Seminar 9

Non-linear consumption function

Exercises

Economic model:

$$C\ PM = f\ (UV, CP\ PM, CP\ ChM, Income)$$

Data table:

Year	C PM	CP PM	CP ChM	Income
Unit	kg	CZK/kg	CZK/kg	thousand CZK/person
1995	8,67	85	53,35	72,3066
1996	8,52	90,28	63,64	72,8801
1997	8,45	92,07	71,96	82,7072
1998	9,9	84,25	74,5	83,9766
1999	10,2	80,56	56,42	86,237
2000	9,32	89,96	61,79	89,056
2001	9,35	101,66	71,27	95,9531
2002	9,95	89,89	62,4	99,4625
2003	10,45	82,8	60,66	104,5126
2004	10,27	85,43	62,63	108,9004
2005	11,18	85,3	62,73	116,5735
Average	9,66	87,93	63,76	92,05

Log-values

Year	C PM	CP PM	CP ChM	Income
1995	2,16	4,44	3,98	4,28
1996	2,14	4,5	4,15	4,29
1997	2,13	4,52	4,28	4,42
1998	2,29	4,43	4,31	4,43
1999	2,32	4,39	4,03	4,46
2000	2,23	4,5	4,12	4,49
2001	2,24	4,62	4,27	4,56
2002	2,3	4,5	4,13	4,6
2003	2,35	4,42	4,11	4,65
2004	2,33	4,45	4,14	4,69
2005	2,41	4,44	4,14	4,76
Average	2,26	4,48	4,15	4,49

1. Explain the contents of matrix **X** and vector y for parameters' estimation using OLSM of the power function specified above.

y		X			
2,16		1	4,44	3,98	4,28
2,14		1	4,5	4,15	4,29
.		.	.	.	.
.		.	.	.	.
2,33		1	4,45	4,14	4,69
2,16		1	4,44	4,14	4,76

2. Explain the contents of matrix X and vector y for parameters' estimation using OLSM of the semilogarithmic function specified above.

y		X			
8,67		1	4,44	3,98	4,28
8,52		1	4,5	4,15	4,29
.		.	.	.	.
.		.	.	.	.
10,27		1	4,45	4,14	4,69
11,18		1	4,44	4,14	4,76

3. Following parameters were estimated using OLSM. Rewrite linearized power function and power function and process economic and statistical verification.

Parameters	2,68326	14,6327				
POWER	-0,60964		**Control**	9,66	=	9,66
	0,02426		**calculation**	2,26	=	2,26
	0,489275					

Adjusted residual variance	0,00138
R^2	0,8355

	UV	C PM	CP ChM	Income
Parameter	2,68326	-0,60964	0,02426	0,489275
t-value	2,94165	-2,76456	0,17675	6,43455
S/I	S	S	I	S

7 degrees of freedom, 95 % significance level, t-tab=2,36

Linearized power function:

Power function:

4. Verify that the exponents of the power function represent coefficients of elasticity.

5. Rewrite estimated parameters into semilogarithmic function and process economic and statistical verification.

Parameters	14,87502				
SEMILOG	-6,16874	**Control calculation**	9,66	=	9,66
	0,33338				
	4,655213				

Adjusted residual variance	0,114926
R^2	0,8507

	JV	C PM	CP ChM	Income
Parameter	14,87502	-6,16874	0,33338	4,655213
t-value	1,78869	-3,06832	0,26642	6,71514
S/I	I	S	I	S

7 degrees of freedom, 95 % significance level, t-tab=2,36

6. Explain the difference in calculation of intercept term of power and semilogarithmic function.

7. Compare results of statistical verification of power and semilogarithmic function.

8. Calculate coefficients of elasticity of semilogarithmic function.

9. Declare vectors and matrices required for the parameters' estimation of the following functions in power and semilogarithmic form using OLSM:

   C BM = f (CP BM, CP PM, Income)

   C ChM = f (CP ChM, CP PM, CP BM, Income)

10. The data-set for the estimation and following analysis of the **1st Tornquist function** represents year 2004. The notation of employed variables is as follows:

    x_1 income per year per capita in thousand CZK
    y_1 beef meat expenditure per year per capita in thousand CZK
    y_2 beef meat consumption per year per capita in kg
    y_3 pork meat expenditure per year per capita in thousand CZK
    y_4 pork meat consumption per year per capita in kg
    y_5 chicken meat expenditure per year per capita in thousand CZK
    y_6 chicken meat consumption per year per capita in kg

Income group	1	2	3	4	5	6	7	8	9	10
x_1	56,77	72,117	81,424	87,787	93,888	101,815	110,723	126,083	151,390	207,007
y_1	161	228	280	296	261	346	295	351	388	439
y_2	1,45	2,03	2,6	2,68	2,38	3,14	2,59	3,09	3,3	3,72
y_3	601	698	846	848	866	942	939	961	1000	1082
y_4	7,24	8,03	10,52	10,12	10,31	10,62	11,38	10,88	11,36	12,22
y_5	600	734	880	843	868	1031	968	1036	1121	1173
y_6	9,89	11,99	14,87	14,12	14,45	16,23	14,95	16,03	17,25	17,36

11. Declare matrix X and vector y for the parameters' estimation of 1. TQ which describe beef meat consumption and beef meat expenditure using OLSM.

12. Quantify and interpret the following 1. TQ:

    a) beef meat expenditures are influenced by income, the linearized parameters are following:

$a_1' = 0{,}0005486$
$a_2' = 0{,}287204$

    b) beef meat consumption is influenced by income, the linearized parameters are following:

$a_1' = 0{,}08032991$
$a_2' = 30{,}3476$

13. On the basis of equations specified in example 12, calculate the theoretical value of beef meat expenditures and its consumption for the first and last income group.

14. Calculate the income elasticity for both variables in the points calculated above. Interpret the results.

15. Calculate average beef meat consumer price in CZK/kg for each income group. Prove the possibility of utilisation for the calculation of saturation level in example 13.

16. Calculate beef meat consumption and the change in kg for the first and last income group, if the income increases:

    a) by 1000 CZK

    b) by 10 % compared to the last period.

17. Compare following functions on the basis of economic and statistical verification.

Linear function – chicken meat

Dependent variable	**Econometric model**	**R^2**	**Direct price elasticity**
Expenditure (CZK/person)	$y_i = 536{,}56 + 0{,}0036x_p + u_i$	0,89	0,42 %
Consumption (kg/person)	$y_i = 10{,}03 + 0{,}00004x_p + u_i$	0,81	0,29 %

Tornquist functions – chicken meat

Consumption (kg/person)								
1.TQ		R^2	2.TQ		R^2	3.TQ		R^2
a_1	23,86	0,91	a_1	19,3	0,96	a_1	0,000 003 85	0,91
a_2	62 323,56		a_2	-23 799,8		a_2	57 196,5	
			a_3	40 051,4		a_3	-5 888 000	
Expenditures (CZK/person)								
1.TQ		R^2	2.TQ		R^2	3.TQ		R^2
a_1	1 786,76	0,95	a_1	1 480,01	0,98	a_1	0,000 287	0,95
a_2	94 296,81		a_2	1 457,1		a_2	86 865,1	
			a_3	32 500,5		a_3	-5 872 000	