Tasks for Introductory Econometrics

2. The multiple regression model

2.1 What are the standard assumptions of the multiple regression model?

2.2 Derive the least squares estimators $\hat{\beta}_1$ and $\hat{\beta}_2$ for the regression coefficients β_1 and β_2 without using matrix calculus!

2.3 For the demand of natural gas (GASD) and natural gas price (GASP) data are available for a 7-year period (energy model Ia):

t	1	2	3	4	5	6	7
GASV	1,0	0,8	0,7	0,9	1,2	1,1	1,4
GASP	12,9	13,8	13,7	13,2	12,2	12,9	12,5

Estimate the demand function for natural gas with the ordinary least squares method using the sum formulas! Interpret the estimated demand function!

2.4 For the demand of natural gas (GASD) and disposable income (DINC) data are available for a 7-year period (energy model Ib):

t	1	2	3	4	5	6	7
GASD	1,0	0,8	0,7	0,9	1,2	1,1	1,4
DINC	12	12	9	11	13	13	15

Estimate the demand for natural gas depending on the disposable income with the OLS method using matrix calculus! Interpret the estimated demand function!

2.5 The demand for natural gas should explained by the natural gas price (GASP) and disposable income (DINC) (energy model II). Determine the OLS estimator of the linear demand function for natural gas (for data, see tasks 2.3 and 2.4)!

Note: The inverse of the product matrix **X'X** is given by:

$$(\mathbf{X}'\mathbf{X})^{-1} = \begin{pmatrix} 255{,}7066 & -15{,}7459 & -4{,}1520 \\ -15{,}7459 & 0{,}997745 & 0{,}2262 \\ -4{,}1520 & 0{,}2262 & 0{,}099228 \end{pmatrix}$$

2.6 What is a BLUE estimator?

2.7 Explain the consistency property verbally! What value would you attach to this estimation property in applied econometrics depending on the type of data?

2.8 Calculate the determination coefficient for the energy model Ib (see task 2.4) using the sum formula and interpret it!

2.9 Calculate the determination coefficient for the energy model II (see task 2.5) using the OLS estimator and interpret it!

2.10 Explain the two different ways of interpreting the coefficient of determination!

2.11 What role could the adjusted coefficient of determination play in model selection?