A summary of the main properties of the expected value and variance of the estimators is presented:

|  |  |  |
| --- | --- | --- |
|  | E[c1+c2.u] = c1+c2.E[u] | V[c1+c2.u] = c2.V[u].c2T |
| *1*- | Random variable, ε | εn. (independent) |
|  | Expected value of ε | E[ε] = 0. |
|  | Variance of ε | V[ε](n.n)= E[ε.εT]=I. σ2 |
| *2* - | Observed response variable y | y = Y+ε |
|  | Expected value of y | E[y] = Y = X.B. |
|  | Variance of y | V[y](n.n)= V[ε](n.n)= I. σ2 |
| *3* - | Estimator of B | http://www.fao.org/docrep/006/X8498E/x8498ecz.gif= (XT.X)-1.XT.y |
|  | Expected value of http://www.fao.org/docrep/006/X8498E/x8498ed0.gif | E[http://www.fao.org/docrep/006/X8498E/x8498ed1.gif] = B |
|  | Variance of http://www.fao.org/docrep/006/X8498E/x8498ed2.gif | V[http://www.fao.org/docrep/006/X8498E/x8498ed3.gif](k.k)= (XT.X)-1. σ2 |
| *4* - | Estimator of Y of the model | http://www.fao.org/docrep/006/X8498E/x8498ed4.gif= X. http://www.fao.org/docrep/006/X8498E/x8498ed5.gif = L.y |
|  | Expected value of http://www.fao.org/docrep/006/X8498E/x8498ed6.gif | E[http://www.fao.org/docrep/006/X8498E/x8498ed7.gif] = Y. |
|  | Variance of http://www.fao.org/docrep/006/X8498E/x8498ed8.gif | V[http://www.fao.org/docrep/006/X8498E/x8498ed9.gif] = L. σ2 |
| *5* - | Residual e | e = y-http://www.fao.org/docrep/006/X8498E/x8498eda.gif= (I-L).y |
|  | Expected value of e | E[e] = 0 |
|  | Variance of e | V[e] = (I-L). σ2 |

*6* - Sum of squares

*6.1* - Residual Sum of squares = SQ residual(1.1) = (y-http://www.fao.org/docrep/006/X8498E/x8498edb.gif)T(y-http://www.fao.org/docrep/006/X8498E/x8498edc.gif) = yT(I-L)y

This quantity indicates the residual variation of the observed values in relation to the estimated values of the model, that is, the variation not explained by the model.

*6.2*- Sum of squares of the deviation of the model = SQ model(1.1) = (http://www.fao.org/docrep/006/X8498E/x8498edd.gif-http://www.fao.org/docrep/006/X8498E/x8498ede.gif)T(http://www.fao.org/docrep/006/X8498E/x8498edf.gif-http://www.fao.org/docrep/006/X8498E/x8498edg.gif) = yT(L-M)y

This quantity indicates the variation of the estimated response values of the model in relation to the mean, that is*,*the variation explained by the model*.*

*6.3*- Total Sum of the squares of the deviations = SQ total(1.1) = (y-http://www.fao.org/docrep/006/X8498E/x8498edh.gif)T(y-http://www.fao.org/docrep/006/X8498E/x8498edi.gif) = yT(I-M) y

This quantity indicates the total variation of the observed values in relation to the mean.

It is easy to verify the following relation:

SQtotal = SQmodel + SQresidualor

http://www.fao.org/docrep/006/X8498E/x8498edj.gif

or 1 = R2 + (1 - R2)

where:

R2 is the percentage of the total variation that is*explained* by the model. In matrix terms it will be:

R2= [yT(L - M)y].[ (yT(I - M)y]-1

1-R2 is the percentage of the total variation that is not explainedby the model.

The ranks of the matrices (I-L), (I-M) and (L-M) respectively equal to (n-k), (n-1) and (k-1), are the degrees of freedom associated with the respective sums of squares.