ANALYSING THE RELEVANCE OF MIP SCOREBOARD'S INDICATORS

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The Motivation

- This research aims:
  - to evaluate the Macroeconomic Imbalance Procedure (MIP) Scoreboard's indicators in a multivariate setting, in an effort to assess the relevance of each particular MIP indicator in a common system, via its statistical significance in a probability model (similar approach was suggested by Kaminsky, Lizando, and Reinhart 1998);
  - to provide information on their joint in-sample performance;
- Although the performance of MIP indicators in regard to predicting economic crisis was already evaluated (Csortos and Szalai 2013) it was done through univariate signaling approach;

Macroeconomic Imbalance Procedure

- Recent period of economic and financial crises followed by the debt crisis has shown how vulnerable some of the member states of the European Monetary Union (EMU) are;
- EMU countries are subjected to a single monetary authority and also constrained with national fiscal policies (which are extraordinarily restrictive due to subsequent Stability and Growth Pact - SGP);
- The MIP was introduced in December 2011 as a surveillance mechanism for an early identification of potential risks and for prevention from excessive imbalances;

Alert Mechanism Report

External imbalances and competitiveness		Indicative thresholds
Current account balance	% of GDP. 3-year backward moving average	+6% and -4%
Net international investment position	% of GDP	-35%
Real effective exchange rate	42 trading partners. HICP deflator. 3-year % change	±5% (EMU). ±11 (non-EMU)
Export market share	% of world exports. 5-year % change	-6%
Nominal unit labour cost	2010=100. 3-year % change	9% (EMU). 12% (non-EMU)
Internal imbalances		
House price index	deflated. 1-year % change	6%
Private sector debt	consolidated. % of GDP	133% (previously 160%)
Private sector credit flow	consolidated. % of GDP	14% (previously 15%)
General government gross debt	% of GDP	60%
Unemployment rate	3-year backward moving average	10%
Total financial sector liabilities	non-consolidated. 1-year % change	16.5%
New employment indicators		
Activity rate	% of total population aged 15-64. 3-year change	-0.2 p.p.
Long-term unemployment rate	% of active population aged 15-74. 3-year change	0.5 p.p.
Youth unemployment rate	% of active population aged 15-24. 3-year change	2.0 p.p.

