NOMINAL CONVERGENCE EXAMINATION OF NEW EU MEMBER STATES USING MULTICRITERIA DECISION MAKING METHODS

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1. Multicriteria evaluation of alternatives

→ belongs among the basic decision problems of multicriteria decision making with very large possibilities of real applications (evaluation of investment alternatives, evaluation of credibility of bank clients, rating of companies, consumer goods evaluation and many others)

The multicriteria evaluation of alternatives problem is usually defined by criterion matrix as follows:

$$\begin{array}{c} \\ X_1 \\ X_2 \\ \vdots \\ X_n \end{array} \begin{array}{c} \begin{array}{cccc} Y_1 & Y_2 & \cdots & Y_k \end{array} \\ \begin{bmatrix} y_{11} & y_{12} & \cdots & y_{1k} \\ y_{21} & y_{22} & \cdots & y_{2k} \\ \vdots & & \ddots & \\ y_{n1} & y_{n2} & \cdots & y_{nk} \end{bmatrix} \end{array}$$

where $X_1, X_2, ..., X_n$ is the set of n alternatives,

$Y_1, Y_2, ..., Y_k$ is the set of k criterions,

y_{ij} is the criterion value of the alternative X_i, i=1,2,...,n, j=1,2,...,k.

The basic objectives of the evolution of alternatives mostly are:

- selection of the "best" alternative,
- complete ranking of alternatives.

The main aim of contribution:

evolution of nominal convergence of Slovak republic and comparing it with other new members of EU via multicriteria decision making methods

We defined three assignments:

1. Evaluation of nominal convergence process of Slovak republic according to Maastricht criterions in 2001 – 2003
2. Ranking and comparing V4 countries according to Maastricht criterions in 2003
3. Ranking and comparing all new EÚ member states (excluding Slovenia, Estonia, Lithuania) according to Maastricht criterions in 2003

2. Examination of Slovak republik economic convergence

→ accession to Europen union (10 new members) on May 1st, 2004

→ in accessing agreement all new member committed entering the Eurozone

→ fulfilment of Maastricht criterions (see table 1)

→ National bank of Slovakia joined the agreement of central banks – first step for joining exchange rate mechanism ERMII

Table 1 Maastricht criterions

Criterion	**Definition**	**Assessment period**
1. Price stability	Inflation must not exceed average inflation (measured by HICP) of three EU countries with the lowest inflation +1.5 percentage point.	last 12 months
2. Long-term interest rates	Long-term interest rates (5 years and longer) must not be higher than average interest rate of three EU countries with the lowest inflation + 2 percentage points.	last 12 months
3. Public finance deficit	Planned or actual budget deficit must not be higher than 3% of GDP.	last calendar year
4. Gross government debt	Gross government debt must not exceed 60% of GDP, respectively must tend significantly to this value in previous years.	last calendar year, respsctively development of debt reduction in previous years
5. Exchange rate stability	Membership in ERM2, exchange rate fluctuation in band +/-15% against fixed central euro parity.	at least 2 years

