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WHAT WILL IT TAKE TO STABILISE DEBT IN ADVANCED COUNTRIES?

ZSOLT DARVAS, GONZALO HUERTAS, LENNARD WELSLAU AND JEROMIN ZETTELMEYER

This paper analyses the prospects for debt stabilisation in the countries of the European Union, the United Kingdom and the United States, using two methodologies. First, we estimate the level of the structural primary balance that is required to asymptotically stabilise the debt ratio with a 70 percent probability, and assess the plausibility of reaching this level over the medium term, using both historical benchmarks and stochastic forecasts centred on International Monetary Fund projections. Second, we estimate 'fiscal reaction functions' that measure the reaction of the primary balance to the debt level.

We find that: 1) debt-stabilising primary balances are generally within historical precedent – well below 3 percent of GDP; 2) the fiscal adjustment required to reach debt-stabilising primary balances is very high in several countries – specifically, the US, France, the UK, Slovakia, Poland and Romania, which must increase their primary fiscal balances by over 5 percentage points of GDP; 3) the feedback coefficient from debt to the primary balance remains positive in all countries, but has significantly declined since the global financial crisis and is not significantly different from zero in most countries.

Our main conclusion is that public debt in the countries in our sample remains sustainable in the sense that the fiscal adjustment required to stabilise the debt is feasible. However, undertaking this adjustment will require a larger and/or more protracted fiscal effort than has been typical for most advanced countries and that is currently expected by the IMF. In the meantime, countries with large adjustment needs could be vulnerable to shifts in market sentiment.

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Zsolt Darvas (zsolt.darvas@ bruegel.org) is a Senior Fellow at Bruegel
Gonzalo Huertas is an Economist at the International Monetary Fund
Lennard Welslau is a doctoral student at the University of Copenhagen and Danmarks Nationalbank and a former Bruegel Research Analyst
Jeromin Zettelmeyer (jeromin.zettelmeyer@ bruegel.org) is Director of Bruegel

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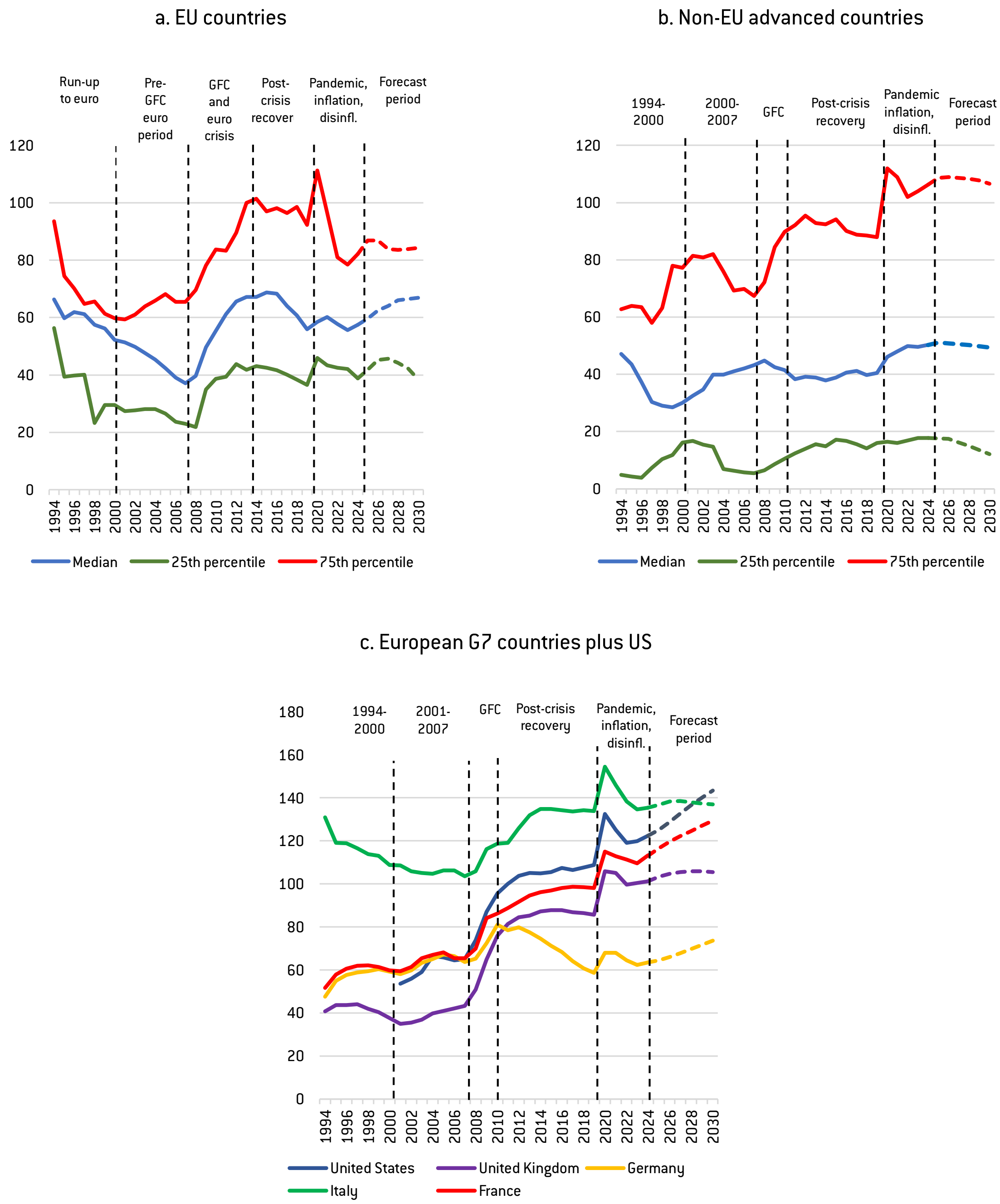
1 Introduction

During the 2020 COVID-19 pandemic, a combination of high deficits and large output declines pushed up debt as a share of GDP to high levels in most advanced countries (Figure 1). Debt ratios have since declined as a result of post-COVID-19 recoveries and the 2022-23 burst in inflation, but significant concerns about fiscal sustainability persist. Debt remains high and debt drivers appear to have shifted in the wrong direction [1]. Compared to 2019, real interest rates have increased by about 2.5 percentage points in advanced economies, while growth remains tepid in the European Union, working populations are projected to shrink, and the fiscal costs of pensions and long-term care are rising. Many advanced countries face new sources of fiscal pressure, including public spending on climate and defence. Trade conflict and economic fragmentation may further weigh on productivity growth.

The International Monetary Fund expects the median and 75th percentile levels of the debt distribution to stabilise within the five-year forecast period of its *World Economic Outlook* (WEO; see Figure 1), but this does not necessarily dispel the concerns. First, the projections underlying Figure 1 do not take into account uncertainty: adverse growth or interest rate shocks, or lower-than-projected fiscal balances, could push debt above the IMF's baseline expectations. Second, the WEO's five-year projection horizon may be too short to capture the impact of debt drivers that are likely to push debt back up. These include both ageing costs and average borrowing costs, which rise slowly as low-interest rate bonds mature. Third, Panels A and B in Figure 1 do not show the debt trajectories of individual countries. As of October 2025, the IMF was projecting the 2030 debt ratio to exceed the debt ratio in 2024 in 23 out of the 37 advanced countries represented in Panels A and B of Figure 1, including five of the G7 countries (France, Germany, Italy, the United Kingdom and the United States, with large differences across these countries – see Figure 1, Panel C).

[1] See, among other, Auerbach (2025), IMF (2024), Jiang *et al* (2024), Darvas *et al* (2024b), Summers (2023) and Zettelmeyer *et al* (2023).

Figure 1: General government gross debt, % of GDP, 1990-2024 and 2025-2030 forecasts



Source: IMF World Economic Outlook Database, October 2025. Note: EU sample includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Netherlands, Portugal, Spain and Sweden from 1994, Cyprus, Czech Republic, Estonia, Hungary, Ireland, Luxembourg, Malta, Poland, Slovak Republic, Slovenia from 1995, Bulgaria, Croatia, Latvia and Lithuania from 1998, and Romania from 2000. Non-EU sample includes Australia, Canada, Iceland, Japan, Korea, New Zealand, Norway, Singapore, Switzerland and the United Kingdom from 1994, Taiwan PoC from 1997, Israel from 2000, the United States from 2001 and Hong Kong SAR from 2004.

This paper provides a granular, country-by-country debt sustainability assessment for the EU countries, the US and the UK, based on two approaches that have been used in the empirical literature on debt sustainability since the late 1990s.

The first is based on a stochastic forecast of the debt ratio, conditional on growth, interest-rate and exchange-rate expectations and assumptions about future fiscal policy, as summarised by the annual structural primary balance (SPB, the difference between cyclically adjusted non-interest spending and revenues). In 2024, the structural primary balance was in deficit in 21 of the 29 countries in our main sample. In many of these countries, failure to reduce these deficits would likely lead to exploding debt. This does not mean that debt is necessarily unsustainable, but it means that countries need to adjust. To see by how much, we compute the structural primary balance that would be required by the end of a seven-year adjustment period to stabilise the debt ratio with 70 percent probability at the end of a 20-year horizon. We then evaluate the feasibility and plausibility of reaching this SPB against a variety of benchmarks, including countries' medium term fiscal plans, past episodes of fiscal adjustment and IMF forecasts.

The second approach involves the estimation of a fiscal reaction function – that is, the feedback from higher debt to the primary balance. It is intuitive (and easy to show) that a sufficiently large and positive feedback (higher debt induces fiscal adjustment) will rule out explosive debt paths. We compare the strength of fiscal reactions over time and across countries using multiple specifications, including a cubic reaction function to allow for the possibility that the reaction of the primary surplus to higher debt declines for high debt levels (*"fiscal fatigue"*, see Ghosh *et al*, 2013).

The two approaches have different strengths and weaknesses. The first approach can be sensitive to assumed growth and interest-rate forecasts, the stochastic projection methods used and the definition of by when debt is required to stabilise. The strength of the fiscal reaction function approach is that it does not rely on projections. But it makes some assumptions of its own, which we discuss briefly in the next section.

Based on both approaches, our main conclusion is that debt in advanced countries remains sustainable in the sense that the primary balance required to stabilise the debt ratio is likely feasible. However, the adjustment needed to get there is exceptionally high in a handful of countries, implying that these countries will need to continue running substantial deficits – and will thus be vulnerable to a loss of market confidence – for a protracted period.

In the remainder of the paper, we begin by defining 'debt sustainability' and describing in greater detail our two approaches for analysing it. Section 3 presents medium-term fiscal adjustment requirements based on a stochastic debt sustainability analysis. Section 4 discusses the feasibility and plausibility of these requirements. Section 5 estimates and evaluates fiscal reaction functions. Section 6 concludes.

2 Debt sustainability: what it means and how it can be measured

Sovereign debt is considered unsustainable *"if it cannot be repaid without changing the contractual terms of the debt or rendering them irrelevant, via default, restructuring, or hyperinflation"* (Willems and Zettelmeyer, 2022). This definition implies a distinction between debt sustainability and the sustainability of fiscal policy. The latter is unsustainable if debt cannot be repaid based on *current* fiscal policy – for example, if high deficits lead to ever-higher debt levels, to the point that markets refuse to roll over maturing debt. In contrast, debt is unsustainable if it cannot be repaid under *any feasible* fiscal policy. Hence, the statement that debt is unsustainable is much stronger than the statement that fiscal policy is unsustainable.

Empirical tests of debt sustainability in advanced countries initially focused on ruling out government 'Ponzi schemes', in which the value of the debt rises over time purely in the expectation that it can be resold in the future [2]. If the government does not engage in Ponzi schemes, the present value of debt must be matched by repayment capacity. However, statistical tests of the 'no-Ponzi-scheme' condition did not always lead to clear results.

Starting with a seminal paper by Kremers (1988), much of the empirical literature on debt sustainability has therefore focused on a somewhat strong condition that is easy to test: stabilisation of the debt-to-GDP ratio [3]. Ever-growing debt as a share of GDP will eventually overwhelm a country's ability to repay. This leads to the debt sustainability definition used in this paper: we consider debt to be sustainable when the fiscal effort required to stabilise the debt profile looks feasible [4].

The question is how to determine 'feasibility'. We follow two approaches.

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[2] See Willems and Zettelmeyer (2022) for references and a survey.

[3] Denoting the debt-to-GDP ratio at time t with d_t, debt stabilisation requires $\lim_{t\to\infty} d_t = d$, where d is a constant greater or equal to zero. In contrast, the no-Ponzi-scheme condition requires $\lim_{t\to\infty} q_t d_t = 0$, where q_t is the growth-adjusted discount factor between time 0 and time t: $q_t \equiv \prod_{n=0}^{t-1} \frac{1+r_n}{1+g_n}$, where r_n and g_n denote the interest rate and the economic growth rate, respectively. Hence, debt stabilisation is a stronger condition than the no-Ponzi-scheme condition: the former states that the rate of growth of the debt ratio is asymptotically zero, whereas the latter implies that the asymptotic rate of growth of the debt ratio can be positive, so long as it grows more slowly than the growth-adjusted asymptotic interest rate.

[4] This is a simplified version of the debt sustainability definition used by the IMF: *"Public debt can be regarded as sustainable when the primary balance needed to at least stabilize debt under both the baseline and realistic shock scenarios is economically and politically feasible, such that the level of debt is consistent with an acceptably low rollover risk and with preserving potential growth at a satisfactory level."* See IMF (2013, 2021, p. 6). Unlike the IMF's Sovereign Risk and Debt Sustainability Framework (SRDSF) for market access economies (IMF, 2021, 2022), our analysis ignores rollover risk. Like the IMF's SRDSF, we do not address the question whether debt stabilisation might lowering rather than just stabilising debt might generate growth benefits (on the relationship between debt and economic growth, see Pescatori *et al*, 2014, and Cecchetti *et al*, 2011).

2.1 Plausibility of reaching the debt-stabilising primary balance

The first is used by policy organisations including the IMF, European Commission, European Central Bank and European Stability Mechanism, as well as in an academic literature that includes Celasun *et al* (2006), Consiglio and Zenios (2017), Zenios *et al* (2021) and Blanchard (2021). This computes the medium-term fiscal adjustment required to stabilise the debt with some probability, using stochastic debt projections that assume that the parameters of fiscal policy under the direct control of governments – tax rates, discretionary spending and the parameters governing entitlement spending – remain unchanged after the adjustment period. At the IMF, this is normally three to four years (the maximum length of an IMF programme), while the European fiscal rules require adjustment within four to seven years.

