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Online Appendix for The Interest Rate Effects of Government Debt and Deficits: Does Domestic Borrowing Have a Different Impact Than Foreign Borrowing?

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Online appendix for The interest rate effects of government debt and deficits: Does domestic borrowing have a different impact than foreign borrowing?*

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1 Introduction

This appendix presents the results from various robustness tests described in the main text. First, we present the graphs in Figures 1 and 2 in the text for each of the rest of the counties in the sample. Second, we present the results from a sample ending in 2007, replicating the original Gruber and Kamin (2012) results. Third, we present the results from the regression specification in the text using 5-year-ahead expectations from the IMF instead of the 2-year-ahead expectations from the OECD. Fourth, we present the results estimating the main regression and marginal effects in the text using differences, not levels.

2 Figures 1 and 2 for the other countries in the sample

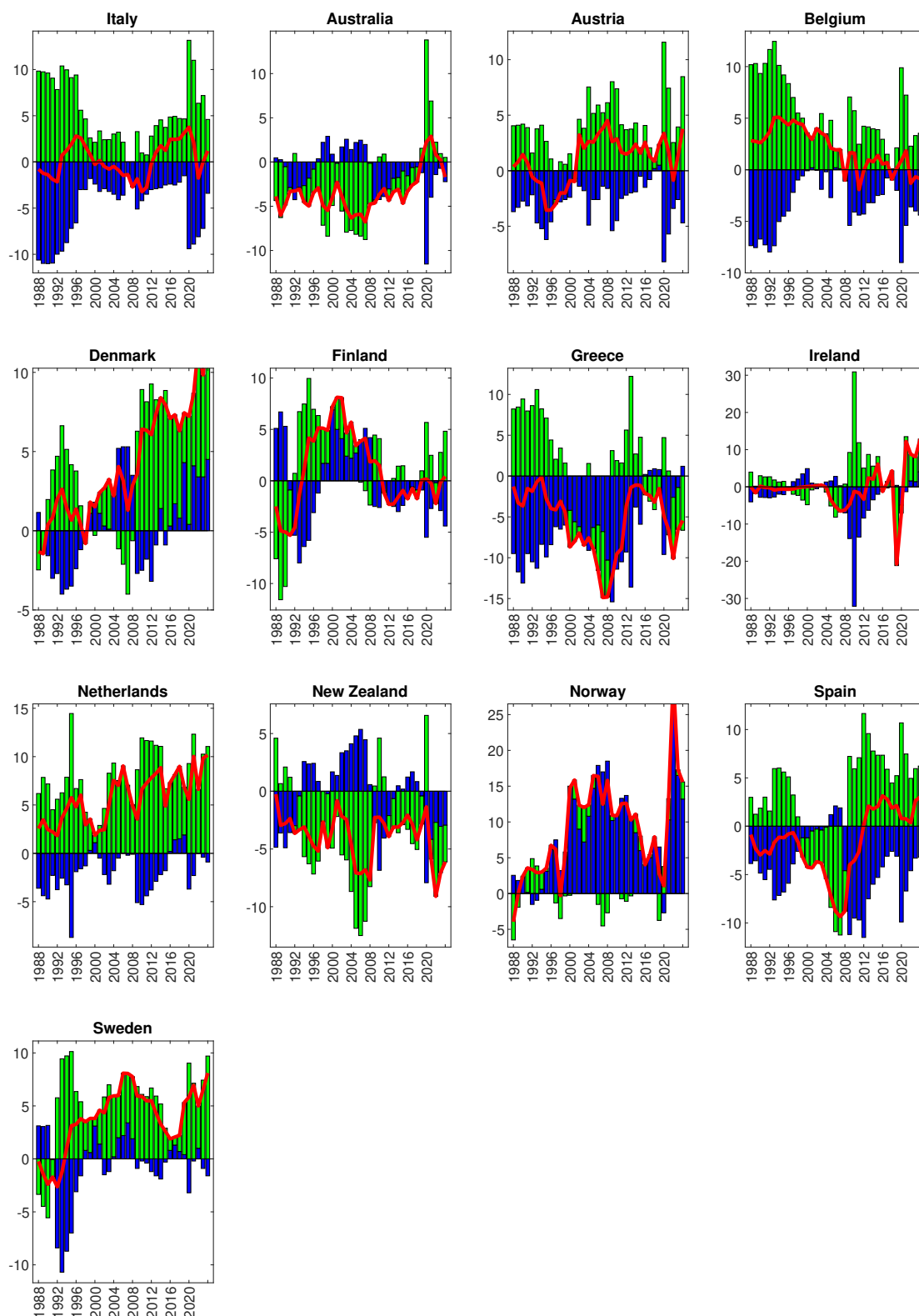
In the introduction we presented one figure showing government savings, private sector savings, and the current account, and another showing gross government debt and the net foreign liability position for six major advanced economies. In this appendix we present the same graphs for the other 13 countries in the sample.