2.1 Price stability

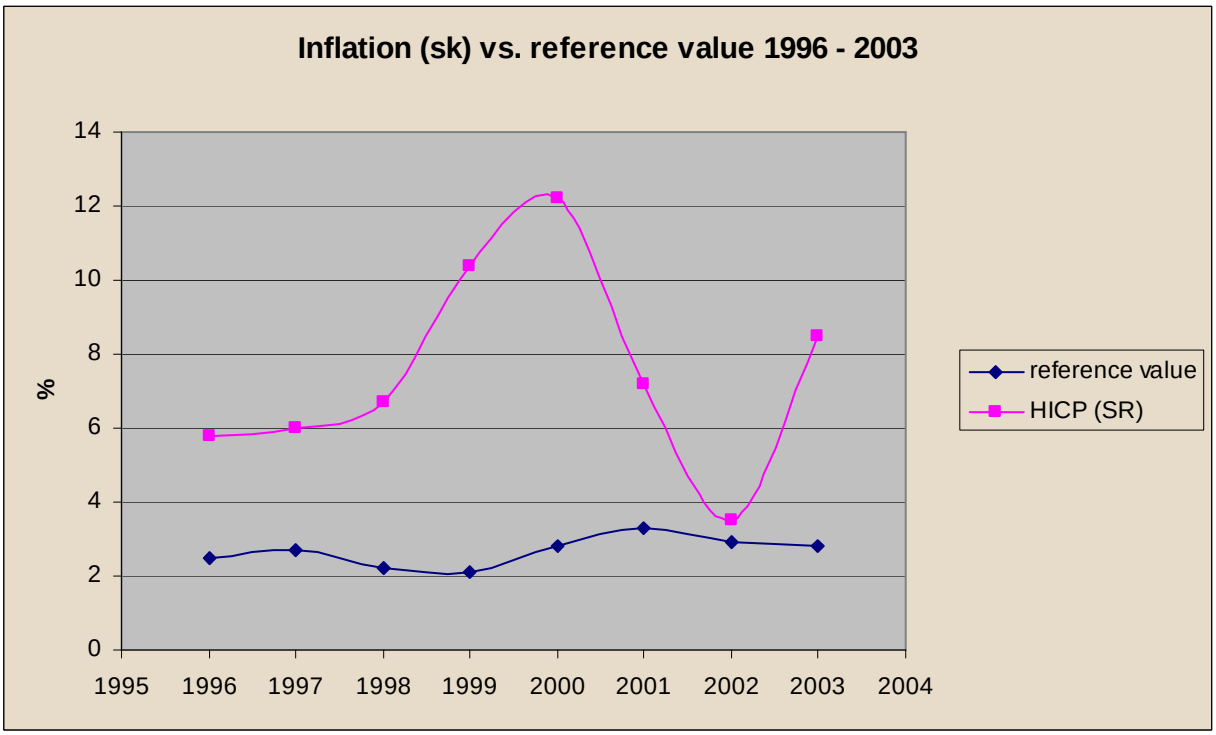
→ Average year on year inflation measured by harmonized consumer prices index (HICP) was higher than the reference value in all years of assessed period (starting 1996). The difference from reference value was the lowest in 2002 when inflation was exceeded reference value only by 0.6% (see table2, figure 1)

Table 2

	1996	1997	1998	1999	2000	2001	2002	2003
HICP SR (%)	5,8	6	6,7	10,4	12,2	7,2	3,5	8,5
Ref. value (%)	2,5	2,7	2,2	2,1	2,8	3,3	2,9	2,8

