FACULTEIT ECONOMIE
EN BEDRIJFSKUNDE

TWEEKERKENSTRAAT 2
B-9000 GENT
Tel. : 32 - (0)9 – 264.34.61
Fax. : 32 - (0)9 – 264.35.92

WORKING PAPER

On the Estimation of Panel Fiscal Reaction Functions: Heterogeneity or Fiscal Fatigue?

Gerdie Everaert and Stijn Jansen

January 2017
2017/930

D/2017/7012/04

On the Estimation of Panel Fiscal Reaction Functions: Heterogeneity or Fiscal Fatigue?

Gerdie Everaert* and Stijn Jansen

Ghent University & SHERPPA

Abstract

This paper investigates whether fiscal fatigue is a robust characteristic of the fiscal reaction function in a panel of OECD countries or merely an artifact of ignoring important aspects of the panel dimension of the data. More specifically, we test whether the quadratic and cubic debt-to-GDP terms remain significant once heterogeneous slopes are allowed for.

JEL Classifications: E62, H62, H63, H68

Keywords: Fiscal reaction function, fiscal fatigue, panel data, heterogeneity

1 Introduction

The European sovereign debt crisis, rising age-related public expenditures and the fear of a secular stagnation of output growth have put renewed emphasis on questions about the sustainability of fiscal policy. Bohn (1995, 1998) shows that a positive reaction of the primary balance to lagged debt is a sufficient condition for the government to satisfy its intertemporal budget constraint and hence fiscal policy to be sustainable. He suggests to estimate a fiscal reaction function (FRF) to determine whether increases in the public debt-to-GDP ratio elicit increases in the primary balance. The most simple FRF is a linear one. However, in an attempt to stabilize the debt-to-GDP ratio at a reasonable level, fiscal policy may respond more when debt is high and/or rising while being less responsive at lower debt levels. Ghosh et al. (2013) argue that the primary balance cannot always increases with debt because, at sufficiently high debt levels, this would require primary balances that exceed GDP. Using a panel of 23 advanced countries over the period 1970-2007, they find strong support for a non-linear FRF that exhibits this alleged 'fiscal fatigue' characteristic.

*Corresponding author at: Department of Social Economics, Sint-Pietersplein 6, 9000 Gent, Belgium, Tel:+32 (0)9 264.78.78, Email: gerdie.everaert@UGent.be

In this paper, we investigate whether fiscal fatigue is a robust characteristic of the FRF in a panel of 21 advanced economies over the period 1970-2014 or is merely an artifact of ignoring heterogeneity. Because debt-to-GDP ratios often show only small variation over time within countries, most of the current literature estimating FRFs relies on panel datasets. Adding a cross-sectional dimension and using a homogeneous panel specification ensures that there is sufficient information in debt-to-GDP ratios to identify non-linearities in the FRF. However, the identified fiscal fatigue may very well be induced by slope heterogeneity. If some countries react less to debt than others, these countries will over time end up with a higher debt level. When estimating a homogeneous FRF, high debt will coincide with a weak reaction in the primary balance not because of fiscal fatigue but due to unmodeled heterogeneity.

2 Empirical specification

Our starting point is the static homogeneous non-linear panel FRF proposed by Ghosh et al. (2013)

$$pb_{it} = \alpha_i + \beta_1 d_{i,t-1} + \beta_2 d_{i,t-1}^2 + \beta_3 d_{i,t-1}^3 + \phi gap_{it} + Z_{it}\omega + \varepsilon_{it}, \tag{1}$$

where pb_{it} denotes the primary balance in country i at time t, $d_{i,t-1}$ the lagged public debt-to-GDP ratio and gap_{it} the output gap. Following the literature (see e.g. Mendoza and Ostry, 2008; Ghosh et al., 2013), the vector of control variables Z_{it} includes inflation ($infl_{it}$), the implicit interest rate on public debt (iir_{it}), the current account balance as a percentage of GDP ($curac_{it}$), trade openness ($open_{it}$), the ratio of elderly (old_{it}), the future ratio of elderly ($Fold_{it}$) and three dummy variables that capture whether a country is part of the Euro area in a specific year (D_{it}^{euro}), elections where held in a certain year (D_{it}^{elec}) and whether a country adopted some type of fiscal program (D_{it}^{fisc}).