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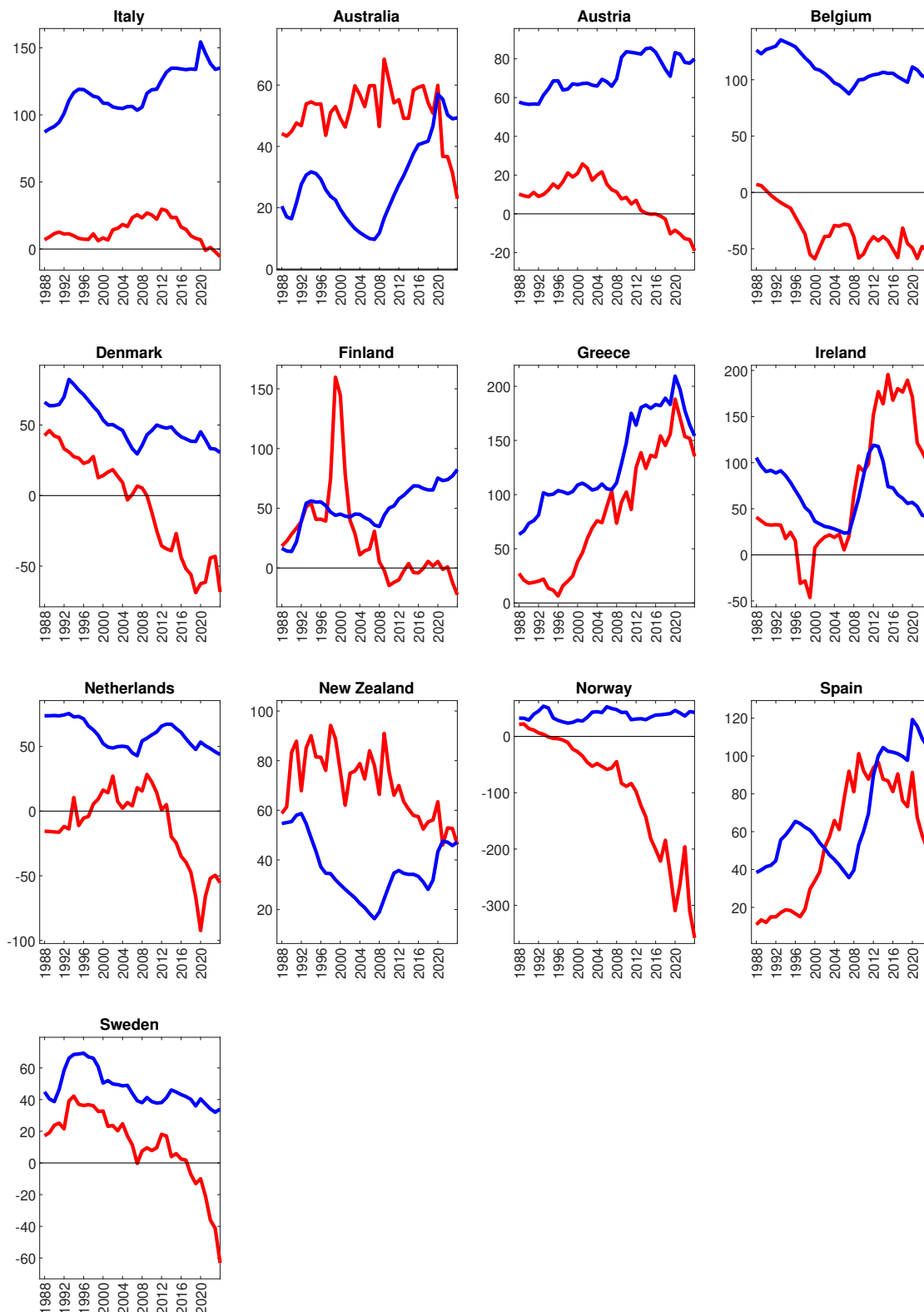
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Figure 1: Government net saving, private net saving, and current account (percent of GDP)



