

Performance of the Macroeconomic Imbalance Procedure (MIP) in Light of Historical Experience in CEE region

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Introduction

- Motivation
- Methodology (MIP and EWS)
- Results
- Discussion
- Conclusions

Motivation

- in light of recent experience with internal EA BoP crisis the MIP was introduced (2012) to serve as EWS within EU28 economic area;
- only few studies (Csontos and Szalay, 2013; Knedlik 2014, 2015; Domonkos et al., 2016) have empirically assessed the signaling power of MIP;
- none of them have used broader set of countries nor focused specifically on CEE region even though a call for more country group-specific targets has been issued (Knedlik, 2014; Knedlik, 2015);
- **Main objective** of this paper is to review the signaling power of MIP using the set of CEE countries during transformation period, thus assessing predictive power of this EWS system in economic conditions of CEE countries;

Signaling Approach

Adjusted Noise-to-Signal Ratio:

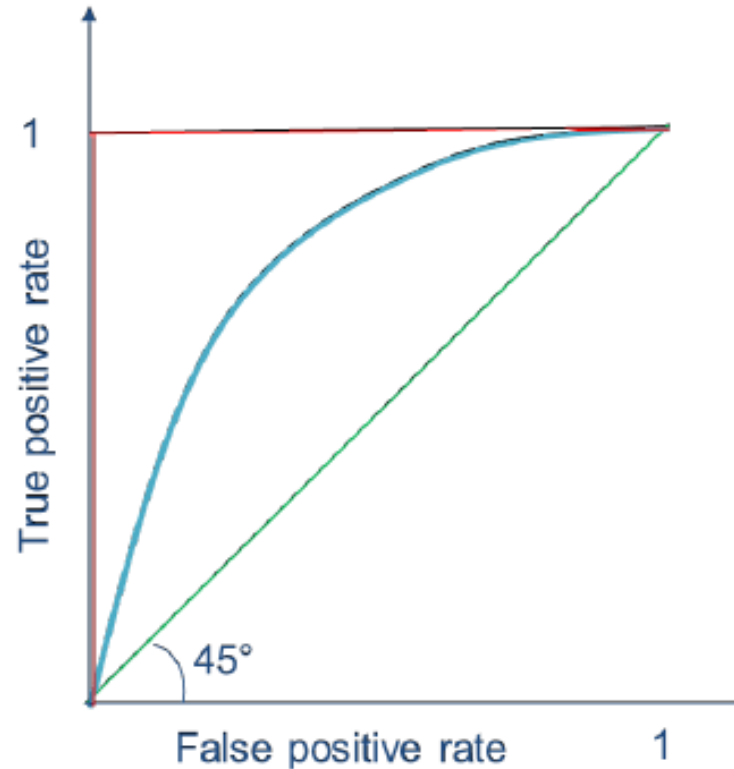
	Crisis event	No crisis event
EWI prediction	A	B
No EWI prediction	C	D

$$aNtS = (B / (B + D)) / (A / (A + C)) \quad [1]$$

- the adjusted noise-to-signal ratio (aNtS) serves as a tool for evaluating the performance of the individual EWI or entire system (Kaminsky et al., 1998; Kaminsky et al., 1999; Alessi et al., 2015) by comparing false and true warning rate;
- in general, the desirable outcome of [1] is below unity with a strategy to minimize the ratio given the set of plausible thresholds (Edison, 2003). This approach also gives rise to the AUROC-based methodology using the inverse of the [1] in order to assess reliability of the indicator benchmarking it with a random model.