The fiscal fatigue proposition of a positive but eventually slowing response of the primary balance to rising debt should show up as a $\beta_3 < 0$ (cubic specification) or $\beta_2 < 0$ and $\beta_3 = 0$ (quadratic specification). Using a panel of 23 advanced economies over the period 1970-2007, Ghosh et al. (2013) find $\beta_1 < 0$, $\beta_2 > 0$ and $\beta_3 < 0$. Their results imply that the marginal response of the primary balance is at its maximum for a debt-to-GDP ratio of around 90-100%, starts to decline beyond that level and becomes negative when debt exceeds 150% of GDP. However, this downward sloping segment of the FRF is identified mainly from the behavior of Japan, and to a lesser extent Belgium and Italy, as over the period 1970-2007 only these countries have episodes where the debt-to-GDP ratio is well above 100%. Hence, it is not obvious that fiscal fatigue is a general characteristic present in all countries.

To investigate the robustness of the fiscal fatigue proposition, we extend the baseline specification

of the panel FRF in equation (1) to

$$pb_{it} = \alpha_i + \delta_t + \gamma pb_{i,t-1} + \beta_{1i} d_{i,t-1} + \beta_{2i} d_{i,t-1}^2 + \beta_{3i} d_{i,t-1}^3 + \phi gap_{it} + Z_{it}\omega + \varepsilon_{it}. \tag{2}$$

The introduction of the heterogeneous coefficient β_{1i} makes it possible to discriminate between the fiscal fatigue premise that the response of the primary balance eventually decreases at high debt levels ($\beta_3 < 0$ or $\beta_2 < 0$, $\beta_3 = 0$) in all countries and the hypothesis that the response to debt is heterogeneous (β_{1i} is different) across countries. Adequately discriminating between these two propositions requires sufficiently rich data, i.e. the panel should contain enough countries with considerable variation in their debt-to-GDP ratio over time. The recent sovereign debt crisis entails interesting new information in this respect as there was a widespread increase in debt levels, with additional countries moving into the area where fiscal fatigue may set in or at least witnessed an increase from relatively low to higher levels of debt. This was especially the case for Ireland, Greece and Portugal and to a lesser extent for France, Spain, the UK and the US. We will further test whether there is a heterogeneous non-linear reaction to lagged debt by also allowing β_{2i} or β_{3i} to differ across countries.

Our extended specification nests two further generalizations. First, the highly politicized nature of government budgeting makes it hard to react immediately to changes in debt and other economic conditions. Ghosh et al. (2013), however, consider a static FRF, dealing with the resulting strong autocorrelation in the error terms using a Generalized Least Squares (GLS) correction. In fact, the underlying assumption of an autoregressive pattern in the error terms implies that the persistence in the primary balance is assumed to stem from autocorrelation in exogenous shocks. To allow for sluggishness in the response of fiscal policy, we add the lagged primary balance $pb_{i,t-1}$ to the explanatory variables.[1] Second, global trends and common shocks can cause cross-sectional dependence and are potentially also a source of persistence. We account for this by adding time fixed effects δ_t.

3 Estimation results

Our dataset is an update of Mauro et al. (2015) and comprises unbalanced data for 21 advanced countries over the period 1970-2014. Exact definitions and data sources can be found in Table A-1 in the Supplementary Appendix. Estimation results are reported in Table 1.

In line with Ghosh et al. (2013), the baseline specification in column (1) implies fiscal fatigue. The marginal response of the primary balance to lagged debt starts to decline at a debt level of around 100% of GDP and becomes negative when the debt-to-GDP ratio exceeds 170%.

Estimates for the dynamic specification are reported in column (2). The coefficient on the lagged

[1] Although the fixed effects estimator suffers from a dynamic panel data bias, due to our sufficiently long time dimension ($T = 45 > 30$) this should be negligibly small (see Judson and Owen, 1999).