Notes: Blue bars represent government net saving (negative of budget deficit). Green bars show private net saving (current account minus government net saving). Red line indicates the current account.
Source: Global Macro Database from Müller et al. (2025).

Figure 2: Government debt and net foreign liability position (percent of GDP)



Notes: Blue line shows gross government debt, and the red line shows the net foreign asset position.
Source: Global Macro Database from Müller et al. (2025) and External Wealth of Nations Database from Lane and Milesi-Ferretti (2007).

3 Sample ending in 2007

The time sample in the text is 1988-2024. Gruber and Kamin (2012) ended their sample in 2007. So here we present our results from the text using a sample that ends in 2007. Our findings hold in that earlier sample as well.

Table 1: Regression of 10yr interest rate, in differences

	Dependent Variable: i_t^{10y}							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i_t^{3m}	0.229*** (0.021)	0.231*** (0.036)	0.233*** (0.025)	0.237*** (0.048)	0.227*** (0.020)	0.232*** (0.037)	0.222*** (0.024)	0.231*** (0.047)
i_{t-1}^{10y}	0.466*** (0.030)	0.471*** (0.028)	0.473*** (0.040)	0.472*** (0.039)	0.445*** (0.030)	0.430*** (0.039)	0.455*** (0.034)	0.447*** (0.052)
$g_t^{e,2}$	10.455** (4.912)	10.363 (7.953)	10.755* (5.629)	11.615 (9.248)	5.823 (4.410)	6.169 (5.748)	5.869 (5.325)	7.014 (7.347)
$\pi_t^{e,2}$	23.265*** (4.737)	24.138** (9.526)	22.596*** (5.219)	24.702** (9.704)	23.684*** (4.394)	24.135** (9.788)	21.603*** (5.251)	21.335* (12.002)
$D_{gross,t}^{e,2}$	0.459*** (0.175)	0.482** (0.228)						
$D_{gross,t}^{e,2} F_{nfa,t}^{e,2}$		-0.004 (0.003)						
$D_{net,t}^{e,2}$			0.329** (0.158)	0.670*** (0.190)				
$D_{net,t}^{e,2} F_{nfa,t}^{e,2}$				-0.010*** (0.003)				
$D_{Def,t}^{e,2}$					4.349*** (1.152)	7.705*** (2.742)		
$D_{Def,t}^{e,2} F_{CA,t}^{e,2}$						-0.560*** (0.142)		
$D_{Pri,t}^{e,2}$							3.009** (1.446)	6.254** (2.513)
$D_{Pri,t}^{e,2} F_{CA,t}^{e,2}$								-0.570*** (0.133)
$F_{NFA,t}^{e,2}$		0.117 (0.209)		0.382** (0.180)				
$F_{CA,t}^{e,2}$						-1.933* (1.045)		-1.647 (1.239)
R2	0.975	0.975	0.974	0.975	0.976	0.978	0.970	0.971
Obs.	340	340	288	288	360	360	291	291

See notes to Table 1 in the text.

Table 2: Marginal effect of debt and deficits on 10yr interest rate, estimated from differences regression

Gross Debt:			Net Debt:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	0.617	1.207**	Financed Home	0.507*	2.033***
Financed Abroad	0.994***	1.585**	Financed Abroad	0.432	1.958***
Difference top to bottom	0.377*		Difference top to bottom	-0.075	
Difference left to right	0.591		Difference left to right	1.526***	
Deficit:			Primary Deficit:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	10.567***	16.458***	Financed Home	8.215**	14.394***
Financed Abroad	15.429***	21.320***	Financed Abroad	10.369***	16.547***
Difference top to bottom	4.863**		Difference top to bottom	2.154	
Difference left to right	5.891***		Difference left to right	6.179***	

Computes the marginal effects from the regression equations using the specification in the table in section 2. Computed using the regression results in Table 1. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4 Estimation using IMF expectations

As discussed in the text, the potential endogeneity of current government debt or deficits will add a negative bias to any estimates of the effects of fiscal positions on interest rates. U.S. based studies are able to use 5-year ahead forecasts. In international data, 2-year ahead forecasts are the best publicly available. In this study we focus on international data since we are looking for variation in current accounts and net foreign asset positions.

