STRUCTURAL BREAKS IN PUBLIC FINANCES IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

Astrid Ayala and Szabolcs Blazsek

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Structure

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MOTIVATION

Motivation

- After the political and economic changes that started in 1989, the Central and Eastern European Countries (CEECs) have exhibited a catch-up process to the developed Western European countries.
- During this process, ten CEECs have joined the European Union: *Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia*.

Motivation

- In the 1990s, the EU countries established the *Economic and Monetary Union* (EMU or Eurozone) adopting the Euro as the common currency.
- The EU member states have accepted various criteria for entrance to the Eurozone, the so-called '*Maastricht convergence criteria*'.

Motivation

- These criteria are for
- (1) three nominal economic variables: *inflation*, *interest rate* and *exchange rate*;
- (2) two fiscal variables: *government deficit to Gross Domestic Product (GDP)* and *government debt to GDP*.
- In 1998, 11 EU member states had met the Maastricht criteria, and the Eurozone initiated on 1 January 1999.

Motivation

- *Estonia, Latvia, Slovakia, and Slovenia* have already adopted the Euro currency.
- *Lithuania* is expected to enter EMU from January 2016.
- *Bulgaria, Czech Republic, Hungary, Poland, and Romania* have not adopted yet the common currency. They are obliged to join the Eurozone. Nevertheless, there is no deadline for joining the Eurozone.

Motivation for this paper #1

- First, several previous works emphasized the importance of a prudent and sustainable fiscal policy during the EMU convergence process:
  - *Brücker et al. (2005), De Grauwe and Schnabl (2005), Kattai and Lewis (2005), Kocenda et al. (2005), Kutan (2006), Berger et al. (2007), Hallett and Lewis (2007), Mikek (2008), Salsecci and Pesce (2008), and Staehr (2008).*

Motivation for this paper #2

- Second, the 2008 subprime mortgage crisis of the United States and the subsequent global financial and economic crises influenced the fiscal position of CEECs negatively, affecting their future EMU accession possibilities.
  - *See Lewis (2010) and Staehr (2010).*

OBJECTIVES

Objectives

- (a) *Identify structural breaks in government Total Deficit (TD) to GDP and government debt to GDP ratios for the CEEC-7 states over the period 2000 Q1 to 2011 Q2.*
- (b) *Study the evolution of these fiscal variables, considering structural changes in their level and trend over the period 2000 Q1 to 2011 Q2.*

CONTRIBUTION

Contribution to existing literature #1

- Previous works on the fiscal convergence process of the CEECs have employed *models incorporating only one structural break* (e.g. Kocenda et al., 2008; Hanousek and Kocenda, 2010).
- We consider unit root tests without structural breaks, with one structural break, with multiple structural breaks, and select the best performing model to determine the number and date(s) of structural break(s) in fiscal variables.

Contribution to existing literature #2

- Compared to previous studies, the *data set covers an extended time period* and additional CEECs.
- By considering data series until 2011 Q2, we study the evolution of fiscal variables before and after the beginning of the global economic meltdown of 2008.
- We provide a context for the results by stating international circumstances and specific policies and measures in individual countries from 2000 Q1 until 2011 Q2.

DATA

Data

- Quarterly fiscal data were obtained from the *Eurostat Statistics Database* of the European Commission (henceforth Eurostat).
- We collected data for each *CEEC-7* and also for the *total EMU17*.
- The data set includes government TD to GDP and government debt to GDP over the period *2000 Q1 to 2011 Q2*.

Data

- The TD to GDP time series exhibit unstable behavior.
- We use the *Holt–Winters exponential smoothing technique* (Holt, 1959; Winters, 1960).

Descriptive statistics of fiscal ratios.

Country	TD to GDP				Debt to GDP			
	Mean	Max	Min	SD	Mean	Max	Min	SD
EMU17	2.57	6.26	0.03	1.65	72.15	87.30	66.30	5.51
Bulgaria	−1.72	2.61	-3.62	1.57	36.13	79.20	13.40	22.05
Czech Rep.	4.79	8.12	1.43	1.56	29.25	40.50	16.50	5.70
Hungary	5.59	10.34	−3.90	2.86	64.85	83.90	51.80	9.56
Latvia	1.97	9.16	−1.50	2.75	18.41	45.20	8.80	11.31
Lithuania	2.62	9.07	−1.16	2.75	22.68	39.20	14.30	6.56
Poland	4.51	7.60	2.22	1.22	46.07	56.00	36.00	5.18
Romania	3.05	8.40	−1.61	2.47	20.24	34.30	11.30	6.03

Notes: Max, Min and SD denote maximum, minimum and standard deviation, respectively. The scale of fiscal data is percentage points. There are $T=46$ time periods (quarters) between 2000 Q1 and 2011 Q2.