Table 1: Fiscal policy reaction function: pooled and mean group coefficient estimates

Dependent variable: pb_{it} Sample period: 1970-2014, 21 countries

	(1)	(2)	(3)	(4)	(5)	(6)
$pb_{i,t-1}$		0.731***	0.735***	0.664***	0.620***	0.665***
		(0.053)	(0.058)	(0.060)	(0.056)	(0.059)
$d_{i,t-1}$	−0.066**	0.011	−0.005	**0.006**	**−0.065**	**0.027*** **
	(0.030)	(0.015)	(0.014)	**(0.006)**	**(0.181)**	**(0.006)**
$d^2_{i,t-1}$	1.5e-3***	4.1e-4**	4.3e-4**	2.4e-4	**−9.1e-4**	
	(3.4e-4)	(1.8e-4)	(1.7e-4)	(3.0e-4)	**(4.7e-3)**	
$d^3_{i,t-1}$	−5.1e-6***	−1.8e-6***	−1.7e-6***	−6.5e-7	**3.8e-5**	
	(1.1e-6)	(5.7e-7)	(5.5e-7)	(7.5e-7)	**(6.1e-5)**	
gap_{it}	0.447***	0.158***	0.066**	0.122***	0.115***	0.119***
	(0.041)	(0.032)	(0.028)	(0.033)	(0.035)	(0.033)
$infl_{it}$	0.012	0.017	0.070**	0.130***	0.167***	0.133***
	(0.029)	(0.026)	(0.027)	(0.031)	(0.036)	(0.032)
iir_{it}	0.134***	0.081***	0.044*	0.013	−0.015	0.021
	(0.046)	(0.024)	(0.026)	(0.039)	(0.046)	(0.034)
$curac_{it}$	0.165***	0.115***	0.082***	0.113***	0.127***	0.098***
	(0.037)	(0.025)	(0.022)	(0.021)	(0.021)	(0.021)
$open_{it}$	0.055***	0.026***	0.011	0.007	0.022	0.008
	(0.013)	(0.009)	(0.010)	(0.011)	(0.014)	(0.012))
D^{euro}_{it}	−0.323	−0.471**	−0.173	−0.165	−0.440	−0.230
	(0.408)	(0.234)	(0.222)	(0.254)	(0.354)	(0.255)
D^{elec}_{it}	−0.184**	−0.154	−0.230**	−0.212*	−0.211*	−0.230**
	(0.087)	(0.130)	(0.122)	(0.114)	(0.109)	(0.114)
D^{fisc}_{it}	0.494*	0.590***	0.580***	0.424**	0.358*	0.440**
	(0.291)	(0.191)	(0.205)	(0.218)	(0.221)	(0.219)
old_{it}	−0.347**	−0.132	−0.045	0.147	0.266	0.134
	(0.153)	(0.083)	(0.078)	(0.108)	(0.164)	(0.104)
$Fold_{it}$	−0.044	−0.087**	−0.025	−0.048	−0.136*	−0.048
	(0.093)	(0.043)	(0.047)	(0.051)	(0.080)	(0.053)
Country fixed effects	yes	yes	yes	yes	yes	yes
Time fixed effects	no	no	yes	yes	yes	yes
GLS	yes	no	no	no	no	no
Heterogeneous coefficients	no	no	no	$d_{i,t-1}$	$d^{1,2,3}_{i,t-1}$	$d_{i,t-1}$
AR(1) autocorrelation test	414.422***	8.391***	0.028	0.064	0.153	0.051
Average pairwise correlation	0.150	0.243	−0.048	−0.047	−0.047	−0.046
Wald heterogeneity test				65.159***	166.236***	83.720***

Notes: pb_{it} is the primary balance as % of GDP. The GLS estimator corrects for an AR(1) structure and cross-sectional heteroskedasticity in the error terms. When GLS is not used, we report White robust standard errors for the homogeneous coefficients. For the heterogeneous coefficients we report (in bold) mean group estimates with standard errors calculated non-parametrically from the distribution of the individual coefficients. Statistical significance at the 10%, 5% and 1% level is indicated using *, ** and *** respectively.

The output gap is instrumented by its first and second lag and a weighted average of foreign countries' output gaps. The current account and implied interest rate are instrumented by their first and second lags.

The AR(1) test is the Cumby and Huizinga (1992) test for first-order serial correlation in the error terms. This test is robust to heteroskedasticity. It is calculated from regressions results before applying the GLS correction. The pairwise correlation coefficient is the average of the country-by-country cross-correlation in the estimated error terms. The Wald heterogeneity test is for the null hypothesis that the heterogeneous slopes are actually homogeneous across countries.

primary balance is 0.731 and highly significant, showing considerable persistence in the formation of the government budget. Note that the test for autocorrelation in the error terms reported in the bottom of Table 1 shows that even in the dynamic specification there is significant autocorrelation left. Moreover, the average pairwise correlation coefficient shows that there is cross-sectional correlation in the error terms of specifications (1) and (2). To allow and correct for common shocks, column (3) adds time fixed effects to the model. This reduces the cross-sectional correlation in the error terms to a negligibly small number. It also removes the autocorrelation in the error terms, suggesting that this was induced by persistence in shocks common to all countries.

