Finding the Bottom Line: A Quantitative Model of the EU's Fiscal Rules and their Compliance

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Motivation

- The EU's new fiscal framework with multiple rules and target measures is complex, and a clearer view is warranted to facilitate its better functioning.
  - Currently, it is hard to *objectively* measure how large (and at what pace) fiscal adjustments has to be done to achieve compliance with the multiple short- and long-term goals. (For example, is the recent slowdown of fiscal adjustment in the EA still in the spirit of the rules?)
- The previous literature has mainly devoted to individual minimum rules of the framework, identification of fiscal effort, and shortcomings of using the structural balance (see, e.g., Eyraud and Wu 2015; Barnes et al. 2016; Claeys et al. 2016). However,
  - The adjustments have typically exceeded the statutory minimum of the individual rules. (For example, in the early 2010s $\Delta SB >> 0.5\%$ of GDP in the EDP countries with debt sustainability problems.)
  - The analysis of the different measures is not helpful in quantifying the underlying requirements.

This paper

- **Methodology:** This paper uses a dynamic simulation model to quantify the (minimum) constraint that the rules impose on fiscal policy during consolidations.
  - In particular, the simulator quantifies multi-year adjustment programs that minimize (in expectation) the need of fiscal adjustments while being compliant with the key elements of the framework and the FIPO output responses.
- **Application:** Insights into the EDP fiscal adjustments that started in 2010.
  - Revisions of the economic forecasts have a large effect on the simulated adjustments and may facilitate policy volatility.
  - Anticipation of the (downturn) FIPO economic responses provide less volatile policy steering.
- Work in progress.

Quantification of the Fiscal rules

The EU's fiscal rules: A static view

Enforcement mechanism	Fiscal measure bound by the rule	Rule/correction
Corrective arm of the SGP, the excessive deficit procedure triggered by non-compliance	General gov. budget deficit ("deficit rule")	not higher than 3 %
		If higher, the structural balance (SB) to be adjusted by min 0.5 pps per year
	General gov. gross debt ("Debt convergence rule")	not higher than 60 % of GDP
		If higher, debt in excess of the 60% of GDP to be reduced by 1/20th per year
	General gov. gross debt ("transition debt rule")	Compliance with the debt benchmark by the end of 3rd year following exit from the EDP.
Preventive arm of the SGP + Fiscal compact	The SB ("MTO/SB rule")	not lower than the medium-term objective (MTO)
		If the MTO is not achieved, the adjustment follows the "flexibility guidance".
	General gov. expenditures ("the expenditure rule")	Growth of expenditures net of discretionary revenues not higher than long-term output growth
		0.5 pps adjustment per year

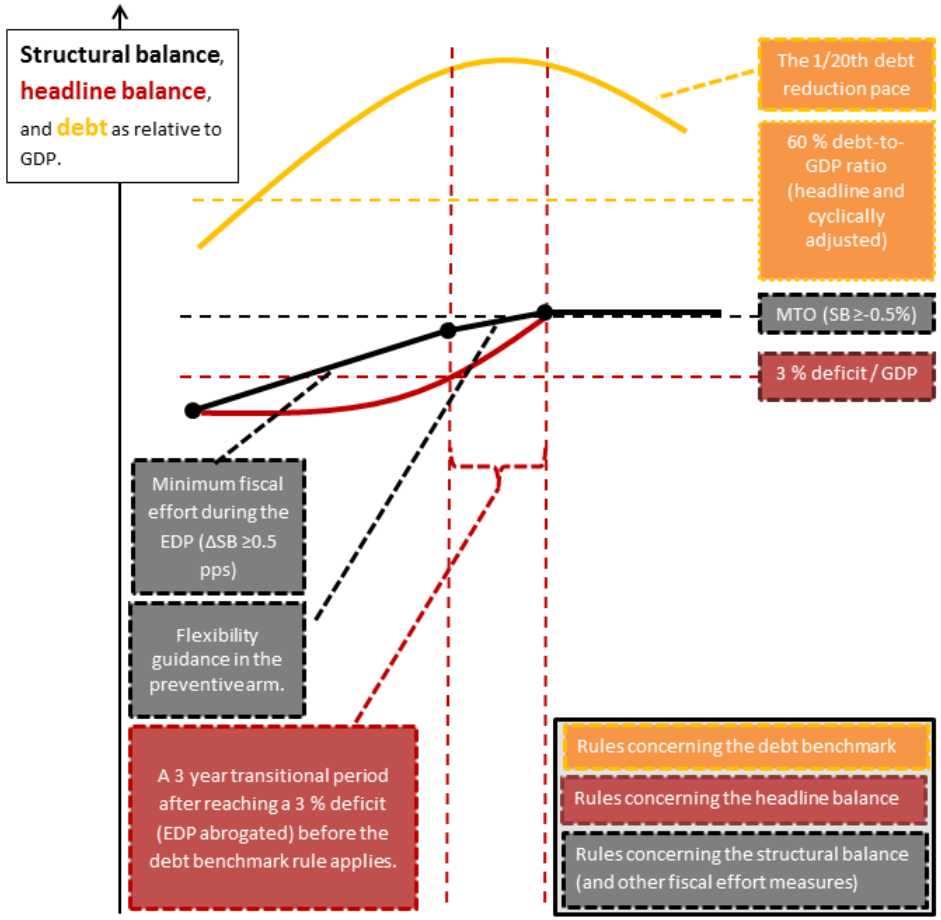
Table: Source: Barnes et al. (2016), but updated with the flexibility guidance

The flexibility guidance

		Required annual fiscal adjustment*	
	Condition	Debt below 60% and no sustainability risk	Debt above 60% or sustainability risk
Exceptionally bad times	Real growth <0 or output gap <-4	No adjustment needed	
Very bad times	-4 ≤ output gap <-3	0	0.25
Bad times	-3 ≤ output gap < -1.5	0 if growth below potential, 0.25 if growth above potential	0.25 if growth below potential, 0.5 if growth above potential
Normal times	-1.5 ≤ output gap < 1.5	0.5	> 0.5
Good times	output gap ≥ 1.5%	> 0.5 if growth below potential, ≥ 0.75 if growth above potential	≥ 0.75 if growth below potential, ≥ 1 if growth above potential

* all figures are in percentage points of GDP

This paper introduces the rules as dynamic features of an adjustment program



In particular, the rules characterize constraints of a dynamic minimization problem

- The average adjustment of the cyclically-adjusted primary balance $\frac{CAPB_\tau - CAPB_0}{\tau}$ during an adjustment program is minimized (in expectation) with respect to two unknowns: the change of the structural balance during the EDP phase of the program (x), and the total length of the adjustment program (τ).
- Motivation:
  - The rules curtail short-term political incentives.
  - The rules have been binding: The steered policy has been stricter than in the past based on historical FIPO response functions.
  - The cyclically-adjusted primary balance is a standard measure of the fiscal consolidations' size.