The primary indicator used to assess the feasibility of adjustment is the level of the (permanent) primary balance required to stabilise the debt. While there are episodes of high primary surpluses over short periods (for example, Belgium and Italy achieved primary surpluses of over 5 percent of GDP in the run-up to the euro, and Greece and Cyprus achieved primary surpluses of over 4 percent in the aftermath of their debt crises in the last decade), sustained high primary surpluses in excess of 3 percent are rare. The record holder in the EU is Belgium, which achieved this level in 15 of the last 45 years, followed by Italy and Cyprus, with seven of the last 45 years (see section 4.2, and Eichengreen and Panizza, 2014, and Zettelmeyer *et al*, 2017, for historical analyses). Hence, a debt-stabilising primary surplus above 3-3.5 percent of GDP would normally be viewed as a red flag.

A secondary indicator is the required adjustment over the medium term, ie the difference between the primary surplus 'target' (the debt-stabilising surplus) and the primary balance prior to adjustment. The feasibility of this adjustment can again be assessed using the historical record. In addition, medium-term budgetary plans may indicate the willingness (or lack thereof) of a current government to make the adjustment.

Importantly, feasibility assessments based on the level of the debt-stabilising primary surplus are generally on firmer ground than those based on the total size of the adjustment that needs to be undertaken to reach that level. This is because the latter is much more sensitive than the former to the assumed time horizon of adjustment. While the assumed adjustment horizon influences the level of the debt-stabilising primary balance – because slower adjustment leads to higher debt at the end of the adjustment period – the impact is typically in the low decimal range [5]. In contrast, for countries with large deficits, adjustment over short periods might be politically and economically unfeasible but

[5] This relates to the fact that the debt-stabilising primary balance is defined as a *permanent* fiscal balance to stabilise the debt. Hence, so long as the differential between interest rates and growth rates is low, even a substantial increase in the debt ratio can be paid off with a modest increase in the structural primary balance. For example, if the impact of a longer adjustment period is to raise the debt by 10 percentage points and the interest-growth differential is 2 percent, then the debt-stabilising primary balance will increase by approximately $0.02 * 10 = 0.2$ percent of GDP.

could become feasible, from the debtor country perspective, if stretched over time. The feasibility of stretching adjustment over time will depend on the patience of private and/or official lenders, which is very difficult to assess.

2.2 Reaction of the primary balance to debt level

The second approach adopted in this paper follows a methodology first applied by Henning Bohn (1998). This consists of estimating a fiscal reaction function (FRF) of the type:

$$s_t = \rho d_{t-1} + z_t + \epsilon_t \qquad (1)$$

where s_t is the primary surplus as a share of GDP, d_{t-1} is debt as a share of GDP, z_t is a set of controls, and ε_t is the error term. If the feedback parameter ρ is large enough – specifically, if $1+\rho$ is larger than $\frac{1+r_t}{1+g_t}$ (or equivalently, $\rho \gtrsim r_t - g_t$) then the debt ratio will stabilise [6]. Bohn (1998) estimated the feedback parameter ρ to be about 0.05. Since $r_t - g_t$ in advanced countries has historically been negative or in the order of a few basis points, this is more than enough for debt stabilisation [7].

There is a potential problem, however. What if the feedback from debt to the primary surplus weakens at high debt levels? Ghosh *et al* (2013) referred to this phenomenon as *"fiscal fatigue"*. Once fiscal fatigue sets in, primary surpluses may not be high enough to offset debt-interest payments and the debt dynamics become explosive, especially if the risk premium rises with the debt level. To allow for this possibility, we follow Ghosh *et al* (2013) by estimating a third-order polynomial fiscal reaction function of the form:

$$s_t = f(d_{t-1}) + z_t + \epsilon_t \qquad (2)$$

where $f(d_{t-1})$ is a cubic function of lagged debt. This specification also allows the estimation of a 'debt limit', the level of the debt ratio above which debt would not be stabilised because of the inability to raise the primary surplus further and the rising risk premium. We compare current debt and fiscal positions to the estimated debt limits.

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[6] To see this, start with the debt dynamics identity $d_{t+1} = \frac{1+r_t}{1+g_t} d_t - s_{t+1}$ and substitute $s_{t+1} = \rho d_t + z_{t+1} + \epsilon_{t+1}$. Solving for d_{t+1} leads to $d_{t+1} = \left[\frac{1+r_t}{1+g_t}/(1+\rho)\right] d_t - v_{t+1}$, where $v_{t+1} \equiv -(z_{t+1} + \epsilon_{t+1})/(1+\rho)$. Hence, if $\frac{1+r_t}{1+g_t} d_t < 1$, and z_t is stationary, the debt ratio will revert to a stationary mean. See Willems and Zettelmeyer (2022) for a discussion.

[7] Auerbach (2003, 2025) proposed a closely related approach: estimating fiscal reactions to *projected* deficits. This works well for the US, where the Congressional Budget Office undertakes such projections twice a year.

The advantage of the fiscal reaction function approach is that it does not require an assumption that fiscal adjustment must happen within a pre-determined timeframe, nor does it depend on future growth and interest rate assumptions. But it makes some strong assumptions of its own, particularly that the average response of the primary balance to the debt ratio in the past will continue in the future. We return to these issues in section 5.

3 Medium-term fiscal adjustment requirements

3.1 Methodology

Our main vehicle for determining medium-term fiscal adjustment requirements is a stochastic debt sustainability analysis (SDSA). This approach is similar to that used by the European Commission and to the fanchart module of the IMF's debt sustainability framework for market-access countries, but with some significant differences (Box 1).

Like the Commission's SDSA, our methodology starts with a deterministic projection of the debt ratio, based on assumptions about the future evolution of the primary balance, nominal growth, inflation, interest rates and exchange rates, using forecasts from both official sources (for growth) and market sources (for interest rates, exchange rates and inflation rates) [8].

[8] For growth, we use medium-term projections from the EU's Potential Output Working Group and long-term projections from the EU Ageing Cost Working Group (see annex I for details), UK projections from the Office of Budget Responsibility, and US forecasts from the Congressional Budget Office. Nominal interest rates are assumed to converge to 10-year ahead financial market expectations, and long (short) term rates then converge to 4 (2) percent in the long-term. Inflation in assumed to linearly converge to 10-year ahead financial market expectations, and subsequently to national inflation targets (2 percent except for Poland, Romania and Hungary).

Box 1: Main features of the stochastic DSA methodology used in this paper

Our SDSA methodology borrows from the European Commission (2024) methodology and from the fanchart module of the IMF's (2021, 2022) sovereign risk and debt sustainability framework, but differs in some significant aspects (Table B1).

Table B1: Comparison of stochastic DSA methodologies

Category	IMF	European Commission	Our methodology
Maturity structure of public debt	Bond-level data	Simplifying assumptions based on average maturity of debt stock	Bond-level data
Modelling of uncertainty	Block bootstrap (consecutive historical debt driver realisations, allows asymmetric distributions)	Normal shock distribution (based on estimated variance-covariance matrix, symmetric distributions)	VAR-Bootstrap (coefficients and residual draws from VAR(1) estimated on historical data, allows asymmetric distributions)
Uncertainty during adjustment period	All debt drivers stochastic from outset	Uncertainty only after adjustment period	All debt drivers stochastic from outset (primary balance s.t. uncertainty after adjustment period)
Fanchart Length	5 years (10 years in debt restructuring contexts)	5 years	20 years
Debt sustainability requirement	Debt-risk score (low/moderate/high) based on fanchart width, probability of debt non-stabilisation, and terminal debt level	Debt at 5-year fanchart end lower with 70% probability than adjustment period end, continuous 10-year decline under deterministic stress tests	Debt stabilisation with probability 70% at 20-year horizon end (flat slope of 70th percentile in last 5 years)
Deterministic stress tests	No deterministic stress tests	Three deterministic stress tests (SPB decline, interest rate-growth differential increase, temporary borrowing cost rise)	No deterministic stress tests

Maturity structure of public debt. Like the IMF, we use bond-level data for the exact maturity of public debt components, while the Commission adopts simplifying assumptions about the maturity structure of debt. This can make a significant difference, with the Commission methodology implying up to a half percentage point higher average interest rate, thereby overestimating the fiscal adjustment needs.

Modelling of uncertainty. We use a bootstrap approach (Bouabdallah *et al*, 2017) which draws shocks from the error term of a VAR model estimated on historical data of the main debt drivers, such as interest rates, the primary balance, real growth and inflation. This involves estimating a vector autoregression (VAR) model of the debt drivers, which captures their interdependencies. For each year and debt driver, we take a random draw from the set of historical residuals of the estimated model, and use these and the model's estimated coefficients to calculate a new path for the debt drivers and for the associated debt. By repeating this process, we generate thousands of distinct debt paths, allowing us to approximate a probability distribution around the deterministic forecast. The Commission instead estimates the variance-covariance matrix of a normal distribution of shocks. The IMF (2021, 2022) uses a block bootstrap, directly drawing consecutive historical realisations of debt drivers to construct the debt paths. Our approach models cross-sectional and serial correlation more explicitly, without imposing structural breaks every two years.

Uncertainty during the adjustment period. Like the IMF, we consider all debt drivers to be stochastic from the outset, except for the primary balance which we treat as a policy variable during the adjustment period. This differs from the approach of the European Commission, which considers uncertainty only after the adjustment period, and makes our SDSA more conservative than the Commission's DSA in the sense of requiring more fiscal adjustment to achieve a debt reduction with a given probability, since it leads to a wider fanchart after the adjustment period has ended.

Fanchart length and methodology. Since debt sustainability is a long-term property, we use a 20-year fanchart – the longest that we feel we can estimate with reasonable reliability – while the European Commission uses five years (as does the IMF except in debt-restructuring contexts, when a 10-year fanchart is used). Furthermore, the bootstrap approach used to create our fancharts allows asymmetric distributions – that is, risks weighted to the upside or downside – whereas the Commission methodology does not (it is based on the assumption that distributions are normal).

Requirement of debt stabilisation, not average debt decline. The European Commission's methodology requires debt at the end of the five-year fanchart horizon to be lower with a 70 percent probability than at end of the adjustment period, and for debt to fall continuously for at least 10 years under three deterministic stress tests (see below). In contrast, we require debt stabilisation with probability p (where p is normally 70 percent) at the end of the 20-year horizon, as measured by a flat (zero) slope of the p*-th* percentile of the fanchart in the last five years. In principle, this could be consistent with a higher expected debt level the end of the 20-year horizon relative to its level at the end of the adjustment period. However, even in our approach, the requirement that debt stabilises with 70 percent probability typically implies that median debt (i.e. debt at the 50th percentile) will fall.

No deterministic stress tests. Like the IMF, we take a fully stochastic approach, eschewing deterministic stress tests. The European Commission implements three such stress tests: involving a permanent decline of SPB^* by 0.5 percent of GDP following the end of the adjustment period, a permanent increase in the interest rate-growth differential by 1 percentage point above the baseline assumption, and a temporary rise in borrowing costs. Even in the Commission's methodology, however, the requirement that debt declines with 70 percent probability is normally binding (Darvas *et al*, 2024a).

With respect to the primary balance, the projection distinguishes between two periods. During the first, the ‘adjustment period’, the primary balance is treated as a policy variable. After the end of the adjustment period, the primary balance is kept constant, except for changes in expenditures and revenues arising from demographic developments (‘ageing costs’). For example, the primary balance excluding future changes in ageing costs might be held fixed at 1 percent of GDP, but the fiscal implications of demographic change – via education, pension costs or long-term care costs – might drive the overall primary balance into deficit territory over time. Ageing-cost projections are taken from the most recent available estimates from the EU Ageing Cost Working Group and from social and healthcare spending projections by the Congressional Budget Office for the US.

The next step is to create a ‘fanchart’ – that is, quantify the uncertainty – around the simulated debt path. This is done by simulating shocks based on the historical behaviour of relevant macroeconomic variables, as described in Box 1. We do this in two variants: one that estimates the VAR and the associated distributions of the debt drivers country-by-country, and one that pools all observations from all euro-area members in 2010 that did not receive emergency financial assistance during the euro crisis [9].

The final step is to set a structural (i.e. cyclically adjusted and net of one-time fiscal measures) primary balance target for the end of the adjustment period. This target, denoted *SPB**, is chosen to be high enough for debt to stabilise with a given probability p. We follow the convention of the EU fiscal rules in setting p to 70 percent.

In line with the academic literature, we think of debt stabilisation as an asymptotic condition ($\lim_{t \to \infty} d_t = d$, where d is a constant greater or equal to zero), but we also need to consider the reality that model uncertainty will render long fancharts increasingly unreliable. Our proposed compromise is to set *SPB** such that the slope of the p-th percentile in the last five years of a 20-year fanchart equals zero. Compared to the European Commission’s methodology, which uses a short, five-year fanchart, this tends to push the required debt-stabilising primary balance up. This is because fancharts widen over time, and the absolute widening will be larger between years 15 to year 20 of the fanchart (for which we assess debt stabilisation) than between years four and nine (or seven and 12, for countries adjusting over seven years), for which the Commission assesses stabilisation. To ensure that debt falls with a 70 percent probability despite this greater uncertainty requires a greater adjustment effort.

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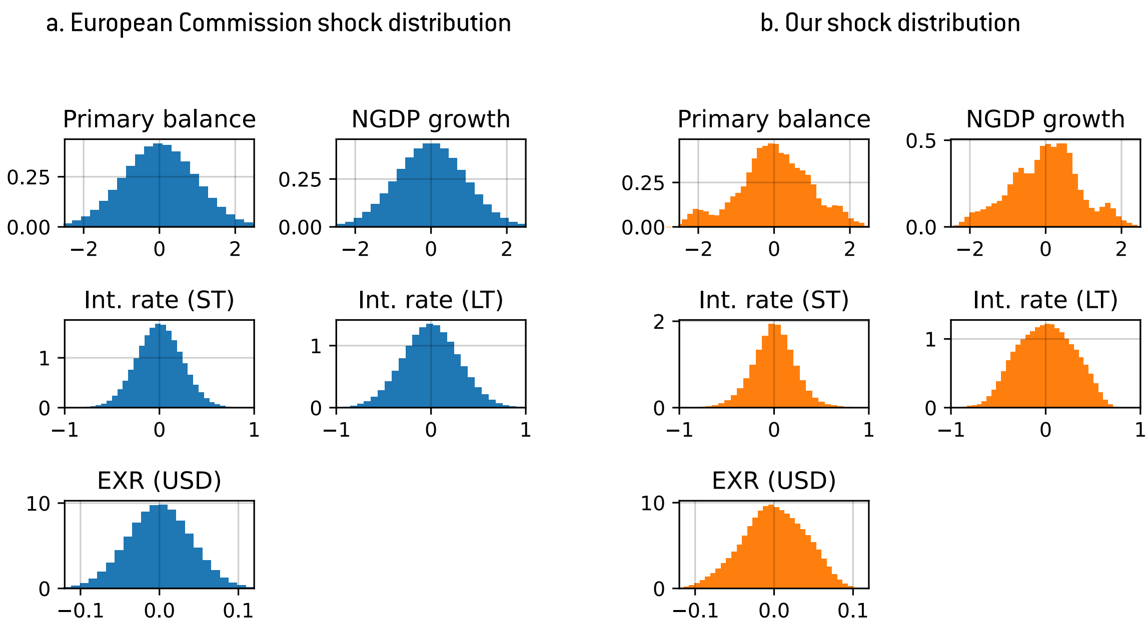
[9] That is, we estimate the VAR on the average quarterly changes in debt drivers of Austria, Belgium, Estonia, Finland, France, Germany, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Slovakia and Slovenia.

