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- 0. Getting Started
- 1. Introduction to Observation Theory
- 2. Mathematical model
- 3. Least Squares Estimation (LSE)
- 4. Best Linear Unbiased Estimation (BLUE)

Warming up

4.1. Estimates vs Estimators

4.2. Best Linear Unbiased Estimation (BLUE)

Assessment
Graded Assignment due Feb 8, 2017 17:30 IST

Exercises: Estimator properties

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Theory on estimators of linear models

4/4 points (ungraded)

Assume a linear model $E\{\underline{y}\} = \boldsymbol{A}\boldsymbol{x}$, and the WLS estimator $\underline{\hat{x}}_{\mathrm{WLS}} = (A^T W A)^{-1} A^T W \underline{y}$

For each of the folowing statements, select whether the statement is true or false.

$\underline{\hat{x}}_{\mathrm{LS}}$ is a non-linear estimator.

False ✔ **Answer:** False

Answer

Correct: The WLS estimator is a linear function of $\underline{y}$ as $L\underline{y}$, where $L = (A^T W A)^{-1} A^T W$

$\underline{\hat{x}}_{\mathrm{LS}}$ is always normally distributed.

False ✔ **Answer:** False

Answer

Correct:
It is true only if $\underline{y}$ is normally distributed. For non-Gaussian observations, this statement is not correct.

$\underline{\hat{x}}_{\mathrm{LS}}$ may or may not be biased, depending on the chosen weight matrix.

Q&A Forum

4.ⓔ Non-linear Least Squares (optional topic)

Feedback

- 5. How precise is the estimate?
- Pre-knowledge Mathematics
- MATLAB Learning Content

False ✔ **Answer:** False

Answer
Correct: The weighted least squares estimator is always unbiased.

The expectation of $\underline{\hat{x}}_{\mathrm{LS}}$ is equal to the estimate $\hat{x}$ (or $E\{\underline{\hat{x}}_{\mathrm{LS}}\} = \hat{x}$)

False ✔ **Answer:** False

Answer
Correct:
The WLS estimator is an unbiased estimator, and so its expectation is equal to the true value of x.

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✔ Correct (4/4 points)

Expectation of estimator error

2/2 points (ungraded)

Assume the canal width problem, with vector of observables $\underline{y} = \begin{bmatrix} \underline{y}_1 \\ \underline{y}_2 \\ \underline{y}_3 \\ \underline{y}_4 \\ \underline{y}_5 \end{bmatrix}$, and a set of observations $y = \begin{bmatrix} 10.1 \\ 10.15 \\ 9.9 \\ 10.2 \\ 10.1 \end{bmatrix}$. The least squares estimate is given as $\hat{x} = 10.09.$

What is the expectation of the estimator $\underline{\hat{x}}$?

- 0
- 10.09
- 10
- Unknown ✔

Answer
Correct:
The LS estimator is unbiased, and so its expectation is equal to the true value of the canal width which is unknown.

What is the expectation of the estimation error $\underline{\epsilon} = \underline{\hat{x}} - x$? (x is the true value of the canal width)?

- (•) 0 ✔
- ( ) 10.09
- ( ) 10
- ( ) Unknown

Answer
Correct: The LS estimator is unbiased, and so the expectation of the estimation error is zero.

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✔ Correct (2/2 points)