Source: Eurostat

Figure 1

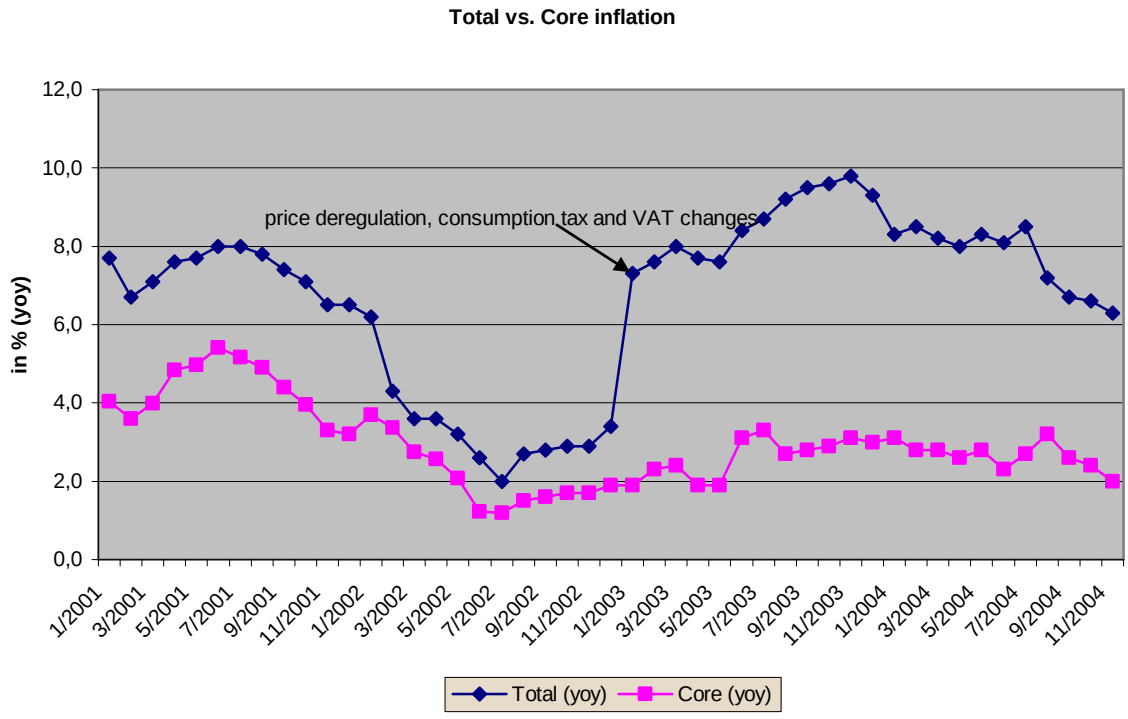


→ until 1996 inflation mainly influenced by lower speed of transformation process (postponed structural reforms and price deregulation)

→ economic policy change in 1999 the reason for accelerating of inflation (the first inflation peak)

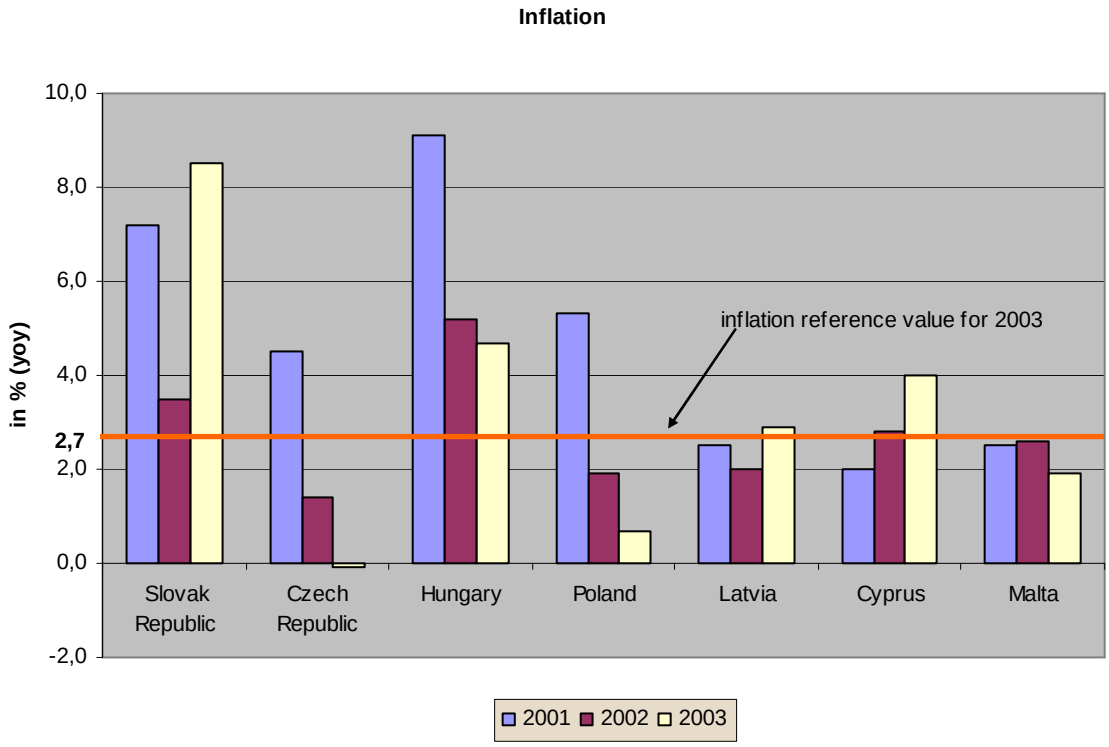
→ in 2003 continuing in liberalization of regulated prices and tax reform - change in VAT charges (the second inflation peak – see figure 2)