Here we rerun everything using 5-year ahead forecasts from the IMF. These are observed twice a year since 1990 as part of the IMF World Economic Outlook. Prior to 2009 the forecasts of government debt and deficits were not made public, and were only used as inputs into other forecasts. Our results using these IMF 5-year ahead forecasts are both qualitatively and quantitatively similar to those using the 2-year ahead OECD forecasts, even though these IMF forecasts were not publicly available for more than half of our sample period. This suggests that even though these forecasts are not publicly available, market participants could infer something similar using publicly available data. However, since the IMF forecasts are not publicly available we keep these results as a robustness check and focus on the OECD forecasts in the main text.

Table 3: Regression of 10yr interest rate, using IMF 5yr ahead expectations

	Dependent Variable: i_t^{lt}							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i_t^{st}	0.140*** (0.013)	0.146*** (0.022)	0.147*** (0.013)	0.157*** (0.024)	0.168*** (0.012)	0.170*** (0.019)	0.135*** (0.012)	0.135*** (0.023)
i_{t-1}^{lt}	0.658*** (0.019)	0.655*** (0.045)	0.667*** (0.019)	0.657*** (0.041)	0.649*** (0.017)	0.646*** (0.030)	0.628*** (0.020)	0.627*** (0.067)
$g_t^{e,5}$	-1.073 (2.869)	-1.930 (2.777)	-4.045 (2.870)	-5.053* (2.907)	-1.299 (2.303)	-1.015 (2.998)	-7.681*** (2.572)	-7.804** (3.208)
$\pi_t^{e,5}$	2.200 (3.247)	2.932 (4.373)	1.688 (3.325)	3.894 (4.180)	8.914*** (2.887)	8.627** (4.169)	-2.415 (3.161)	-2.558 (4.599)
$D_{gross,t}^{e,5}$	0.295*** (0.064)	0.329*** (0.092)						
$D_{gross,t}^{e,5} F_{nfa,t}^{e,5}$		-0.001 (0.001)						
$D_{net,t}^{e,5}$			0.138*** (0.045)	0.228*** (0.061)				
$D_{net,t}^{e,5} F_{nfa,t}^{e,5}$				-0.001*** (0.000)				
$D_{Def,t}^{e,5}$					1.429*** (0.500)	2.198*** (0.759)		
$D_{Def,t}^{e,5} F_{CA,t}^{e,5}$						-0.150** (0.074)		
$D_{Pri,t}^{e,5}$							0.382 (0.553)	-0.070 (0.668)
$D_{Pri,t}^{e,5} F_{CA,t}^{e,5}$								-0.016 (0.060)
$F_{NFA,t}^{e,5}$		0.057 (0.061)		-0.063 (0.040)				
$F_{CA,t}^{e,5}$						-0.392 (0.537)		-1.083** (0.486)
R2	0.986	0.986	0.985	0.986	0.987	0.988	0.985	0.985
Obs.	986	986	1047	1047	1147	1147	934	934

The dependent variable in each regression is the 10 year interest rate i_t^{lt} . i_t^{st} is the 3m interest rate, $g_t^{e,5}$ is the expectation for real GDP growth in five years, $\pi_t^{e,5}$ is the expectation for inflation in five years, $D_{gross,t}^{e,5}$ is the expectation for the level of gross government debt in five years, $D_{net,t}^{e,5}$ is the expectation for the level of net government debt in five years, $D_{Def,t}^{e,5}$ is the expectation for the level of the government budget deficit in five years, $D_{Pri,t}^{e,5}$ is the expectation for the level of the government primary budget deficit in five years, $F_{NFA,t}^{e,5}$ is the expectation for the level of the net foreign asset position in five years, and $F_{CA,t}^{e,5}$ is the expectation for the level of the current account in five years. Standard errors clustered by country in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Regression of 5yr-5yr forward interest rate, using IMF 5yr ahead expectations