In column (4), we further extend the specification by allowing the coefficient on lagged debt $d_{i,t-1}$ to vary across countries. Although the Mean Group (MG) estimate for the reaction of the primary balance to lagged debt of 0.006 is not significant, the Wald test shows that the cross-country heterogeneity is highly significant. Moreover, it also renders the homogeneous coefficients on the non-linear debt terms $d^2_{i,t-1}$ and $d^3_{i,t-1}$ insignificant. This suggests that the response to debt is heterogeneous over countries and that the finding of fiscal fatigue is caused by imposing homogeneity. In column (5), we further allow for heterogeneous coefficients on the quadratic and cubic debt terms. Despite significant heterogeneity, as indicated by the Wald test, non of the MG estimates is significant. The heterogeneous coefficients reported in Table A-2 of the Supplementary Appendix imply that only Denmark, Portugal and Japan show significant fiscal fatigue. This further highlights that fiscal fatigue is not a general characteristic of advanced economies. Finally, Column (6) reports results removing $d^2_{i,t-1}$ and $d^3_{i,t-1}$. The average reaction to lagged debt is now significantly positive. The heterogeneous reactions reported in Table A-2 show that countries with the biggest positive response to lagged debt are Greece, Ireland, Italy, Norway, Portugal and Sweden. Japan is the only country with a significantly negative response.

4 Conclusion

This paper has investigated whether fiscal fatigue is a robust characteristic of the fiscal reaction function in a panel of advanced economies over the period 1970-2014 or an artifact of ignoring coefficient heterogeneity. We find that the quadratic and cubic debt-to-GDP terms that induce fiscal fatigue become insignificant once a heterogeneous reaction to lagged debt is allowed for. When modeling a fully heterogeneous non-linear reaction to lagged debt, fiscal fatigue only shows up in 3 out of the 21 considered countries. This implies that fiscal fatigue is not a general characteristic, but may still be relevant in some countries. To gain further insight in the sustainability of fiscal policy, future research should look into the determinants of the heterogeneous response to debt. Also the role played by other type of non-linearities like fiscal plans and consolidation periods is worth investigating.

Acknowledgments

We thank Freddy Heylen, Ruben Schoonackers and Luc Van Meensel for useful comments and suggestions. We acknowledge financial support from the National Bank of Belgium through the sponsorship project "Time-varying fiscal policy reaction functions: the role of government debt and public institutions".

References

Bohn H. 1995. The Sustainability of Budget Deficits in a Stochastic Economy. *Journal of Money, Credit and Banking* **27**: 257–71.

Bohn H. 1998. The Behaviour of U.S. Public Debt and Deficits. *The Quarterly Journal of Economics* **113**: 949–963.

Cumby RE, Huizinga J. 1992. Testing the autocorrelation structure of disturbances in ordinary least squares and instrumental variables regressions. *Econometrica* **60**: 185–195.

Ghosh AR, Kim JI, Mendoza EG, Ostry JD, Qureshi MS. 2013. Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies. *The Economic Journal* **123**: 4–30.

Judson A, Owen A. 1999. Estimating Dynamic Panel Data Models: A Guide for Macroeconomists. *Economics Letters* **65**: 9–15.

Mauro P, Romeu R, Binder A, Zaman A. 2015. A modern history of fiscal prudence and profligacy. *Journal of Monetary Economics* **76**: 55–70.

Mendoza EG, Ostry JD. 2008. International evidence on fiscal solvency: Is fiscal policy responsible? *Journal of Monetary Economics* **55**: 1081–1093.

