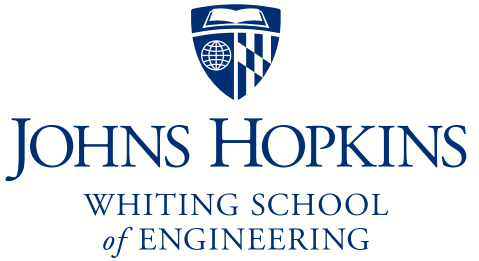
Introduction to Regression Modeling – Part II

Johns Hopkins Engineering

625.461 Statistical Models and Regression

Module 1 – Lecture 1C



Two Main Types of Regression Models

Mechanistic model

Regression model (empirical model)

$\Rightarrow$ approximate the unknown true functional model

Linear Regression Approximation

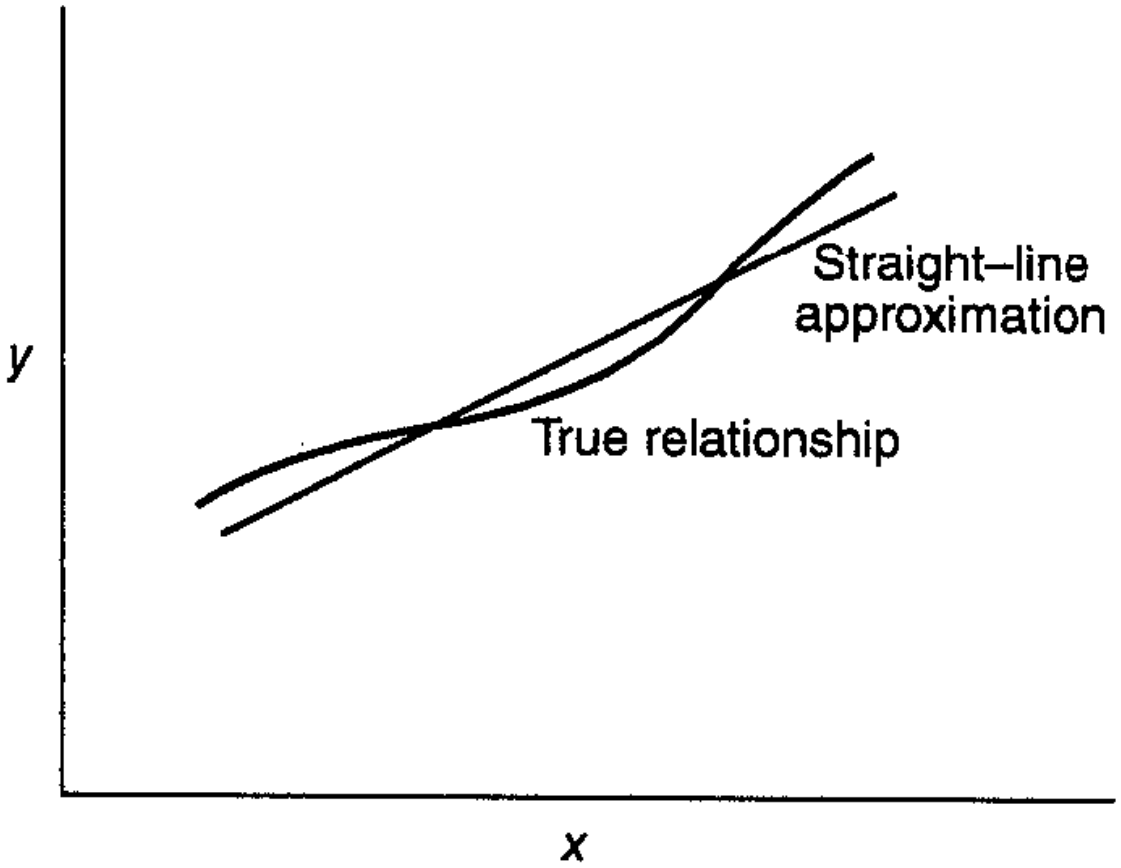


Figure 1.3 Linear regression approximation of a complex relationship.