ROC and AUROC Measure

- ROC (receiver operating characteristic) curve and AUROC (area under ROC) are common tools for assessing the performance of a binary classifier given the threshold setting – more recently applied in economics (Berge and Jordá, 2011; Jordá and Taylor, 2011; Candelon et al., 2012; Jordá, 2012; Drehman and Juselius, 2014; Betz et al., 2013; Behn et al., 2013);
- part of standard package by ESRB utilized for assessing the need and timing of **counter-cyclical capital buffer** (European Systemic Risk Board) in Detken et al. (2014, Occasional Paper Series June 2014 by ESRB);
- ROC plots the noise ratio (false positive rate) against signal ratio (true positive rate) for every possible threshold value;
- **area under ROC (integral)** provides summary measure ranging from 0 to 1 -> AUROC larger than 0.5 signals and informative indicator; for values less than 0.5 indicator underperforms random choice model;



Utility Function in Signaling Framework

- summarizing the goodness of EWIs based on associated frequency of missed crisis (Type I error) and false alarms (Type II error) by policy maker's loss function,
- utility function assess how much the policy makers gain by using a particular EWI compared to using naïve predictor (Alessi and Detken, 2011);
- Alessi and Detken (2011) standard utility function has been since used in various applications (e.g. Csontos and Szalai, 2014; Knedlik, 2014; Knedlik, 2015);
- Sarlin (2013) following Demirguc-Kunt and Detragiache (2000) amends the Alessi and Detken (2011) standard utility function to account for unconditional probability of a crisis;

- **Loss function by Sarlin (2013):**

$$L(\mu) = \mu T_1 P + (1 - \mu) T_2 (1 - P)$$

- **Utility function by Sarlin (2013):**

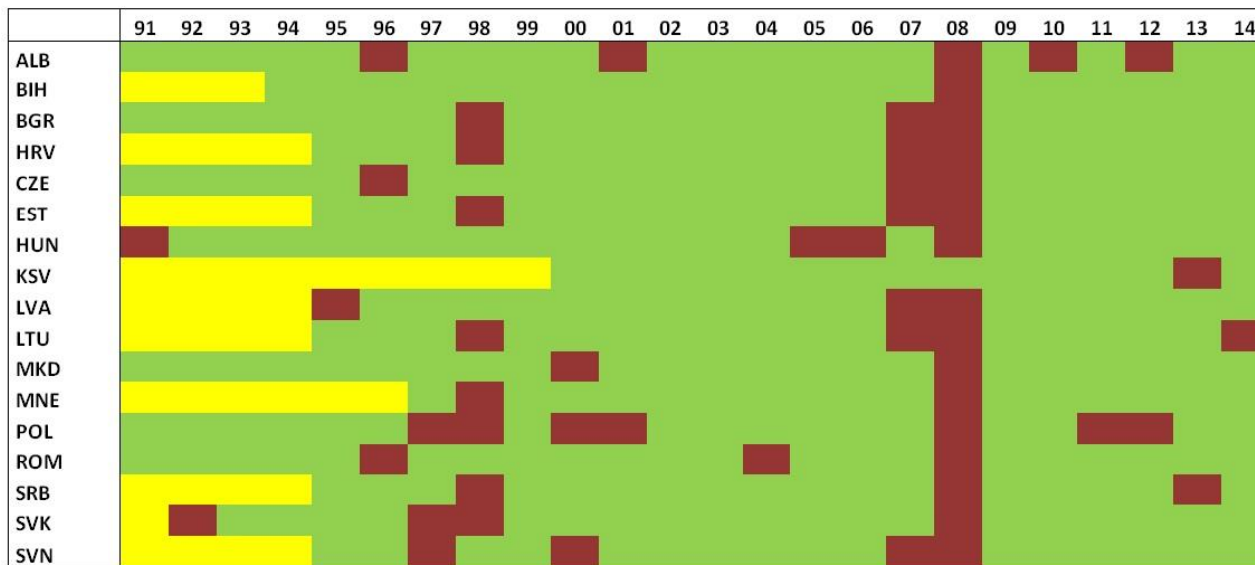
$$U(\mu) = \min[\mu P; (1 - \mu)(1 - P)] - L(\mu)$$

- as pointed out in Alessi and Detken (2014) reaction to Sarlin (2013), amended utility function introduces time-varying utility function dependent on change in crisis frequency, and usefulness of EWI is highly sensitive to specification of policy maker preferences captured by mu parameter;