Figure 2



→ price deregulation significantly affects inflation development in 2004 in further years the impact of administrative interventions on inflation will go down that should create good starting position for meeting of Maastricht inflation criterion in years 2006 - 2007 as core inflation development is close to reference value

Figure 3 – Inflation of new EÚ(7) member states



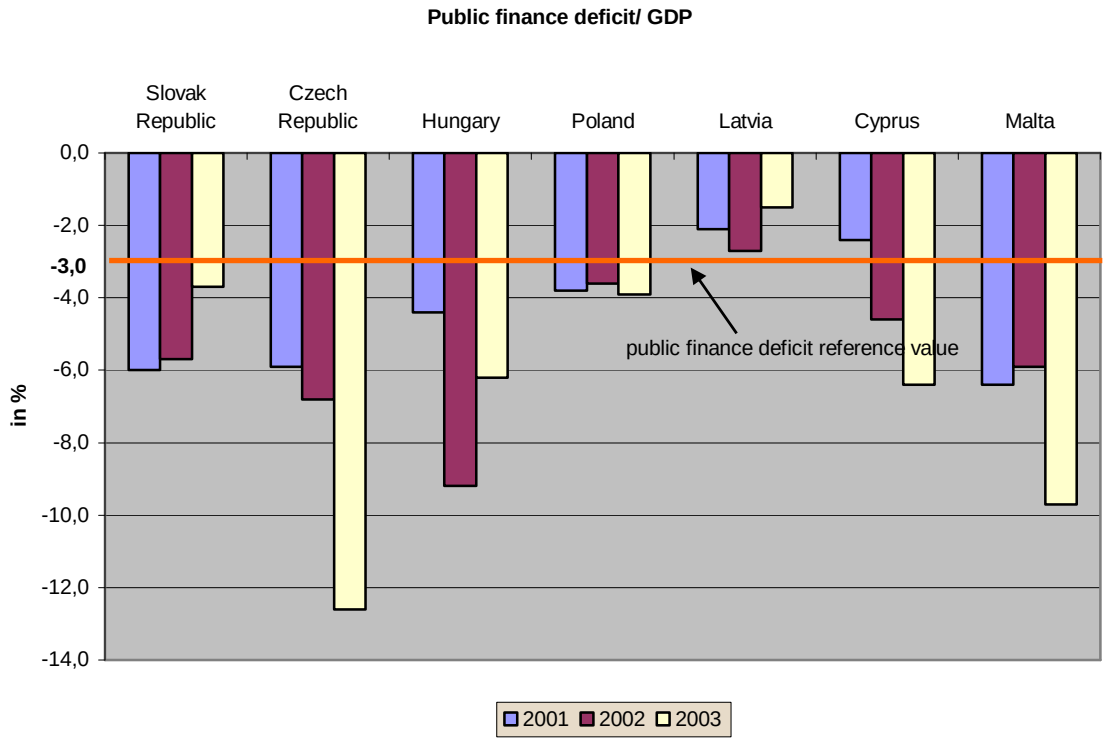
2.2 Budget deficit

→ Slovakia's public finance deficit exceeds this limit in all assessed period (starting 2000)

→ high deficits were caused expecially above by costs on restructualization of banking sector

→ achievement of 3% of GDP limit should be postponed by launching of pension reform and tax Reform