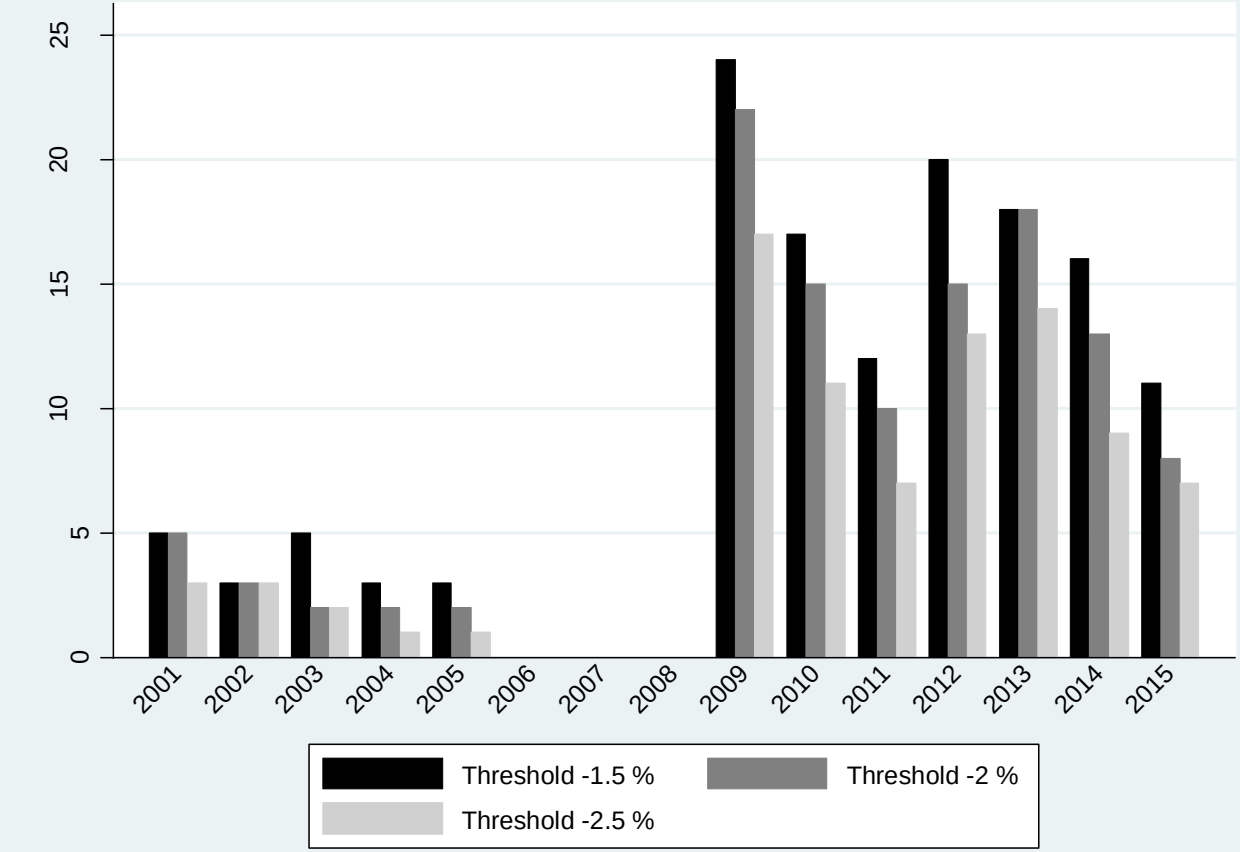
Related Research

- Similar research focused on the possibilities and weaknesses of MIP targeting: indicator thresholds (Alcidi et al. 2014, Hallwirth 2014), symmetry in the adjustment mechanism (De Grauwe 2012), cross-country differences (Moschella 2014), and excessive imbalances (Kamps et al. 2013);
- Early Warning Systems (EWS) are generally analysed using:
  - Signals approach (Kaminsky and Reinhart 1999, Csortos and Szalai 2013, Sarlin 2013, El-Shagan et al. 2013);
  - Binary response models (Canova 1994, Antunes 2014, Alessi et al. 2014);

The definition of macroeconomic imbalance

- Macroeconomic imbalances are rather loosely defined and majority of previously mentioned EWS are oriented on financial crises (Kaminsky and Reinhart 1999, Canova 1994, Antunes 2014, Alessi et al. 2014);
- In contrast, presented paper was rather focusing on the manifestation of macroeconomic in the real economy;
- Following the example of Csortos and Szalai (2013), the crisis in real economy was defined as a period when output-gap dropped below -2%;

Occurrence of crisis events



Data and Methodology

- Analysis utilized annual imbalanced panel data of 28 EU member states available from Eurostat for most of 2005-2015;
- The multivariate binary response models were used as the primary tool for described analysis;
- Average marginal effects (AME) of MIP indicators were quantified using pooled **logit model** estimated by maximum likelihood method with confidence intervals of AME computed by delta method and by pooled **linear probability model** (LPM) estimated by OLS;
- Following the Cameron and Trivedi (2010) cluster-robust standard errors were used to account for within-cluster serial correlation;
- EWS's crisis predictive power was examined for time horizon 1, 2, and 3 periods in advance;

Estimated Model

- The latent variable y* was modeled as:

$$y^*_{i;t} = \beta_0 + \beta_1 AR_{i;t-j} + \beta_2 LTUR_{i;t-j} + \beta_3 YUR_{i;t-j} + \beta_4 EMS_{i;t-j} + \beta_5 PSD_{i;t-j} + \beta_6 UR_{i;t-j} + \beta_7 GGD_{i;t-j} + \beta_8 NIIP_{i;t-j} + \beta_9 REER_{i;t-j} + \beta_{10} CA_{i;t-j} + \beta_{11} NULC_{i;t-j} + \beta_{12} PSCF_{i;t-j} + \beta_{13} TFSL_{i;t-j} + \beta_{14} HPI_{i;t-j}$$