METHODOLOGY

Augmented Dickey-Fuller (1979) test

- H0: *unit root process*
- H1: *trend stationary process*
- The unit root test includes constant and linear time trend. This test does not consider structural changes.
- If H1 is evidenced, we estimate the following linear regression model:

$$y_t = \mu + \beta t + u_t$$

Lee-Strazicich (2004) test

- H0: *unit root process with one breakpoint*
- H1: *trend stationary process with one breakpoint*
- The test equation includes constant and linear trend. One breakpoint date is estimated.
- If H1 is evidenced, we estimate the following linear regression model:

$$y_t = \mu_1 DU_{1t} + \mu_2 DU_{2t} + \beta_1 TIME_{1t} + \beta_2 TIME_{2t} + u_t$$

Lee-Strazicich (2003) test

- H0: *unit root process with two breakpoints*
- H1: *trend stationary process with two breakpoints*
- The test equation includes constant and linear trend. Two breakpoint dates are estimated.
- If H1 is evidenced, we estimate the following linear regression model:

$$y_t = \mu_1 DU_{1t} + \mu_2 DU_{2t} + \mu_3 DU_{3t} + \beta_1 TIME_{1t} + \beta_2 TIME_{2t} + \beta_3 TIME_{3t} + u_t$$

RESULTS

Unit root tests for the period 2000 Q1 to 2011 Q2.

Country	ADF test		LS (2004) test			LS (2003) test			
	TS	R^2_a (%)	TS	T_B	R^2_a (%)	TS	T_{1B}	T_{2B}	R^2_a (%)
Government TD to GDP									
Bulgaria	−1.79	61	−5.13***	06Q1	71	−5.76**	01Q4	08Q4	75
Czech Rep.	−1.69	2	−4.50**	06Q4	35	−7.81***	02Q3	08Q4	67
Hungary	0.82	6	−3.03	05Q3	18	−5.83**	01Q4	06Q2	58
Latvia	−4.02**	70	−7.10***	09Q1	90	−8.68***	08Q3	10Q2	92
Lithuania	−0.88	1	−5.54***	09Q1	74	−6.49***	08Q4	10Q2	78
Poland	−3.81**	66	−5.05**	10Q1	78	−6.28**	04Q1	08Q2	83
Romania	−2.21	31	−5.05***	06Q4	66	−6.05**	08Q4	10Q3	72
EMU17	−6.18***	78	−7.77***	05Q4	82	−8.16***	05Q2	08Q3	84

Unit root tests for the period 2000 Q1 to 2011 Q2.

Country	ADF test		LS (2004) test			LS (2003) test			
	TS	R_a^2 (%)	TS	T_B	R_a^2 (%)	TS	T_{1B}	T_{2B}	R_a^2 (%)
Government debt to GDP:									
Bulgaria	−0.02	10	**−4.55***	**08Q4**	**74**	−7.79***	04Q1	07Q3	70
Czech Rep.	−2.26	19	−3.13	06Q1	29	**−5.73****	**04Q2**	**09Q1**	**57**
Hungary	−3.48*	19	−4.39*	04Q3	25	**−6.89*****	**01Q2**	**08Q3**	**64**
Latvia	−2.35	32	−5.35***	08Q2	61	**−6.74*****	**08Q3**	**10Q1**	**70**
Lithuania	0.27	12	−6.38***	08Q3	67	**−8.57*****	**08Q3**	**10Q1**	**78**
Poland	−1.52	10	−3.97	06Q3	25	**−5.84****	**04Q1**	**08Q3**	**50**
Romania	1.57	20	**−4.44***	**08Q3**	**59**	−5.72**	03Q1	08Q3	54
EMU17	−2.82	53	−5.34***	06Q3	67	**−7.16*****	**05Q2**	**08Q3**	**74**