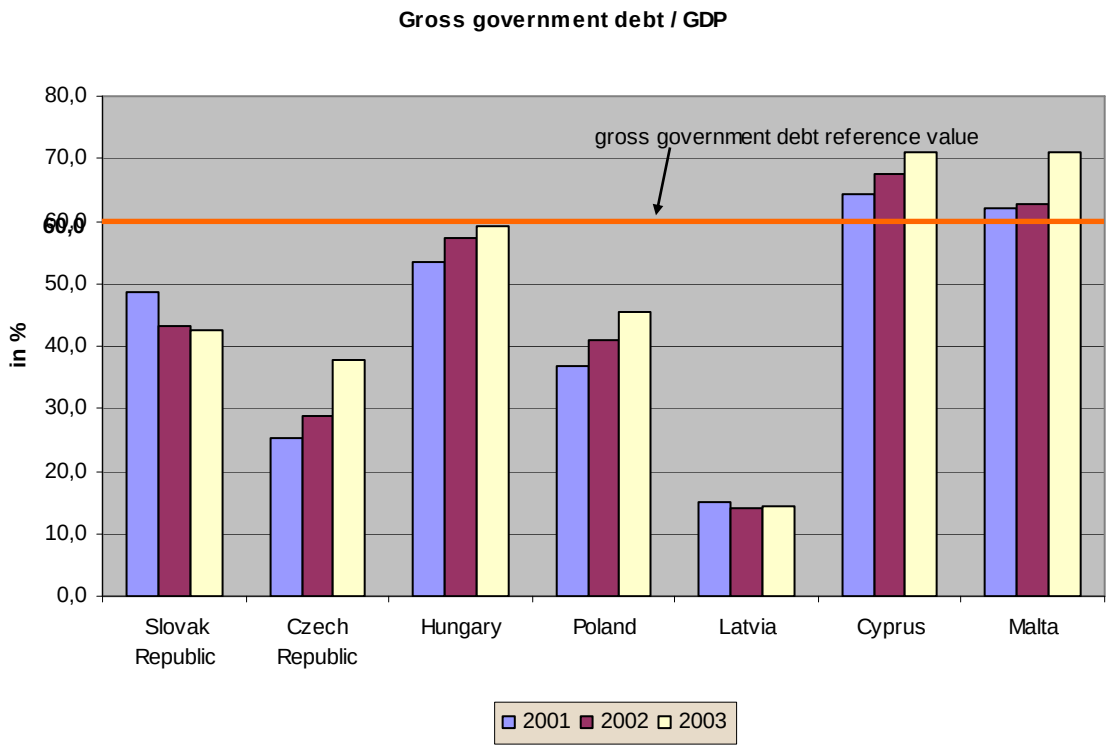
Figure 4 – Public finance deficit/GDP of new EÚ(7) member states



2.3 Government debt

→ Criterion of gross government debt Slovakia fulfills in each year of assessed period and set reference value (60% of GDP)

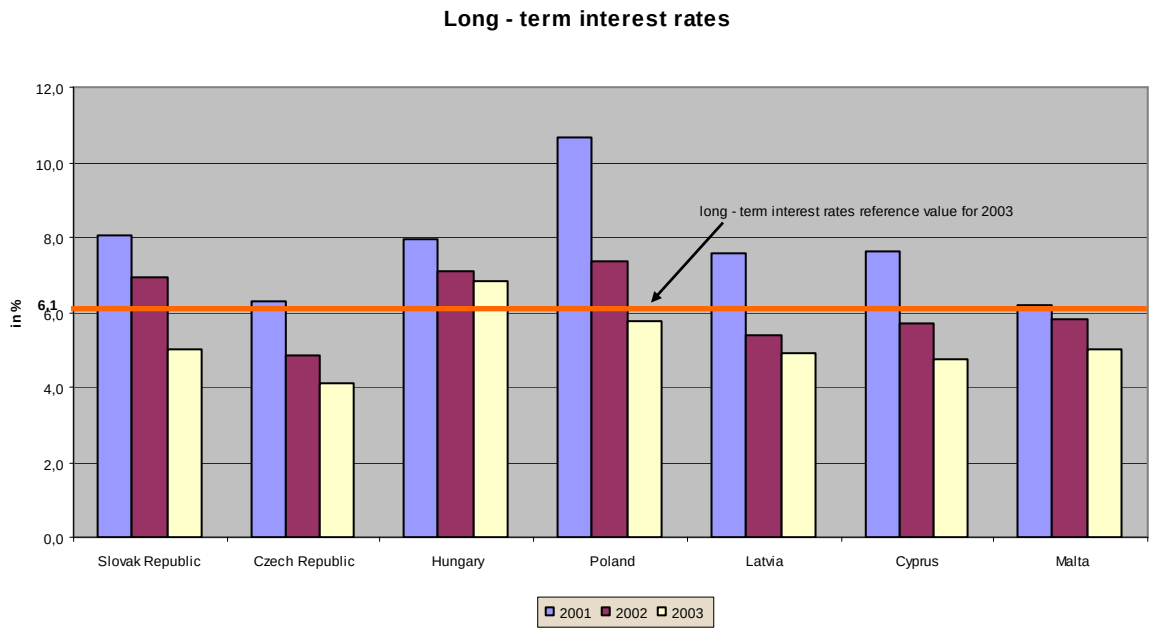
Figure 5 – Gross goverment debt/GDP of new EÚ(7) member states