Piecewise Linear Approximation

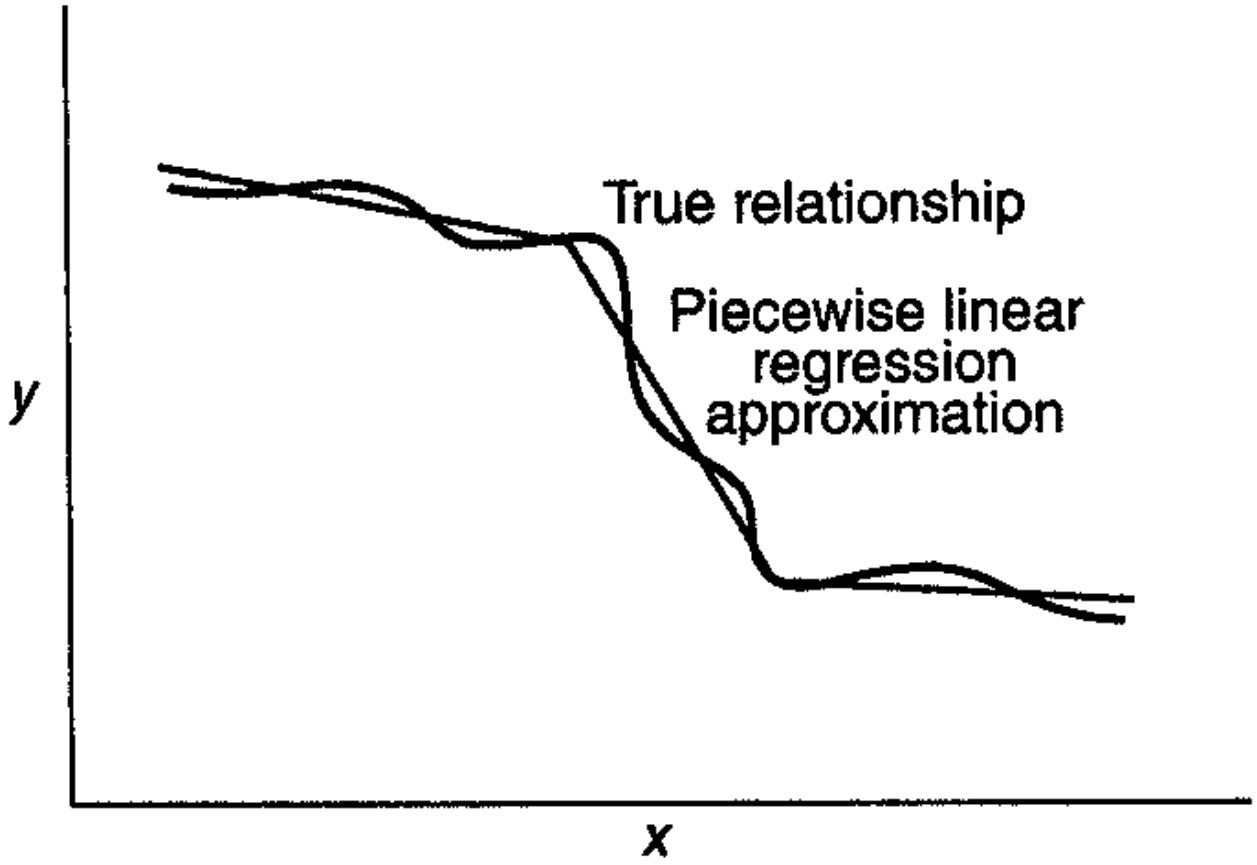


Figure 1.4 Piecewise linear approximation of a complex relationship.

