Seminar 14

Utilization of econometric model for prognostic purposes

Exercises

Data set:

y_4	y_1	y_2	y_3
GDP	Consumption	Investments	Foreign trade balance
mil. CZK	mil. CZK	mil. CZK	mil. CZK
540367	398781	123086	18500
627100	452200	158400	16500
761700	527100	181600	53000
856500	613700	235200	7600
1030600	732900	289600	8100
1170600	862500	339800	-31700
1353500	976800	442400	-65700
1539400	1123200	500600	-84400
1640200	1221400	514400	-95600
1772700	1290200	508100	-25600
1937314	1406764	603450	-72900

Modified data:

	y_1	y_2	y_3	y_4	x_1	$y_{1(t-1)}=x_2$	$y_{2(t-1)}=x_3$
Unit							
	45,22	15,84	1,65	62,71	1	39,8781	12,3086
	52,71	18,16	5,3	76,17	1	45,22	15,84
	61,37	23,52	0,76	85,65	1	52,71	18,16
	73,29	28,96	0,81	103,06	1	61,37	23,52
	86,25	33,98	-3,17	117,06	1	73,29	28,96
	97,68	44,24	-6,57	135,35	1	86,25	33,98
	112,32	50,06	-8,44	153,94	1	97,68	44,24
	122,14	51,44	-9,56	164,02	1	112,32	50,06
	129,02	50,81	-2,56	177,27	1	122,14	51,44
	140,676	60,345	-7,29	193,731	1	129,02	50,81
Average	92,0676	37,736	-2,91	126,896	1	81,9878	32,9319

Econometric model:

$$y_{1t} = -2{,}64528 + 0{,}746381y_{4t} + u_{1t}$$

$$y_{2t} = -2{,}5756 + 0{,}2346y_{4t} + 0{,}32006y_{2(t-1)} + u_{2t}$$

$$y_{3t} = 19{,}09553 - 1{,}56561y_{1t} + 1{,}489y_{1(t-1)} + u_{3t}$$

$$y_{4t} = y_{1t} + y_{2t} + y_{3t}$$

1. Calculate standardized deviation for 1st equation if total variance $S_y^2 = 1014{,}677$ and real and theoretical values of dependent variable are following:

Table 1

Year	y_{1t}	$\hat{y}_{1t}$	$\mathbf{N_{it}}$
1	45,22	44,160	0,033
2	52,71	54,207	-0,047
3	61,37	61,282	
4	73,29	74,277	
5	86,25	84,726	
6	97,68	98,377	
7	112,32	112,253	
8	122,14	119,776	
9	129,02	129,666	
10	140,68	141,952	

2. Calculate standardized deviations for i-th endogenous variable and for each year of the time series. Interpret the results.

Table 2

N_{it}^2											$\sum N_{it}^2$	N_i
y_{1t}	0,0011	0,0022	0,0000	0,0010	0,0023	0,0005	0,0000	0,0055	0,0004	0,0016	0,0146	0,0382
y_{2t}	0,0003	0,0219	0,0002	0,0001	0,0001	0,0789	0,0251	0,0011	0,0981	0,0066	0,2324	
y_{3t}	1,6439	0,0832	0,0271	1,1355	0,5764	0,0674	0,3506	1,0147	0,1169	0,1226	5,1383	
$\sum N_{it}^2$	1,6452	0,1073	0,0273	1,1366	0,5788	0,1468	0,3757	1,0213	0,2155	0,1308	5,3852	
N_t	0,7405	0,1891										

3. Calculate standardized deviation of the whole econometric model specified above and interpret the result.

4. Formulate medium-term prognosis of endogenous variables:
   a) based on each equation of the model
   b) based on matrix formula $\hat{\underline{y}}_{n+j} = \underline{M\hat{x}}_{n+j}$

Matrix of multipliers **M**:

8,67813853	0,93629078	0,20117389
0,98356807	0,29430709	0,38328652
5,50934055	0,02384286	-0,31492799
15,1710472	1,25444074	0,26953243

5. Calculate interval prognosis for 1st endogenous variable according to the following formula:

$$\hat{y}_{t+1} \pm t_{\alpha} tabulkove * SE(y_{t+1} - \hat{y}_{t+1}) \qquad (14.6)$$

where $SE(y_{t+1} - \hat{y}_{t+1})$ is estimate RMSFE (Root Mean Squared Forecast Error). RMSFE represents typical error of model utilization for prognostic purposes. Variance of ex-post prognosis might be approximated by residual variance.

Residual variance: $S_u^2 = 1{,}47899$

6. The following model contains explanatory variables x_{4t} (trust in economy index) a x_{5t} (real exchange rate) instead of variables $y_{1(t-1)}$ a $y_{2(t-1)}$. Quantified form of the model is following:

$$y_{1t} = -3{,}645 + 0{,}6638y_{4t} + u_{1t}$$

$$y_{2t} = -1{,}0757 + 0{,}4191y_{4t} - 0{,}2309x_{4t} + u_{2t}$$

$$y_{3t} = -2{,}6001 - 0{,}078y_{1t} + 0{,}1101x_{5t} + u_{3t}$$

$$y_{4t} = y_{1t} + y_{2t} + y_{3t}$$

Matrix of multipliers M:

146,4283	4,924604	-2,3482
93,67532	2,878322	-1,48257
-14,0215	-0,38412	0,293259
226,0821	7,4188	-3,53751

Calculate medium-term prognosis of endogenous variables using the following trend functions:

$$\hat{x}_{4t} = 8{,}133 + 0{,}1939t$$
(SE) (0,724) (0,022)

$$\hat{x}_{5t} = 14{,}01 + 1{,}0485t$$
(SE) (0,546) (0,032)

7. Calculate short-tem interval prognosis using quantified interval prognoses of predetermined (exogenous) variables x_{4t} a x_{5t} based on the trend functions specified above according to the following formulas:

$$\underline{\hat{x}}_{n+j}^{\min} = (a - 2SE_a) + (b - 2SE_b).(n + j) \qquad (14.7)$$

$$\underline{\hat{x}}_{n+j}^{\max} = (a + 2SE_a) + (b + 2SE_b).(n + j) \qquad (14.8)$$

Individual exercises

1. Verify prognostic character of econometric model specified and estimated in Seminar 6.

2. Formulate medium-term prognosis of endogenous variables of this model.