2.4 Long-term interest rates

→ notabe descending trend of long term interest rates that makes assumptions of meeting this criterion reasonable (see figure 6)

Figure 6 – Long – term interest rates of new EÚ(7) member states



2.5 Exchange rate stability

→ for assessment of exchange rate stability according to Maastricht criterions,up to this time Slovakia does not fulfil basic system requirements:

- attendance of Slovak koruna in exchange rate mechanism ERM2 (for at least two years before entering EMU),
- setting of central parity SKK/EU

3. Comparison using methods of classes PROMETHEE

→ methods PROMETHEE requires the knowledge of criterion matrix, weights of the criteria and preference functions of criteria with their parameters for measuring the strength of the preference of the pairs of alternatives with respect to the given criterion

→ PROMETHEE I method provides partial ranking of alternatives, PROMETHEE II method offers complete ranking according to the net flow values

→ SANNA (System for ANalysis of Alternatives) application for multicriteria evaluation of alternatives developed under MS Excel environment

→ in solving of all three assignments was used the first type of preference function (does not require any parameters)

→ all criterion were of the same importance

→ as criterions were used differences from reference value and were minimized

Macroeconomic indicatores EU (7) and differences from reference value 2001 – 2003

in % average yoy inflation		**2001**	**2002**	**2003**
sk Slovak Republic	**Inflation**	7,2	3,5	8,5
	Difference	3,7	0,5	5,8
cz Czech Republic	**Inflation**	4,5	1,4	-0,1
	Difference	1,0	0,0	0,0
hu Hungary	**Inflation**	9,1	5,2	4,7
	Difference	5,6	2,2	2,0
pl Poland	**Inflation**	5,3	1,9	0,7
	Difference	1,8	0,0	0,0
lv Latvia	**Inflation**	2,5	2,0	2,9
	Difference	0,0	0,0	0,2
cy Cyprus	**Inflation**	2,0	2,8	4,0
	Difference	0,0	0,0	1,3
mt Malta	**Inflation**	2,5	2,6	1,9
	Difference	0,0	0,0	0,0
Reference value		*3,5*	*3,0*	*2,7*

As criterions were used differences from reference value and better values of indicatores than reference value were not taken into account.

Example:

sk inflation 2001 (7,2) – reference value 2001(3,5) = difference (3,7) = criterion value (inflation) of alternative (sk) in 2001

cz inflation 2002 (1,4) – reference value 20002 (3,0) = difference (-1,6) => 0 = criterion value (inflation) of alternative (cz) in 2002

in % as a ratio to GDP		**2001**	**2002**	**2003**
sk Slovak Republic	**Public fin. deficit**	-6,0	-5,7	-3,7
	Difference	3,0	2,7	0,7
cz Czech Republic	**Public fin. deficit**	-5,9	-6,8	-12,6
	Difference	2,9	3,8	9,6
hu Hungary	**Public fin. deficit**	-4,4	-9,2	-6,2
	Difference	1,4	6,2	3,2
pl Poland	**Public fin. deficit**	-3,8	-3,6	-3,9
	Difference	0,8	0,6	0,9
lv Latvia	**Public fin. deficit**	-2,1	-2,7	-1,5
	Difference	0,0	0,0	0,0
cy Cyprus	**Public fin. deficit**	-2,4	-4,6	-6,4
	Difference	0,0	1,6	3,4
mt Malta	**Public fin. deficit**	-6,4	-5,9	-9,7
	Difference	3,4	2,9	6,7
Reference value		*-3,0*	*-3,0*	*-3,0*