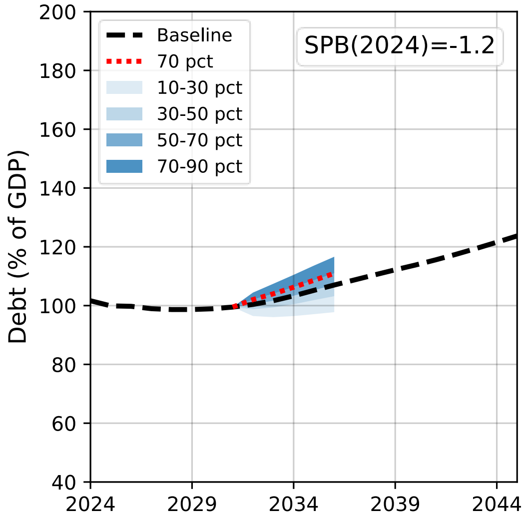
The other two main differences between our methodology and that of the Commission – that we allow asymmetric probability distributions of the debt drivers, and that require debt to stabilise in the long term, rather than immediately after the adjustment period – could impact our adjustment requirement compared to the Commission's in either direction. For example, if negative growth shocks are more likely than positive growth shocks, this would increase the adjustment requirement in our methodology compared to the Commission's. If ageing costs rise fast initially but eventually stabilise, then our methodology might deliver lower adjustment requirements than the Commission's.

Figures 2 and 3 illustrate our methodology and compare it to that of the Commission using two specific examples, Spain and Finland (chosen because the two methodologies deliver different results). Each figure consists of six charts arranged in a three-by-two matrix. The first row, denoted (a) and (b), shows the distribution of shocks to the primary balance, nominal GDP growth, short- and long-term interest rate and the €/$ exchange rate. The second row, denoted (c) and (d), shows deterministic and stochastic debt projections conditional on the 2024 structural primary balance. Both fancharts trend upwards. The third row, denoted (e) and (f), finally, shows debt projections conditional on the structural primary balance that stabilises the debt with 70 percent probability. The left column (blue) shows the results from the European Commission's methodology, while the right column (orange) shows the results from our methodology.

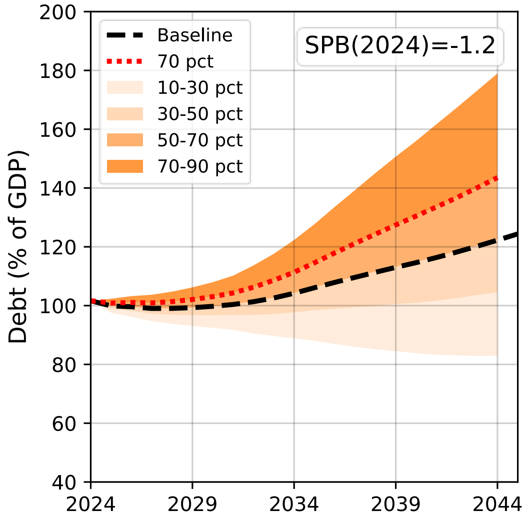
Figure 2: Comparison of SDSA methodologies for Spain



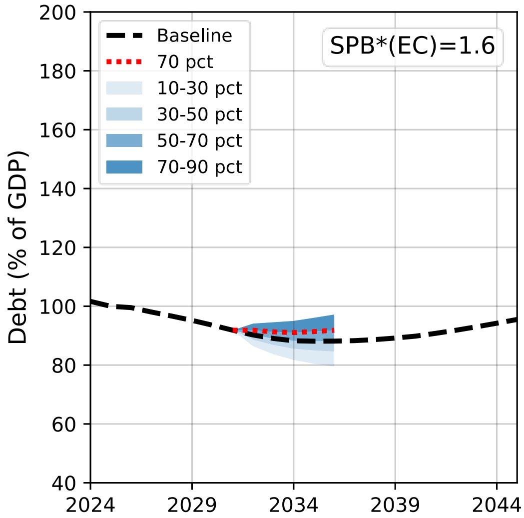
c. European Commission no-policy change scenario



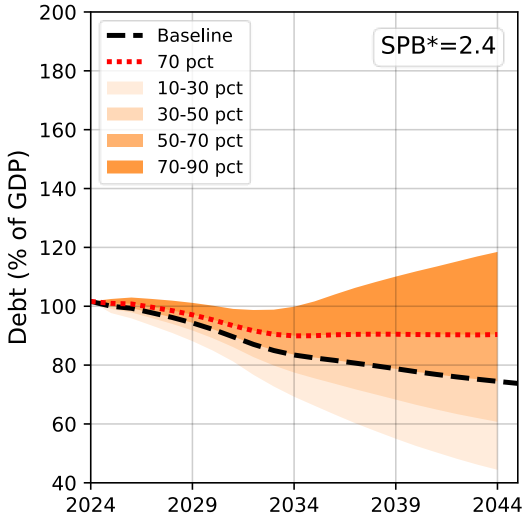
d. Our no-policy change scenario



e. European Commission debt-stabilising scenario

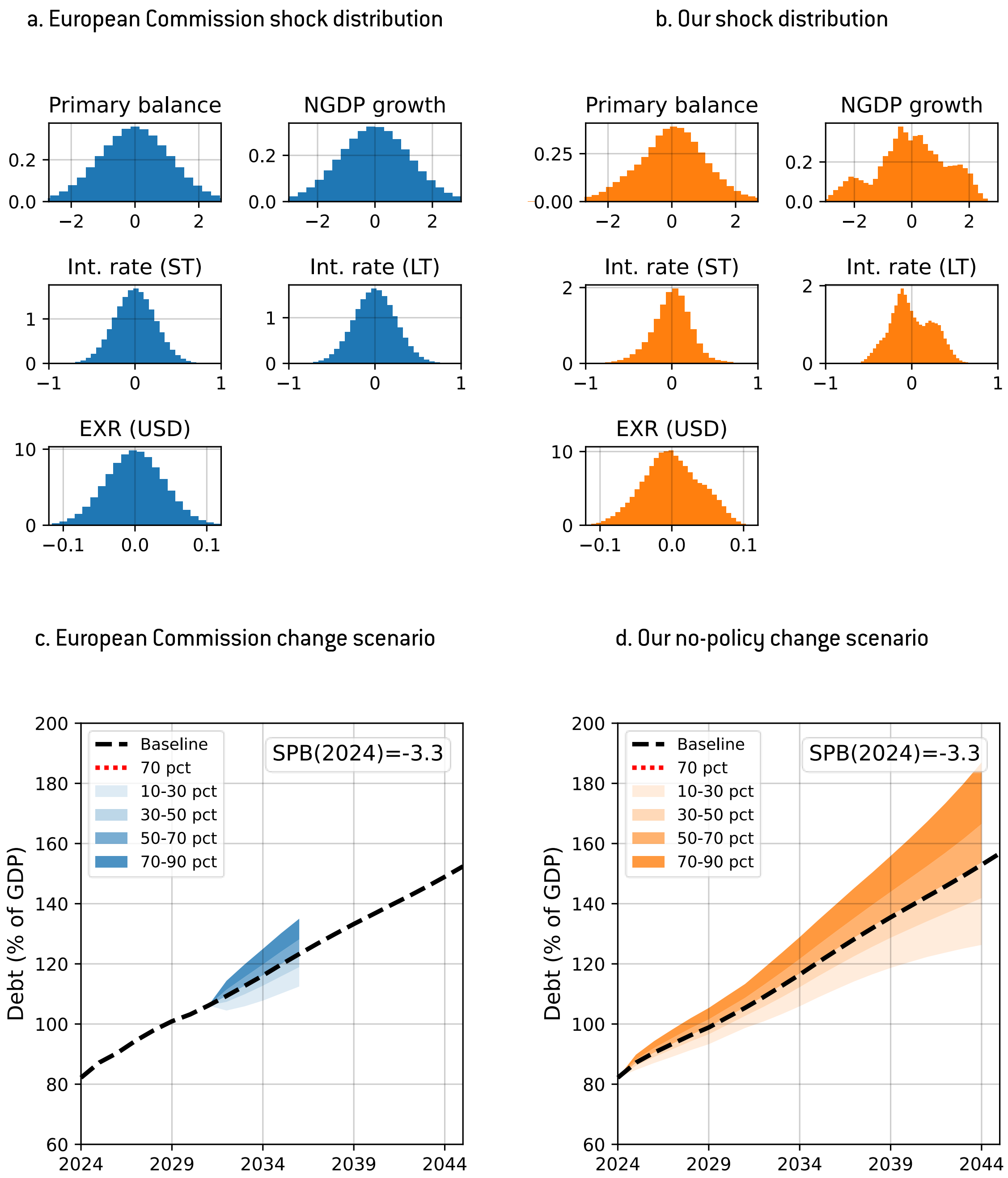


f. Our debt-stabilising scenario

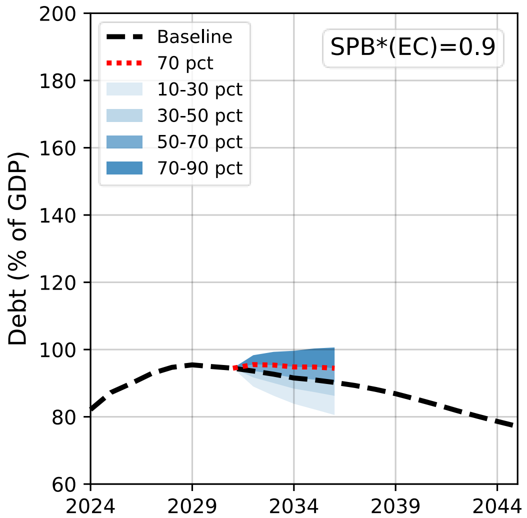


Source: Bruegel based on European Commission (2022), European Commission May 2025 forecasts, the April 2024 EU Ageing report, Bloomberg, and ECB. Notes: Columns (a) show the distribution of shocks used to construct the fancharts in columns (b) and (c). Top row shows European Commission estimates, based on the estimated variance-covariance function of a normal distribution of the exchange rate, short and long interest rates, the nominal growth rate, and the primary balance. The bottom row shows bootstrapped errors based on a vector autoregression in the same variables. Column (b) shows stochastic and deterministic debt projections for 2025-2045 conditional on maintaining the structural balance at its 2024 level (except for changes in ageing costs). Top row shows a fanchart estimated using the European Commission methodology, while the bottom row shows our fanchart. Column (c) shows fancharts conditional on raising the structural primary balance by 2031 to the level that is required to stabilise the debt with 70 percent probability. The top row uses the stabilisation criterion of the European Commission; the bottom row shows our stabilisation criterion (Box 1).

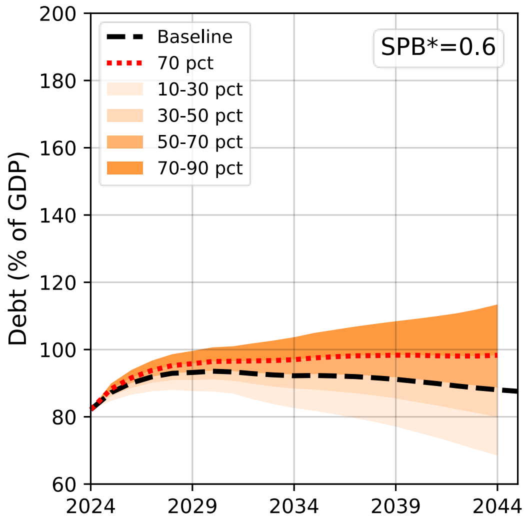
Figure 3: Comparison of SDSA methodologies for Finland



e. European Commission debt-stabilising scenario



f. Our debt-stabilising scenario



Source and notes: see Figure 2.

The differences mentioned above are visible from the comparison of the two columns. The distribution of shocks is symmetric by construction in the case of the Commission, but asymmetric in our case. The middle row illustrates the difference between the fancharts, with that of the Commission starting only at the end of the adjustment period and ending after five years, while we use a 20-year fanchart from the beginning of the adjustment period. The bottom row, finally, shows the difference in the debt-stabilisation criterion (for $p = 70\%$). In the left column, this is applied immediately after the end of the adjustment period. In our fanchart, the right column, it applies to the last five years of the fanchart (years 15 to 20).

The comparison also illustrates how the differences in methodology impact the results. The fact that we allow asymmetric distributions of the shocks turns out not to matter much, as the asymmetric and symmetric distributions are close. As a result, the medians and means of the no-policy-change-scenario fancharts are also close. However, the remaining difference matters a great deal:

- Because the no-policy-change-scenario fanchart for Spain widens substantially by 2044 in panel 2d, the 70th percentile of our fanchart (orange) in the middle row of Figure 2 is much steeper between 2039 and 2044 than the 70th percentile of the fanchart based on the Commission's methodology (blue) between 2031 and 2036. As a result, 'bending down' the 70th percentile, such that it becomes flat in the period over which debt stabilisation is defined, requires significantly greater fiscal effort under our methodology than under the Commission's (see the bottom row of Figure 2).

- In contrast, for Finland, our fanchart (orange) in the middle row of Figure 3 is less steep between 2039 and 2044 than the 70th percentile of the fanchart based on the Commission's methodology (blue) between 2031 and 2036. There are two reasons for this. First, the Finnish fanchart in panel 3d widens less than the Spanish fanchart in panel 2d because of the lower volatility of underlying shocks. Second, the growth of the median and 70th percentile of Finnish debt slows over time in panel 3d [10], while there is some acceleration for Spain in panel 2d. As a result, 'bending down' the 70th percentile for Finland, such that it becomes flat, requires less fiscal effort under our methodology that under the Commission's.

3.2 Results

Table 1 shows our results for all EU countries, the United States and the UK. The first three columns show the European Commission's Spring 2025 estimates of 2024 public debt, the fiscal balance and the structural primary balance. Columns (4) and (5) present our two main estimates of the structural balance required to achieve debt stabilisation based on our stochastic DSA methodology, that is, the primary balance that countries would need to achieve by 2031 to stabilise debt within 20-years with a 70 percent probability. SPB^* (column 4) is based on country-specific distributions of the debt drivers; $SPB^*(pooled)$ (column 5) on a common distribution drawn from a pooled regression that includes the non-crisis euro-area countries. Column (6) shows estimates according to the European Commission's SDSA methodology.