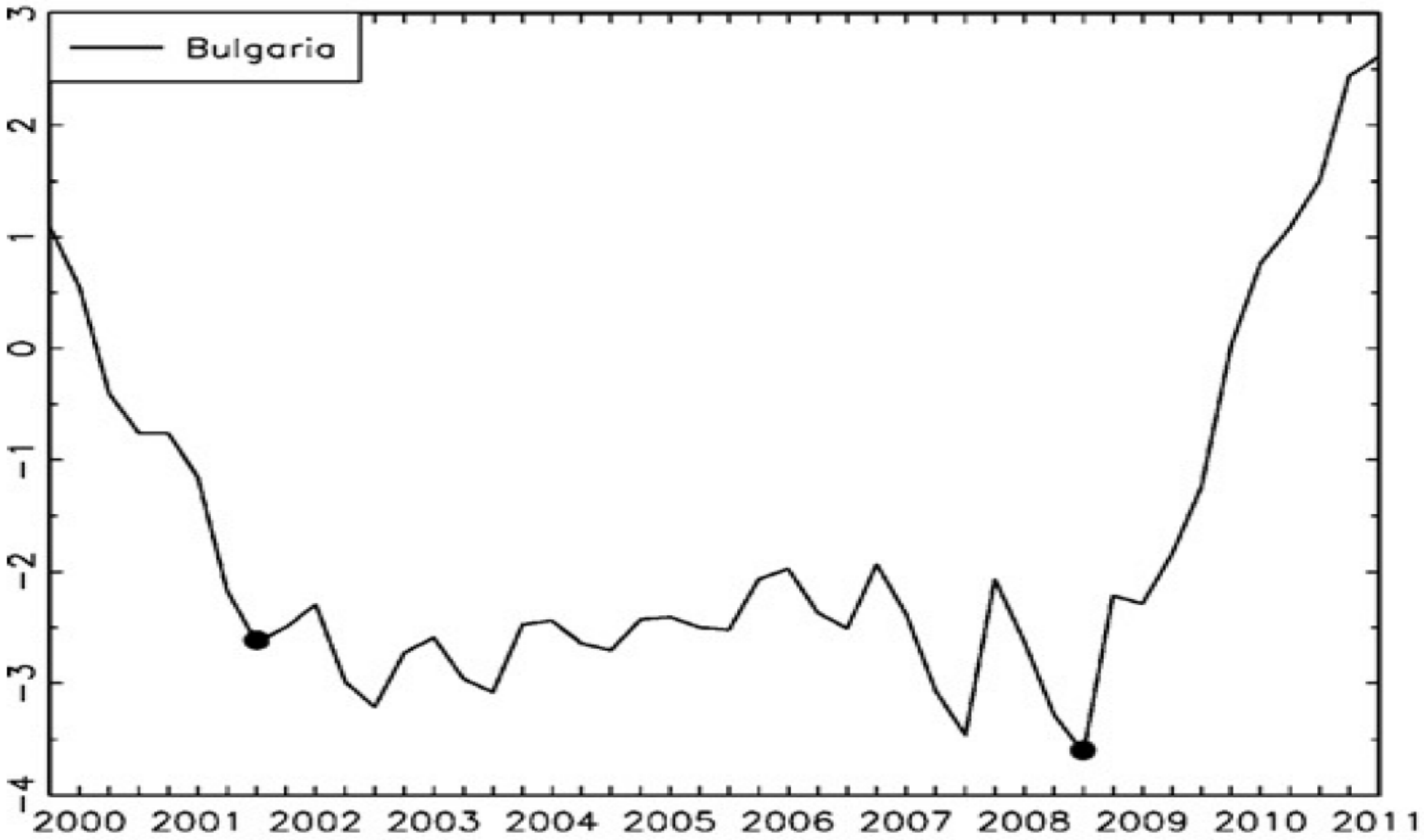
Breaking trend regression results.

Country	μ_1	β_1	Σ	T_{1B}	μ_2	β_2	Σ	T_{2B}	μ_3	β_3	Σ	Crisis
Government TD to GDP												
Bulgaria	1.46***	−0.50***	D	01Q4	−2.58***	0.00	C_	**08Q4**	−3.28***	0.61***	U	0.61
Czech Rep.	3.05***	0.35***	UU	02Q3	7.54***	−0.23***	DD	**08Q4**	2.10***	0.28***	U	0.51
Hungary	6.05***	−0.57***	DD	01Q4	1.81***	0.39***	U	06Q2	10.74***	−0.51***	DD	NA
Latvia	2.38***	−0.09***	D	**08Q3**	−0.06	1.20***	U	10Q2	7.84***	0.26	C_+	1.29
Lithuania	2.78***	−0.08***	D	**08Q4**	2.66***	1.13***	U	10Q2	8.55***	−0.41***	DD	1.21
Poland	2.52***	0.19***	U	04Q1	5.63***	−0.19***	DD	**08Q2**	2.35***	0.42***	U	0.61
Romania	3.96***	−0.09**	DD	**08Q4**	2.59***	0.57***	U	10Q3	7.92***	−0.48***	DD	0.66
EMU17	0.38	0.14***	U	05Q2	3.23***	−0.16***	DD	**08Q3**	1.25***	0.45***	U	0.61

Breaking trend regression results.