in % as a ratio to GDP		**2001**	**2002**	**2003**
sk Slovak Republic	**Government debt**	48,7	43,3	42,6
	Difference	0,0	0,0	0,0
cz Czech Republic	**Government debt**	25,3	28,8	37,8
	Difference	0,0	0,0	0,0
hu Hungary	**Government debt**	53,5	57,2	59,1
	Difference	0,0	0,0	0,0
pl Poland	**Government debt**	36,7	41,1	45,4
	Difference	0,0	0,0	0,0
lv Latvia	**Government debt**	14,9	14,1	14,4
	Difference	0,0	0,0	0,0
cy Cyprus	**Government debt**	64,3	67,4	70,9
	Difference	4,3	7,4	10,9
mt Malta	**Government debt**	62,2	62,7	71,1
	Difference	2,2	2,7	11,1
Reference value		*60,0*	*60,0*	*60,0*

in % p. a.		2001	2002	2003
sk Slovak Republic	**Interest rates**	8,0	6,9	5,0
	Difference	1,1	0,1	0,0
cz Czech Republic	**Interest rates**	6,3	4,9	4,1
	Difference	0,0	0,0	0,0
hu Hungary	**Interest rates**	8,0	7,1	6,8
	Difference	1,1	0,3	0,7
pl Poland	**Interest rates**	10,7	7,4	5,8
	Difference	3,8	0,6	0,0
lv Latvia	**Interest rates**	7,6	5,4	4,9
	Difference	0,7	0,0	0,0
cy Cyprus	**Interest rates**	7,6	5,7	4,7
	Difference	0,7	0,0	0,0
mt Malta	**Interest rates**	6,2	5,8	5,0
	Difference	0,0	0,0	0,0
Reference value		*6,9*	*6,8*	*6,1*

3.1 Assessment of meeting the requirements of Maastricht criterions in 2001 - 2003 (solution of assignment 1)

→ the goal of first assignment was to examine how was Slovak republic successful in fulfilling of Maastricht criterions in years 2001 to 2003, as a result should be ranking of all three years from the best to the worst and this ranking then could be used for showing the trend of nominal convergence development

→ during the whole examined period Slovakia was successful in fulfiling of only one from above mentioned criterions: ratio of public debt to GDP and in addition in 2003 Slovakia succeeded in meeting long-term interest rates criterion (values of criterions that are already fulfilled are equal to zero)

Following net flow ($F = F^{(+)} – F^{(-)}$) as the best years were classified years 2002 and 2003 due to identical net flow (0.25).

Preferenční funkce:

1 - obecná	1 - obecná	1 - obecná	1 - obecná

Příprava

	1	1	1	1
	Inflácia	Deficit	Dlh/HDP	Úrok. Miery
q-indif				
p-abs-pref				
sigma				

Aktivace

Vstupní data:

	MIN Inflácia	MIN Deficit	MIN dlh/HDP	MIN Úrok. Miery
2001	3,7	3	0	1,14
2002	0,5	2,7	0	0,14
2003	5,8	0,7	0	0
Váhy	0,25000	0,25000	0,25000	0,25000

Matice A:

	2001,00000	2002,00000	2003,00000	F(+)	F
2001,00000	0,00000	0,00000	0,25000	0,12500	-0,50000
2002,00000	0,75000	0,00000	0,25000	0,50000	0,25000
2003,00000	0,50000	0,50000	0,00000	0,50000	0,25000
F(-)	0,62500	0,25000	0,25000		

SEŘAZENÍ DLE PROMETHEE II.:

Pořadí	Varianta	F	F+	F-
1 -- 2	2002	0,25000	0,50000	0,25000
1 -- 2	2003	0,25000	0,50000	0,25000
3	2001	-0,50000	0,12500	0,62500