The main result from columns (4), (5) and (6) is that the structural primary balance required to reduce the debt is generally within historical precedent – that is, well below 3 percent of GDP. The only exceptions are the high SPB* for Greece and Hungary shown in column (4). For Greece, this turns out to reflect the interaction of our debt-stabilisation criterion, which measures stabilisation in the long term, with the high volatility of debt drivers experienced during the Greek debt crisis (Box 2). This is clear from the fact that the *SPB** for Greece is much lower in columns (5) and (6). For Hungary, however, SPB* remains above 3 percent of GDP even when the shocks underlying the fanchart are drawn from the pooled distribution (see Table 1, column 5).

[10] In Finland, the main driver of gross public debt increases – both historically and over the next two decades – is the accumulation of state pension surpluses as financial assets, which leads to upward stock-flow adjustments in public debt (see Darvas and Boivin, 2025). The slower growth of the median and the 70 percentiles of the Finnish public debt ratio distribution in 2039-2044 reflects the expectation that the contribution of this factor will decline over time.

Columns (7), (8) and (9) show the fiscal adjustment requirements corresponding to each estimate of *SPB** shown in columns (4), (5) and (6). Depending on the methodology, the adjustment requirement exceeds 3 percent of GDP for eleven to thirteen countries. Five countries – the United States, France, Slovakia, Poland and Romania – must adjust by 5 percent of GDP or more. Romania has the largest adjustment requirement, over 8 percent of GDP, reflecting its extremely large 2024 deficit (8.7 percent).

Table 1: Fiscal adjustment requirements

	2024 outcomes			Structural primary balances to stabilise debt with *p*=70%			Required adjustment from 2024 SPB levels		
	Debt	Fiscal balance	SPB	SPB*	SPB* (pooled)	SPB*(EC)	SPB*	SPB* (pooled)	SPB*(EC)
	(1)	(2)	(3)	(4)	(5)	(6)	(7) = (4)-(3)	(8)=(5)-(3)	(9)=(6)-(3)
Greece	155	1	4	3.4	1.5	2.0	-0.5	-2.4	-1.9
Italy	135	-3.4	0.3	2.5	2.3	2.3	2.2	2.0	2.0
United States	122	-8.0	-4.1	1.3	1.3	1.3	5.5	5.5	5.5
France	113	-5.8	-3.9	1.3	1.6	1.0	5.2	5.5	4.9
Belgium	105	-4.5	-2.9	1.8	1.9	0.7	4.7	4.8	3.6
Spain	102	-3.1	-1.2	2.4	2.3	1.6	3.6	3.5	2.8
United Kingdom	101	-5.7	-3.6	1.8	1.8	1.4	5.4	5.4	5.0
Portugal	95	0.7	2.2	2.7	1.9	2.0	0.5	-0.3	-0.2
Finland	82	-4.4	-3.3	0.6	0.8	0.9	4.0	4.2	4.2
Austria	81	-4.6	-3.1	0.7	0.8	0.8	3.8	3.9	3.9
Hungary	73	-4.9	-0.2	3.5	3.1	3.3	3.8	3.3	3.5
Slovenia	67	-0.9	-1.4	1.9	1.7	0.7	3.2	3.0	2.0
Cyprus	65	4.3	5.3	1.4	1.1	1.9	-4.0	-4.3	-3.4
Germany	63	-2.7	-1.1	0.4	0.6	0.6	1.6	1.7	1.7
Croatia	58	-2.0	-2.0	0.3	0.1	0.6	2.3	2.1	2.6
Romania	57	-8.7	-6.9	1.8	1.4	1.2	8.8	8.3	8.2
Slovakia	57	-5.3	-3.9	1.7	1.6	1.1	5.7	5.6	5.0
Poland	55	-6.6	-3.8	1.7	1.7	1.3	5.5	5.4	5.1
Latvia	47	-1.8	-0.8	1.1	0.6	1.2	1.9	1.4	2.0
Malta	46	-3.6	-2.5	0.3	0.3	0.4	2.8	2.8	2.9
Netherlands	44	-0.9	-0.7	0.9	1.0	0.7	1.6	1.7	1.5
Czechia	43	-2.0	-0.7	1.5	1.4	1.2	2.1	2.1	1.8
Ireland	39	4.1	-1.0	0.9	0.7	0.6	1.9	1.6	1.5
Lithuania	38	-1.3	-0.4	1.6	1.3	1.2	2.0	1.7	1.6
Sweden	33	-1.7	-0.6	-0.4	-0.4	-0.3	0.2	0.2	0.3
Denmark	31	4.5	1.9	-0.7	-0.7	-0.3	-2.6	-2.6	-2.2
Luxembourg	26	1.0	-0.3	0.0	0.1	-0.6	0.3	0.4	-0.3
Bulgaria	24	-3.0	-2.9	0.5	0.2	1.6	3.5	3.1	4.5
Estonia	23	-1.5	-0.9	0.0	-0.1	0.2	0.9	0.8	1.1

Source: Bruegel based on October 2025 IMF World Economic Outlook data, European Commission prior guidance reports, the April 2024 EU Ageing report, Bloomberg, ECB, Refinitiv Eikon, US Congressional Budget Office, UK Office for Budget Responsibility. Note: SPB* (column 4) refers to the structural primary balance at the end of a seven-year adjustment period that stabilises debt with 70 percent probability in 2039-2044, based on country-specific probability distributions. SPB*(pooled) (column 5) reflects the same concept except that a common probability distribution is used for all countries, based on a pooled VAR regression including the non-crisis euro area members. SPB*(EC) (column 6) shows the structural primary balance at the end of a seven-year adjustment period that stabilises debt with 70 percent probability based on the European Commission's (2024) methodology. Debt and deficit numbers refer to the general government for all countries except the United States, for which only the federal government is considered. Pink shading highlights SPB* in excess of 2 percent of GDP; yellow shading highlights total adjustment requirement in excess of 2.5 of GDP over five years or 3 percent of GDP over seven years.

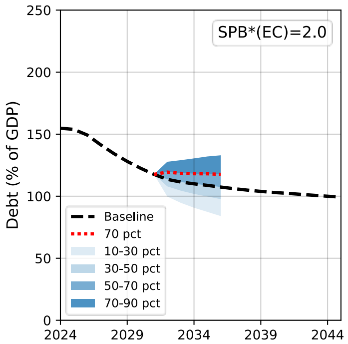
Box 2: Explaining the differences in *SPB estimates for Greece**

Figure 4 illustrates what drives the difference between the *SPB** estimates for Greece shown in columns (4), (5) and (6) of Table 1. The top left chart shows the fanchart underlying column (6) for Greece, based on the European Commission's methodology, on the assumption that Greece reaches by 2031 the structural primary balance of 2.0 percent that would stabilise debt within five years after the end of the adjustment period with a 70 percent probability. The top right chart shows the consequence of holding SPB constant at 2.0 percent of GDP after 2031 (except for changes in ageing costs) based on our methodology. Because of the sharp widening of the debt fanchart after the mid-2030s, this is not high enough to stabilise the debt asymptotically. The 70th percentile initially falls but then starts rising again after 2035.

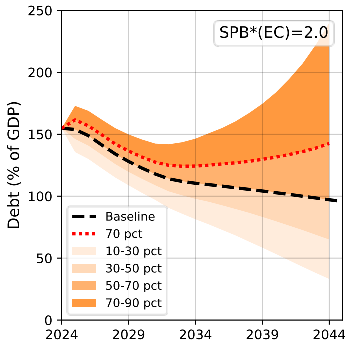
The bottom left chart in Figure 4 shows that this would not happen if the fanchart is estimated using the average volatility of the debt drivers in the non-crisis euro countries. In this case, an SPB of 2.0 is well above the minimum balance needed to stabilise the 70th percentile ($SPB^*(\text{pooled}) = 1.5$). Finally, the bottom right chart corresponds to the case shown in column (4) of Table 1: assuming a fanchart based on our methodology and Greece-specific volatility of debt drivers, the SPB must reach 3.4 percent of GDP in 2031 in order to stabilise the debt in the long run.

Figure 4: Fancharts for Greece

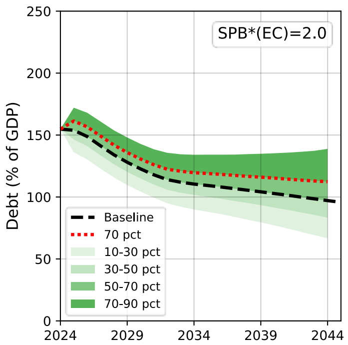
a. European Commission method, SPB*(EC)=2.0



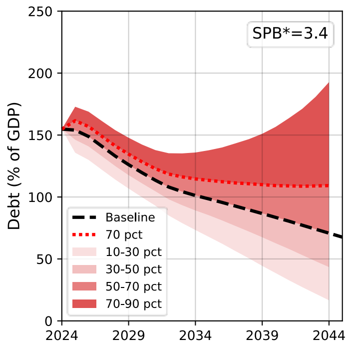
b. Our single-country method with SPB*(EC)=2.0



c. Our pooled method with SPB*(EC)=2.0



d. Our single-country method SPB*= 3.4



Notes: see Figure 2.

4 The plausibility of meeting medium-term fiscal adjustment requirements

We now address the question of whether the fiscal adjustments shown in Table 1 look feasible. We present evidence from three angles.

The first is simply to compare adjustment requirements with adjustment intentions. A necessary but by no means sufficient condition for fiscal adjustment is that countries want to adjust in line with what is required – as reflected in relevant multi-year fiscal plans. Most EU countries formulated such plans in autumn 2024, and some in the first half of 2025, in line with the requirements of the new EU fiscal framework. This facilitates a comparison. For the UK and US, we use the latest projections made by the independent fiscal institutions of those countries.

Second, we look at historical precedents. In section 4.2, we show how frequently (1) countries have met the target structural primary balances implied by our SDSA, and (2) countries have undertaken the adjustment that would be needed to reach those targets.

Third, we compare the required adjustments with the adjustments that are being projected by the IMF's *World Economic Outlook*, which generally represent the IMF's best guess about how fiscal variables will evolve. Specifically, we ask how likely it is that countries will adjust in line with the requirement in Table 1 based on a stochastic forecast centred on IMF projections about the evolution of the primary balance. We also present IMF sovereign debt risk indicators to help decide whether expected shortfalls in the degree of fiscal adjustments should be considered a problem or not.

4.1 Willingness/plans to undertake required adjustment

EU governments have submitted national medium-term fiscal plans to the European Commission, in line with the requirements of the EU fiscal framework, which was revised in 2024 [11]. With only two exceptions, the plans were approved as submitted by the respective countries [12].

Figure 5 Panel A compares the medium-term structural primary balance targets of these plans with *SPB**, the structural balance required to achieve debt stabilisation with 70 percent probability based on our stochastic DSA methodology when the shocks were drawn separately for each country (Table 1). Of the 27 countries, 10 submitted plans with structural balance targets about in line with or above the *SPB**. Most of the remaining countries – 14 of the 17 – are countries with debt below 60 percent of GDP. Among the 12 EU members with 2024 debt above 60 percent of GDP, only Greece (with a public debt ratio of 154 percent), Hungary (73 percent) and Slovenia (67 percent) target a substantially

[11] Twenty-two countries submitted their plans in late 2024, with the remaining five countries (Austria, Belgium, Bulgaria, Germany and Lithuania) submitting between February and July 2025.

[12] Hungary's plan was significantly revised after negotiations with the Commission, while the approved trajectory for the Netherlands was based on reference information prepared by the Commission because the plan did not meet the requirements (see Boivin and Darvas, 2025). The German plan has not yet been evaluated at the time of writing.

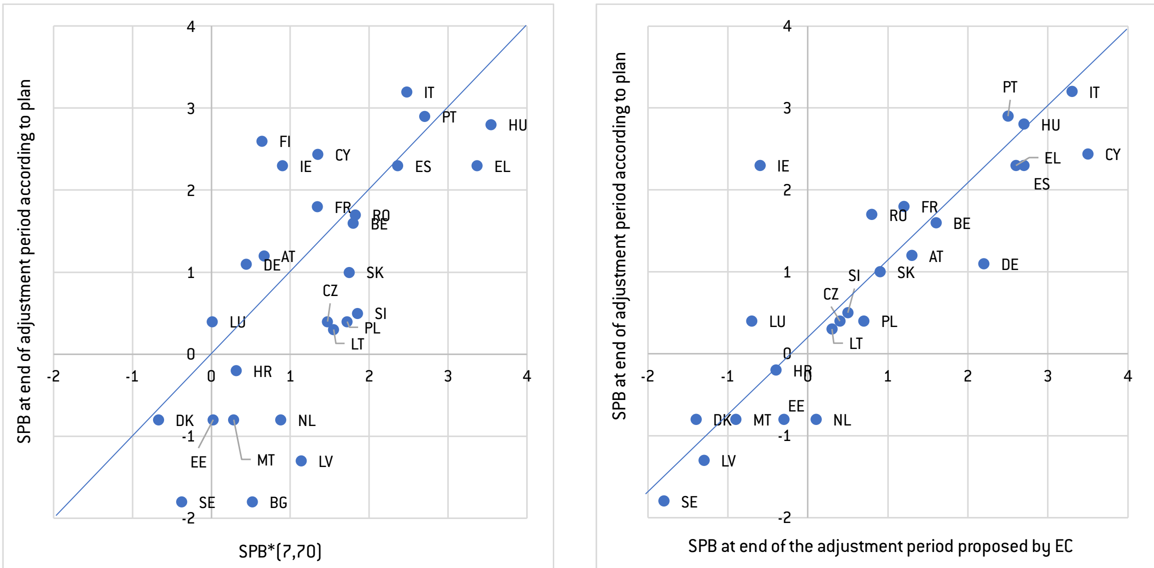
lower SPB than our *SPB** estimate. However, we argued earlier that the significant volatility of Greek macroeconomic variables throughout the Greek fiscal crisis of the early 2010s might exaggerate the SDSA requirements for Greece. Greece plans a higher SPB than $SPB^*(\text{pooled})$, which considers volatility from non-crisis euro-area countries, leaving only Hungary and Slovenia planning lower fiscal targets than our calculations would prescribe. Hence, based on our SDSA, the planned fiscal adjustments are insufficient to make debt sustainable. However, since both countries have relatively low debt, the fact that the adjustments that are planned over the next four years fall short of achieving debt sustainability is not overly concerning.