Country	μ_1	β_1	Σ	T_{1B}	μ_2	β_2	Σ	T_{2B}	μ_3	β_3	Σ	Crisis
Government debt to GDP												
Bulgaria	79.31***	−2.01***	DD	**08Q4**	13.43***	0.26***	U	NA	NA	NA	NA	2.27
Czech Rep.	15.80***	0.98***	U	04Q2	30.17***	−0.08*	D	**09Q1**	33.13***	0.86***	U	0.94
Hungary	60.31***	−1.38***	DD	01Q2	52.84***	0.56***	U	**08Q3**	67.02***	0.88***	UU	0.32
Latvia	14.71***	−0.11**	D	**08Q3**	12.81***	4.88***	U	10Q1	42.68***	0.48**	U	4.99
Lithuania	25.90***	−0.31***	D	**08Q3**	15.74***	3.87***	U	10Q1	34.68***	0.90***	U	4.18
Poland	40.51***	0.66***	U	04Q1	49.00***	−0.25***	D	**08Q3**	46.67***	0.94***	U	1.19
Romania	23.02***	−0.45***	D	**08Q3**	12.23***	2.08***	U	NA	NA	NA	NA	2.53
EMU17	72.40***	0.04	C_+	05Q2	71.48***	−0.36***	DD	**08Q3**	67.05***	1.58***	UU	1.94