3.2 Assessment of meeting the requirements of Maastricht criterions of V4 countries using PROMETHEE II methods in 2003 (solution of assignment 2)

Preferenční funkce:

	1 - obecná	1 - obecná	1 - obecná	1 - obecná
Příprava				
	1	1	1	1
	Inflácia	Deficit	Dlh/HDP	Úrok. Miery
q-indif				
p-abs-pref				
sigma				

Vstupní data:

Aktivace	MIN Inflácia	MIN Deficit	MIN Dlh/HDP	MIN Úrok. Miery
SR	5,8	0,7	0	0
ČR	0	9,6	0	0
MR	2	3,2	0	0,72
PL	0	0,9	0	0
Váhy	0,25000	0,25000	0,25000	0,25000

Matice A:

	SR	ČR	MR	PL	F(+)	F
SR	0,00000	0,25000	0,50000	0,25000	0,33333	0,08333
ČR	0,25000	0,00000	0,50000	0,00000	0,25000	0,00000
MR	0,25000	0,25000	0,00000	0,00000	0,16667	-0,41667
PL	0,25000	0,25000	0,75000	0,00000	0,41667	0,33333
F(-)	0,25000	0,25000	0,58333	0,08333		

SEŘAZENÍ DLE PROMETHEE II.:

Pořadí	Varianta	F	F+	F-
1	PL	0,33333	0,41667	0,08333
2	SR	0,08333	0,33333	0,25000
3	ČR	0,00000	0,25000	0,25000
4	MR	-0,41667	0,16667	0,58333

Final ranking was as following: Poland -> Slovakia -> Czech republic -> Hungary.

3.3 Assessment of meeting the requirements of Maastricht criterions of seven new EU member states using PROMETHEE II methods in 2003 (assignment 3 solution)

Preferenční funkce:

	1 - obecná	1 - obecná	1 - obecná	1 - obecná
Příprava	Inflácia	Deficit VF	Dlh/HDP	Úrok.miery
q-indif				
p-abs-pref				
sigma				

Vstupní data:

	MIN	MIN	MIN	MIN
Aktivace	Inflácia	Deficit VF	Dlh/HDP	Úrok.miery
SR	5,8	0,7	0	0
ČR	0	9,6	0	0
MR	2	3,2	0	0,72
PL	0	0,9	0	0
LV	0,2	0	0	0
CY	1,3	3,4	10,9	0
MT	0	6,7	11,1	0
Váhy	0,25000	0,25000	0,25000	0,25000

Matice A:

	SR	ČR	MR	PL	LV	CY	MT	F(+)	F
SR	0,00000	0,25000	0,50000	0,25000	0,00000	0,50000	0,50000	0,33333	0,04167
ČR	0,25000	0,00000	0,50000	0,00000	0,25000	0,50000	0,25000	0,29167	0,04167
MR	0,25000	0,25000	0,00000	0,00000	0,00000	0,50000	0,50000	0,25000	-0,33333
PL	0,25000	0,25000	0,75000	0,00000	0,25000	0,75000	0,50000	0,45833	0,37500
LV	0,50000	0,25000	0,75000	0,25000	0,00000	0,75000	0,50000	0,50000	0,37500
CY	0,25000	0,25000	0,50000	0,00000	0,00000	0,00000	0,50000	0,25000	-0,29167
MT	0,25000	0,25000	0,50000	0,00000	0,25000	0,25000	0,00000	0,25000	-0,20833
F(-)	0,29167	0,25000	0,58333	0,08333	0,12500	0,54167	0,45833		

SEŘAZENÍ DLE PROMETHEE II.:

Pořadí	Varianta	F	F+	F-
1 -- 2	LV	0,37500	0,50000	0,12500
1 -- 2	PL	0,37500	0,45833	0,08333
3	ČR	0,04167	0,29167	0,25000
4	SR	0,04167	0,33333	0,29167
5	MT	-0,20833	0,25000	0,45833
6	CY	-0,29167	0,25000	0,54167
7	MR	-0,33333	0,25000	0,58333