random Sampling

Sample data are obtained by selecting a **simple random sample** of n items from the entire population of N items and recording the values for the response variable Y and the predictor variables $X_1, \ldots, X_k$, for each item in the sample. Refer to Section 1.6.

Random Sampling with Preselected *X* values

Specific values of the predictor variables $X_1, \ldots, X_k$ are preselected by the investigator, and each of these preselected sets of values determines a subpopulation of Y values. A simple random sample of one or more Y values is selected from each of these subpopulations. The number of observations to be sampled from each subpopulation is also predetermined by the investigator.

Regression Analysis:
Concepts and Applications