Formally ...

$$\min_{x,\tau}[\frac{CAPB_\tau - CAPB_0}{\tau}] \tag{1}$$

so that

the adjustment pace exceeds the minimum in the EDP / preventive arm:

$$\frac{SB_t}{GDP_t} - \frac{SB_{t-1}}{GDP_{t-1}} = \begin{cases} x \geq 0.005 & \text{if } \frac{B_t}{GDP_t} < -0.03 \text{ and } 0 < t \leq \tau \\ \text{Flex. guidance} & \text{if } \frac{B_t}{GDP_t} \geq -0.03 \text{ and } 0 < t \leq \tau \\ x \geq 0.005 & \text{if flex. guidance indetermined,} \end{cases} \tag{2}$$

while the MTO and the debt benchmark are reached at the end of the program:

$$\frac{SB_\tau}{GDP_\tau} \geq MTO \tag{3}$$

$$\min\left(\frac{D_\tau}{GDP_\tau} - DD_\tau, \frac{D_{\tau+2}}{GDP_{\tau+2}} - DD^f_{\tau+2}, \frac{\tilde{D_\tau}}{GDP_\tau} - 0.6\right) \leq 0 \text{ if } \frac{D_\tau}{GDP_\tau} \geq 0.6 \tag{4}$$

... in max 3 years after the EDP exit, and the final SB is maintained for 3 years:

$$\frac{B_t}{GDP_t} < -0.03 \text{ if } 0 \leq t < \tau - 3 \tag{5}$$

$$\frac{SB_t}{GDP_t} = \frac{SB_\tau}{GDP_\tau} \text{ if } \tau \leq t \leq \tau + 2 \tag{6}$$

... continued

, where D = gross general government debt, B = Public balance. Structural balance:

$$\frac{SB_t}{GDP_t} = \frac{PB_t}{GDP_t} - \frac{i_t^{exo} * D_{t-1}}{GDP_t} - \xi * OG_t + OO_t \tag{7}$$

The debt accumulation equation (sfa = stock-flow adjustment):

$$D_t = D_{t-1} - B_t + sfa_t \tag{8}$$

The backward-looking debt reduction effort:

$$\begin{aligned} DD_t = {} & 0.6 + (0.95)/3(D_{t-1}/(GDP_{t-1} - 0.60) \\ & + 0.95^2/3(D_{t-2}/GDP_{t-2} - 0.60) + 0.95^3/3(D_{t-3}/GDP_{t-3} - 0.60) \end{aligned} \tag{9}$$

The forward-looking debt reduction effort:

$$\begin{aligned} DD^f_{t+2} = {} & 0.6 + (0.95)/3(D_{t+1}/(GDP_{t+1} - 0.60) \\ & + 0.95^2/3(D_t/GDP_t - 0.60) + 0.95^3/3(D_{t-1}/GDP_{t-1} - 0.60) \end{aligned} \tag{10}$$

The cyclically adjusted debt ratio (C = cyclical adjustment, g^{pot} potential output growth, p = GDP inflation):

$$\tilde{D_t} = \frac{D_t + \sum_{j=0}^{2} C_{t-j}}{GDP_{t-3} \prod_{h=0}^{2}(1 + g^{pot}_{t-h})(1 + p_{t-h})} \tag{11}$$

The underlying economic conditions

1. Fixed economic forecasts based on different data vintages
   - How are data revisions affecting the size of the simulated adjustments?
2. Economic forecasts that take into account the output response of the fiscal policy.
   - Can the change in economic conditions be anticipated already during the planning of the fiscal adjustment?
   - Measuring the output response builds on Auerbach and Gorodnichenko's (2012) smooth transition SVAR model.

Simulated adjustments during the European Sovereign Debt Crisis

The economic forecasts are first treated as exogenous variables to analyse the role of revisions.

	Nominal GDP growth %		Government implicit interest rate %		Stock-flow adjustment % of GDP		Cyclical component of the gov. budget % of GDP	
	Early 2010	2016	Early 2010	2016	Early 2010	2016	Early 2010	2016
Austria	2.5	2.2	4.2	3.5	0.2	1.4	0.7	1.1
Belgium	2.9	2.1	3.9	3.5	0.1	0.3	0.9	0.4
Cyprus	3.5	-1	4.4	3.8	0	2.7	0.4	2.8
France	3.2	1.3	3.6	2.9	0.1	0.1	1.5	0.8
Germany	1.9	2.5	3.7	3	0.4	1.7	0.6	0.8
Greece	3.2	-4.4	4.7	3.3	0.4	-7.5	0.5	6.6
Ireland	2.8	5.2	4.7	3.9	0.2	-0.8	0.8	5.1
Italy	2.7	0.1	4.7	3.9	0.1	1	0.9	1.2
Malta	4.2	5.4	5	4.7	0	1	0	-0.4
Netherlands	1.8	0.8	3.8	2.7	-0.5	-1.5	0.8	1.3
Portugal	2.5	0.1	4.6	4	0.1	1.2	0.7	2.3
Spain	2.9	-0.5	4.3	3.9	0.7	0.2	0.8	3.7
Slovakia	6.2	2.6	5	3.9	0.4	-0.1	0.5	0.4
Slovenia	3.7	0.3	5.1	4.7	0.8	2.8	0.8	3.3
Average	3.1	1.2	4.4	3.7	0.2	0.2	0.7	2.1
Average (excl. Greece)	3.1	1.6	4.4	3.7	0.2	0.8	0.7	1.8

Table: The averages of key exogenous macroeconomic variables for the years 2009-2015. Early 2010 = data collected from the SG programmes of the late 2009 and the early 2010. 2016: Ameco data, the autumn 2016 vintage.

09-12 simulated minimum adjustments (with 2010 data) align well with the EDP program goals for most countries