- Where AR – activity rate, LTUR – long term unemployment rate, YUR – youth unemployment rate, EMS – export market share, PSD – private sector debt, UR – unemployment rate, GGD – general government debt, NIIP – net international investment position, REER – real effective exchange rate, CA – current account balance, NULC – nominal unit labor cost, PSCF – private sector credit flow, TFSL – total financial sector liabilities, HPI – house price index;
- The obtained results for some indicators seem to contradict prior assumptions about the signs which led to examination of possible multicollinearity;

Correlation Matrix of Indicators

Ind.	AR	LTUR	YUR	EMS	PSD	UR	GGD	NIIP	REER	CA	NULC	PSCF	TFSL	HPI
AR	1.00													
LTUR	-0.29	1.00												
YUR	-0.31	0.82	1.00											
EMS	0.27	-0.30	-0.24	1.00										
PSD	-0.21	0.18	0.16	-0.32	1.00									
UR	-0.07	0.63	0.39	-0.09	-0.15	1.00								
GGD	-0.22	0.43	0.34	-0.55	0.07	0.39	1.00							
NIIP	0.07	-0.37	-0.33	-0.14	0.14	-0.59	-0.16	1.00						
REER	0.07	-0.26	-0.03	0.38	-0.15	-0.16	-0.26	-0.04	1.00					
CA	-0.08	-0.02	-0.08	-0.38	0.35	-0.20	-0.11	0.61	-0.20	1.00				
NULC	0.29	-0.52	-0.29	0.50	-0.11	-0.39	-0.42	0.03	0.37	-0.41	1.00			
PSCF	0.03	-0.20	-0.24	0.17	0.21	-0.22	-0.22	0.11	0.05	0.03	0.13	1.00		
TFSL	0.18	-0.40	-0.39	0.37	-0.03	-0.31	-0.40	0.15	0.02	-0.09	0.33	0.32	1.00	
HPI	0.17	-0.35	-0.52	0.15	0.00	-0.18	-0.23	0.27	-0.03	0.16	0.02	0.29	0.51	1.00

Addressing the effects of multicollinearity

- Re-estimation of all models for each indicator that might cause multicollinearity with specification excluding other indicators with coefficients of correlation which are in absolute value higher than 0.5 – designated as the adjusted models;
- Performing factor analysis on all headline indicators and using the resulting factors instead of original factors in additionally estimated models;

Results of the factor analysis

	Factor1	Factor2	Factor3	Uniqueness
Youth unemployment rate	***0.5376***	-0.2450	***-0.5870***	0.3065
Long-term unemployment rate	***0.7193***	-0.4282	-0.3396	0.1840
Unemployment rate	***0.8735***	-0.1809	-0.0135	0.2041
Net international investment position	***-0.8025***	-0.3083	0.1360	0.2424
Nominal unit labour cost	-0.3347	***0.8318***	-0.0738	0.1906
Export market shares	0.1035	***0.8211***	0.2222	0.2657
House price index	-0.1560	-0.0597	***0.9063***	0.1507
Total financial sector liabilities	-0.1454	0.3885	***0.6793***	0.3665

The interpretation of factors

- **Factor 1 (Labour-Capital Nexus):** The relationship of the unemployment and net international investment position might be connected to the hypothesis of demography-induced capital flows, as presented in Marchiori, Pierrard, and Sneessens (2011);
- **Factor 2 (Catch-up Effect):** The Central and Eastern European Countries have not only been successful in increasing their world export market share, but also managed to shift towards more sophisticated products outperforming the EU benchmark (Cazacu Bancu, 2015) witch is also associated with their convergence in income levels (Barrios, Barry, and Strobl 2002) and this is ultimately transmitted into growth rates in unit labour costs;
- **Factor 3 (Real estate bubble):** This factor embodies the harmful developments in real estate markets and, at the same time, captures the vulnerability of young people to unemployment when a real estate market bubble burst may occur. Such crises tend to severely aggravate unemployment among young people, as pointed out by Verick (2011);

