Performance of the Macroeconomic imbalance procedure in light of historical experience in the CEE region

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Outline

- Motivation

- Empirical Approach and Dataset

- Results

- Open Issues

Motivation

- **Macroeconomic Imbalance Procedure**
  - in light of recent experience with internal EA BoP crisis the MIP was introduced (2012) -> to serve as an EWS within EU28 economic area?,
  - only few studies (Csortos and Szalay, 2013; Knedlik 2014, 2015; Domonkos et al., 2016) have empirically assessed the signaling power of MIP - **new evidence** (Erhart et al., 2018; Sondermann and Zorell, 2019),
  - 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:

$$aNtS = \frac{B/(B+D)}{A/(A+C)} \tag{1}$$

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

- 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 asses reliability of the indicator benchmarking it with a random model,

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Area Under Receiver Operating Characteristic (AUROC):
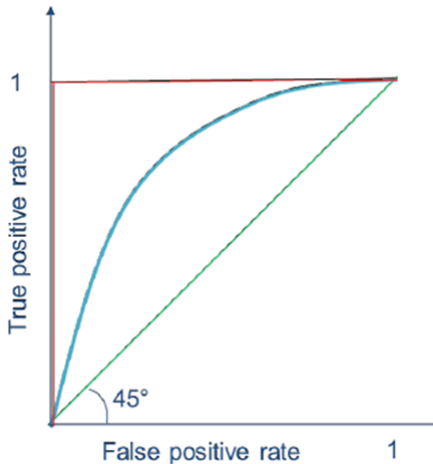
Signaling Approach

- 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 (ESRB) in Detken et al. (2014),

- 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

Policy Maker Loss Function:

$$L(\mu) = \mu T_1 P + (1 - \mu) T_2 (1 - P) \tag{2}$$

- summarizing the goodness of EWIs based on associated frequency of missed crisis (Type I error - T_1) and false alarms (Type II error - T_2) by policy maker's loss function,

- Alessi and Detken (2011) standard utility function has been since used in various applications (e.g. Csortos 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 P,

- usefulness of EWI is highly sensitive to specification of policy maker preferences captured by μ parameter,

Policy Maker Utility Function:

$$U(\mu) = min[\mu P; (1 - \mu)(1 - P)] - L(\mu) \tag{3}$$

Dataset

- set of 42 MIP indicators (14 core + 28 auxilliary); but only set of 24 MIP indicators (12/14 core + 12/25 auxilliary) for wider set of countries (World Bank, IMF, OECD); ,
- 3 main indicator groups (external imbalances and competitiveness; internal imbalances focusing on labour market indicators; Indebtedness indicators and others),
- 17 CEE countries since 1991 to 2014 (given data availability),
- ALB, BIH, BGR, HRV, CZE, EST, HUN, KSV, LVA, LTU, MKD, MNE, POL, ROM, SRB, SVK, SVN,

Crisis specification

- As the MIP should be a general procedure that warns before the overall economic crisis caused by deepening of internal of external imbalances within the individual countries and EMU as a whole we opt for a more comprehensive definition of an **economic crisis** - Erhart et al. (2018), Sondermann and Zorell (2019),
- deviations of the real GDP growth from its five-year average by more than one standard deviation,

Dataset

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Albania						X					X							X		X		X		
Bosnia and Hercegovina	na.	na.	na.															X						
Bulgaria								X									X	X						
Croatia	na.	na.	na.	na.				X									X	X						
Czechia					X												X	X						
Estonia	na.	na.	na.	na.				X									X	X						
Hungary	X														X	X		X						
Kosovo	na.	na.	na.	na.	na.	na.	na.	na.	na.												X			
Latvia	na.	na.	na.	na.	X												X	X						
Lithuania	na.	na.	na.	na.				X									X	X						X
FYROM										X								X						
Montenegro	na.	na.	na.	na.	na.	na.		X										X						
Poland							X	X		X	X							X			X	X		
Romania						X									X			X						
Serbia	na.	na.	na.	na.				X										X				X		
Slovakia	na.	X					X	X										X						
Slovenia	na.	na.	na.	na.		X				X							X	X						

Note: Crisis period indicated by "X" signifies period when the real GDP growth drops more than one standard deviation from its 5-year average. Year indicated by "na." has no data available.