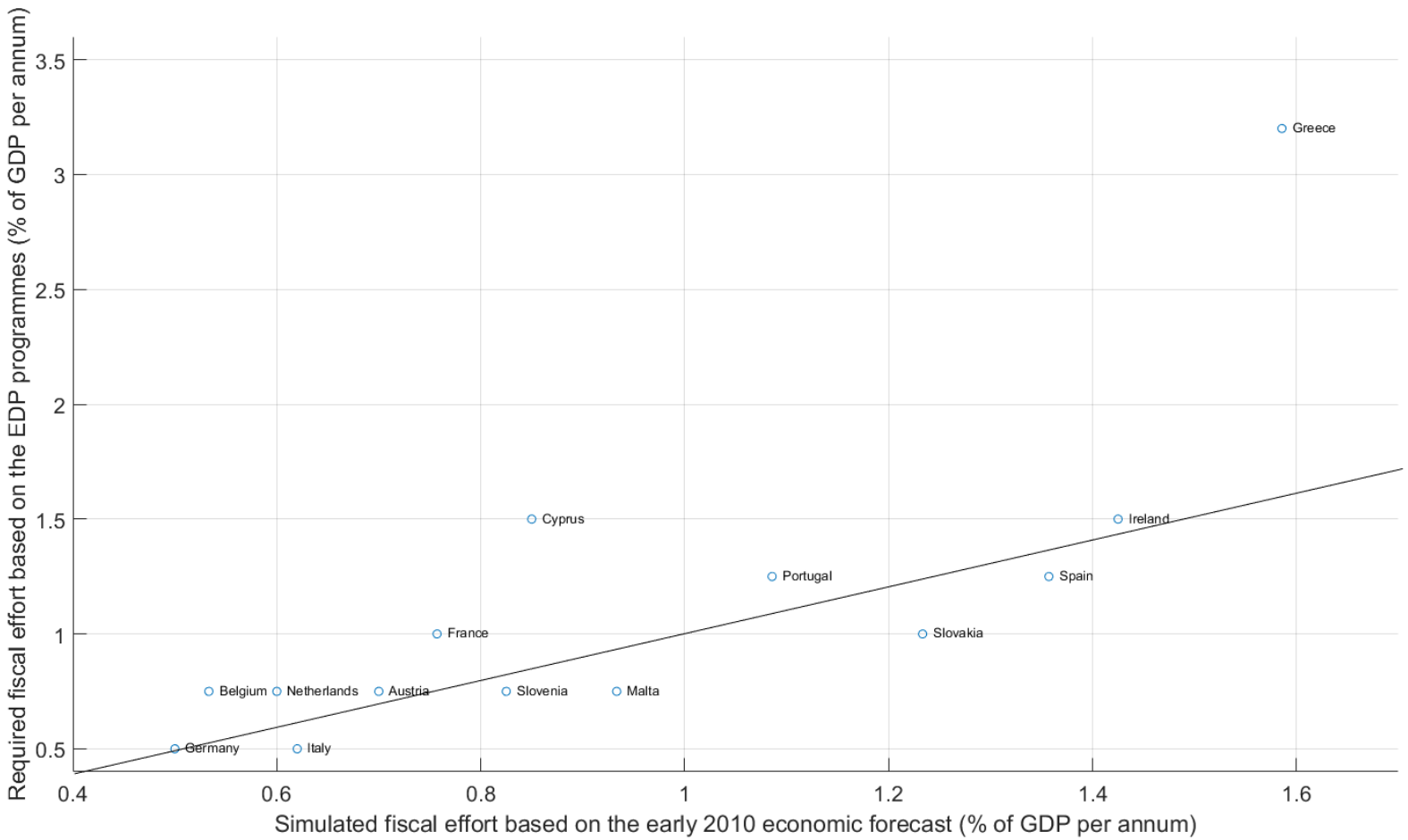


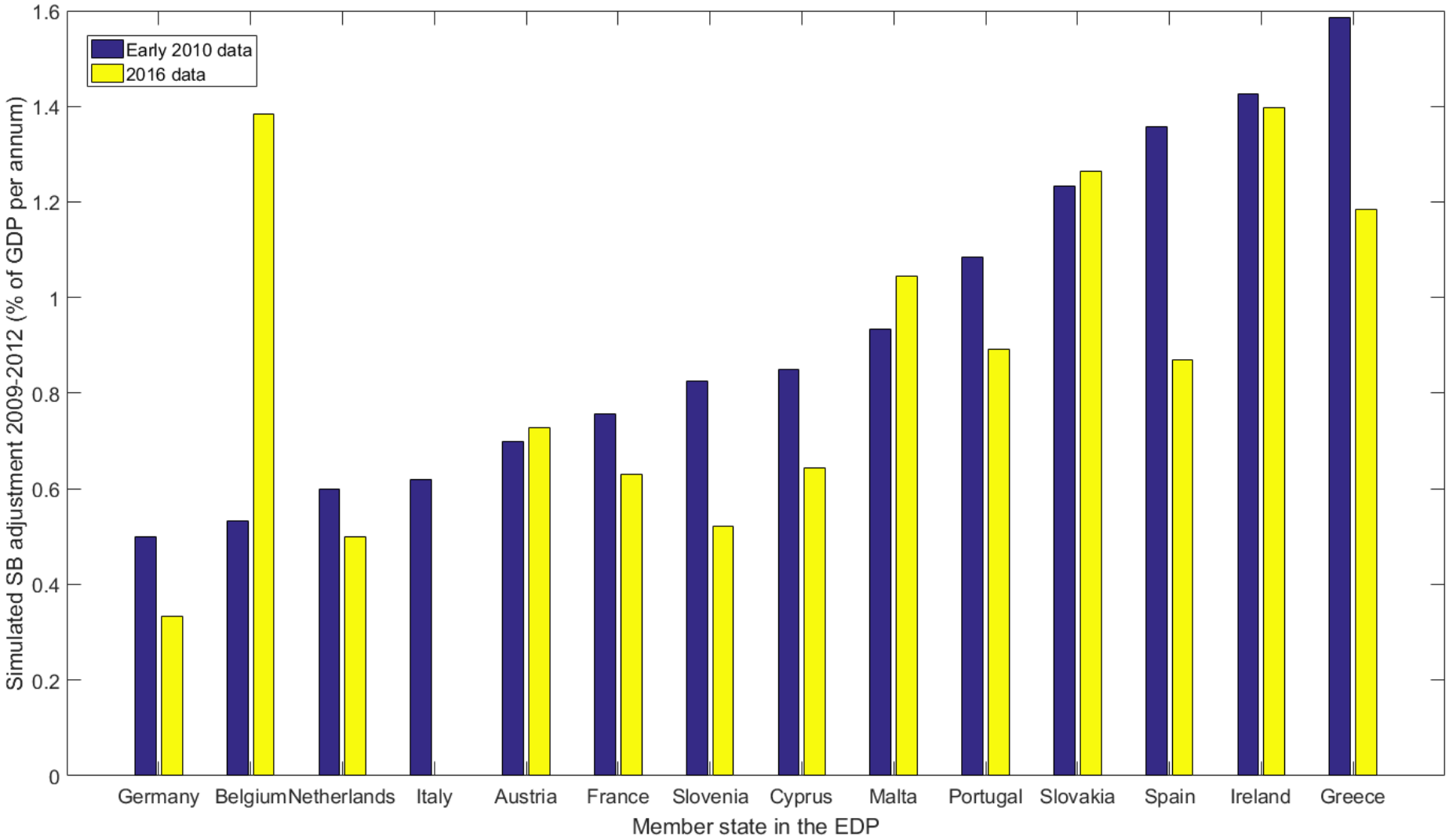
Figure: The simulated minimum fiscal effort based on the early 2010 (SGP) forecasts, and the 2010 EDP program goals. Fiscal effort is measured as the improvement of the structural balance per annum. The line indicates when the EDP goals and simulated effort is the same. On top of the line the EDP goal is stricter. Below the line the simulated effort is stricter.

The longer-term policy goals (debt targets, MTOs) have not been reached.

	Adjustment (09-12) $\frac{SB_{12}-SB_{09}}{3}$ (pps.)		EDP target Annual ΔSB	Adjustment (09-16) $\frac{SB_{16}-SB_{09}}{7}$ (pps.)		Final target SB_{τ}	Debt ratio at the peak (% of GDP)		The year of the debt peak (median)	
	Simulator 09 data	Observed 16 data	Observed 09-10 plans	Simulator 09 data	Observed 16 data	Simulator 09 data	Simulator 09 data	Observed 16 data	Simulator 09 data	Observed 16 data
Austria	0.7	0.26	0.75	0.3	0.24	0.5	68	86	2011	2015
Belgium	0.53	0.17	0.75	0.46	0.17	0.5	101	107	2011	2017
Cyprus	0.85	0.63	1.5	0.73	0.93	0.5	64	108	2011	2015
France	0.76	0.66	1	0.76	0.52	0.5	88	97	2013	2018
Germany	0.5	0.18	0.5	0.21	0.19	0	73	81	2010	2010
Greece	1.59	5.03	3.2	1.59	2.47	0.5	131	182	2012	2016
Ireland	1.43	1.28	1.5	1.26	1.13	0.5	79	120	2011	2012
Italy	0.62	0.91	0.5	0.44	0.38	0.5	117	133	2010	2017
Malta	0.93	0.05	0.75	0.4	0.36	0.5	67	70	2010	2011
Netherlands	0.6	0.69	0.75	0.43	0.53	0.5	67	68	2012	2014
Portugal	1.09	1.67	1.25	1.09	0.87	0.5	92	131	2013	2014
Spain	1.36	1.72	1.25	1.36	0.68	0.5	79	100	2013	2014
Slovakia	1.23	1.41	1	0.67	0.83	0.5	42	55	2011	2013
Slovenia	0.83	0.92	0.75	0.61	0.37	0.5	43	83	2012	2015
Average	0.93	1.11	1.1	0.74	0.69	0.5	79	102		
Average (excl. Greece)	0.88	0.83	0.95	0.68	0.56	0.46	76	96		
Median									2011	2015

Table: Details of the implied minimum adjustments based on the early 2010 forecast data.