Indicator (Lag 1)	Logit	Logit Adj.	Logit FA	LPM	LPM Adj.	LPM FA
Youth unemployment rate	***-0.017****	***0.011****		-0.011	***0.012****	
	(0.089)	***(0.051)***		(0.323)	***(0.041)***	
Long-term unemployment rate	***0.081****	0.022		***0.068****	0.023	
	(0.037)	(0.126)		***(0.057)***	(0.118)	
Unemployment rate	-0.015	0.003		-0.014	0.007	
	(0.287)	(0.723)		(0.409)	(0.488)	
Net international investment position	-0.001	0.000		-0.001	-0.001	
	(0.508)	(0.661)		(0.414)	(0.252)	
Factor 1: Labour-Capital Nexus			***0.073****			***0.078****
			(0.019)			***(0.090)***
Export market shares	-0.002	-0.003		-0.001	-0.001	
	(0.272)	(0.202)		(0.718)	(0.731)	
Nominal unit labour cost	0.000	-0.005		0.005	0.000	
	(0.929)	(0.334)		(0.336)	(0.962)	
Factor 2: Catch-up Effect			0.001			0.034
			(0.979)			(0.524)
Total financial sector liabilities	0.001	***-0.007****		0.002	***-0.007****	
	(0.615)	***(0.096)***		(0.479)	***(0.039)***	
House price index	***-0.035*****	***-0.033*****		***-0.021*****	***-0.019*****	
	(0.000)	***(0.000)***		***(0.000)***	***(0.000)***	
Youth unemployment rate	***-0.017****	***0.011****		-0.011	***0.012****	
	(0.089)	***(0.051)***		(0.323)	***(0.041)***	
Factor 3: Real estate bubble			***-0.222*****			***-0.178*****
			(0.000)			***(0.000)***
Current account balance	-0.001	-0.006	-0.005	-0.005	-0.013	-0.007
	(0.912)	(0.420)	(0.528)	(0.638)	(0.120)	(0.432)
Real effective exchange rate	0.005		-0.004	0.001		-0.005
	(0.413)		(0.446)	(0.937)		(0.390)
General government gross debt	0.000	0.001	0.000	0.000	0.001	0.001
	(0.880)	(0.529)	(0.782)	(0.781)	(0.683)	(0.766)
Private sector domestic credit	***0.002*****		***0.002*****	***0.002*****		***0.002*****
	(0.000)		***(0.000)***	***(0.004)***		***(0.000)***
Private sector credit flow	***-0.004*****		***-0.004***	***-0.004*****		***-0.003*****
	(0.094)		***(0.211)***	***(0.000)***		***(0.000)***
Activity rate	-0.044		***-0.046****	***-0.056****		***-0.059****
	(0.107)		***(0.098)***	***(0.062)***		***(0.028)***
Number of observations	213		213	213		213
R-squared / Pseudo R-squared	0.418		0.334	0.389		0.355
Correct prediction rate	0.808		0.808	0.798		0.793

Indicator (Lag 2)	Logit	Logit Adj.	Logit FA	LPM	LPM Adj.	LPM FA
Youth unemployment rate	0.000	***0.011****		0.001	***0.011****	
	(0.986)	***(0.095)***		(0.953)	***(0.085)***	
Long-term unemployment rate	0.035	0.004		0.034	0.005	
	(0.355)	(0.795)		(0.384)	(0.745)	
Unemployment rate	-0.024	-0.007		-0.024	-0.007	
	(0.226)	(0.588)		(0.267)	(0.658)	
Net international investment position	-0.001	***-0.002****		-0.002	***-0.002****	
	(0.248)	***(0.077)***		(0.350)	***(0.095)***	
Factor 1: Labour-Capital Nexus			0.016			0.019
			(0.711)			(0.728)
Export market shares	0.000	0.000		-0.001	0.000	
	(0.835)	(0.876)		(0.787)	(0.974)	
Nominal unit labour cost	0.007	0.002		0.008	0.003	
	(0.144)	(0.696)		(0.160)	(0.599)	
Factor 2: Catch-up Effect			0.074			0.081
			(0.246)			(0.297)
Total financial sector liabilities	0.003	-0.002		0.003	-0.002	
	(0.232)	(0.499)		(0.245)	(0.538)	
House price index	***-0.011*****	***-0.011****		***-0.011****	***-0.011****	
	(0.007)	***(0.025)***		***(0.011)***	***(0.018)***	
Youth unemployment rate	0.000	***0.011****		0.001	***0.011****	
	(0.986)	***(0.095)***		(0.953)	***(0.085)***	
Factor 3: Real estate bubble			***-0.105****			***-0.107****
			(0.020)			***(0.023)***
Current account balance	-0.012	***-0.022****	***-0.019****	-0.013	***-0.025*****	-0.019
	(0.289)	***(0.011)***	***(0.089)***	(0.324)	***(0.008)***	(0.116)
Real effective exchange rate	***-0.015****		***-0.018****	***-0.014****		***-0.017*****
	(0.037)		***(0.010)***	***(0.036)***		***(0.008)***
General government gross debt	0.000	0.000	0.000	0.000	0.000	0.000
	(0.944)	(0965)	(0.921)	(0.929)	(0.999)	(1.000)
Private sector domestic credit	***0.001*****		***0.002*****	***0.002****		***0.002*****
	(0.007)		***(0.000)***	***(0.042)***		***(0.002)***
Private sector credit flow	0.000		0.000	0.000		0.000
	(0.870)		(0.772)	(0.773)		(0.755)
Activity rate	***-0.088*****		***-0.102*****	***-0.095****		***-0.106*****
	(0.003)		***(0.000)***	***(0.010)***		***(0.003)***
Number of observations	186		186	186		186
R-squared / Pseudo R-squared	0.284		0.261	0.329		0.304
Correct prediction rate	0.780		0.763	0.774		0.769