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Optimalization - Labor Market Indicators

				Official threshold				Optimal threshold				Time horizon	
	Auxiliary Indicator	#	Probability of event (%)	Value	Implied Preferences	Max Absolute Utility	AUROC	Value	Implied Preferences	Max Absolute Utility	Inverse aNtS	Lag/ Interval	AUROC
(a)													
Youth UR	NO	287	16.72	2.00	0.777	−0.052	0.377	0.62	0.833	−0.021	0.723	3/3	0.526
Sensitivity	*−10%*				0.816	−0.034	0.377	0.56	0.833	−0.021	0.723		
interval	*+10%*				0.777	−0.051	0.380	0.68	0.833	−0.021	0.723		
Long-term UR	NO	155	20.65	0.50	0.729	−0.046	0.442	0.41	0.794	−0.014	0.835	2/3	0.518
Sensitivity	*−10%*				0.642	−0.090	0.442	0.37	0.794	−0.014	0.835		
interval	*+10%*				0.729	−0.046	0.449	0.45	0.794	−0.014	0.835		
UR	NO	229	18.78	10.00	0.803	−0.048	0.365	6.40	0.813	−0.001	0.992	3/3	0.503
Sensitivity	*−10%*				0.809	−0.039	0.363	5.80	0.813	−0.001	0.992		
interval	*+10%*				0.803	−0.046	0.364	7.10	0.813	−0.001	0.992		
Activity rate	NO	295	16.61	−0.20	0.810	−0.009	0.503	−0.20	0.834	0.003	1.053	2/3	0.553
Sensitivity	*−10%*				0.810	−0.008	0.502	−0.18	0.834	0.003	1.053		
interval	*+10%*				0.810	−0.009	0.507	−0.22	0.834	0.003	1.053		
Employment	YES	302	16.56	NA	NA	NA	0.338	−5.34	0.834	−0.004	0.447	3/3	0.477
Sensitivity	*−10%*				NA	NA	0.339	−5.94	0.834	0.000	1.117		
interval	*+10%*				NA	NA	0.338	−5.88	0.834	−0.004	0.447		
Participation Rate	YES	302	16.56	NA	NA	NA	0.439	58.05	0.835	0.001	1.017	3/1	0.464
Sensitivity	*−10%*				NA	NA	0.441	52.20	0.835	0.001	1.017		
interval	*+10%*				NA	NA	0.440	71.10	0.835	0.002	1.013		
YNEET	YES	204	19.12	NA	NA	NA	0.392	25.65	0.788	0.012	3.362	3/3	0.588
Sensitivity	*−10%*				NA	NA	0.393	23.10	0.788	0.012	3.362		
interval	*+10%*				NA	NA	0.391	28.20	0.788	0.012	3.362		