Supplementary Appendix

Table A-1: Variables used in the FRF regressions (21 countries, 1970-2014, yearly data)

Variable	**Description**	**Source**
Primary Balance	Primary balance as % of GDP	Data up to 2011 based on Mauro et al. (2015) from which we selected the relevant countries and updated these with more recent data (2012-2014) using the OECD Economic Outlook database
Debt	Gross public debt as % of GDP	Data up to 2011 based on Mauro et al. (2015) from which we selected the relevant countries and updated these with more recent data (2012-2014) using the IMF World Economic Outlook database
Output Gap	Output gap in % of potential GDP	IMF World Economic Outlook database
Inflation	Growth rate GDP deflator (in %)	World Bank and OECD National Accounts data
Implied interest rate	Gross interest payments as a ratio of total gross debt	Mauro et al. (2015)
Current account balance	External sectors, trade and payments: Current account balance, as a % of GDP	OECD Economic Outlook (International Monetary Fund, Balance of Payments Statistic for Greece)
Trade Openness	Sum of exports and imports of goods and services, as a % of GDP	World bank, World Development indicators
Euro area	Dummy that is 1 for countries belonging to the Euro area, 0 otherwise	http://ec.europa.eu/economy_finance/euro/index_en.htm
Election year	Dummy that is 1 when an election (legislative or presidential) was held in a certain year, 0 otherwise	World Bank, database of Political Institutions
Fiscal Program	Dummy that is 1 if a fiscal program was in place in a certain year, 0 otherwise	Budina, Kinda, Schaechter and Weber. 2012. Fiscal Rules at a Glance: Country Details from a New Dataset. International Monetary Fund, Working Papers 273. Dong-won, Weh-sol and Jong-kyu. 2013. A Defense against Fiscal Crises: Fiscal Rules. SERIWorld reports 9-6. Shyn. Managing Public Debts with Tighter Fiscal Rules. 2013. Korea Institute of Finance, Weekly Financial Review 13: 6-8.
(Future) old	Percentage of the total population older than 60, current or in 20 years	United Nations, Population by age, sex and urban/rural residence