Indicator (Lag 3)	Logit	Logit Adj.	Logit FA	LPM	LPM Adj.	LPM FA
Youth unemployment rate	***0.026****	0.009		***0.022****	0.009	
	(0.027)	(0.127)		***(0.048)***	(0.155)	
Long-term unemployment rate	-0.057	***-0.033****		-0.042	-0.032	
	(0.173)	***(0.091)***		(0.328)	(0.130)	
Unemployment rate	-0.032	-0.022		-0.029	-0.020	
	(0.230)	(0.294)		(0.213)	(0.312)	
Net international investment position	***-0.003****	***-0.003*****		-0.003	***-0.003*****	
	(0.066)	***(0.002)***		(0.151)	***(0.013)***	
Factor 1: Labour-Capital Nexus			-0.042			-0.043
			(0.531)			(0.539)
Export market shares	-0.001	0.000		-0.001	0.000	
	(0.705)	(0.908)		(0.706)	(0.961)	
Nominal unit labour cost	***0.011****	***0.009****		***0.012****	***0.010****	
	(0.056)	***(0.043)***		***(0.085)***	***(0.052)***	
Factor 2: Catch-up Effect			0.080			0.084
			(0.244)			(0.271)
Total financial sector liabilities	-0.002	0.001		-0.002	0.001	
	(0.522)	(0.602)		(0.523)	(0.649)	
House price index	***0.011****	0.005		***0.010****	0.005	
	(0.022)	(0.335)		***(0.036)***	(0.357)	
Youth unemployment rate	***0.026****	0.009		***0.022****	0.009	
	(0.027)	(0.127)		***(0.048)***	(0.155)	
Factor 3: Real estate bubble			-0.001			0.000
			(0.980)			(0.995)
Current account balance	-0.011	***-0.027*****	***-0.023****	-0.011	***-0.029*****	***-0.024****
	(0.326)	***(0.000)***	***(0.040)***	(0.442)	***(0.001)***	***(0.049)***
Real effective exchange rate	***-0.018****		***-0.013****	***-0.018****		***-0.013****
	(0.020)		***(0.050)***	***(0.022)***		***(0.043)***
General government gross debt	0.001	0.001	0.000	0.001	0.000	0.000
	(0.718)	(0.721)	(0.990)	(0.792)	(0.810)	(0.960)
Private sector domestic credit	***0.002*****		***0.002*****	***0.002*****		***0.002*****
	(0.008)		***(0.000)***	***(0.022)***		***(0.000)***
Private sector credit flow	0.000		-0.001	0.000		-0.001
	(0.886)		(0.371)	(0.886)		(0.426)
Activity rate	***-0.073****		***-0.096*****	***-0.075****		***-0.094****
	(0.026)		***(0.009)***	***(0.062)***		***(0.023)***
Number of observations	159		159	159		159
R-squared / Pseudo R-squared	0.253		0.168	0.294		0.210
Correct prediction rate	0.755		0.723	0.736		0.711