Optimalization - External Imbalances Indicators

		Auxiliary Indicator	#	Probability of event (%)	Official threshold					Optimal threshold					Time horizon	
					Value	Implied Preferences	Max Absolute Utility	AUROC	Value	Implied Preferences	Max Absolute Utility	Inverse aNtS		Lag/ Interval	AUROC
NULC		NO	196	18.88	12.00	0.864	−0.065	0.363	26.37	0.811	−0.017	0.337		3/3	0.533
Sensitivity	−10%					0.837	−0.045	0.360	24.39	0.811	−0.015	0.355			
interval	+10%					0.864	−0.067	0.360	20.79	0.811	−0.017	0.499			
Terms of trade		YES	112	23.21	NA	NA	NA	0.520	−3.90	0.768	0.017	1.470		1/1	0.548
Sensitivity	−10%					NA	NA	0.520	−3.50	0.750	0.013	1.470			
interval	+10%					NA	NA	0.519	−4.30	0.750	0.013	1.470			
REER		NO	+	161	18.01	11.00	0.821	0.022	0.600	8.85	0.820	0.027	1.454	1/1	0.638
Sensitivity	−10%					0.821	0.023	0.601	7.95	0.820	0.027	1.454			
interval	+10%					0.821	0.024	0.598	9.70	0.820	0.027	1.454			
			−	161	18.01	−11.00	0.846	−0.021	0.472	−10.45	0.819	0.006	2.985	3/3	0.556
Sensitivity	−10%					0.850	−0.025	0.472	−9.40	0.800	0.006	2.985			
interval	+10%					0.850	−0.026	0.472	−11.50	0.800	0.006	2.985			
EMS		NO	251	16.33	−6.00	0.929	0.002	0.697	−17.94	0.837	0.052	1.999		1/3	0.707
Sensitivity	−10%					0.950	−0.005	0.709	−17.34	0.850	0.048	2.163			
interval	+10%					0.950	−0.005	0.691	−17.64	0.850	0.044	1.916			
CA balance		NO	+	263	17.11	6.00	NA	NA	0.489	0.96	0.828	0.001	1.481	2/3	0.500
Sensitivity	−10%					NA	NA	0.489	0.84	0.828	0.001	1.481			
interval	+10%					NA	NA	0.489	1.08	0.828	0.001	1.481			
			−	263	17.11	−4.00	0.855	−0.005	0.562	−7.44	0.829	0.021	1.646	1/1	0.593
Sensitivity	−10%					0.850	−0.005	0.561	−8.68	0.800	0.015	2.105			
interval	+10%					0.900	−0.016	0.563	−10.64	0.800	0.015	2.105			
CA and CAP balance		YES	253	17.79	NA	NA	NA	0.643	−6.84	0.822	0.038	2.267		1/1	0.678
Sensitivity	−10%					NA	NA	0.642	−6.16	0.800	0.032	2.267			
interval	+10%					NA	NA	0.642	−7.52	0.800	0.032	2.267			
Productivity		YES	302	16.56	NA	NA	NA	0.433	−5.76	0.834	−0.004	0.701		1/1	0.492
Sensitivity	−10%					NA	NA	0.433	−5.46	0.834	−0.003	0.744			
interval	+10%					NA	NA	0.433	−6.00	0.834	−0.005	0.627			

Regression Results - Indebtedness Indicators

		Auxiliary Indicator	#	Probability of event (%)	Official threshold				Optimal threshold				Time horizon	
					Value	Implied Preferences	Max Absolute Utility	AUROC	Value	Implied Preferences	Max Absolute Utility	Inverse aNtS	Lag/ Interval	AUROC
FDI flows		YES	301	16.28	NA	NA	NA	0.584	5.60	0.837	0.019	1.516	1/1	0.611
Sensitivity	−10%					NA	NA	0.584	5.05	0.837	0.019	1.516		
interval	+10%					NA	NA	0.583	6.15	0.837	0.019	1.487		
FDI stocks		YES	204	19.12	NA	NA	NA	0.444	29.20	0.809	0.002	1.023	3/3	0.506
Sensitivity	−10%					NA	NA	0.444	26.40	0.809	0.002	1.023		
interval	+10%					NA	NA	0.443	32.00	0.809	0.002	1.023		
Net IIR		NO	204	19.12	−35.00	0.824	−0.020	0.459	−70.70	0.809	0.007	1.260	1/1	0.589
Sensitivity	−10%					0.824	−0.020	0.460	−63.70	0.809	0.007	1.260		
interval	+10%					0.850	−0.022	0.460	−77.70	0.800	0.005	1.260		
Gross external debt		YES	98	11.22	NA	NA	NA	0.504	26.80	0.888	0.022	1.323	2/3	0.535
Sensitivity	−10%					NA	NA	0.504	24.00	0.888	0.022	1.323		
interval	+10%					NA	NA	0.505	29.60	0.888	0.022	1.323		
Public sector debt		NO	118	20.34	60.00	0.000	−0.153	0.466	19.80	0.797	0.018	1.183	3/3	0.650
Sensitivity	−10%					0.000	−0.109	0.468	17.40	0.797	0.018	1.183		
interval	+10%					0.769	−0.018	0.467	21.60	0.797	0.018	1.183		
Private sector debt		NO	297	15.82	133.00	NA	NA	0.536	33.25	0.842	0.014	1.198	1/1	0.549
Sensitivity	−10%					NA	NA	0.536	29.26	0.842	0.013	1.177		
interval	+10%					NA	NA	0.537	30.59	0.842	0.014	1.174		
HPI		NO	70	24.29	6.00	0.589	0.052	0.752	5.82	0.757	0.085	6.545	2/3	0.864
Sensitivity	−10%					0.589	0.052	0.753	5.28	0.757	0.085	6.545		
interval	+10%					0.589	0.046	0.752	6.42	0.757	0.085	6.545		