	Dependent Variable: i_t^{5y5y}							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i_t^{st}	-0.085*** (0.015)	-0.075*** (0.020)	-0.062*** (0.015)	-0.049** (0.023)	-0.026* (0.014)	-0.025 (0.024)	-0.100*** (0.014)	-0.102*** (0.017)
i_{t-1}^{lt}	0.792*** (0.025)	0.790*** (0.036)	0.787*** (0.023)	0.765*** (0.039)	0.778*** (0.023)	0.776*** (0.038)	0.769*** (0.024)	0.765*** (0.028)
$g_t^{e,5}$	3.905 (3.011)	2.676 (2.972)	1.630 (3.000)	0.067 (2.981)	0.335 (2.605)	0.644 (3.519)	-5.037* (2.673)	-5.372* (2.844)
$\pi_t^{e,5}$	-0.980 (3.445)	-0.103 (4.181)	-3.184 (3.521)	-0.707 (4.335)	2.001 (3.272)	1.967 (4.646)	-7.452** (3.315)	-7.687** (3.462)
$D_{gross,t}^{e,5}$	0.410*** (0.069)	0.448*** (0.099)						
$D_{gross,t}^{e,5} F_{nfa,t}^{e,5}$		-0.002* (0.001)						
$D_{net,t}^{e,5}$			0.252*** (0.048)	0.353*** (0.063)				
$D_{net,t}^{e,5} F_{nfa,t}^{e,5}$				-0.002*** (0.000)				
$D_{Def,t}^{e,5}$					2.685*** (0.595)	3.021*** (0.909)		
$D_{Def,t}^{e,5} F_{CA,t}^{e,5}$						-0.092 (0.073)		
$D_{Pri,t}^{e,5}$							0.063 (0.562)	-0.600 (0.705)
$D_{Pri,t}^{e,5} F_{CA,t}^{e,5}$								0.012 (0.063)
$F_{NFA,t}^{e,5}$		0.052 (0.067)		-0.103** (0.042)				
$F_{CA,t}^{e,5}$						-0.453 (0.568)		-1.136*** (0.431)
R2	0.982	0.982	0.982	0.983	0.983	0.983	0.982	0.982
Obs.	959	959	1015	1015	1066	1066	914	914

The dependent variable in each regression is the 5yr-5yr forward interest rate i_t^{5y5y} . For other variable definitions see notes to Table 3.

Table 5: Marginal effect of debt and deficits on long-term interest rates, estimated using IMF 5yr ahead expectations

10y Interest Rate:					
Gross Debt:			Net Debt:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	0.809***	1.101***	Financed Home	0.509***	0.818***
Financed Abroad	0.939***	1.231***	Financed Abroad	0.824***	1.133***
Difference top to bottom	0.130		Difference top to bottom	0.315**	
Difference left to right	0.292		Difference left to right	0.309***	
Deficit:			Primary Deficit:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	4.930***	7.470***	Financed Home	-0.317	-0.058
Financed Abroad	6.672***	9.211***	Financed Abroad	2.553	2.813
Difference top to bottom	1.741		Difference top to bottom	2.870***	
Difference left to right	2.539**		Difference left to right	0.259	
5y5y Forward Interest Rate					
Gross Debt:			Net Debt:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	1.776***	2.499***	Financed Home	1.241***	1.766***
Financed Abroad	2.258***	2.981***	Financed Abroad	1.902***	2.427***
Difference top to bottom	0.482*		Difference top to bottom	0.661***	
Difference left to right	0.723*		Difference left to right	0.525***	
Deficit:			Primary Deficit:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	12.254***	14.717***	Financed Home	-2.400	-2.713
Financed Abroad	14.890***	17.353***	Financed Abroad	2.478	2.165
Difference top to bottom	2.636		Difference top to bottom	4.878***	
Difference left to right	2.463		Difference left to right	-0.313	

Computes the marginal effects from the regression equations using the specification in the table in section 2. Computed using the regression results in Tables 3 and 4. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