Data

- set of 42 MIP indicators (14 core + 28 auxiliary)
- 3 main indicator groups (external imbalances and competitiveness; internal imbalances focusing on labour market indicators; Indebtedness indicators and others)
- 24 are available for wide set of countries (World Bank, IMF, OECD...)
- 17 CEE countries since 1991 (or data availability) to 2014
 - ALB, BIH, BGR, HRV, CZE, EST, HUN, KSV, LVA, LTU, MKD, MNE, POL, ROM, SRB, SVK, SVN

Definition (Indication) of Crisis Periods



- crisis periods captured by deviations of the real GDP growth from its 5-year average by more than one standard deviation, similar to Crostos and Szalai (2013) and Csontos and Szalai (2014) in use of real GDP and to Knedlik (2014) in use of standard deviations from a long-term trend.

Labour Market Indicators

	Auxiliary Indicator	#	Probability of event	Official threshold			AUROC	Optimal threshold				
				Value	Implied Preferences	Max Absolute Utility		Value	Implied Preferences	Max Absolute Utility	Inverse aNTS	
Youth UR												
<i>Sensitivity Interval</i>	-10 percent	NO	287	16.72%	2.00	0.777	-0.0518	0.3771	0.62	0.833	-0.0214	0.723
	+10 percent					0.816	-0.0337	0.3771	0.56	0.833	-0.0214	0.723
						0.777	-0.0508	0.3794	0.68	0.833	-0.0214	0.723
Long-term UR												
<i>Sensitivity Interval</i>	-10 percent	NO	155	20.65%	0.50	0.729	-0.0462	0.4419	0.41	0.794	-0.0142	0.835
	+10 percent					0.642	-0.0895	0.4419	0.37	0.794	-0.0142	0.835
						0.729	-0.0462	0.4491	0.45	0.794	-0.0142	0.835
UR												
<i>Sensitivity Interval</i>	-10 percent	NO	229	18.78%	10.00	0.803	-0.0482	0.3635	6.40	0.813	-0.0012	0.992
	+10 percent					0.809	-0.0393	0.3631	5.80	0.813	-0.0012	0.992
						0.803	-0.0459	0.3635	7.10	0.813	-0.0012	0.992
Activity rate												
<i>Sensitivity Interval</i>	-10 percent	NO	295	16.61%	-0.20	0.810	-0.0088	0.5028	-0.20	0.834	0.0033	1.053
	+10 percent					0.810	-0.0076	0.5022	-0.18	0.834	0.0033	1.053
						0.810	-0.0091	0.5065	-0.22	0.834	0.0033	1.053
Employment												
<i>Sensitivity Interval</i>	-10 percent	YES	302	16.56%	NA	NA	NA	0.3383	-5.34	0.834	-0.0038	0.447
	+10 percent					NA	NA	0.3388	-5.94	0.834	0.0003	1.117
						NA	NA	0.3384	-5.88	0.834	-0.0038	0.447
Participation Rate												
<i>Sensitivity Interval</i>	-10 percent	YES	302	16.56%	NA	NA	NA	0.4391	58.05	0.835	0.0012	1.017
	+10 percent					NA	NA	0.4413	52.20	0.835	0.0012	1.017
						NA	NA	0.4404	71.10	0.835	0.0017	1.013
YNEET												
<i>Sensitivity Interval</i>	-10 percent	YES	204	19.12%	NA	NA	NA	0.3923	25.65	0.788	0.0121	3.362
	+10 percent					NA	NA	0.3927	23.10	0.788	0.0121	3.362
						NA	NA	0.3907	28.20	0.788	0.0121	3.362