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,
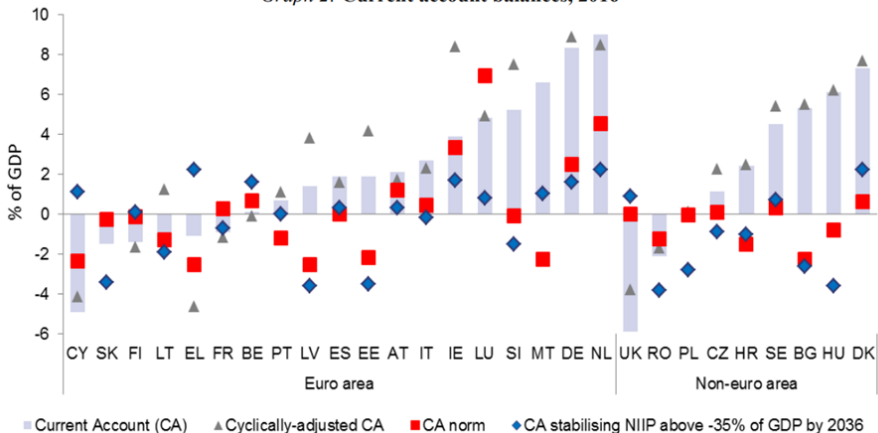
Open Issues

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**? (Alert Mechanism Report, 2016)

- macroeconomic imbalances understood as the **BoP crisis** - hence adjusting the definition?

- associating indicators with different types of crisis, e.g. Babecky et al. (2014), lo Duca et al. (2017) - the unexplained drops in GDP treated as a separate type of crisis (Sondermann and Zorell, 2019)

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Equilibrium values - EC, Alert Mechanism Report (2018)

Graph 2: **Current account balances, 2016**

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Data Revisions - Domonkos et al. (2018, Firstrun WP D2.5)
-> most sensitive indicators belong to the external imbalances group (mean squared error, MSE);

	#	Publication Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Revision	1	2012	x	x	x	x	x	x	x	x	x	x					
	2	2012	x	x	x	x	x	x	x	x	x	x	x				
	3	2013			x	x	x	x	x	x	x	x	x	x			
	4	2014				x	x	x	x	x	x	x	x	x	x		
	5	2015					x	x	x	x	x	x	x	x	x	x	
	6	2016						x	x	x	x	x	x	x	x	x	x

Scoreboard Indicators 1Y Lag		aNtS						MSE
	Revisions	#1	#2	#3	#4	#5	#6	
External Sector Indicators								
Current account balance - % of GDP, 3 years average	UP	0,75	0,75	0,71	0,71	0,71	0,67	*4,39*
	DOWN	1,05	1,05	1,00	1,00	0,60	0,61	*142,17*
Real effective exchange rate, 42 trading partners - 3 years % change	UP	0,75	0,75	0,62	0,62	0,62	0,62	*6,22*
	DOWN	0,09	0,11	0,17	0,14	0,14	0,14	*0,89*
Export market shares - 5 years % change	UP	x	x	x	x	x	x	*x*
	DOWN	0,23	0,23	0,21	0,21	0,26	0,33	*10,49*
Nominal unit labour cost index - 3 years % change	UP	0,45	0,42	0,46	0,52	0,52	0,49	*1,98*
	DOWN	x	x	x	x	x	x	*x*
Net international investment position - % of GDP	UP	x	x	x	x	x	x	*x*
	DOWN	0,51	0,51	0,63	0,60	0,66	0,54	*5,12*

Thank you for your attention!

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