5 Estimation with differences, not levels

Plante et al. (2026) argue that debt non-stationarity complicates estimation using the Laubach (2009) specification. Government debt levels have been steadily increasing over time and interest rates have been decreasing, so a regression in levels will pick up a spurious negative correlation between the two. In their study focusing on U.S. data, Plante et al. (2026) estimate in difference, not levels. Thus as an alternative specification we can estimate in year-over-year differences

$$\Delta i_{j,t}^{10y} = \gamma_2 \Delta i_{j,t}^{3m} + \gamma_3 \Delta g_{j,t}^{e,2} + \gamma_4 \Delta \pi_{j,t}^{e,2t} + \gamma_5 \Delta D_{j,t}^{e,2} + \gamma_6 \Delta (F_{j,t}^{e,2} D_{j,t}^{e,2}) + \gamma_7 \Delta F_{j,t}^{e,2} + \epsilon_{j,t} \quad (1)$$

Following the steps discussed in section 2 of the main text, the marginal effects of an increase in D on interest rates is given by (using the fact that $\Delta (F_{j,t}^{e,2} D_{j,t}^{e,2}) \approx F_{j,t}^{e,2} \Delta D_{j,t}^{e,2} + D_{j,t}^{e,2} \Delta F_{j,t}^{e,2}$):

	Creditor	Debtor
Financed Home	$\gamma_5 + \gamma_6 \bar{F}$	$\gamma_5 - \gamma_6 \bar{F}$
Financed Abroad	$\gamma_5 + \gamma_6 \bar{F} + \gamma_6 \bar{D} - \gamma_7$	$\gamma_5 - \gamma_6 \bar{F} + \gamma_6 \bar{D} - \gamma_7$

Table 6: Regression of 10yr interest rate, in differences

	Dependent Variable: Δi_t^{lt}							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δi_t^{st}	0.341*** (0.029)	0.345*** (0.030)	0.348*** (0.034)	0.351*** (0.035)	0.347*** (0.028)	0.348*** (0.027)	0.341*** (0.031)	0.344*** (0.030)
$\Delta g_t^{e,2}$	17.121*** (5.923)	17.244*** (5.966)	18.698*** (6.325)	18.438*** (6.363)	21.953*** (5.729)	22.489*** (5.852)	19.563*** (6.378)	20.439*** (6.534)
$\Delta \pi_t^{e,2}$	36.115*** (6.441)	36.180*** (6.468)	35.356*** (6.533)	35.345*** (6.541)	40.753*** (6.390)	39.545*** (6.313)	37.641*** (7.556)	36.605*** (7.343)
$\Delta D_{gross,t}^{e,2}$	0.984** (0.449)	1.064** (0.472)						
$\Delta D_{gross,t}^{e,2} F_{nfa,t}^{e,2}$		-0.007* (0.004)						
$\Delta D_{net,t}^{e,2}$			0.481 (0.421)	0.576 (0.454)				
$\Delta D_{net,t}^{e,2} F_{nfa,t}^{e,2}$				-0.003 (0.002)				
$\Delta D_{Def,t}^{e,2}$					6.652*** (2.003)	7.768*** (2.147)		
$\Delta D_{Def,t}^{e,2} F_{CA,t}^{e,2}$						-0.310** (0.146)		
$\Delta D_{Pri,t}^{e,2}$							2.264 (1.753)	3.288 (2.590)
$\Delta D_{Pri,t}^{e,2} F_{CA,t}^{e,2}$								-0.184 (0.149)
$\Delta F_{NFA,t}^{e,2}$		0.406* (0.238)		0.010 (0.039)				
$\Delta F_{CA,t}^{e,2}$						-2.761 (1.949)		-3.084 (2.034)
R2	0.394	0.397	0.397	0.399	0.393	0.398	0.391	0.394
Obs.	543	543	492	492	587	587	482	482

See notes to Table 1 in the text.