TD to GDP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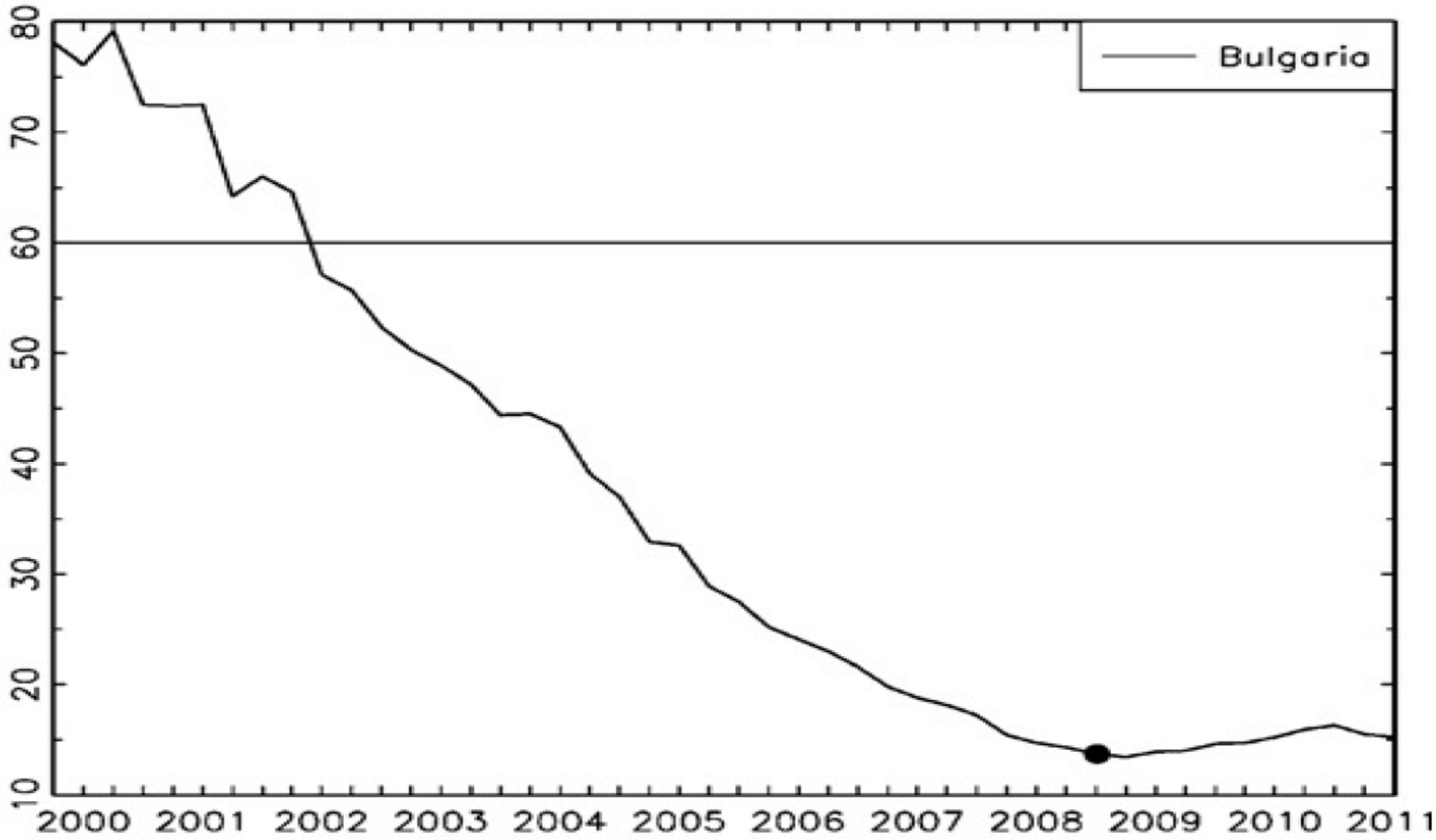
Debt to GDP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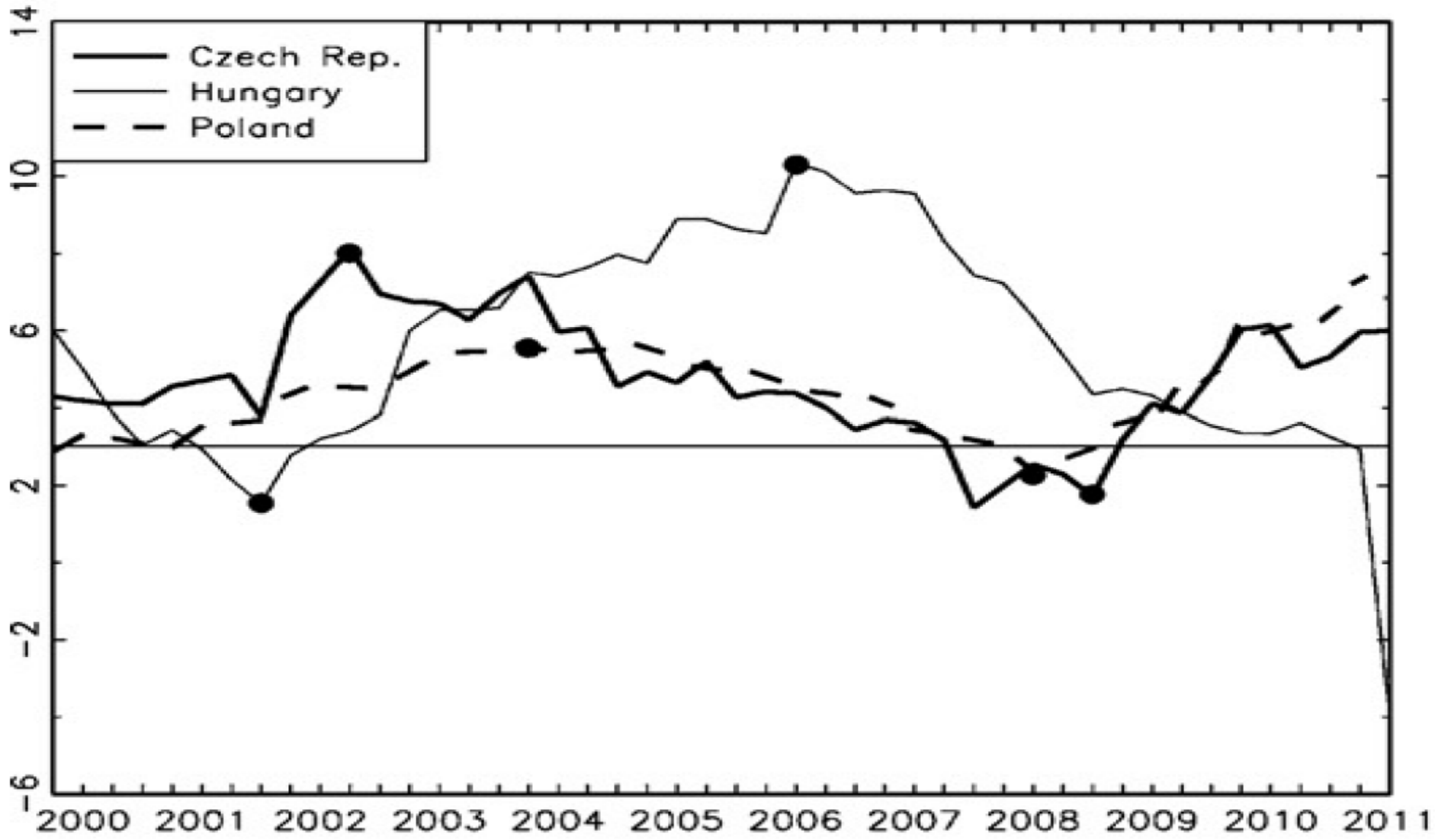
TD to GDP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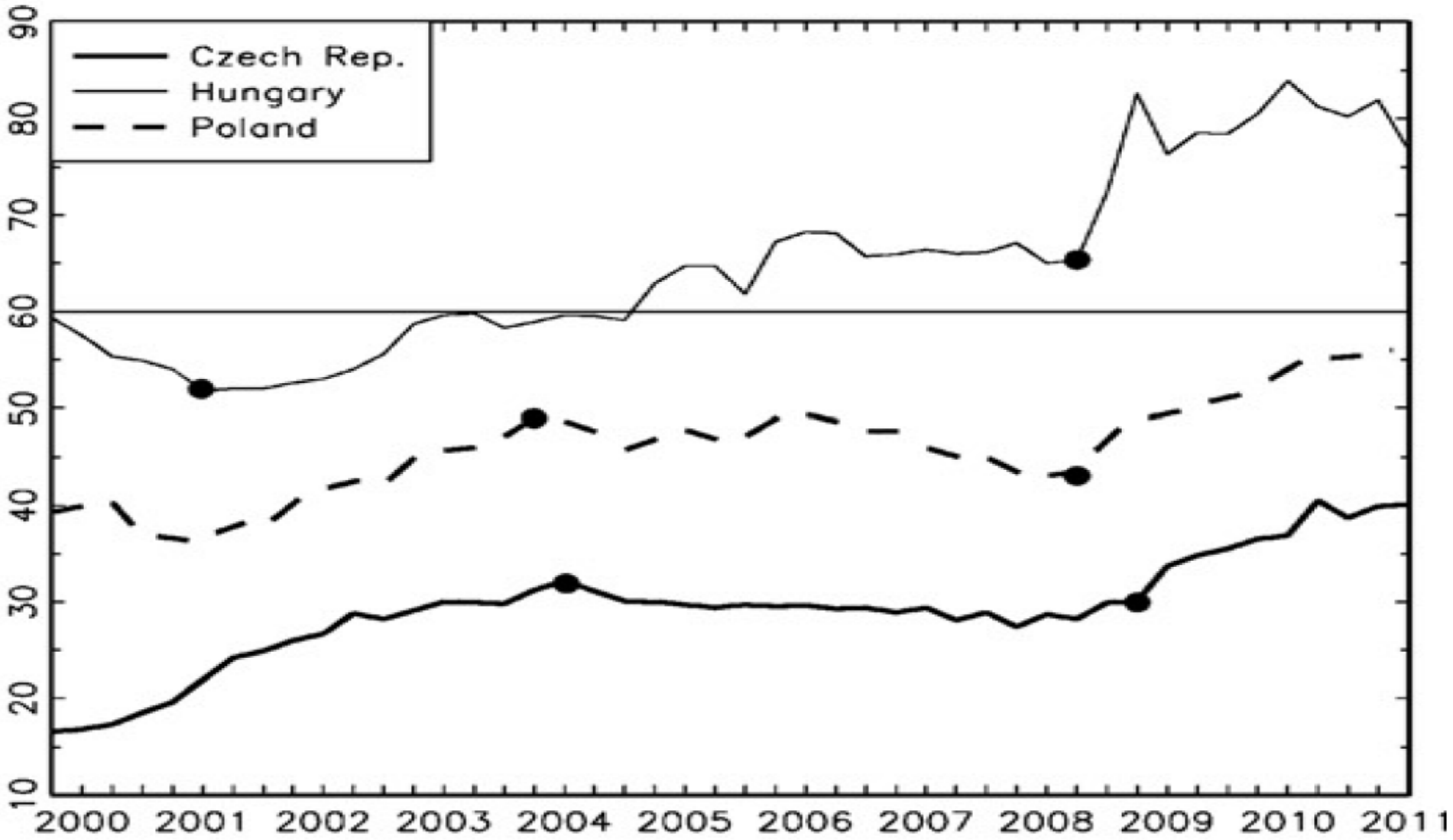