However, a switch to the 2016 economic data lowers the initial adjustment pace for most of the countries

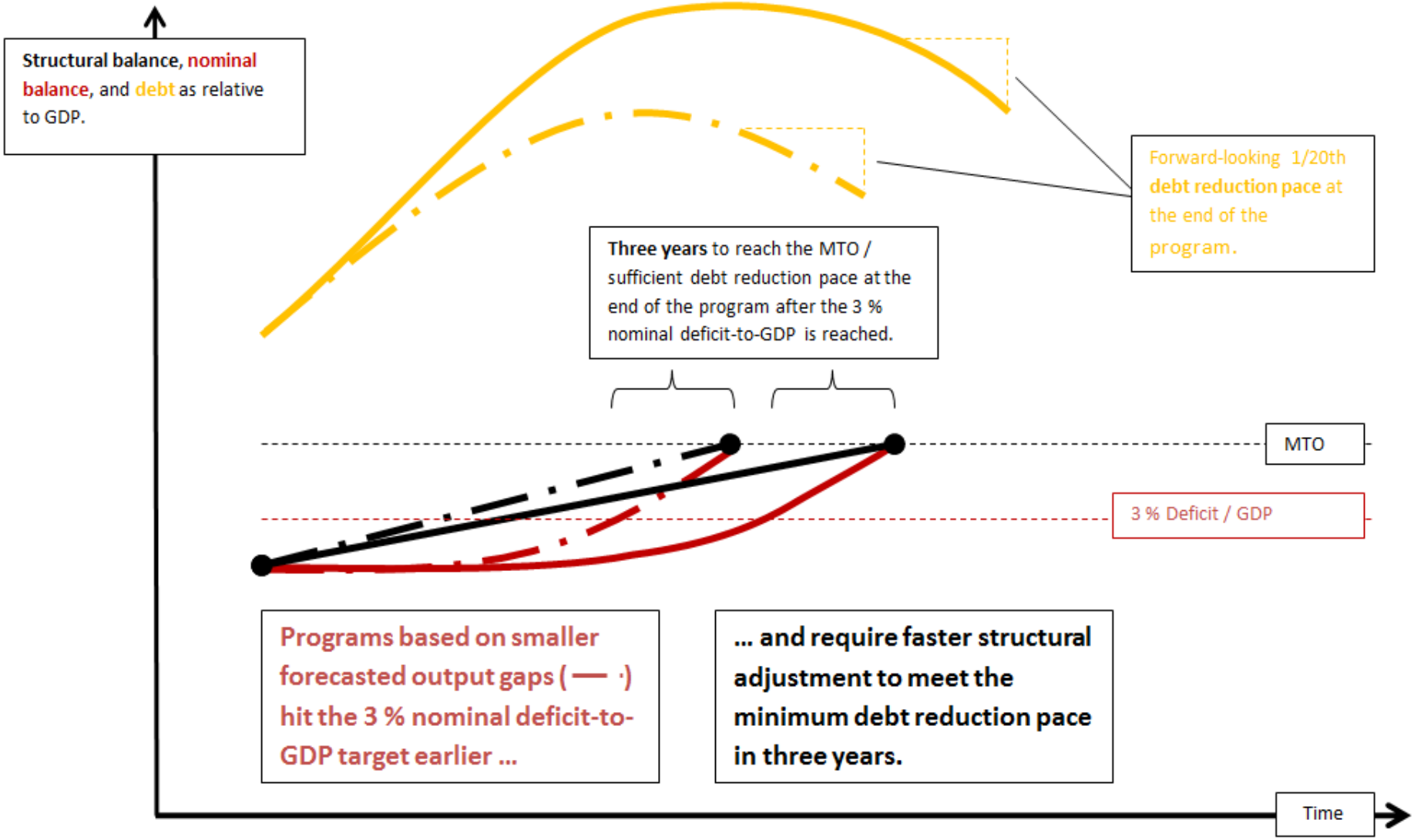


The 2016 data also leads to more moderate debt targets

	Adjustment (09-12) $\frac{SB_{12}-SB_{09}}{3}$ (pps.)		Adjustment (09-16) $\frac{SB_{16}-SB_{09}}{7}$ (pps.)		Debt ratio at the peak (% of GDP)			The year of the debt peak (median)		
	Simulator 16 data	Observed 16 data	Simulator 16 data	Observed 16 data	Simulator 09 data	Simulator 16 data	Observed 16 data	Simulator 09 data	Simulator 16 data	Observed 16 data
Austria	0.73	0.26	0.31	0.24	68	81	86	2011	2010	2015
Belgium	1.38	0.17	0.59	0.17	101	100	107	2011	2009	2017
Cyprus	0.64	0.63	0.64	0.93	64	123	108	2011	2016	2015
France	0.63	0.66	0.63	0.52	88	96	97	2013	2015	2018
Germany	0.33	0.18	0.14	0.19	73	79	81	2010	2010	2010
Greece	1.18	5.03	1.18	2.47	131	252	182	2012	2017	2016
Ireland	1.4	1.28	1.31	1.13	79	118	120	2011	2013	2012
Malta	1.05	0.05	0.45	0.36	67	68	70	2010	2009	2011
Netherlands	0.5	0.69	0.5	0.53	67	71	68	2012	2014	2014
Portugal	0.89	1.67	0.89	0.87	92	136	131	2013	2016	2014
Spain	0.87	1.72	0.87	0.68	79	109	100	2013	2014	2014
Slovakia	1.26	1.41	1.05	0.83	42	57	55	2011	2013	2013
Slovenia	0.52	0.92	0.52	0.37	43	82	83	2012	2015	2015
Average	0.88	1.13	0.7	0.71	76	106	99			
Average (excl. Greece)	0.85	0.83	0.66	0.58	72	94	93			
Median								2011	2014	2014

Table: Details of the simulated programs based on the 2016 Ameco data

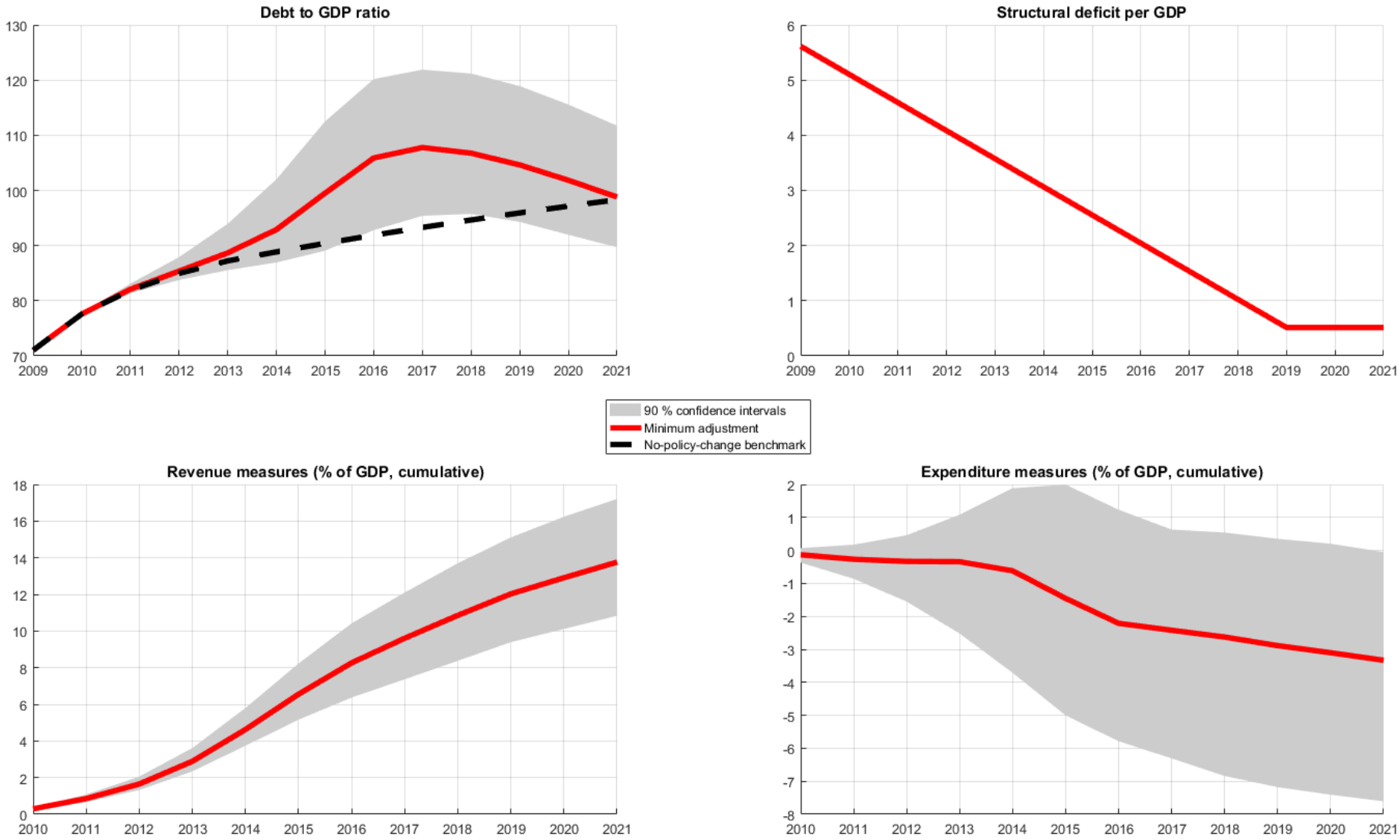
Why?