Country specific prediction rates for the members of PIIGS and Hungary

Lag 1		Base model					Factor model				
		Obs.	N.Cri.	Pr.Cri.	aNtS	CPR	Obs.	N.Cri.	Pr.Cri.	aNtS	CPR
EL	LPM	6	6	1.000	N/A	1.000	6	6	1.000	N/A	1.000
	Logit	6	6	1.000	N/A	1.000	6	6	0.833	N/A	0.833
ES	LPM	3	3	1.000	N/A	1.000	3	3	1.000	N/A	1.000
	Logit	3	3	1.000	N/A	1.000	3	3	1.000	N/A	1.000
HU	LPM	7	4	1.000	0.333	0.857	7	4	0.500	0.667	0.571
	Logit	7	4	1.000	0.333	0.857	7	4	0.750	0.444	0.714
IE	LPM	8	5	1.000	0.333	0.875	8	5	1.000	0.333	0.875
	Logit	8	5	1.000	0.333	0.875	8	5	1.000	0.333	0.875
IT	LPM	11	6	0.333	0.600	0.545	11	6	0.500	0.400	0.636
	Logit	11	6	0.500	0.400	0.636	11	6	0.667	0.300	0.727
PT	LPM	11	6	1.000	1.000	0.545	11	6	1.000	0.800	0.636
	Logit	11	6	0.667	1.500	0.364	11	6	1.000	0.600	0.727

Country specific prediction rates for the members of PIIGS and Hungary

Lag 2		Base model					Factor model				
		Obs.	N.Cri.	Pr.Cri.	aNtS	CPR	Obs.	N.Cri.	Pr.Cri.	aNtS	CPR
EL	LPM	5	5	1.000	N/A	1.000	5	5	1.000	N/A	1.000
	Logit	5	5	1.000	N/A	1.000	5	5	1.000	N/A	1.000
ES	LPM	2	2	0.500	N/A	0.500	2	2	1.000	N/A	1.000
	Logit	2	2	0.500	N/A	0.500	2	2	1.000	N/A	1.000
HU	LPM	6	3	0.667	0.500	0.667	6	3	0.667	0.500	0.667
	Logit	6	3	1.000	0.333	0.833	6	3	0.667	0.500	0.667
IE	LPM	7	5	0.800	1.250	0.571	7	5	0.800	1.250	0.571
	Logit	7	5	0.800	1.250	0.571	7	5	0.800	1.250	0.571
IT	LPM	10	6	0.333	0.000	0.600	10	6	0.333	0.000	0.600
	Logit	10	6	0.333	0.000	0.600	10	6	0.333	0.000	0.600
PT	LPM	10	6	1.000	1.000	0.600	10	6	1.000	1.000	0.600
	Logit	10	6	1.000	1.000	0.600	10	6	1.000	1.000	0.600

Country specific prediction rates for the members of PIIGS and Hungary

Lag 3		Base model					Factor model				
		Obs.	N.Cri.	Pr.Cri.	aNtS	CPR	Obs.	N.Cri.	Pr.Cri.	aNtS	CPR
EL	LPM	4	4	1.000	N/A	1.000	4	4	1.000	N/A	1.000
	Logit	4	4	1.000	N/A	1.000	4	4	1.000	N/A	1.000
ES	LPM	1	1	0.000	N/A	0.000	1	1	0.000	N/A	0.000
	Logit	1	1	0.000	N/A	0.000	1	1	0.000	N/A	1.000
HU	LPM	5	2	1.000	0.333	0.800	5	2	0.500	0.667	0.600
	Logit	5	2	1.000	0.333	0.800	5	2	0.500	0.667	0.600
IE	LPM	6	4	1.000	1.000	0.667	6	4	0.750	1.333	0.500
	Logit	6	4	1.000	1.000	0.667	6	4	0.750	1.333	0.500
IT	LPM	9	6	0.500	0.000	0.667	9	6	0.167	0.000	0.444
	Logit	9	6	0.667	0.000	0.778	9	6	0.333	0.000	0.556
PT	LPM	9	6	1.000	1.000	0.667	9	6	1.000	1.000	0.667
	Logit	9	6	1.000	1.000	0.667	9	6	1.000	1.000	0.667