Table A-2: Fiscal policy reaction function: heterogeneous coefficient estimates

	Specification (4)		Specification (5)					Specification (6)	
	α_i	$d_{i,t-1}$	α_i	$d_{i,t-1}$	$d^2_{i,t-1}$	$d^3_{i,t-1}$	Wald	α_i	$d_{i,t-1}$
Australia	−3.001	0.034	−12.199	1.490	−0.074	0.001	4.16	−3.188	0.049
	(2.044)	(0.040)	(9.610)	(1.243)	(0.061)	(0.001)		(2.018)	(0.038)
Austria	−2.145	−0.027	−8.549	0.504**	−0.014***	1.2e-4***	13.77***	−2.323	−0.007
	(2.247)	(0.024)	(5.279)	(0.211)	(0.005)	(4.0e-5)		(2.203)	(0.013)
Belgium	−4.122	−0.007	21.872	−0.901	0.010	−3.2e-5	1.32	−5.112**	0.022*
	(2.695)	(0.045)	(26.618)	(0.832)	(0.009)	(3.0e-5)		(2.529)	(0.012)
Canada	−2.232	0.003	−23.082	1.038*	−0.016*	8.2e-5**	13.78***	−2.970*	0.023**
	(1.873)	(0.038)	(22.648)	(0.610)	(0.009)	(4.0e-5)		(1.718)	(0.011)
Denmark	−3.497	0.015	−0.625	−0.350***	0.009***	−6.3e-5***	14.77***	−3.718*	0.034**
	(2.253)	(0.029)	(3.296)	(0.114)	(0.003)	(2.0e-5)		(2.221)	(0.014)
Finland	−1.244	−0.034	0.268	−0.264	0.007	−5.8e-5	10.23**	−1.278	−0.018
	(1.952)	(0.021)	(2.664)	(0.170)	(0.006)	(5.7e-5)		(1.902)	(0.014)
France	−3.179	−0.010	−0.665	−0.195*	0.003	−8.6e-6	30.26***	−3.326*	0.009
	(2.035)	(0.024)	(3.442)	(0.111)	(0.002)	(1.3e-5)		(1.979)	(0.008)
Germany	−2.961	−0.014	−6.835	0.293	−0.008	5.7e-5*	6.56*	−3.209	0.008
	(2.216)	(0.030)	(5.340)	(0.244)	(0.005)	(3.2e-5)		(2.162)	(0.011)
Greece	−7.515***	0.028	−0.337	−0.318	0.004	−1.5e-5	27.17***	−8.246***	0.054***
	(2.372)	(0.036)	(6.358)	(0.248)	(0.003)	(9.8e-6)		(2.260)	(0.017)
Ireland	−5.956***	0.030	10.221*	−0.873	0.013	−5.2e-5	10.62**	−6.383***	0.053***
	(2.209)	(0.037)	(5.266)	(0.625)	(0.009)	(3.9e-5)		(2.159)	(0.018)
Italy	−6.770***	0.021	1.748	−0.276	0.003	−8.6e-6	22.99***	−7.590***	0.049***
	(2.245)	(0.043)	(12.818)	(0.292)	(0.004)	(1.3e-5)		(2.084)	(0.011)
Japan	−0.621	−0.042	−2.257	0.057*	−8.7e-4***	2.4e-6***	10.54**	−1.124	−0.016**
	(1.832)	(0.041)	(2.043)	(0.035)	(3.2e-4)	(8.7e-7)		(1.761)	(0.007)
Korea	−1.736	0.028	0.463	−0.394	0.019	−2.4e-4	3.27	−1.762	0.037
	(1.215)	(0.034)	(4.287)	(0.478)	(0.025)	(4.0e-4)		(1.176)	(0.035)
Netherlands	−2.151	−0.027	25.713	−1.411	0.021	−1.0e-4	7.86**	−2.643	−0.002
	(2.177)	(0.037)	(31.543)	(1.063)	(0.019)	(1.1e-4)		(2.111)	(0.021)
New Zealand	−0.990	−0.031	1.218	−0.229	0.005	−3.2e-5	3.44	−1.385	−0.011
	(1.956)	(0.032)	(6.173)	(0.386)	(0.010)	(7.4e-5)		(1.908)	(0.019)
Norway	−3.489	0.060	2.861	−0.523	0.014	−1.1e-4	10.25**	−3.584	0.078**
	(2.506)	(0.040)	(22.543)	(1.607)	(0.038)	(2.9e-4)		(2.452)	(0.034)
Portugal	−4.975**	0.020	4.657	−0.573***	0.010***	−4.6e-5***	22.62***	−5.613***	0.046***
	(2.136)	(0.034)	(4.787)	(0.220)	(0.004)	(1.7e-5)		(2.044)	(0.013)
Spain	−3.842**	0.014	−4.878*	0.085	−0.002	1.8e-5	11.16**	−3.980**	0.031***
	(1.935)	(0.022)	(2.649)	(0.099)	(0.002)	(1.5e-5)		(1.881)	(0.010)
Sweden	−6.657***	0.053*	−0.820	−0.487	0.013	−8.9e-5	21.24***	−6.925***	0.074***
	(2.412)	(0.030)	(7.774)	(0.406)	(0.009)	(6.6e-5)		(2.367)	(0.014)
United Kingdom	−5.101**	0.018	−49.054**	2.259***	−0.038***	2.0e-4***	29.50***	−5.337**	0.036**
	(2.326)	(0.027)	(21.245)	(0.815)	(0.014)	(7.8e-5)		(2.253)	(0.017)
United States	−2.542	−0.011	4.620	−0.307	0.004	−1.3e-5	7.03*	−2.975	0.011
	(2.004)	(0.030)	(17.156)	(0.534)	(0.008)	(3.6e-5)		(1.892)	(0.013)

Notes: Specifications (4), (5) and (6) refer to the respective columns in Table 1 in the main paper. The Wald test is for the joint significance of the three debt terms. White robust standard errors are reported in parentheses. Statistical significance at the 10%, 5% and 1% level is indicated using *, ** and *** respectively. See Table 1 for further notes.

The heterogeneous coefficients reported for specification 5 imply that only Denmark, Portugal and Japan show significant fiscal fatigue. For Denmark and Portugal this is due to β_3 being significantly smaller than zero. The coefficient estimates imply that the marginal response of the primary balance to lagged debt becomes negative at debt levels of around 70% and 100% of GDP, respectively, in these countries. Japan is a special case as we obtain $\beta_2 < 0$ and $\beta_3 > 0$ sch that the primary balance will ultimately show an increasingly positive response as debt becomes sufficiently high. However, the coefficient estimates imply that this response only becomes positive when the debt-to-GDP ratio exceeds 260%. Hence, over the historically relevant range of debt-to-GDP ratios up to 250%, Japan shows very strong fiscal fatigue. Note that also in Austria, Canada and the UK we obtain significant $\beta_2 < 0$ and $\beta_3 > 0$, but the specific coefficient values do not imply any relevant fiscal fatigue in these countries.