Structural balance, nominal balance, and debt as relative to GDP.
Forward-looking 1/20th debt reduction pace at the end of the program.
Three years to reach the MTO / sufficient debt reduction pace at the end of the program after the 3 % nominal deficit-to-GDP is reached.
MTO
3 % Deficit / GDP
Programs based on smaller forecasted output gaps (— ·) hit the 3 % nominal deficit-to-GDP target earlier ...
... and require faster structural adjustment to meet the minimum debt reduction pace in three years.
Time

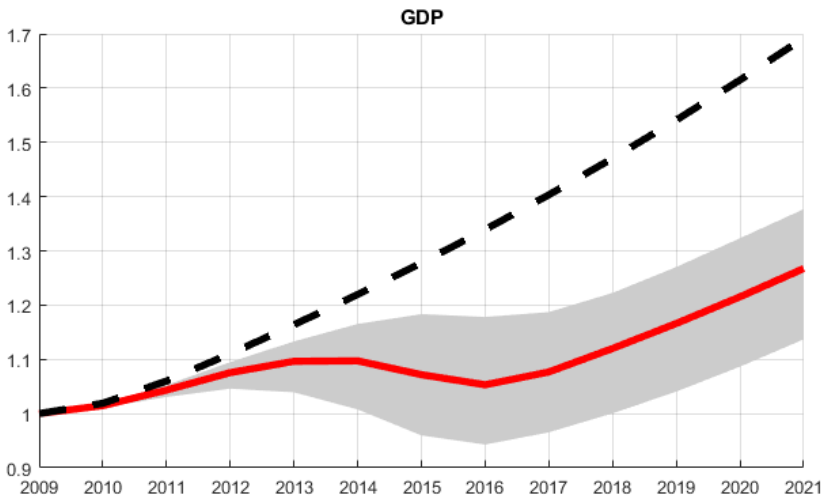
Can the change in economic conditions be anticipated already during the planning of the fiscal adjustment?

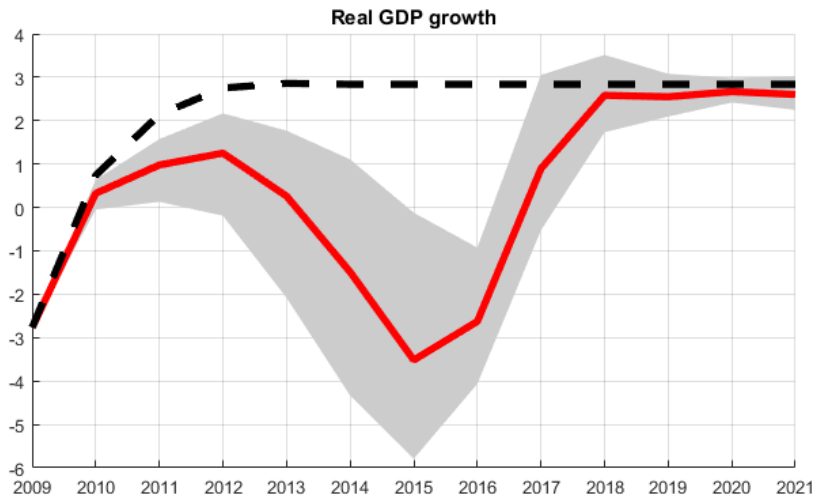
- A no-policy-change scenario is built based on the European Sovereign Debt Crisis data.
  - The annual averages of the 14 EDP countries' early 2010 economic forecasts.
  - The initial conditions in 2009: Government gross debt is 71 % of GDP, the headline balance is -7 % of GDP, and the structural balance is -5.6 % of GDP. The initial output gap is -2.6 % of the potential GDP. Inflation and the real GDP growth revive and grow at 1.9 % and 2.6 % by 2012, respectively. The average stock-flow adjustments have been small, and they are therefore omitted in the simulation.
- Output responses are measured for a wide variety of candidate adjustment programs based on the Auerbach and Gorodnichenko's (2012) STVAR model, and the implementation follows Keränen and Kuusi (2016).
  - STVAR includes 4 variables: gov. expenditures, gov. net revenues, real GDP, expected SB. Structural shocks govern the adjustment.
  - Further identifying assumptions: one-year-ahead unbiased expectations regarding the SB, fixed ratio of revenue and expenditure measures, no additional GDP shocks. The output gap and inflation are estimated based on the output response, other variables remain exogenous.
  - Quarterly data for the Finnish economy 1975-2015, including the Finnish Great Depression of the 1990s.
- The **average** outcomes of the simulated SB adjustments are used as inputs of the minimization problem, and the minimum path is selected.

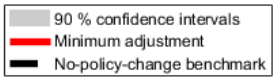
The simulated minimum fiscal adjustment is demanding ...