Figure 5 Panel B shows that with a few exceptions, the medium-term SPB targets of these countries are in fact aligned with the structural primary balance targets required by the Commission. Hence, these countries did not plan more-ambitious adjustment targets over the medium term because they were not asked. The reason for this is that the EU fiscal rules do not require debt stabilisation for countries with debt below 60 percent of GDP; only that debt should remain below 60 percent with a 70 percent probability over the next 14 years. In contrast, SPB^* describes the total fiscal adjustment that needs to happen to asymptotically stabilise the debt of any country with 70 percent probability – including countries with low initial debts – based on the assumption that after seven years, the SPB is kept constant, except for changes in ageing costs. However, the latter is a purely technical assumption. Low-debt countries may be able to afford less adjustment over this period, if this is followed by stabilisation at a later stage.

Figure 5: Medium-term structural primary balance targets proposed by member states' medium-term fiscal plan, compared to debt-stabilising primary balances

a. Debt-stabilising structural primary balances compared to structural primary balance targets proposed by EU members

b. Structural primary balances proposed by European Commission compared to structural primary balance targets proposed by EU members



Source: Bruegel. Note: Germany submitted its plan after the so-called national escape clause (NEC) of EU fiscal rules was activated, which temporarily allows higher defence spending to be exempted from the EU fiscal rule safeguards. The plan included two scenarios: a non-NEC scenario with an SPB target of 2.1 percent for 2031, and a NEC scenario with a 1.1 percent SPB target. In this chart, we use the non-NEC scenario, which is comparable to the Commission's prior guidance requiring an SPB target of 2.2 percent.

For the United Kingdom, the March 2025 fiscal projections of the UK Office for Budget Responsibility (OBR, 2025) incorporate the British government's latest policy measures. The projections suggest that the cyclically adjusted primary balance (as information on the SPB is not available) is expected to improve from a deficit of 1.9 percent of GDP in fiscal year 2024-2025, to a surplus of 1.0 percent in 2029-2030. This falls short our 1.5 percent estimate for SPB^*, indicating that government policies currently expected by the Office for Budget Responsibility would not achieve the necessary adjustment to place public debt on a declining path with a 70 percent probability from 2039 to 2044[13].

For the United States, May 2025 Congressional Budget Office projections (CBO, 2025) predict about the same average primary deficit in 2030-2035 as in 2024. This projected primary balance hence falls well short – by over 5 percent of GDP – of the 1.2 percent primary surplus that would be required to stabilise the debt (Table 1). Consistent with this, both the baseline and seven alternative scenarios

[13] However, the long-term projections of the Office for Budget Responsibility (OBR, 2024) suggest that the UK's public debt could exceed 250 percent of GDP by 2070 under unchanged policies.

considered in CBO (2025) foresee a continuous increase in the US debt ratio up to 2055 (the end of the forecast horizon) [14].

The conclusion is that, among the 29 fiscal plans analysed in this paper, only those of four countries – Hungary, Slovenia, the UK and the US – would fall short of stabilising the debt ratio, if implemented. While the shortfall would be moderate for Hungary, Slovenia and the UK, it would be very large for the US.

4.2 Plausibility of adjustment based on historical patterns

Two measures of the plausibility of the adjustment needs in Table 1 are the frequency with which both the required *SPB** and the required adjustments to *SPB** have been observed in the past, and the length of the period over which *SPB** has been sustained.

Table 2 provides this information for SPB^* for 1970-2022 [15]. Column (1) reproduces SPB^* (the structural primary balance in 2031 that will lead to falling debt with a 70 percent probability in 2039-2044). The next two columns report the frequency with which a primary balance of at least the magnitude reported in column (1) is observed [16]. Column (2) is based on a sample that contains data for all countries shown in the table (except for Lithuania and Malta, which are missing from the IMF's dataset), while column (3) is based only on data from the country itself. The main result is that with some exceptions – reflecting very large values of SPB^* and/or short sample lengths – structural primary balances at the level that our SDSA would 'require' countries to reach have not been unusual historically.

The shaded cells in column (3) indicate relative frequencies of the required *SPB** of less than 10 percent. For some countries (Slovakia, Poland, Romania, Latvia and Czechia) this reflects short sample periods related to data availability. But for others – including Greece, the United States, Spain and Portugal – it shows that primary balances of the magnitude required for debt stabilisation in the future were rare from 1970-2022.

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[14] The eighth alternative scenario assumes that the primary deficits are reduced each year so that debt remains at 100 percent of GDP (its level in fiscal year 2025) throughout the projection period.

[15] Extending the period to 1950-2022 does not meaningfully change the results. Reducing it to 1990-2022 also does not have a significant impact on the relative frequencies reported in the table (columns 2, 3, 7, and 8), but does shorten the maximum length of spells reported in columns 4 and 5. Note that for some countries, notably the formerly planned economies of central and eastern Europe, the sample periods are shorter because of the lack of data; for these economies, the samples typically start in 1995.

[16] Unfortunately, the *structural* primary balance is not available for the full period of 1970-2022. We use overlapping samples (i.e. 1970-1977, 1971-1978, 1972-1979, and so on), implying that annual fiscal adjustments in the years 1977, 1978, 1979, …, 2014, 2015, 2016 appear seven times in the combined sample, while adjustments in 1976 and 2017 appear six times, adjustments in 1975 and 2018 five times, and so on.

The relative frequencies reported in columns (2) and (3) do not tell us whether countries have managed to sustain primary balances at the level of *SPB** or higher over extended periods. To shed light on that question, columns (4) and (5) show the maximum number of years that countries have managed to keep their average primary balances above the level indicated in column (1), after this had been exceeded for the first time [17]. Column (4) shows the average of the maxima across the entire sample, and hence represents the behaviour of an average economy. Column (5) shows the maximum length of a primary balance spell exceeding *SPB** on average for each country. For example, the maximum duration of a primary balance spell of 1.2 percent – the debt-stabilising level for the United States – was 19 years on average, but the maximum period for which the US managed to maintain its average primary balance at that level was only seven years (from 1996 until 2003). The reverse is true for Italy. On average, the cross-country average of the maximum periods for which countries were able to maintain their primary balances above 2.4 percent – the debt stabilising level for Italy – was 14 years, but Italy managed to pull off a 22-year spell during which its primary balance remained at that level on average. This picks up Italy's pre-euro accession adjustment effort, which led to very high primary surpluses between 1993 and 2002, and an average primary surplus above 2.5 percent of GDP for the 1995-2016 period.

Finally, columns (7) and (8) are analogous to (2) and (3), except that they now refer to the relative frequency of the *adjustment* needed to reach SPB^*, shown in column (6). For example, a fiscal adjustment of 2.1 percent, the increase in the primary balance required of Italy over seven years if it wants to stabilise its debt, was observed in 25 percent of all time intervals of seven years or less for the entire sample, and 26 percent in the Italy sample. But the relative frequency of the adjustment required for France, of almost 5 percent of GDP, has been observed in only 11 percent of the time periods of seven years or less in the whole sample, and has never been achieved by France itself.

The bottom line is that the *level* of primary balances required to stabilise debt levels in advanced and emerging European countries appear feasible, in the sense that they have historical precedents, even for protracted periods. However, *adjustments* of the type required in the handful of countries subject to the greatest fiscal pressures have very rarely happened in periods of seven years or less, particularly in those countries themselves. This does not imply that the adjustments are unfeasible, but it does imply that they will likely take longer than the seven-year period assumed in Tables 1 and 2.

[17] Hence the duration of the 'spells' shown in columns (4) and (5) is the time difference between the first year in which the primary balance exceeded *SPB** and the last year in which the average primary balance since the that first year still exceeded *SPB**.

Table 2: Historical precedents for *SPB and adjustment requirements, 1970-2022**

	SPB*	Relative frequency (percent)		Maximum length of spell (years)		Adjustment to reach SPB* (% of GDP)	Relative frequency (percent)	
		Whole sample	Own country	Whole sample av.	Own country		Whole sample	Own country
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Greece	3.4	17	6	9	4	-0.5	54	55
Italy	2.5	25	17	13	22	2.2	24	26
United States	1.3	38	9	18	7	5.5	9	8
France	1.3	37	13	18	9	5.2	9	0
Belgium	1.8	32	40	17	35	4.7	11	9
Spain	2.4	26	9	14	3	3.6	15	17
United Kingdom	1.8	32	23	17	8	5.4	9	13
Portugal	2.7	23	8	12	2	0.5	43	45
Finland	0.6	45	62	24	53	4.0	14	19
Austria	0.7	45	49	24	17	3.8	14	4
Hungary	3.5	16	4	8	10	3.8	14	6
Slovenia	1.9	31	11	16	6	3.2	17	11
Cyprus	1.4	37	32	18	9	-4.0	85	40
Germany	0.4	48	55	26	25	1.6	30	28
Croatia	0.3	49	19	28	7	2.3	24	13
Romania	1.8	31	14	17	8	8.8	3	0
Slovakia	1.7	33	0	17	3	5.7	8	8
Poland	1.7	33	0	17	6	5.5	9	0
Latvia	1.1	40	4	19	9	1.9	26	13
Malta	0.3	50	...	28	...	2.8	20	...
Netherlands	0.9	43	55	20	52	1.6	30	32
Czechia	1.5	36	11	18	6	2.1	25	15
Ireland	0.9	43	47	20	23	1.9	27	32
Lithuania	1.6	35	...	17	...	2.0	26	...
Sweden	-0.4	60	60	31	29	0.2	47	36
Denmark	-0.7	64	91	32	53	-2.6	74	70
Luxembourg	0.0	55	89	30	28	0.3	45	11
Bulgaria	0.5	47	61	26	28	3.5	16	2
Estonia	0.0	54	50	30	23	0.9	37	9

Source: Bruegel based on IMF Public Finances in Modern History database. Note: 'Whole sample' refers to 38 advanced and EU countries, consisting of all EU countries except Lithuania and Malta, plus Australia, Canada, Hong Kong SAR, Iceland, Israel, Japan, Korea, New Zealand, Switzerland, the United Kingdom and the United States. 'Own country' only contains observations of the country shown in the left column. Red shaded cells denote relative frequencies of less than 10 percent, pink shaded cells relative frequencies below 30 percent. The relative frequencies and the maximum lengths of spells were calculated from unadjusted primary balances, not SPBs.

4.3 Adjustment probabilities and risk assessments based on IMF projections

An important shortcoming of the analysis in section 4.2 is that the Table 2 reference period is *all* recent history, including some periods when countries were trying to adjust, and many periods when they were not. In contrast, as we saw in section 4.1, EU countries today have submitted medium-term fiscal plans that seek to achieve the required adjustment. To assess their plausibility, probabilities of adjustment should be computed based not on adjustment frequencies across the board, but conditional on the adjustment effort that countries are expected to make today.

A potential way to capture the latter is to compute the probability of reaching SPB^* conditional on IMF projections for medium-term fiscal adjustment, taken from the October 2025 World Economic Outlook (WEO). The latter generally represent *"a judgment about policies' most likely path"* by IMF staff (IMF, 2025). That is, unlike European Commission fiscal forecasts, IMF forecasts incorporate expected fiscal adjustment, rather than being conditional on current policies [18]. That said, many IMF desk economists take a conservative view of expected adjustment, including only consolidation measures that are identified by the country authorities (rather than targets declared by the authorities).

We proceed in two steps. First, we create a probability distribution for the structural primary balance in 2030, centred on the IMF's 2030 projections for the structural primary balance, using bootstrapped errors from a vector autoregression (see for example Medeiros, 2012; Bouabdallah *et al*, 2017). 2030 is six years from 2024, our base year for the calculations, thus, we indicate the debt-stabilising structural primary balance as $SPB^*(6)$. Second, for each percentile level of the structural primary balance in this probability distribution, we calculate the probability of debt stabilisation 15 to 20 years from now, applying the same methodology (projections for growth, interest rates and the exchange rates, and bootstrapped errors) that we used in our stochastic DSA analysis in section 3. One can then select the percentile levels of the probability distribution for the 2030 structural primary balance that leads to debt stabilisation with a 70 percent probability. We refer to these as Prob$\{SPB(WEO) > SPB^*(6)\}$.

[18] For the countries covered in this paper, the main exception is France, for which IMF forecasts are conditional on legislated rather than expected policies.

Table 3: Probability of reaching debt stabilising primary balance by 2030 if countries adjust in line with IMF projections

	SPB(2024)	SPB(WEO)	SPB*(6)	Prob {SPB(WEO> SPB*(6)}
Greece	3.9	2.0	3.5	43
Italy	0.3	2.0	2.5	33
United States	-4.1	-3.4	1.4	10
Belgium	-2.9	-3.6	1.8	1
Spain	-1.2	0.6	2.3	22
United Kingdom	-3.6	0.7	1.8	38
Portugal	2.2	0.7	2.8	31
Finland	-3.3	-2.7	0.7	5
Austria	-3.1	-1.6	0.7	17
Hungary	-0.2	0.1	3.5	18
Slovenia	-1.4	-1.5	1.8	8
Cyprus	5.3	2.3	1.5	57
Germany	-1.1	-2.7	0.5	3
Croatia	-2.0	-1.5	0.3	30
Romania	-6.9	-2.1	1.7	10
Slovakia	-3.9	-4.1	1.7	2
Poland	-3.8	-2.3	1.7	4
Latvia	-0.8	-2.7	1.2	11
Malta	-2.5	-1.2	0.2	34
Netherlands	-0.7	-1.6	0.9	8
Czechia	-0.7	-3.1	1.4	4
Ireland	-1.0	-1.1	0.9	35
Lithuania	-0.4	-2.4	1.6	7
Sweden	-0.6	-0.1	-0.3	54
Denmark	1.9	-1.1	-0.7	42
Luxembourg	-0.3	-1.9	0.0	22
Bulgaria	-2.9	-2.1	1.3	27
Estonia	-0.9	-2.3	0.0	27

Source: Bruegel and IMF World Economic Outlook, October 2025. Note. Values are in percent of GDP except in last column, which is expressed in percent. Light pink shaded cells denote probabilities of less than 30 percent, darker pink shaded cells denote probabilities of less than 10 percent. France is missing from the table because IMF fiscal projections for France are based on legislated policy rather than expected policy.

Columns (1) of Table 3 reproduces the realised structural primary balance in 2024 from Table 1 (column (3)). Column (2) shows the IMF's structural primary balance projection for 2030 from the October 2025 WEO [19], denoted as $SPB(WEO)$. $SPB^{*}(6)$, shown in column (3), is the primary balance countries would need to attain to stabilise their debts with a 70 percent probability after six years of adjustment (in line with the IMF's projection horizon for 2030). Because this is a shorter adjustment period than the seven years assumed in the SPB^{*}estimates shown in Table 1, $SPB^{*}(6)$ tend to be smaller than SPB^{*}. Finally, column (4) shows the main result: the probability that the WEO projection for the 2030 structural primary balance will exceed the 2030 structural primary balance that would be required to stabilise the debt with a 70 percent probability.