Extrapolation and Its Danger in Regression

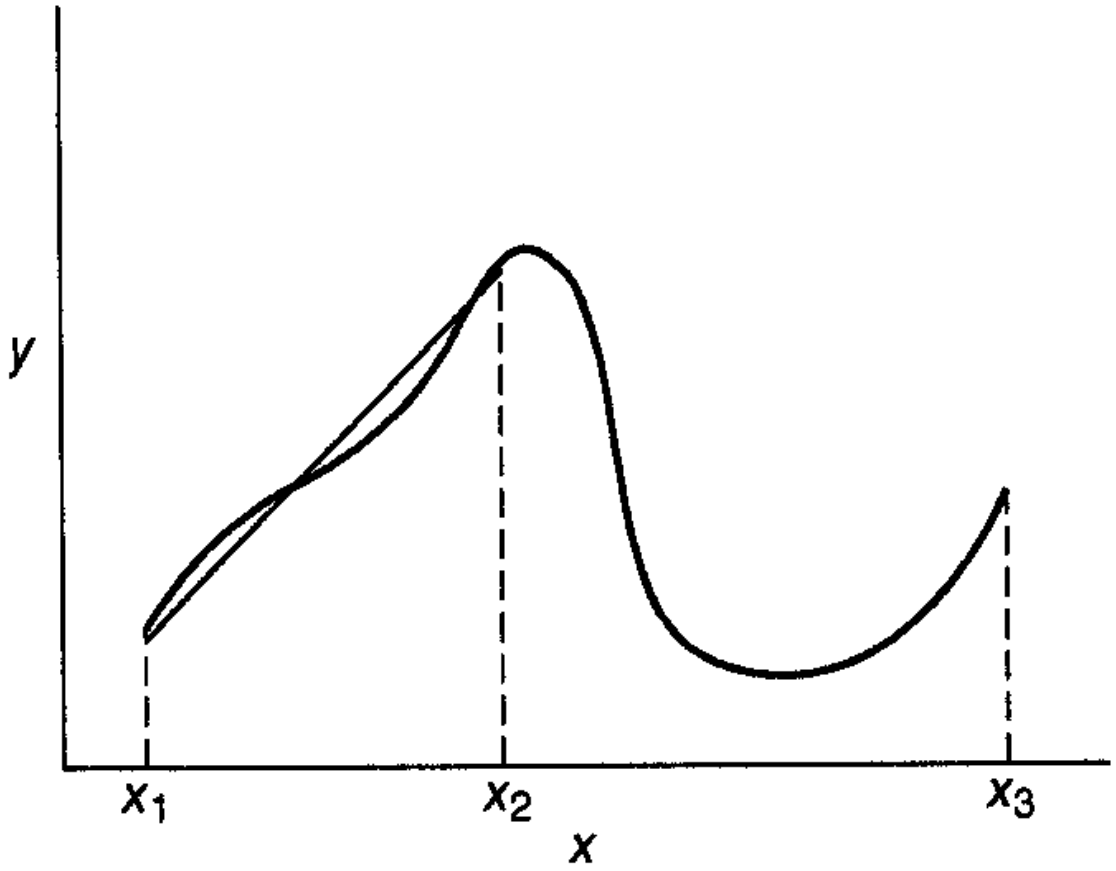


Figure 1.5 The danger of extrapolation in regression.

Multiple Linear Regression Model

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + \varepsilon$$

y : response or dependent variable
x_i : regressor ($i = 1, \ldots, k$)
β_i : regression coefficient

Q: What is the meaning of β_i ?

The values of parameters (regression coefficients) β 's are usually unknown and need to be estimated.

Important Notes

- A regression model does not imply a cause-and-effect relationship between variables.
- To establish causality, the relationship between the regressors and the response must have a basis outside the sample data.
- Regression analysis can aid in confirming a cause-effect relationship, but it cannot be the sole basis of such a claim.
- Model adequacy checking is critically important.

Purposes of Regression Analysis

- Data description
- Parameter estimation
- Prediction and estimation
- Control

Computer Software for Regression Analysis

- Minitab
- SAS
- SPSS
- JMP
- R

Regression Model Building Process

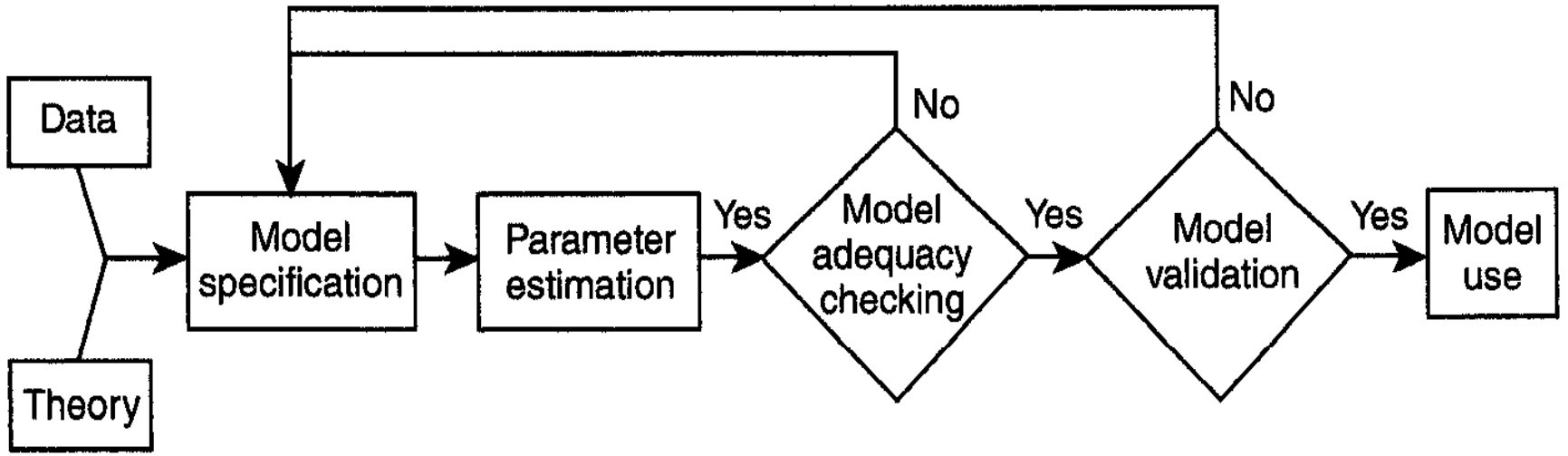


Figure 1.8 Regression model-building process.

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