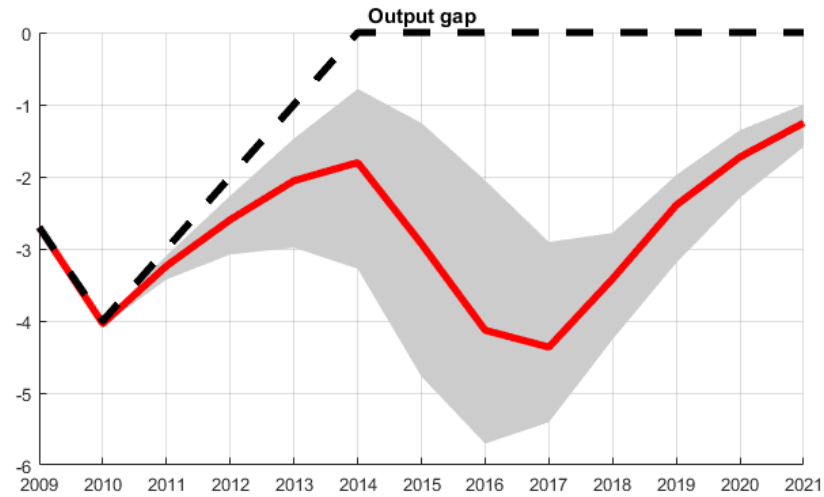


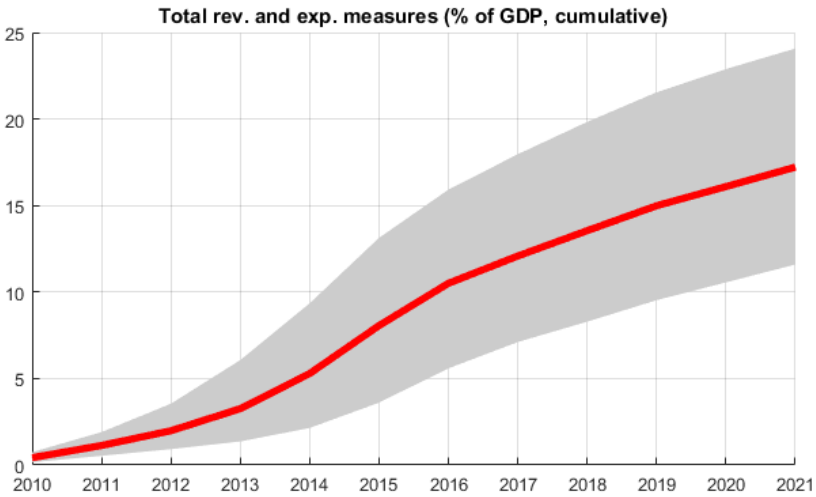
... and generates large and persistent output gaps.











When the effect is anticipated, the necessary pace of fiscal adjustment is slower; an effect similar to the 09→16 data revision

	Adjustment (09-12) $\frac{SB_{12}-SB_{09}}{3}$ (pps.)	Adjustment (09-16) $\frac{SB_{16}-SB_{09}}{7}$ (pps.)	Debt ratio at the peak (% of GDP)	The year of the debt peak (median)
Simulated minimum based on the (fixed) 2009 forecasts	0.73	0.73	79	2012
Simulated minimum based on 2009 data, but modelled output responses	0.51	0.51	107	2015
Actual outcomes based on the 2016 Ameco data (excl. Greece)	1.11 (0.83)	0.69 (0.58)	102	2014

Table: Comparison of simulated effort based on exogenous and endogenous output responses

Conclusions

- This paper uses a dynamic simulation model to quantify the (minimum) constraint that the EU's fiscal rules impose on policy during fiscal consolidations.
  - Motivation: The individual statutory rules of the framework are not sufficient to quantify the minimum adjustment.
  - The model captures reasonably well the actual policy goals (and their changes) in the Euro area.
- The paper shows that revisions of the economic forecasts have a large effect on the simulated adjustments and may facilitate policy volatility.
  - After taking that them account, the recent slowdown of the fiscal adjustment seems to be consistent with the EU's fiscal framework.
- An extension that uses (downturn) economic responses of the adjustment is also considered.
  - The analysis suggests that the changes in economic conditions (and thus the minimum adjustments) can be anticipated. It may facilitate less volatile policy steering in the future.

Appendix

Methodology: Auerbach & Gorodnichenko's (2012) model

The key equations of the model are

$$X_t = C + F(z_{t-1})\Pi_R X_{t-1} + (1 - F(z_{t-1}))\Pi_E X_{t-1} + \epsilon_t \quad (12)$$

$$\epsilon_t \sim N(0, \pi_t) \quad (13)$$

$$\Omega_t = F(z_{t-1})\Omega_R + (1 - F(z_{t-1}))\Omega_E \quad (14)$$

$$F(z_{t-1}) = \frac{exp(-\gamma z_t)}{(1 + exp(-\gamma z_t))}, \gamma > 0, z_t \sim N(0, 1) \quad (15)$$

Methodology: Data

- We include 4 variables (1975-2015): general government (net) revenues (R_t), general government (net) expenditures G_t, gross domestic product GDP_t, and expected change of the structural budget balance one year ahead E_t.
- The first three variables are measured in (log) per capita and real terms. GDP deflator is used as an inflation variable in each case.
- The expectation variable (based on ETLA's forecasts) controls both fiscal foresight, and consistency of expectations during the consolidation program.

Methodology: Data and trends

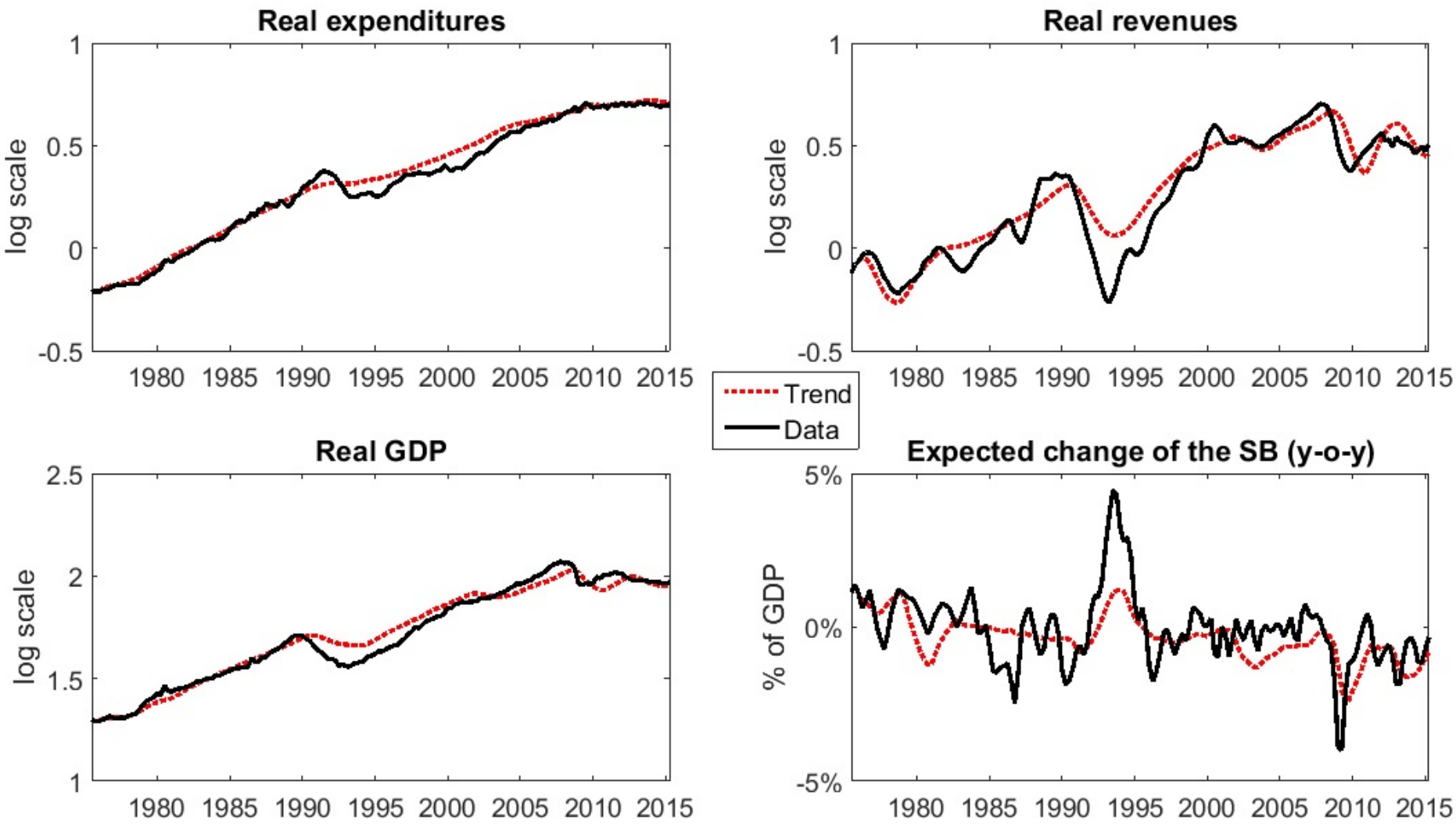


Figure:

Methodology: Regime

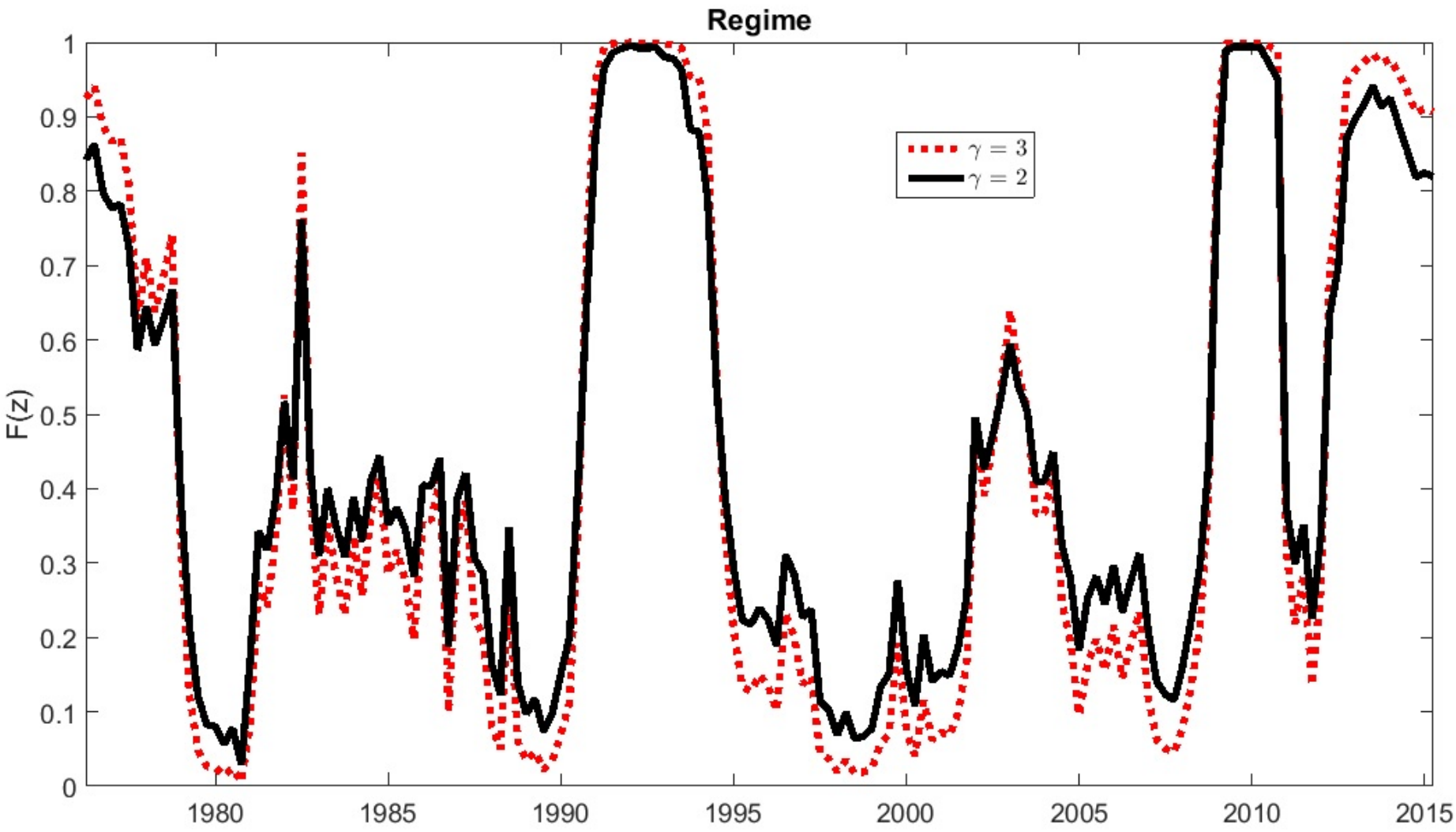
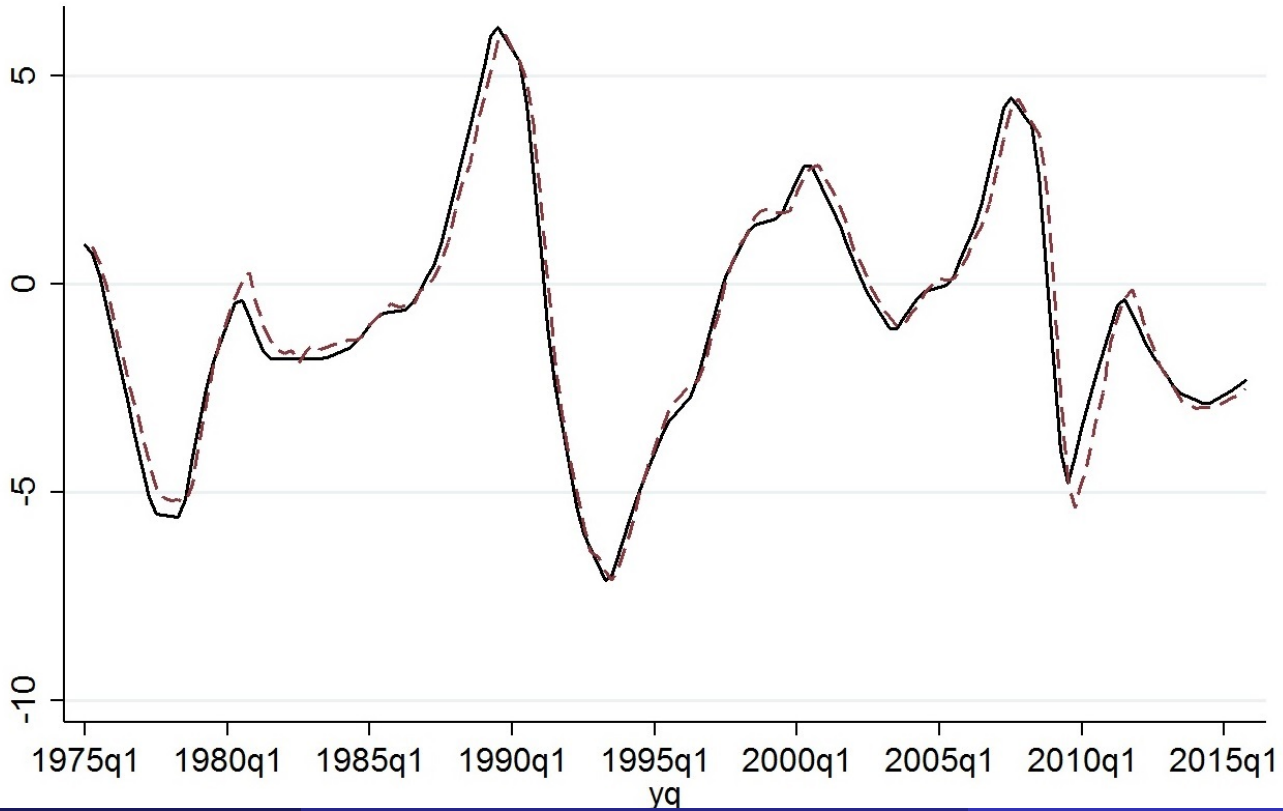


Figure: Regime variable, 7 quarters moving average of real GDP growth.