The bottom line from Table 3, which uses the same shading conventions as Table 2, is that IMF projections generally do not justify greater optimism, as far as the probability of reaching $SPB^{*}(6)$ is concerned, than the assumption that the structural balance will evolve in line with average historical patterns (Table 2). Conditional on WEO forecasts, these probabilities are particularly low for Belgium, Slovakia, Germany, Czechia and Poland. This correlates with probabilities based on the historical track record reported in Table 2, but with significant exceptions. Most notably, Germany has a reasonable chance of stabilising its debt ratio in the medium term based on its historical adjustment performance (about 30 percent, according to Table 2) but a much lower chance based on IMF WEO projections (just 3 percent) [20]. The opposite is true for the United States.

With few exceptions, IMF staff do not expect much adjustment over the medium term in advanced economies. The median difference between $SPB(WEO)$ and $SPB(2024)$ is about 0 for the whole sample, and only about half a percent of GDP for the high-debt countries. According to the IMF, only six countries in our sample will adjust by more than 1.5 percent of GDP by 2030 (Italy, Spain, the UK, Austria, Romania and Poland) and only two countries – the UK and Romania – by more than 3 percent of GDP.

Since the fiscal adjustments projected by the IMF are mostly insufficient to stabilise debt levels, it is worth asking whether the Fund also sees a heightened risk of sovereign debt crises, as proxied by the 'sovereign stress' metric of its sovereign risk and debt sustainability framework for market access countries (SRDSF) [21]. Figure 6 answers this question by showing the distribution of the IMF's fanchart index, an indicator of medium-term debt risk based on the IMF's assessment of the probability that the 2030 primary balance will fail to reach the debt-stabilising balance, the width of the IMF's debt fan

[19] This is computed as the IMF's primary balance projection for 2030, plus the difference between the IMF's primary net borrowing and overall net borrowing projections for 2030.
[20] See Zettelmeyer *et al* (2025) for an analysis of Germany's medium-term fiscal structural plan that corroborates this view (ie sees the chance Germany's debt will stabilise in the medium term as very low).
[21] 'Sovereign stress' is defined by the IMF as a situation involving sovereign default, debt restructurings, loss of market access, large IMF-supported programmes with exceptional financing from other institutions, chronic and excessive inflation or sizable financial repression. See IMF (2022).

chart in 2030 as an additional measure of uncertainty and the 2030 projected debt level interacted with an index for institutional quality (see IMF, 2021, 2022, for details) [22]. Countries with an index below 1.13 are classified as low risk, countries with an index above 2.08 as high risk, and countries with indices between these thresholds as moderate risk. In the 1990-2018 sovereign debt crisis sample that the IMF used to calibrate these thresholds, the probability of experiencing sovereign stress conditional on a high-risk signal was 43 percent, while the probability of experiencing sovereign stress conditional on a low-risk signal was just 4 percent (IMF, 2021, Box 3). The main result of Figure 6, Panel A, is that although less than a quarter of advanced economies are currently classified as low risk, the set of advanced and EU economies with high debt risks, according to the IMF's fanchart index, remains small (four advanced countries, of which three are EU members) [23].

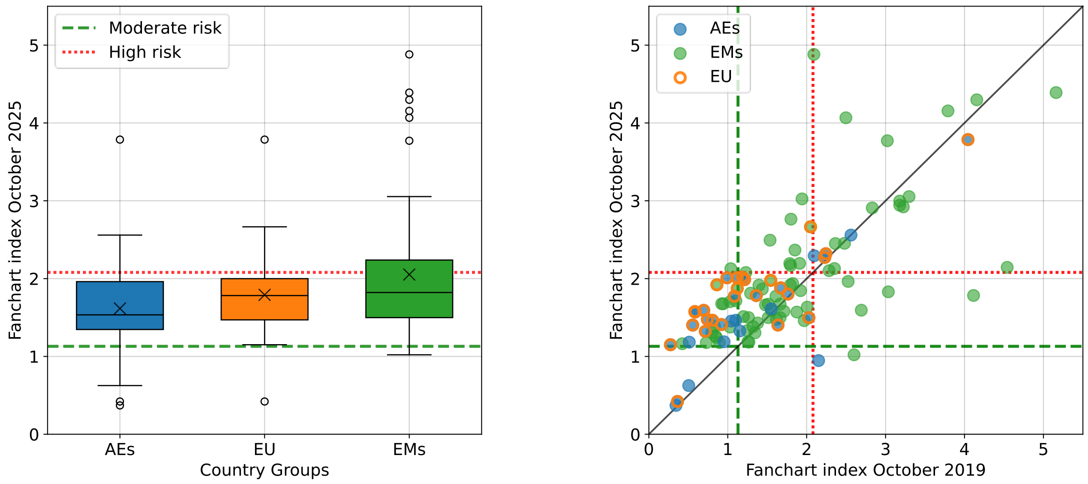
Figure 6 Panel B shows the evolution of the IMF's fanchart index over time. The x-axis measures indices are based on the October 2019 WEO – the last set full set of IMF projections before the pandemic – while the y-axis plots the same data based on the October 2025 WEO. Most data points (75 out of 106 overall, and 26 out of 34 in the advanced economy subsample) are above the 45-degree line, indicating greater debt risks. For the advanced countries, this mostly reflects a movement from low to medium risk levels. In 2019, the IMF classified 19 advanced economies as low risk, nine as medium risk and six as high risk. In 2025, the number of high-risk advanced countries is slightly lower (four rather than six), but the membership of the low-risk category has declined from 19 to four while that of the medium risk category has grown from nine to 26 members. The number of EU countries classified as low risk by the IMF has dropped from 15 to just one, while the medium risk category has grown from nine to 22, and the high-risk category from three to four.

[22] The latter captures the fact that countries with lower debt levels and/or better institutions will be more likely to undertake successful adjustment outside the six-year projection period, rendering debt sustainable, even if the primary balance projected for the end of the six-year period remains below the debt-stabilising primary balance.
[23] Table 4 shows country-level findings taken from recent IMF reports.

Figure 6: Distribution of medium debt risks according to the fanchart module of the IMF's sovereign risk and debt sustainability methodology

a. Distribution of IMF fanchart index, October 2025, by country groups

b. Comparison of October 2025 with October 2019 fanchart indices



Source: Bruegel based on October 2019 and October 2025 databases of the IMF World Economic Outlook. Note: AE = advanced economies, EM = emerging market economies. The 75th percentile, median and 25th percentile index values are 1.2, 1.5 and 1.8 for AEs; 1.4, 1.5 and 1.9 for EU economies, and 1.5, 1.8 and 2.4, respectively, for EMs. The dashed green lines represent the thresholds separating low from moderate risk, while the dashed red lines represent the thresholds separating moderate from high risk.

Table 4 shows the IMF's medium-term debt risk classifications for advanced countries, based on the most recent Article IV country reports. The 'date' reported is the date of the latest Article IV consultation; this implies that the fanchart index and the associated 'fanchart signal' (risk classification) could differ from that of Figure 6, which was based on the October 2025 World Economic Outlook data [24].

In five cases – Greece, Italy, the US, Spain and Romania – the fanchart index crosses into high-risk territory. The IMF's overall medium-term risk classification – which also reflects liquidity risk; see IMF (2021, 2022) – was 'high' for the same countries, with the exception of the US and Spain, where moderate liquidity risk resulted in an overall 'moderate' risk classification.

[24] Most notably, this would be the case for Germany and the United States, for which the most recent Article staff reports, as of mid-November 2025, were published in July of 2024 – more than one year before the October 2025 forecasts underlying Table 3 and Figure 6.

Table 4: Medium-term debt risks based on the IMF's Article IV DSAs

Country	Date	Fanchart index	Fanchart signal	Overall, "mechanical" medium- term signal
Greece	7-Apr-25	3.5	High	High
Italy	22-Jul-25	2.2	High	High
United States	18-Jul-24	2.2	High	Moderate
France	14-Jul-25	2.1	Moderate	Moderate
Spain	6-Jun-25	2.2	High	Moderate
Belgium	20-Mar-25	2.0	Moderate	Moderate
United Kingdom	25-Jul-25	1.6	Moderate	Moderate
Portugal	2-Oct-24	1.7	Moderate	Low
Finland	21-Jan-25	0.7	Low	Low
Austria	3-Jul-25	1.5	Moderate	Low
Hungary	29-Aug-25	1.9	Moderate	Moderate
Cyprus	2-Jun-25	1.3	Moderate	Low
Slovenia	14-May-2024	1.4	Moderate	Low
Germany	18-Jul-2024	1.0	Low	Low
Slovakia	24-Mar-2025	2.0	Moderate	Moderate
Croatia	29-Jul-2024	1.8	Moderate	Low
Poland	21-Jan-2025	1.7	Moderate	Moderate
Malta	22-Jan-2025	1.4	Moderate	Low
Romania	14-Nov-2025	2.6	High	High
Netherlands	21-Jul-2025	1.4	Moderate	Low
Czechia	4-Feb-2025	1.5	Moderate	Low
Latvia	19-Sep-2025	1.8	Moderate	Moderate
Ireland	11-Jun-2025	1.5	Moderate	Low
Lithuania	17-Sep-2025	1.5	Moderate	Low
Sweden	1-Apr-2025	0.1	Low	Low
Luxembourg	5-Jun-2025	0.9	Low	Low
Denmark	4-Jul-2025	1.1	Low	Low
Bulgaria	13-Jun-2024	1.9	Moderate	Moderate
Estonia	14-Jul-2025	1.5	Moderate	Low

Source: Bruegel based on the most recent IMF Article IV country report for each country shown. Note: The table reports the 'mechanical' medium-term risk signals based on the IMF's (2021,2022) sovereign risk and debt sustainability framework, before modifications based on staff judgment. The IMF's overall sovereign risk and debt sustainability ratings seek to additionally capture short-term risks, Fanchart indices rounded to one decimal. Date indicates the publishing date of the country report.

To summarise, there is some overlap between the countries classified as high risk based on the IMF's fanchart index according to Table 4, and the countries with low adjustment probabilities conditional on IMF forecasts identified in Table 3. Romania, the US and Spain are in both sets. However, the IMF's risk classification for Slovakia and Poland is more sanguine than would seem justified on the basis of our DSA conditional on the IMF's forecast (Table 3), while it is less sanguine for Greece. These differences likely relate to the fact that our DSA methodology focuses on debt stabilisation in the long term, while the IMF's fanchart index pays attention both to the probability of debt stabilisation and the debt level interacted with a measure of institutional quality after five years. The latter penalises Greece for its high debt level, but benefits Slovakia and Poland.

5 Fiscal reaction functions

Even if fiscal adjustment does not happen within the timeframe assumed by our DSA, debt might be sustainable if it happens to a sufficient degree later. As described in section 2, a sufficient condition for this to happen is the presence of a systematic negative feedback effect from debt levels to the primary surplus that exceeds the equilibrium interest rate growth differential.

In this section, we look for evidence of such a feedback effect by estimating a fiscal reaction function using a specification close to that proposed by Bohn (1998), namely, controlling for country-specific conditions, cyclical variations in economic growth and the autocorrelation in primary surpluses, plus additional controls for inflation, trade, political stability, crisis related expenditure shocks and the potential endogeneity of the regressors:

$$s_{it} = \phi s_{it-1} + \rho d_{it-1} + \gamma \left(\frac{Y_{it}}{\overline{Y}_{it}} - 1\right) + \theta' Z_{it} + \eta_i + \varepsilon_{it} \tag{3}$$

where s_{it} denotes the primary balance of country i in year t , d_{it-1} the lagged debt to GDP ratio, $\overline{Y}_{it}$ is potential output, Y_{it} is real output, Z_{it} is a vector of controls, η_i is a country fixed effect and ε_{it} is an independent error term.

We estimate equation (3) for a panel of EU countries, the UK and the US, using annual data from 1990 to 2024 [25]. Following Plödt and Reicher (2015) and Checherita-Westphal and Žďárek (2017), we employ an instrumental variable (IV) approach to control for the endogeneity of the output gap. Instruments include the lagged output gap, the second lag of the debt ratio and the first and second lag of output growth gap ($\frac{\overline{Y}_t}{\overline{Y}_{t-1}} - \frac{Y_t}{Y_{t-1}}$). Because of the inclusion of lagged values of the primary balance to control for its autocorrelation and our relatively short sample period, the standard fixed effects estimates may be subject to the Nickel bias. Therefore, we report results based on the Arellano-Bond

[25] For EU countries in our sample that joined the bloc in 2004 and afterwards – Bulgaria, Croatia, Cyprus, Czechia, Estonia, Hungary, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia – data is only available from 1995 onwards.

GMM estimator[26]. A specification using the standard fixed effects estimator and additional robustness checks are presented in Appendix A.

To evaluate differences in fiscal reactions over time, we follow Auerbach and Yagan (2025) and split our sample into two periods: the pre-Global Financial Crisis (GFC) era from 1990 to 2007, and the period from 2008 to 2024, which encompasses the GFC, the sovereign debt crisis and the COVID-19 pandemic. Reflecting the fact that western EU countries are classified as advanced while eastern EU countries are considered emerging market economies, we estimate the average response of primary surpluses to debt ratios separately for western EU countries, eastern EU countries and a sample including western EU countries, the UK and the US (see the note to the table for definitions of eastern and western countries).

Table 5 reports the results. Our findings indicate a notable decline in fiscal responsiveness in western Europe, the UK and the US since the GFC (columns 1 and 3). Between 1990 and 2007, the average fiscal reaction is statistically significant and positive for western Europe, and for the sample including the UK and the US. A percentage point increase in debt was associated with an increase in primary surpluses in the following year of about 0.04 percentage points in western EU countries, and of ca. 0.05 for the sample also including the UK and the US. For eastern European countries, the estimated coefficient was not significantly different from zero (column 2). In the second half of our sample period since 2008, the fiscal reaction to debt is statistically significant at the 1 percent level for all country groups (columns 6-8). Point estimates for western EU, the UK and the US, however, fall to about 0.02. The coefficient for eastern EU countries is the highest, at about 0.03.

[26] The so-called Nickell bias is a downward bias in the standard fixed-effects estimator for the coefficient on a lagged dependent variable in a dynamic panel model, when the time dimension is small relative to the number of observations entities. This bias arises because the demeaned lagged dependent variable is correlated with the demeaned error term. The Arellano-Bond GMM estimator addresses the Nickell bias by using appropriately lagged values of the dependent variable and other regressors as instruments to correct for the endogeneity.