Table 7: Regression of 5yr-5yr forward interest rate, in differences

	Dependent Variable: i_t^{5y5y}							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δi_t^{st}	0.234*** (0.037)	0.241*** (0.038)	0.255*** (0.037)	0.259*** (0.037)	0.240*** (0.034)	0.245*** (0.034)	0.234*** (0.036)	0.238*** (0.036)
$\Delta g_t^{e,2}$	6.121 (5.732)	6.209 (5.777)	9.828* (5.858)	9.584 (5.887)	13.223** (5.572)	13.904** (5.743)	10.363* (5.776)	11.251* (6.028)
$\Delta \pi_t^{e,2}$	23.484*** (7.323)	23.199*** (7.271)	24.519*** (7.563)	24.360*** (7.542)	30.634*** (7.283)	29.190*** (7.172)	28.052*** (7.449)	27.126*** (7.308)
$\Delta D_{gross,t}^{e,2}$	1.056** (0.463)	1.181** (0.493)						
$\Delta D_{gross,t}^{e,2} F_{nfa,t}^{e,2}$		-0.007* (0.004)						
$\Delta D_{net,t}^{e,2}$			0.844** (0.418)	0.951** (0.460)				
$\Delta D_{net,t}^{e,2} F_{nfa,t}^{e,2}$				-0.003 (0.002)				
$\Delta D_{Def,t}^{e,2}$					7.738*** (2.278)	8.757*** (2.246)		
$\Delta D_{Def,t}^{e,2} F_{CA,t}^{e,2}$						-0.266 (0.189)		
$\Delta D_{Pri,t}^{e,2}$							3.207* (1.840)	3.884 (2.570)
$\Delta D_{Pri,t}^{e,2} F_{CA,t}^{e,2}$								-0.121 (0.167)
$\Delta F_{NFA,t}^{e,2}$		0.431* (0.246)		0.006 (0.040)				
$\Delta F_{CA,t}^{e,2}$						-2.261 (2.096)		-2.167 (2.129)
R2	0.184	0.189	0.209	0.212	0.198	0.203	0.197	0.199
Obs.	484	484	454	454	524	524	448	448

The dependent variable in each regression is the 5yr-5yr forward interest rate i_t^{5y5y} . For other variable definitions see notes to Table 1 in the text.

Table 8: Marginal effect of debt and deficits on long-term interest rates, estimated from differences regression

10y Interest Rate:					
Gross Debt:			Net Debt:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	0.785**	1.344**	Financed Home	0.472	0.680
Financed Abroad	0.945**	1.504**	Financed Abroad	0.552	0.760
Difference top to bottom	0.160**		Difference top to bottom	0.081**	
Difference left to right	0.559*		Difference left to right	0.208	
Deficit:			Primary Deficit:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	6.839***	8.698***	Financed Home	2.738	3.839
Financed Abroad	10.064***	11.924***	Financed Abroad	5.675*	6.776*
Difference top to bottom	3.226		Difference top to bottom	2.937	
Difference left to right	1.859**		Difference left to right	1.101	
5y5y Forward Interest Rate:					
Gross Debt:			Net Debt:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	0.881**	1.480**	Financed Home	0.847**	1.056**
Financed Abroad	1.056**	1.654**	Financed Abroad	0.932**	1.142**
Difference top to bottom	0.175**		Difference top to bottom	0.086**	
Difference left to right	0.598*		Difference left to right	0.210	
Deficit:			Primary Deficit:		
	Creditor	Debtor		Creditor	Debtor
Financed Home	7.959***	9.555***	Financed Home	3.522	4.247
Financed Abroad	10.619***	12.215***	Financed Abroad	5.592*	6.317*
Difference top to bottom	2.660		Difference top to bottom	2.071	
Difference left to right	1.596		Difference left to right	0.725	

Computes the marginal effects from the regression equations using the specification in this appendix. Computed using the regression results in Table 6 and 7. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

References

- Gruber, Joseph W, Kamin, Steven B, 2012. Fiscal positions and government bond yields in oecd countries. *Journal of Money, Credit and Banking* 44 (8), 1563–1587.
- Lane, Philip R., Milesi-Ferretti, Gian Maria, 2007. The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970-2004. *Journal of International Economics* 73, 223–250.
- Laubach, Thomas, 2009. New evidence on the interest rate effects of budget deficits and debt. *Journal of the European economic Association* 7 (4), 858–885.
- Müller, Karsten, Xu, Chenzi, Lehib, Mohamed, Chen, Ziliang, 2025. The global macro database: A new international macroeconomic dataset. NBER Working Paper No. 33714.
- Plante, Michael D, Richter, Alexander W, Zubairy, Sarah, 2026. Revisiting the interest rate effects of federal debt. *Review of Economics and Statistics*, 1–24.