Country specific assessment of positive outcome threshold

	Logit						LPM					
	L1 BA	L1 FA	L2 BA	L2 FA	L3 BA	L3 FA	L1 BA	L1 FA	L2 BA	L2 FA	L3 BA	L3 FA
AT	.	.	.	.	.	.	.	.	.	.	.	.
BE	.	.	.	.	.	.	.	.	.	.	.	.
BG	.	.	.	.	.	.	.	.	.	.	.	.
CY	1.000	1.000	1.000	1.000	.	.	1.000	1.000	1.000	1.000	.	.
CZ	0.000	0.000	0.000	0.000	0.429	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DE	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
DK	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
EE	1.000	1.125	0.800	0.800	1.167	0.875	1.125	1.125	0.800	0.800	1.167	0.875
EL	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
ES	1.000	1.000	1.000	1.000	.	.	1.000	1.000	1.000	1.000	.	.
FI	0.550	0.314	0.400	0.000	0.360	0.360	0.000	0.000	0.400	0.000	0.360	0.360
FR	.	.	.	.	.	.	.	.	.	.	.	.
HR	1.071	1.071	1.125	1.125	1.000	1.000	1.071	1.071	1.125	1.125	1.000	1.000
HU	1.167	1.050	1.200	1.000	1.250	0.833	1.167	0.875	1.000	1.000	1.250	0.833
IE	1.143	1.143	1.400	1.400	1.500	1.500	1.143	1.143	1.400	1.400	1.500	1.500
IT	0.786	0.917	0.556	0.556	0.857	0.600	0.611	0.786	0.556	0.556	0.750	0.375
LT	1.000	1.000	0.000	1.000	.	.	0.600	1.000	0.000	1.000	.	.
LU	0.917	1.100	1.000	1.042	1.250	1.071	1.100	1.100	1.000	1.042	1.250	1.071
LV	0.625	1.000	0.964	0.964	1.000	1.000	0.833	1.000	0.964	0.964	1.000	1.000
MT	0.000	0.000	.	.	.	.	0.000	0.000	.	.	.	.
NL	1.500	1.500	1.000	0.833	0.889	0.889	1.500	1.125	1.000	0.833	0.889	0.889
PL	.	.	.	.	.	.	.	.	.	.	.	.
PT	1.833	1.375	1.667	1.667	1.500	1.500	1.833	1.571	1.667	1.667	1.500	1.500
RO	0.900	0.900	1.000	1.000	0.889	0.889	0.960	0.900	1.000	1.000	0.889	0.889
SE	1.000	0.000	0.000	0.000	0.643	0.000	0.000	0.000	0.000	0.000	0.643	0.000
SI	0.825	0.978	0.857	0.750	0.600	0.600	0.978	0.825	0.857	0.750	0.720	0.360
SK	1.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
UK	0.880	0.978	1.250	1.000	1.500	1.500	0.880	0.733	1.250	0.889	1.500	1.500

Concluding remarks

- **Activity rate, house price index, youth unemployment rate** and **private sector debt** are the best performing individual indicators from the MIP scoreboard in the short term horizon, complemented by **current account balance** in long term horizon;
- **Export market share**, and **unemployment rate** do not deliver the expected performance in terms of the models applied;
- The multicollinearity issue was further developed via factor analysis, which showed that several indicators may be jointly affected by common factors such as **demography, structure of the industry**, and **real estate bubbles**, which seems to strongly lead economic crises in short-term horizon given the high marginal effect;
- Most of the members of **PIIGS and Hungary** are on average more reliant on other unobserved phenomena than other EU Member States;
- Regarding country specific heterogeneity most of the cases either models were appropriately set or their performance in predicting crisis and tranquil periods was shifting with the number of lags;