Table 5: Fiscal reaction function estimates

	1990 - 2007				2008 - 2024			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	EU West	EU East	EU West, UK, US		EU West	EU East	EU West, UK, US	
Lagged debt ratio	0.0363***	0.00850	0.0455***		0.0245***	0.0276***	0.0218***	
	(0.00867)	(0.0144)	(0.00972)		(0.00381)	(0.00829)	(0.00368)	
Austria				0.0856***				0.0537
				(0.0215)				(0.0464)
Belgium				0.0448***				-0.00565
				(0.00970)				(0.0451)
Germany				0.109***				0.0744*
				(0.0392)				(0.0449)
Denmark				0.0514***				0.0553**
				(0.0148)				(0.0269)
Spain				0.0768**				0.0318**
				(0.0306)				(0.0139)
Finland				0.0907***				0.0102
				(0.0250)				(0.0122)
France				0.0450				-0.0467
				(0.0341)				(0.0678)
Greece				0.0432***				0.0270***
				(0.0161)				(0.00553)
Ireland				0.0545***				0.0186*
				(0.0104)				(0.0104)
Italy				0.0573***				0.0157
				(0.0208)				(0.0104)
Netherlands				0.0699***				0.0289
				(0.0215)				(0.0411)
Portugal				0.0882***				0.0417***
				(0.0326)				(0.0112)
Sweden				0.132***				0.138**
				(0.0181)				(0.0682)
United Kingdom				0.106*				0.0501***
				(0.0621)				(0.0151)
USA				0.0955***				0.0174
				(0.0301)				(0.0130)
Lagged primary balance	0.609***	0.485***	0.617***	0.657***	0.783***	0.578***	0.759***	0.733***
	(0.0349)	(0.0509)	(0.0384)	(0.0518)	(0.0513)	(0.0817)	(0.0571)	(0.0683)
Output gap	0.326***	0.146**	0.349***	0.380***	0.122**	0.127**	0.108**	0.114**
	(0.0872)	(0.0577)	(0.0844)	(0.0702)	(0.0522)	(0.0535)	(0.0528)	(0.0551)
Irregular expenditures	-0.865***	-0.302	-0.833***	-0.827**	-1.233***	-1.536***	-1.213***	-1.172***
	(0.265)	(0.192)	(0.260)	(0.331)	(0.0677)	(0.280)	(0.0660)	(0.0467)
Trade	0.0205	0.00257	0.0227	0.0238**	0.0121*	0.00999**	0.0258***	0.0267***
	(0.0125)	(0.00989)	(0.0147)	(0.0115)	(0.00651)	(0.00446)	(0.00894)	(0.00949)
Inflation	0.147**	0.00367*	0.169***	0.211***	-0.0999	-0.0707	-0.180*	-0.112
	(0.0657)	(0.00199)	(0.0627)	(0.0665)	(0.0946)	(0.0583)	(0.0960)	(0.0958)
Political stability	0.157**	-0.0377	0.175**	0.120	-0.472***	-0.435**	-0.460***	-0.494***
	(0.0787)	(0.114)	(0.0792)	(0.0845)	(0.162)	(0.191)	(0.161)	(0.170)
Constant	-5.212***	-0.724	-6.050***	-7.574***	0.395	0.435	-0.248	-0.758
	(1.438)	(1.650)	(1.509)	(1.840)	(1.211)	(1.596)	(1.127)	(1.734)
Country fixed effects	x	x	x	x	x	x	x	x
Observations	221	102	255	255	208	192	240	240

Source: Bruegel based on IMF World Economic Outlook, European Commission AMECO, Bureau of Economic Analysis, and ICRG. Note: Arellano-Bond GMM estimates of EU, UK, and the U.S. fiscal reaction functions. EU West encompasses Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Sweden. EU East encompasses Bulgaria, Cyprus, Czechia, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovakia and Slovenia. Country names denote country-specific slope estimates. Instruments for output gap are the lagged output gap, second lag of the debt ratio and first and second lag of output growth gap (following Plödt and Reicher 2015, Checherita-Westphal and Žďárek 2017). Irregular expenditures are public annual changes in public expenditures that lie outside 90 percent of the country's sample. Inflation is a three-year rolling average of the CPI. Trade describes the sum of exports and imports as share of GDP. Political stability is the ICRG Political Risk Index. Significantly negative cubic lagged debt terms indicate fiscal fatigue following Ghosh *et al* (2013). Robust standard errors clustered at country level in parentheses (* $p<0.10$, ** $p<0.05$, *** $p<0.05$).

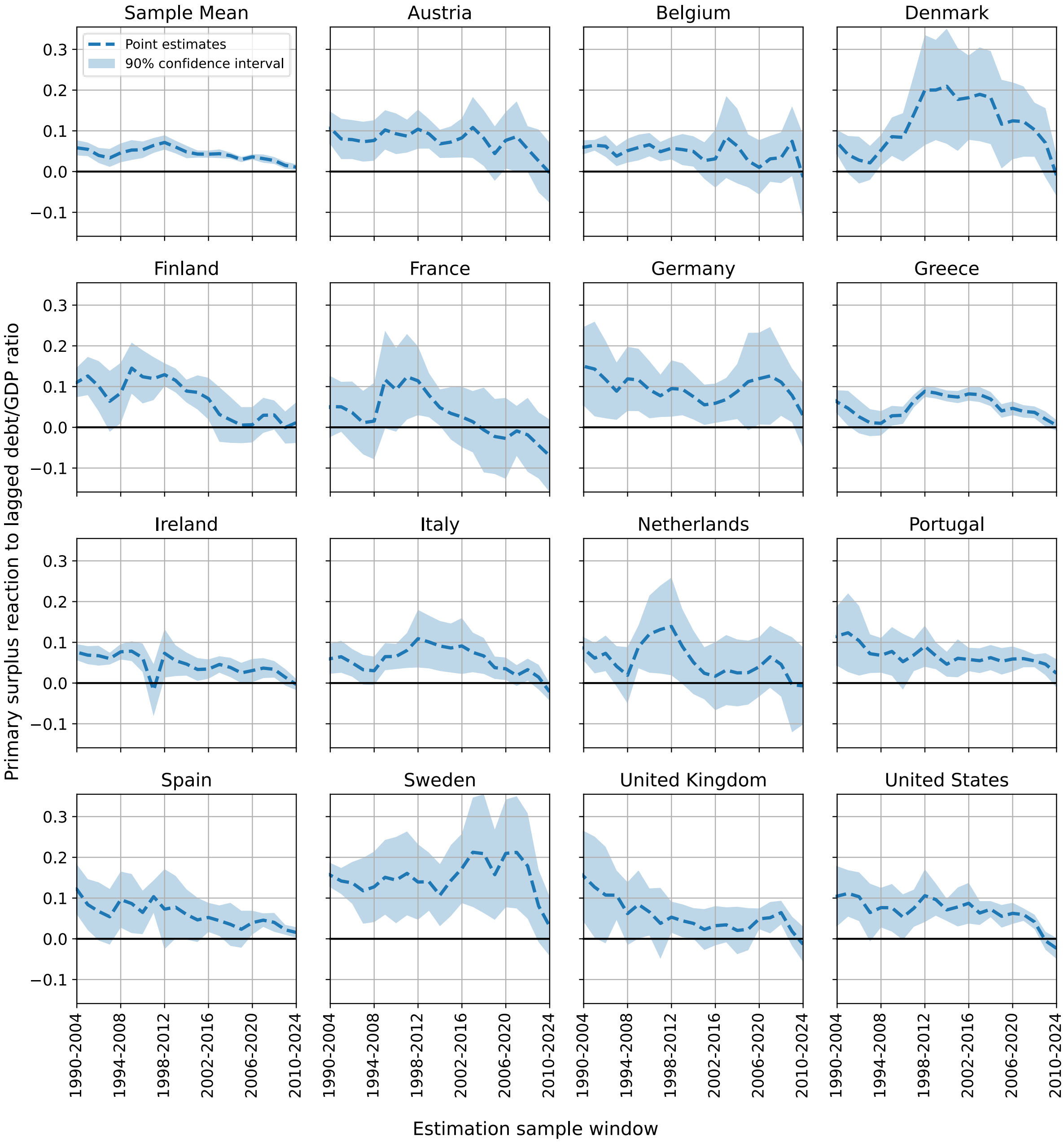
To identify between-country differences, we decompose the aggregate effect of the western EU, UK and US sample by interacting the effect of debt ratios with country dummies (columns 4 and 9). The resulting country-specific slope estimates are positive and significant for all but one country (Spain) in the first sample half, ranging from 0.04 (France) to 0.13 (Sweden). In the second sample half, the fiscal response to debt is only significantly different from zero for seven countries (Germany, Denmark, Spain, Greece, Portugal, Sweden and the UK).

The change in magnitude and statistical significance of point estimates between the two sample periods suggests that fiscal reactions are not structurally stable. Figure 7 illustrates this. It shows the reaction coefficients and 90 percent confidence intervals for a selection of countries based on a rolling 15-year estimation window for western EU countries, the UK and the US. The point estimates are positive for much of the sample in most countries, but appear to decline over time for subsamples in the post-GFC era. For Belgium, France, Italy and the US, this results in negative point estimates for the last 15-years; for Denmark, Germany, Greece, Portugal, Spain and the UK it results in estimates that are close to zero.

Lower coefficient estimates for subsamples ending between 2020 and 2024 could be linked to fiscal stimulus measures adopted during the pandemic, which, partly because of the sharp falls in GDP, coincided with a surge in debt ratios. Our main specification controls for this by including annual deviations in government expenditures that lie outside 90 percent of the sample distribution of annual changes as a regressor in our baseline specification. This 'irregular expenditure' measure spikes during the pandemic and absorbs much of the extraordinary movement in primary balances. In addition, we employ three other robustness checks. First, we run regressions that include time-fixed effects [27]. Second, we report results that include specific dummy variables for the crisis periods of 2008 and 2020. Finally, we estimate our main specification on a subsample from 2008 to 2019. Estimates based on regressions including time-fixed effects and crisis dummies are close to our main specification. Estimates for the sample period leading up to the pandemic are slightly higher than baseline estimates, but still below those of the pre-GFC era.

[27] We do not include two-way fixed-effects in our main specification because resulting estimates may be biased and difficult to interpret. See Kropko and Kubinec (2020) for a discussion.

Figure 7: Reaction of primary surpluses to lagged debt



Source: Bruegel based on IMF World Economic Outlook, IMF Public Finances in Modern History, IMF Direction of Trade Statistics, International Country Risk Guide (ICRG), European Commission AMECO, and Bureau of Economic Analysis. Note: Select 15-year rolling window fiscal reaction estimates from a sample including western EU, US and UK. The model includes controls for country fixed effects, lagged primary balance, output gap, irregular expenditure, trade as share of GDP, inflation, and political stability using the Arellano-Bond GMM estimator. 2025 data based on IMF and European Commission Spring 2024 projections. Solid blue lines are point estimates of the effect of lagged debt ratios on primary surpluses. Shaded areas are 90 percent confidence intervals based on cluster robust standard errors.

The reduction in the strength of fiscal reaction observed in the second half of our sample could also be driven by overall higher debt levels during this period. Ghosh *et al* (2013) proposed to test whether fiscal adjustment diminishes at high debt levels using a fiscal reaction regression with a third-order polynomial in the debt ratio. A negative and significant coefficient of the cubic term implies the presence of *"fiscal fatigue"*. We augment our baseline specification with quadratic and cubic terms of lagged debt to look for evidence of fiscal fatigue in our sample (Table 5, columns 5 and 10). During the first half of our sample, we only find evidence of fiscal fatigue for eastern EU countries. For the second half however, we observe a significant negative coefficient for the samples including western EU countries, as well as the UK and the US (see annex II for fiscal fatigue estimates).

Ghosh *et al* (2013) further showed that the presence of fiscal fatigue implies a *"debt limit"*, above which debt becomes unsustainable. This is given by the highest debt level $\overline{d}$ that solves:

$$\mu + f(\overline{d}) = (r - g)\overline{d} \tag{4}$$

where μ summarises the determinants of the primary balance that are independent of the debt level (that is, the level of the intercept and controls in Z_i). The debt limit is the level of debt at which the primary surplus is exactly sufficient to cover the growth-adjusted interest service of an extra unit of debt. When $d > \overline{d}$, the primary surplus is not sufficient to meet interest payments, the debt grows continuously and the government defaults. Given current average interest-growth differential close to zero, the debt limit is identified by the intersection of $f(d)$ and the negative level of controls $-\mu$. For our estimates, the debt limit is identified and equal to 236 for western EU countries between 2008 and 2024. For the sample also including the UK and the US, it is 217. These estimates are about 30 percentage points above the average debt limits estimated by Ghosh *et al* (2013) for a sample of advanced economies between 1985 and 2007.

To conclude, even when accounting for common economic shocks and country-specific cyclical variations, the positive correlation between primary surpluses and debt ratios appears to have reduced significantly amidst the fiscal turmoil of the past decade and a half. Although a fiscal response of around 0.02 need not result in an explosive debt path (assuming equilibrium interest growth differentials likewise remain below 0.02), the downward trend in fiscal reactions is concerning. The presence of identifiable debt limits for the recent sample period is in line with these findings. These indicate that debt ratios beyond 217 percent of GDP could become unsustainable [28].

[28] Individual debt limits may differ from the estimated average, given country-specific intercepts. However, the identification of country-specific debt limits relies on the implausible assumption of a common slope of all fiscal reactions function; we focus on the average implied limit instead.

The results also show that fiscal reactions to debt ratios vary over time and are thus not structurally immutable. One reason why policy reactions may change, for example, is the evolution of fiscal institutions – such as the new EU fiscal framework – and a recognition, shared by policymakers, that some countries may be close to their borrowing limits. The fact that most EU countries have promised adjustment in line with their medium-term adjustment requirements, as shown in the previous section, could indicate such a structural change. However, should the decrease in fiscal responsiveness continue, or interest-growth differentials increase substantially, debt in Europe may become unsustainable.

6 Conclusion

In this paper, we have examined debt sustainability in EU countries, the United Kingdom and the United States. We employed two methodologies: one focusing on the feasibility of the medium fiscal adjustment required to stabilise the debt ratio, and one based on estimating the average response of the primary balance to changes in the debt ratio. Our findings lead to two main conclusions.

First, we do not consider debt in any of the countries studied to be unsustainable. This conclusion is based on three pieces of evidence: historical precedent for the primary surpluses that countries in our sample would need to achieve and the adjustments require to get there; the fact that, except for the US, all countries have announced plans to adjust in line with, or close to, what is required; and evidence that debt in all countries in our sample is below the level ('debt limit') at which the average response of the fiscal surplus to higher debt would be unable to cover the interest cost of the extra debt.