External Imbalances Indicators

	Auxiliary Indicator	#	Probability of event	Official threshold			AUROC	Optimal threshold				
				Value	Implied Preferences	Max Absolute Utility		Value	Implied Preferences	Max Absolute Utility	Inverse aNtS	
NULC						0.864	-0.0654	0.3628	26.37	0.811	-0.0165	0.337
<i>Sensitivity Interval</i>	-10 percent	196	18.88%	12.00	0.837	-0.0449	0.3602	24.39	0.811	-0.0153	0.355	
	+10 percent				0.864	-0.0672	0.3601	20.79	0.811	-0.0169	0.499	
Terms of trade						NA	NA	0.5198	-3.90	0.768	0.0173	1.470
<i>Sensitivity Interval</i>	-10 percent	112	23.21%	NA	NA	NA	0.5203	-3.50	0.750	0.0133	1.470	
	+10 percent				NA	NA	0.5193	-4.30	0.750	0.0133	1.470	
REER						0.821	0.0218	0.6001	8.85	0.820	0.0269	1.454
<i>Sensitivity Interval</i>	-10 percent	161	18.01%	11.00	0.821	0.0226	0.6009	7.95	0.820	0.0269	1.454	
	+10 percent				0.821	0.0241	0.5980	9.70	0.820	0.0269	1.454	
						0.846	-0.0212	0.4717	-10.45	0.819	0.0060	2.985
<i>Sensitivity Interval</i>	-10 percent	161	18.01%	-11.00	0.850	-0.0249	0.4716	-9.40	0.800	0.0055	2.985	
	+10 percent				0.850	-0.0261	0.4716	-11.50	0.800	0.0055	2.985	
EMS						0.929	0.0019	0.6972	-17.94	0.837	0.0520	1.999
<i>Sensitivity Interval</i>	-10 percent	251	16.33%	-6.00	0.950	-0.0050	0.7089	-17.34	0.850	0.0477	2.163	
	+10 percent				0.950	-0.0053	0.6907	-17.64	0.850	0.0442	1.916	
CA balance						NA	NA	0.4889	0.96	0.828	0.0009	1.481
<i>Sensitivity Interval</i>	-10 percent	263	17.11%	6.00	NA	NA	0.4888	0.84	0.828	0.0009	1.481	
	+10 percent				NA	NA	0.4889	1.08	0.828	0.0009	1.481	
						0.855	-0.0053	0.5620	-7.44	0.829	0.0209	1.646
<i>Sensitivity Interval</i>	-10 percent	263	17.11%	-4.00	0.850	-0.0048	0.5612	-8.68	0.800	0.0148	2.105	
	+10 percent				0.900	-0.0161	0.5627	-10.64	0.800	0.0148	2.105	
CA and CAP balance						NA	NA	0.6426	-6.84	0.822	0.0377	2.267
<i>Sensitivity Interval</i>	-10 percent	253	17.79%	NA	NA	NA	0.6417	-6.16	0.800	0.0322	2.267	
	+10 percent				NA	NA	0.6423	-7.52	0.800	0.0322	2.267	
Productivity						NA	NA	0.4333	-5.76	0.834	-0.0035	0.701
<i>Sensitivity Interval</i>	-10 percent	302	16.56%	NA	NA	NA	0.4334	-5.46	0.834	-0.0028	0.744	
	+10 percent				NA	NA	0.4330	-6.00	0.834	-0.0049	0.627	