Methodology: Auxiliary models

- A simple Okun's law: It is assumed that each percentage point increase in the output gap contemporaneously lowers the inflation by 0.3 percentage points.
- A model of the Commission' PF based output gaps ($OG_t = 0.91 * OG_{t-1} + 0.38 * Z_t + \epsilon_t$)



Methodology: Variant of the Blanchard-Perotti (2002)

$$\epsilon_{g,t} = s_{g,t} \tag{16}$$

$$\epsilon_{r,t} = a_1 * \epsilon_{y,t} + a_2 * \epsilon_{g,t} + s_{r,t} \tag{17}$$

$$\epsilon_{y,t} = c_1 * \epsilon_{r,t} + c_2 * \epsilon_{g,t} + s_{y,t} \tag{18}$$

$$\epsilon_{E,t} = d_1 * \epsilon_{r,t} + d_2 * \epsilon_{g,t} + d_3 * \epsilon_{g,t} + s_{E,t} \tag{19}$$

The business cycle elasticity of revenues ($a1 = 1.16$) is fixed and calibrated based on Virkola (2014), while regime-specific estimates are used for the other parameters.

Methodology: Adjustment programs

A vector of structural shocks $(s_{t,g}, s_{t,r}, s_{t,y}, s_{t,E})$ is solved that maintains the economy at an assigned adjustment path. The path is governed by the following assumptions:

$$\frac{SB_t}{GDP_t} - \frac{SB_{t-1}}{GDP_{t-1}} = x_t^{exo} \tag{20}$$

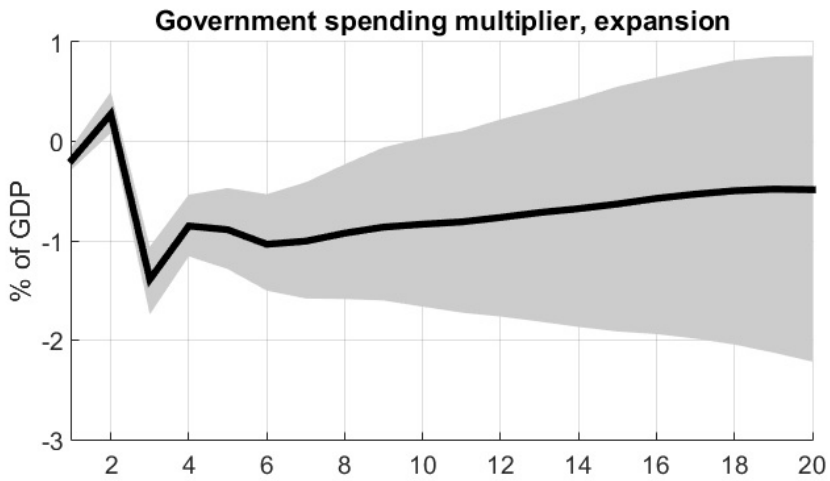
$$\frac{s_{r,t}}{s_{g,t}} = ratio_t^{exo} \tag{21}$$

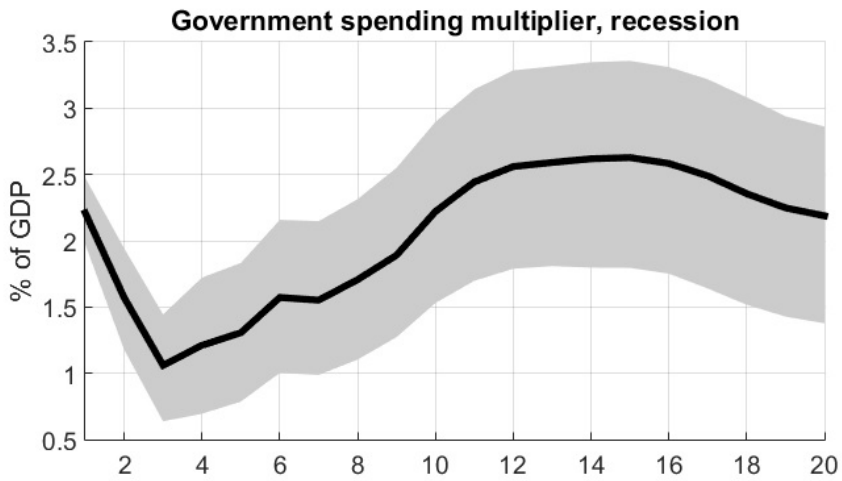
$$E_t[\frac{SB_{t+4}}{GDP_{t+4}} - \frac{SB_t}{GDP_t}] = \frac{SB_{t+4}}{GDP_{t+4}} - \frac{SB_t}{GDP_t} \tag{22}$$

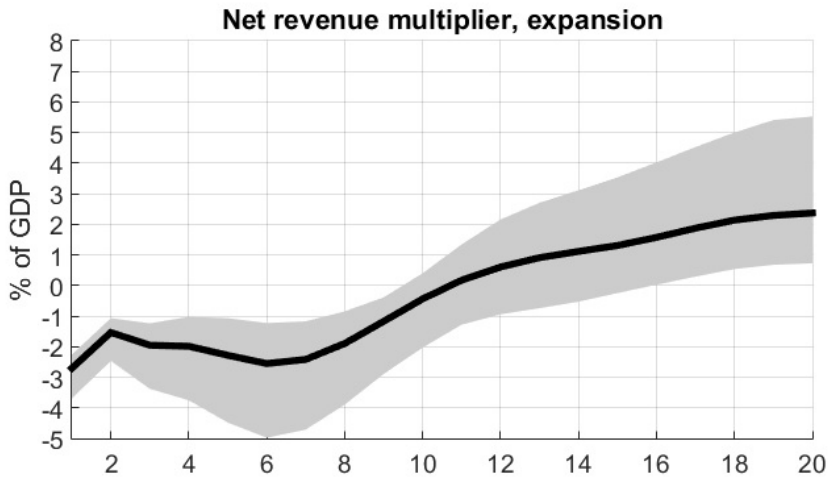
$$s_{t,y} = s_{t,y}^{exo} \tag{23}$$

$$\frac{SB_t}{GDP_t} = \frac{PB_t}{GDP_t} - \frac{i_t^{exo} * D_{t-1}}{GDP_t} - \xi * OG_t + OO_t \tag{24}$$

Results: regime-specific fiscal multipliers







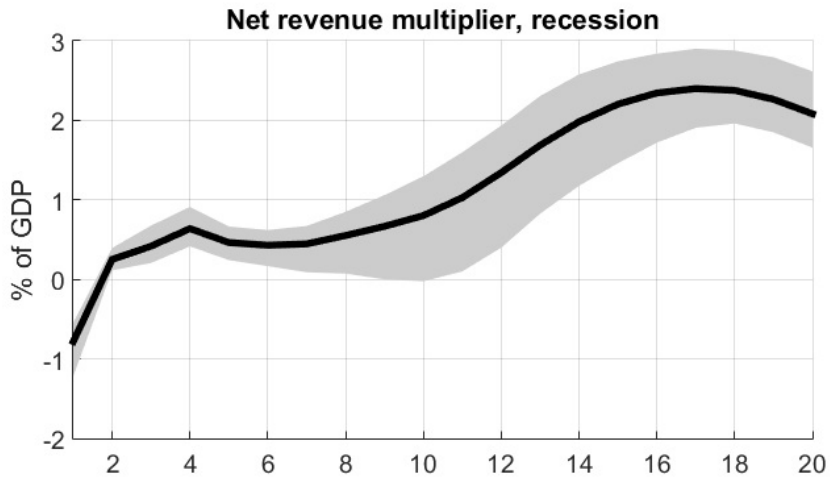


Figure: The figure plots expansion (F = 0) and recession (F = 1) impulse response of output to an unanticipated government net exp. increase shock and