Advanced Higher Statistics

Residual Plots Comments

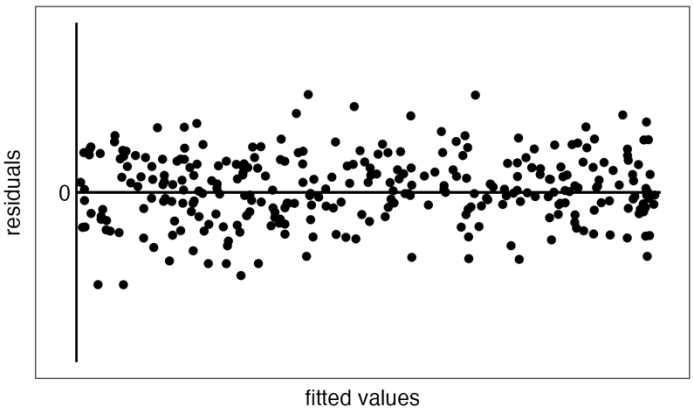
Purpose

This document is for teachers and lecturers, and it exemplifies the valid and acceptable comments that can be made for a variety of residual plots.

Statistical Inference		
Skill	**Explanation**	**Suggested learning and teaching contexts**
Assessing the linear association between two variables	♦ interpreting a residual plot	♦ a residual plot is used to check the model assumptions that: ▪ $E(\varepsilon_i) = 0$ ▪ $V(\varepsilon_i) = \sigma^2$ (a constant for all x_i) Ideally, the plot of residuals against fitted values should show a random scatter centred on zero. If this is not the case (systematic pattern or variance of residuals is not constant), then the model may be inappropriate (perhaps non-linear), or the data may need to be transformed to restore constant variance.

Below is a summary of the valid comments for a collection of different residual plots.

Residual plot

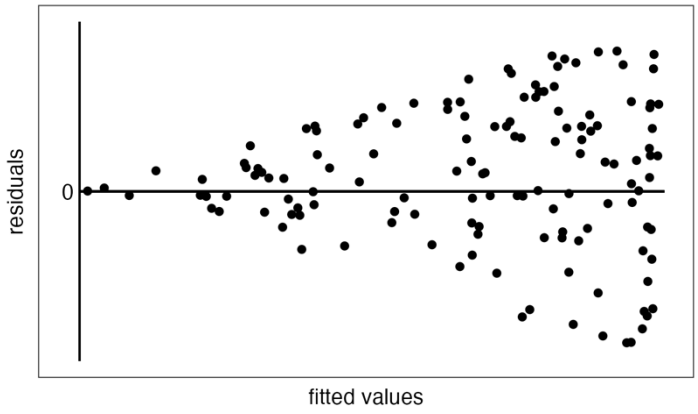


Valid comments

There is a random scatter of points, centred on zero.
The distribution of residuals does not depend upon the fitted value.

$E(\varepsilon_i) = 0$ for all x_i
$V(\varepsilon_i)$ = constant for all x_i

Residual plot

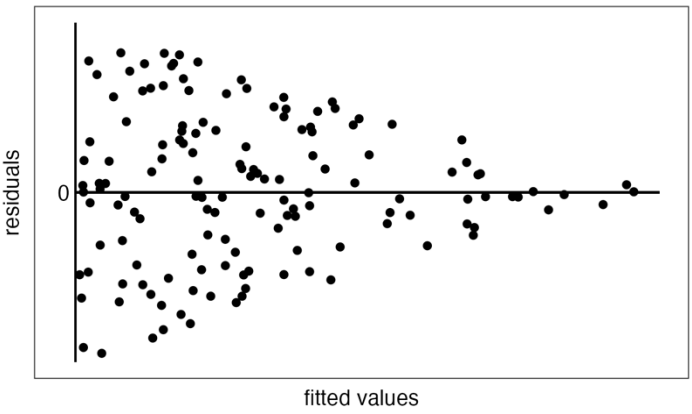


Valid comments

There is a ‘funnel’ shaped pattern, centred on zero.
The variance increases as the fitted values increase.

$E(\varepsilon_i) = 0$ for all x_i
$V(\varepsilon_i) \neq$ constant for all x_i

Residual plot



Valid comments

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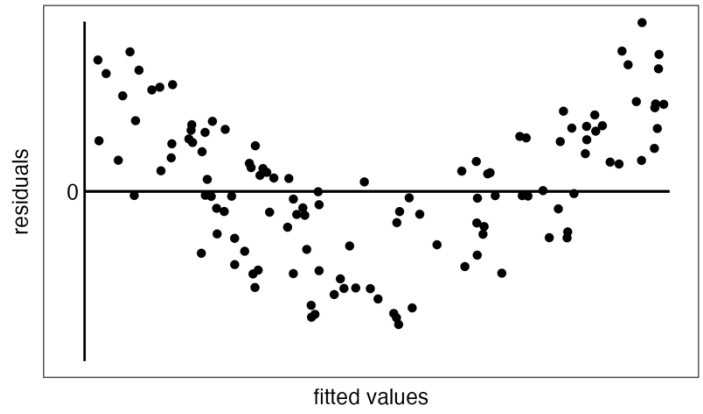
Residual plot



Valid comments

There is a pattern that is quadratic-shaped.
The variance remains constant as the fitted values increase.

$E(\varepsilon_i) \neq 0$ for all x_i
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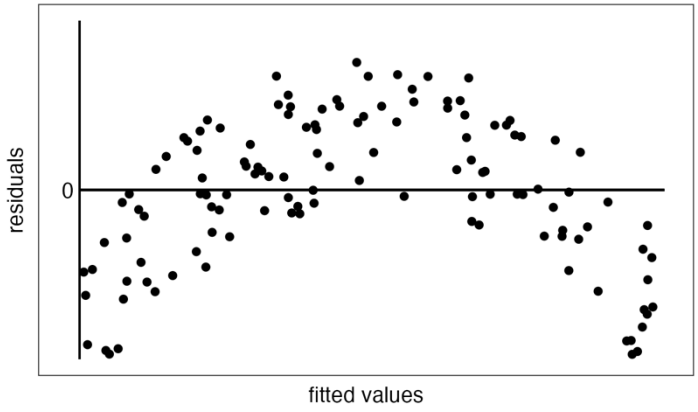
Residual plot



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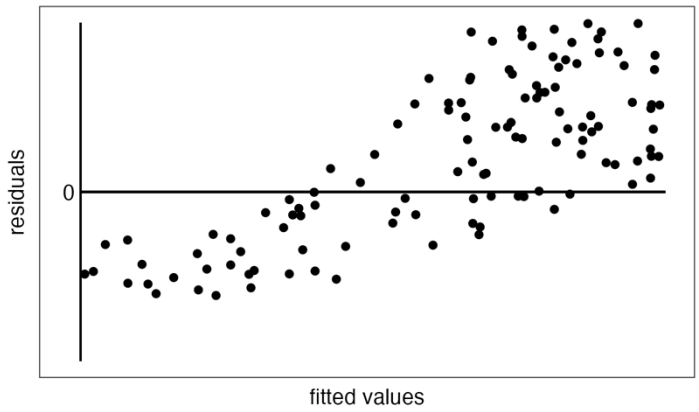
Residual plot



Valid comments

There is a ‘funnel’ shaped pattern, that is quadratic in shape.
The variance increases as the fitted values increase.

$E(\varepsilon_i) \neq 0$ for all x_i
$V(\varepsilon_i) \neq$ constant for all x_i