Indicators of Indebtedness

		Auxiliary Indicator	#	Probability of event	Official threshold			AUROC	Optimal threshold			
					Value	Implied Preferences	Max Absolute Utility		Value	Implied Preferences	Max Absolute Utility	Inverse aNtS
FDI flows						NA	NA	0.5840	5.60	0.837	0.0193	1.516
<i>Sensitivity Interval</i>	-10 percent	YES	301	16.28%	NA	NA	NA	0.5842	5.05	0.837	0.0193	1.516
	+10 percent					NA	NA	0.5834	6.15	0.837	0.0186	1.487
FDI stocks						NA	NA	0.4435	29.20	0.809	0.0020	1.023
<i>Sensitivity Interval</i>	-10 percent	YES	204	19.12%	NA	NA	NA	0.4438	26.40	0.809	0.0020	1.023
	+10 percent					NA	NA	0.4432	32.00	0.809	0.0020	1.023
Net IIR						0.824	-0.0196	0.4592	-70.70	0.809	0.0067	1.260
<i>Sensitivity Interval</i>	-10 percent	NO	204	19.12%	-35.00	0.824	-0.0194	0.4600	-63.70	0.809	0.0067	1.260
	+10 percent					0.850	-0.0224	0.4600	-77.70	0.800	0.0052	1.260
Gross external debt						NA	NA	0.5037	26.80	0.888	0.0216	1.323
<i>Sensitivity Interval</i>	-10 percent	YES	98	11.22%	NA	NA	NA	0.5043	24.00	0.888	0.0216	1.323
	+10 percent					NA	NA	0.5052	29.60	0.888	0.0216	1.323
Public sector debt						0.000	-0.1528	0.4660	19.80	0.797	0.0181	1.183
<i>Sensitivity Interval</i>	-10 percent	NO	118	20.34%	60.00	0.000	-0.1091	0.4675	17.40	0.797	0.0181	1.183
	+10 percent					0.769	-0.0175	0.4665	21.60	0.797	0.0181	1.183
Private sector debt						NA	NA	0.5359	33.25	0.842	0.0136	1.198
<i>Sensitivity Interval</i>	-10 percent	NO	297	15.82%	133.00	NA	NA	0.5363	29.26	0.842	0.0125	1.177
	+10 percent					NA	NA	0.5374	30.59	0.842	0.0139	1.174
HPI						0.589	0.0521	0.7524	5.82	0.757	0.0849	6.545
<i>Sensitivity Interval</i>	-10 percent	NO	70	24.29%	6.00	0.589	0.0521	0.7533	5.28	0.757	0.0849	6.545
	+10 percent					0.589	0.0456	0.7524	6.42	0.757	0.0849	6.545

Other Indicators

	Auxiliary Indicator	#	Probability of event	Official threshold			AUROC	Optimal threshold			
				Value	Implied Preferences	Max Absolute Utility		Value	Implied Preferences	Max Absolute Utility	Inverse aNtS
Poverty					NA	NA	0.4405	9.80	0.799	0.0023	1.017
<i>Sensitivity Interval</i>	-10 percent	YES	204	19.12%	NA	NA	0.4391	6.20	0.799	0.0021	1.013
	+10 percent				NA	NA	0.4408	10.80	0.799	0.0023	1.017
GFCF					NA	NA	0.3422	11.60	0.840	0.0019	2.341
<i>Sensitivity Interval</i>	-10 percent	YES	308	15.91%	NA	NA	0.3420	10.40	0.800	0.0014	2.341
	+10 percent				NA	NA	0.3419	12.80	0.800	0.0014	2.341
RaD					NA	NA	0.4813	1.43	0.818	0.0089	1.065
<i>Sensitivity Interval</i>	-10 percent	YES	230	18.26%	NA	NA	0.4813	1.29	0.850	0.0066	1.065
	+10 percent				NA	NA	0.4817	1.57	0.850	0.0066	1.065

Discussion

- the signals emanated by the set of **all labour market indicators** should be taken with a high caution since they produce significant *portion of noise* – given the historical experience of the CEE region, these outcomes are to be partially expected since the CEE countries have had traditionally long-lasting internal imbalance problems due to the less efficiently functioning labour markets and costs or structural market makeover;
- convergence process in the CEE economies might help them to sustain even higher levels of current account imbalances linked to expected increase in nominal unit labour costs or higher inflow of long-term investment capital – **external imbalances** EWI performance superior over other indicators;
- on the other hand, exposure towards speculative foreign capital and increase in public and private **level of indebtedness** thanks to the access to international capital markets must be investigated carefully as the indicative thresholds point towards much **conservative** policy maker stance than in the case of mature advanced economies;

Discussion

Conceptual questions

- any potential future analysis should make an endeavour towards more country-specific optimal thresholds for selected EWIs along with determining a better specification of proposed indicators (Knedlik, 2014 and Knedlik, 2015);
- specification of EWIs as a deviation from long-term trend or equilibrium values – but do we have theory-based concept of equilibrium values?

Methodological advances

- more extensive dataset in terms of countries and crisis periods covered (out-of-sample performance)
- utility calculation weighted by costs of crisis mitigation (Sarlin, 2014)
- length of the crisis?
- composite indicator of crisis costs? (Babecky et al., 2013)
- fiscal costs of counter-cyclical measures?

Thank you for your attention!

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