Debt to GDP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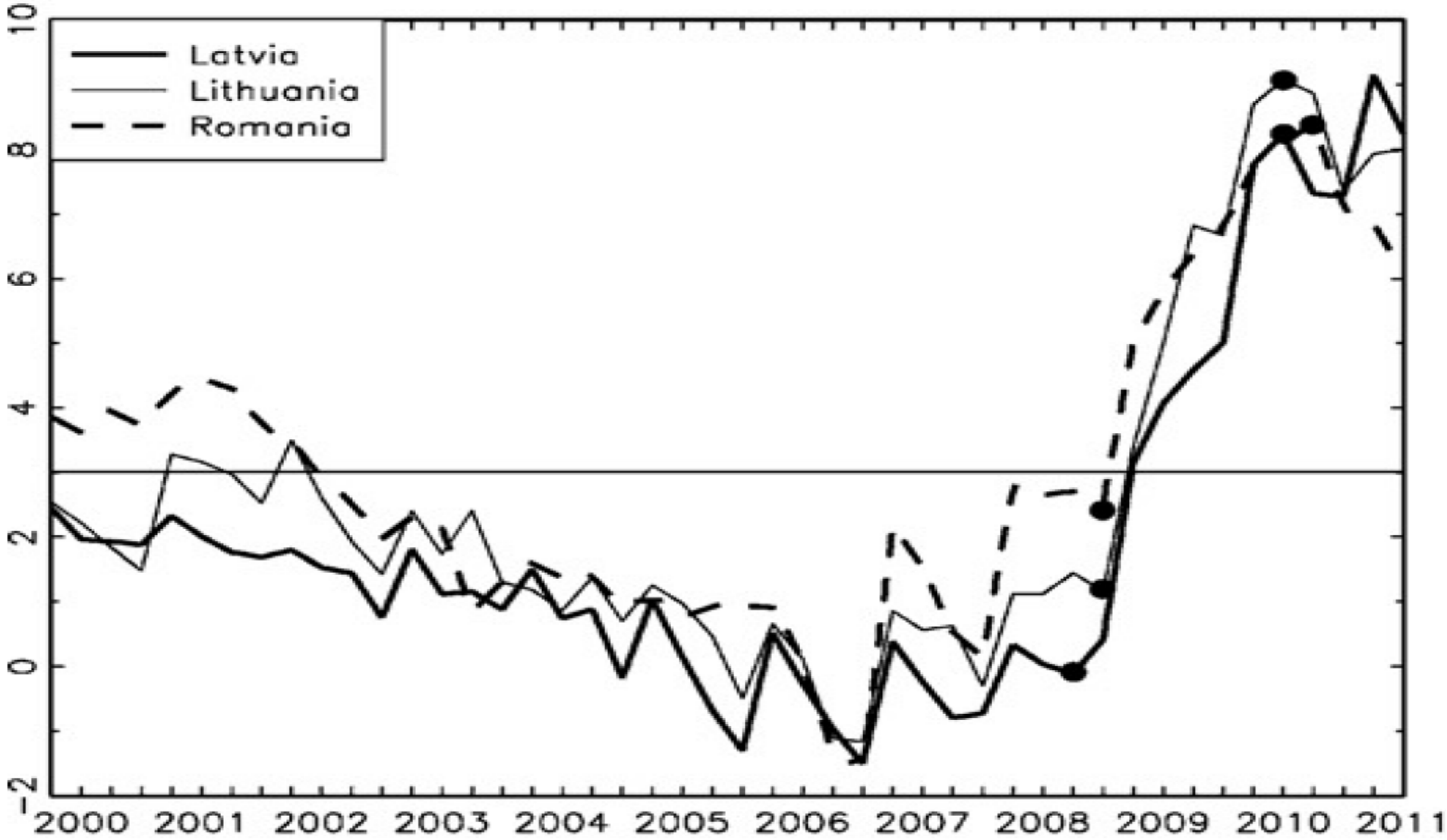
TD to GDP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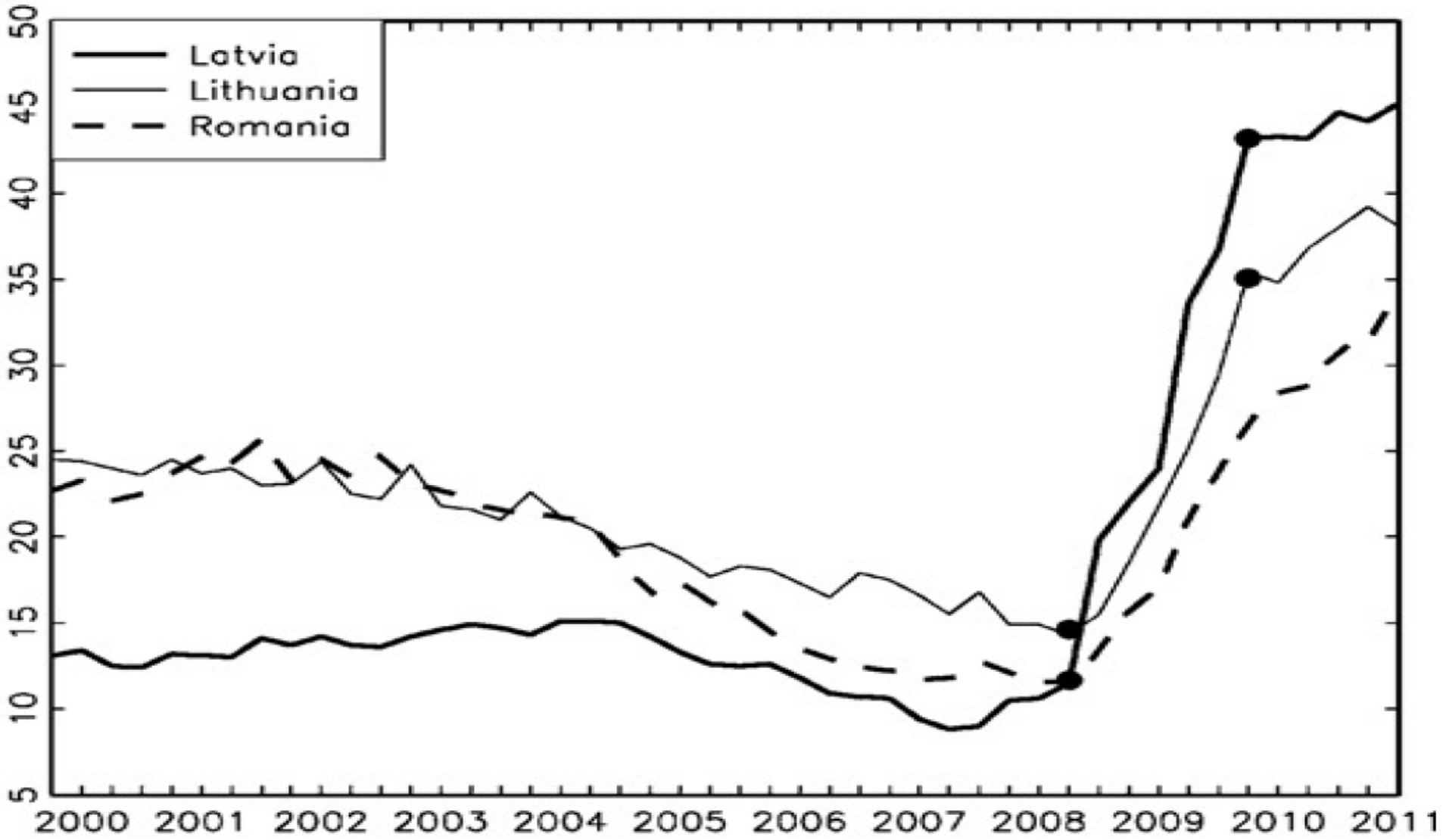
Debt to GDP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ROBUSTNESS ANALYSIS

Robustness analysis

1) *Unit root test with three structural breaks.*
   - Models with one or two break have higher adjusted R-squared. This justifies considering unit root tests with one and two breaks.
2) *Structural breaks over the period 2000 Q1 to 2007 Q4.*
   - For most countries one break is found for the pre-crisis period. This validates the structural break found for the 2008 crisis period.
3) *Comparison with the Eurozone*
   - Similar findings as for the CEECs.

THANK YOU FOR YOUR ATTENTION!