References

- ALCIDI. C. – GROS. D. 2014. Implications of EU Governance Reforms. Rationale and Practical Application. ETLA Reports No 25.
- ALESSI. L. – ANTUNES. A. – BABECKY. J. – BALTUSSEN. S. – BEHN. M. – BONFIM. D. – BUSH. O. – DATKEN. C. – FROST. J. – GUIMARAES. R. – HAVRÁNEK. T. – JOY. M. – KAUKO. K. – MATĚJU. J. – MONTEIRO. N. – NEUDORFER. B. – PELTONEN. T. – RODRIGUES. P.M.M. – RUSNÁK. M. SCHUDEL. W. – SIGMUND. M. – STREMMEL H. – ŠMÍDKOVÁ. K. – VAN TILBURG. R. – VAŠÍČEK. B. – ŽIGAROVÁ. D. 2014. Comparing different early warning systems: Results from a horse race competition among members of the Macro-prudential Research Network. Preliminary and incomplete draft: April 2014. ANTUNES. A. – BONFIM. D. – MONTEIRO. N. – RODRIGUES. P.M.M. 2014. Early Warning Indicators of Banking Crises: Exploring new Data and Tools. Banco de Portugal. Economic Bulletin. April 2014.
- BARRIOS, S., BARRY, F. and STROBL, E. 2002. FDI and Structural Convergence in the EU Periphery. In: Centre for European Policy Research, Workshop and Conferences, no. 2319.
- CAMERON. A.C. - TRIVEDI. P.K. 2010. Microeconometrics Using Stata. Revised Edition. Stata Press
- CANOVA. F. 1994. Were Financial Crises Predictable? In: Journal of Money. Credit and Banking. Volume 26. Issue 1. pp. 102-24.
- CAZACU (BANCU), A-M. 2015. Export Performance of Central and Eastern European Countries: Macro and Micro Fundamentals, In: Procedia - Social and Behavioral Sciences, vol. 195, pp. 514-523.
- CSORTOS. O. – SZALAI. Z. 2013. Assessment of Macroeconomic Imbalance Indicators. MNB Bulletin. October 2013.
- DE GRAUWE. P. 2012. In Search of Symmetry in the Eurozone. CEPS Policy Brief 268.
- DOMONKOS. T. – OSTRIHOŇ. F. – ŠIKULOVÁ. I. 2016. Ex-post evaluation of the MIP scoreboard indicators efficiency in predicting financial and macroeconomic imbalances in the EU. INFER Workshop. 11-12.03.2016. Bratislava
- EL-SHAGI. M. – KNEDLIK. T. – von SCHWEINITZ. G. 2013. Predicting Financial Crises: The (Statistical) Significance of the Signaling Approach. In: Journal of International Money and Finance. Volume 35. pp. 76-103.
- ESSL S. – STIGLBAUER. A. 2012. Prevention and Correction of Macroeconomic Imbalances: the Excessive Imbalance Procedure. In: Monetary Policy & The Economy Q4/11. OeNB. pp. 99-113.
- HALLWIRTH. V. 2014. Überwachung der Wettbewerbsfähigkeit in der Europäischen Wirtschafts- und Währungsunion. In: Wirtschaftsdienst. Volume 94. Issue 11. pp. 798-805.
- KAMINSKY, G., LIZANDO, S. and REINHART, C. 1998, Leading Indicators of Currency Crisis, In: IMF Staff Papers, vol. 45, no. 1.
- KAMINSKY. G.L – REINHART. C.M. 1999. The Twin Crises: The Causes of Banking and Balance-of-Payments Problems. In: American Economic Review. Volume 89. Number. 3. pp. 473-500.
- KAMPS. C. - DE STEFANI. R. – LEINER-KILLINGER. N. – RUEFFER. R. – SONDERMANN. D. 2013. Would the Strengthened EU Fiscal and Economic Governance Framework Have Helped Signalling Sovereign Debt Crises?. paper presented at Banca d'Italia 15th Public Finance Workshop.
- MARCHIORI, L, PIERRARD, O. and SNEESSENS, H. R. 2011. Demography, Capital Flows and Unemployment. In: IZA DP, no. 6094.
- MOSCHELLA. M. 2014. Monitoring Macroeconomic Imbalances: Is EU Surveillance More Effective than IMF Surveillance? In: Journal of Common Market Studies. Volume 52. Number 6. pp. 1273-1289.
- SARLIN. P. 2013. On Policymakers' Loss Functions and the Evaluation of Early Warning Systems. ECB Working Paper Series. Number 1509. February 2013.
- VERICK, Sh. 2011. Giving Up Job Search During a Recession: The Impact of the Global Financial Crisis on the South African Labour Market. In: IZA DP, no. 6116.

Thank you for your attention!