Second, nine countries – Austria, Belgium, Bulgaria, France, Hungary, Poland, Romania, Slovakia and the US – face adjustment needs that, based on the historical record, are unlikely to be achieved over the medium term. October 2025 IMF forecasts give somewhat better odds to Austria, Bulgaria, Hungary, Romania and the United States but not to Belgium, France and Poland. They also give significantly worse odds, to Czechia and Germany (compared to the historical adjustment record). According to the most recent IMF country reports, the IMF's fanchart index – an empirical signal of debt distress probability – indicates high risk of debt distress for Greece, Italy, the Romania, Spain and the United States (though once liquidity risks are also considered, this risk level drops to 'moderate' for the United States and Spain).

While our analysis takes into account fiscal pressures related to ageing populations, it ignores pressures from higher defence spending, particularly in Europe. It is unclear how these will be addressed, but one risk is clearly that deficits will widen, and fiscal adjustment will fall significantly short of what is needed to stabilise the debt. This could lead to a feedback loop of higher debt and higher borrowing costs –or worse, to a sudden jump in borrowing costs that could trigger debt distress. Among the EU countries, this risk is mitigated by the fact that the countries involved have pledged to reduce their deficits at rates that are consistent with, or exceed, what would be required to stabilise their debt levels. The same cannot be said of the United States, where both legislated and announced policies imply accelerating debt levels.

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Annex I: Stochastic DSA methodology

This annex describes the methodology, data sources and implementation of the stochastic debt sustainability analysis. The code and all publicly available data for reproduction of our results are freely available for download from the GitHub repository accompanying this publication[29].

A.I.1 Deterministic debt projections

The starting point for the DSA methodology applied in this paper is the European Commission's Debt Sustainability Monitor (DSM) 2022 (European Commission, 2023). Annex A3 of the DSM describes debt dynamics and the projection of implicit interest rate government debt. The debt ratio in a given year, d_t, is calculated as

$$d_t = \alpha^n \cdot d_{t-1} \cdot \frac{(1 + iir_t)}{(1 + g_t)} + \alpha^f \cdot d_{t-1} \cdot \frac{(1 + iir_t)}{(1 + g_t)} \cdot \frac{e_t}{e_{t-1}} - pb_t + f_t,$$

where α^n represents the share of total government debt denominated in domestic currency, α^f represents the share of total government debt denominated in other currencies, iir_t represents the implicit interest rate on government debt, g_t represents the nominal growth rate of GDP (in national currency), e_t represents the nominal exchange rate (expressed as national currency per foreign currency)[30], pb_t represents the primary balance ratio, and f_t represents stock-flow adjustments over GDP.

Data sources. Shares of euro-denominated debt are calculated based on ECB data. Bond-level debt data is taken from the Refinitiv Eikon database. Exchange rates are taken from Eurostat. Both variables are assumed to remain constant over the projection horizon. Stock-flow adjustments are taken from the AMECO database and based on projections by the European Commission's DG ECFIN, which are available up to 2024; from 2025, stock-flow adjustments are assumed to be zero, except for Finland and Luxembourg, where future stock-flow adjustments take into account respective pension balances. Nominal GDP growth, the primary balance and the implicit interest rate on government debt are endogenous model variables. They build on medium-term real growth, output gap and GDP-deflator projections by the IMF's World Economic Outlook (WEO), long-term growth and ageing-cost projections based on the European Commission's 2024 Ageing Report, long-term market expectations for inflation from Bloomberg, structural primary balance projections from the WEO database, fiscal multiplier data

[29] To access the repository, visit https://github.com/lennardwelslau/advanced-country-debt-sustainability. Bloomberg data can be downloaded via a Bloomberg Terminal. The README file of the GitHub repository details all data sources.

[30] More precisely, we model debt dynamics differently for euro-members and non-members. Only US dollar debt is considered for euro members, while only euro debt is considered for foreign US debt. Both euro and US dollar debt are considered for other non-euro members.

based on Carnot and de Castro (2015) and budget balance semi-elasticities based on Mourre *et al* (2019). The projection of the implicit interest rate on government debt further relies on ECB data on government debt stocks and shares of short- and long-term debt issuance, sovereign bond data from Refinitiv Eikon and market expectations for interest rates from Bloomberg.

Projecting nominal growth. The effect of fiscal stimulus and the cyclical dependence of the budget balance make growth and primary balance projections mutually dependent. These dependencies affect the variables from the beginning of the adjustment period in 2025. Prior to the adjustment period, ie up to 2024, the model relies directly on projections for the primary balance and nominal growth taken from the WEO database. From 2025, real growth, as forecasted by the IMF, is affected by annual adjustments of the structural primary balance. Specifically, in a given year, the effect of the fiscal multiplier effect is proportional to annual adjustments in the structural primary balance relative to its baseline trajectory:

$$m_t = 0.75 * (\Delta spb_t - \Delta spb_t^{BL})$$

Here, 0.75 is the fiscal multiplier of Carnot and de Castro (2015) and Δspb_t^{BL} denotes the annual change in baseline structural primary balance, which is based on the IMF WEO projections up to 2030 and held constant thereafter. The multiplier m_t affects real growth via its persistent effect on the output gap, narrowing the output gap by m_t in the year of the adjustment t, and reducing its impact by one-third of its initial effect in the two consecutive periods. Thus, the total impact on the output gap in a particular year is the sum of the impact in that year plus 2/3 of the impact from the previous year plus 1/3 of the impact from two years before. This definition differs slightly from the implementation of the fiscal multiplier by the European Commission. For euro-area countries, Bulgaria, Czechia, Denmark and Sweden, the inflation numbers used to compute nominal growth rates are based on the WEO forecast up to 2030 (GDP deflator), which are linearly interpolated with market expectations for 2035 implied by euro-area inflation swaps (HICP)[31], before converging to the 2 percent HICP inflation targets of these countries by 2054, in line with the Commission's methodology[32]. For Hungary, Poland and Romania, where the central banks have higher inflation targets, we assume, in line with the Commission's methodology, that half of the spread vis-à-vis euro-area inflation observed in 2026 remains by 2035, which then gradually converges to the national inflation targets by 2054.

Projecting the primary balance. The primary balance ratio is the sum of the structural primary balance ratio, a cyclical component, a property income component and an ageing cost component. Importantly, the latter component, ageing costs net of pension tax revenues, is not separated out during the

[31] Inflation expectations are based on October 2025 averages of daily data collected from Bloomberg on 1 November.

[32] Beyond the DSM, further details about the inflation projection methodology are presented in Box I.2.1 of European Commission (2022) 'Fiscal Sustainability Report 2021', INSTITUTIONAL PAPER 171, Directorate General of Economic Affairs, European Commission.

adjustment period. After the end of the adjustment period, it is assumed that the structural primary balance without the change in ageing costs remains the same, implying that the change in ageing costs affects the structural primary balance after the end of the adjustment. The cyclical component is defined as the product of country-specific budget balance elasticities and the output gap.

Projecting the implicit (average) interest rate. The implicit (average) interest rate on the public debt stock, iir_t, is calculated as the weighted average of the short-term market interest rate i_t^{ST} and the long-term implicit interest rate iir_t^{LT}:

$$iir_t = \alpha_{t-1} * i_t^{ST} + (1 - \alpha_{t-1}) * iir_t^{LT}.$$

Here, α_{t-1} is the share of short-term debt in the total debt stock in t-1 and iir_t^{LT} is calculated as the weighted average of the long-term market rate i_t^{LT} and the long-term implicit market interest rate in t-1:

$$iir_t^{LT} = \beta_{t-1} * i_t^{LT} + (1 - \beta_{t-1}) * iir_{t-1}^{LT},$$

where β_{t-1} is the share of new long-term debt issuance in total long-term debt stock in t-1. Long-term market rates are projected by linearly interpolating from Bloomberg ten-year government bond benchmark rates to 10Y10Y forward rates[33]. Between t+10 and t+30, long-term market rates converge linearly to 2 percent plus national inflation targets, which yields 4.5 percent for Poland and Romania, 5 percent for Hungary and 4 percent for all other countries. Short-term market rates are calculated using three-month benchmark rates, 3M10Y forward rates and 0.5 times the country-specific values for the long-term rate in t+30.

To project the implicit interest rate forward, we calculate the new issuance and total stock of short-term and long-term debt in each period t. Gross financing needs, ie the size of new issuance, are the sum of all interest and amortization payments, and the primary balance. Here, interest on short-term debt is the product of short-term market rates and the stock of short-term debt in t-1. Interest on long-term debt is the product of the implied interest rate on long-term debt iir_t^{LT} and the long-term debt stock in t-1. Short-term debt is redeemed entirely each period. The share of long-term debt maturing each year is based on bond-level data, as well as the eventual maturing of projected new issuance of long-term debt. Given gross financing needs, the share of newly issued short- and long-term debt is calculated

[33] Interest rate expectations are based on averages of daily data between 15 September and 15 October 2025, collected from Bloomberg on 15 October.

such that the share of short-term debt in total debt is held constant. The resulting debt issuances and stocks in period t are then used to calculate the implicit interest rate in t+1.[34]

A.I.2 Stochastic debt projections

Stochastic projections of the debt ratio differ from the European Commission methodology[35]. Similarly to the Commission, our approach consists of drawing multiple shock series distribution of historical quarterly shocks for the primary balance, nominal short- and long-term interest rates, nominal GDP growth and the exchange rates. Rather than drawing from an estimated joint normal distribution, however, we construct a shock series using a VAR. Each period of a projected shock series is the result of combining shocks in previous periods with estimated coefficients and a random error component obtained from bootstrapping the residual term of the VAR. Like Bouabdallah *et al* (2017), we choose the lag length according to the Schwarz information criterion, which results in a single lag for all countries. After transforming the shocks to annual frequency and constructing the shocks to the implicit interest rate, each series is combined with the projected deterministic path of the respective variable. Recalculating the debt ratio path for each draw using the equation in section A.I.1 produces the probability distribution of debt ratio projections. We calculate the distribution based on 100,000 draws.

Definition of shocks. Quarterly shocks are defined as the first differences in the historical quarterly time series. We correct for outliers by replacing observations that are three standard deviations above or below the mean with the respective threshold. Historical series are collected from the same sources that are listed in Annex A4.4 of the DSM (European Commission, 2023). Nominal GDP series for EU countries are constructed by combining series for real GDP growth and the GDP deflator from Eurostat and the IMF's International Financial Statistics database. For the US, we use data from the Bureau of Economic Analysis. UK data is taken from the Office for National Statistics. Short- and long-term interest rates are collected from the IMF's International Financial Statistics and the OECD's key short-term economic indicators. Exchange rates are obtained from Eurostat. Primary balance series are constructed by combining net lending/borrowing and payable interest data from Eurostat for EU countries. For the US, we combine payable interest data from the Bureau of Economic Analysis with net lending/borrowing data from the Board of Governors of the Federal Reserve System. For the UK, we

[34] In the periods up to 2025, the implicit interest rate is assumed to be equal to the projections from the WEO database and the implicit long-term interest rate is constructed to be in line with this assumption.

[35] The Commission DSM methodology is in turn based on Berti (2013) "Stochastic public debt projections using the historical variance-covariance matrix approach for EU countries" European Economy. Economic Papers No. 480. and on Beynet and Paviot (2012) "Assessing the sensitivity of Hungarian debt sustainability to macroeconomic shocks under two fiscal policy reactions" OECD Economics Department Working Paper No. 946.

source interest and overall balance data from the Office for National Statistics. These data sources are described in detail in the 'data sources' file referenced above.

Aggregation of shocks. Quarterly shocks for nominal GDP growth, the primary balance, the nominal exchange rate and the short-term interest rate are transformed into annual frequency by summing the historical shocks in each year. In the first projection year, shocks to the long-term interest rate are transformed in the same way. However, because a change in long-term interest rate in a given quarter will affect overall interest on government debt until the debt issued in that quarter has matured, aggregating quarterly long-term interest rate shocks must account for such persistence. A shock in year t is assumed to carry over to subsequent years, proportionally to the share of maturing debt that is progressively rolled over. Thus, shocks to the implicit long-term interest rate $\varepsilon_t^{i^{LT}}$, from the second projection year onward, are defined as

$$\varepsilon_t^{i^{LT}} = \frac{t}{T} \sum_{q=-4t}^{4} \varepsilon_q^{i^{LT}},$$

where T denotes the average maturity of long-term debt in years, calculated as one over the historical average share of long-term debt maturing, and q denotes the quarters of historical shocks being aggregated. Finally, shocks to the implicit interest rate on government debt are calculated as weighted average of annualised shocks to the short- and long-term interest rate:

$$\varepsilon_t^{iir} = \alpha^{ST} \varepsilon_t^{i^{ST}} + (1 - \alpha^{ST}) \varepsilon_t^{i^{LT}}$$

Here, α^{ST} is the share of short-term debt in total government debt, calculated based on ECB data. The variance-covariance matrix of the resulting annual shock series is then used to estimate a joint normal distribution with zero mean from which the shocks used in the stochastic projection are drawn.

A.I.3 Implementation

The deterministic and stochastic projections described above, as well as methods for the projection for the optimisation of structural primary balance paths under the varying assumptions implemented using Python. Code, data and tutorials to replicate our analysis can be found in the accompanying GitHub repository.

Annex II: Robustness checks for fiscal reaction function

Table A1: Additional estimates for EU13

	1990 - 2007				2008 - 2024				2008 - 2019	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged debt ratio	0.240***	0.0240***	0.0363***	0.0458***	-0.106	0.0110**	0.0150***	0.0261***	0.0374***	0.151***
	(0.0870)	(0.00867)	(0.00867)	(0.0134)	(0.0850)	(0.00503)	(0.00344)	(0.00617)	-0,00535	(0.0489)
Lagged debt ratio*2	-0.00270**				0.00130*					-0.00129**
	(0.00113)				(0.000752)					(0.000509)
Lagged debt ratio*3	0.0000105**				-0.00000385*					0.00000419***
	(0.00000455)				(0.00000197)					(0.00000161)
Lagged PB	0.632***	0.679***	0.609***	0.617***	0.770***	0.851***	0.821***	0.824***	0.793***	0.800***
	(0.0464)	(0.0443)	(0.0349)	(0.0397)	(0.0555)	(0.0580)	(0.0462)	(0.0771)	-0,0469	(0.0578)
Output gap	0.309***	0.332***	0.326***	0.305***	0.133**	0.0217*	0.0390*	-0.00266	0.176***	0.178**
	(0.0817)	(0.103)	(0.0872)	(0.106)	(0.0545)	(0.0117)	(0.0220)	(0.0594)	-0,0665	(0.0736)
Irregular expenditure	-0.800***	-0.775***	-0.865***	-0.894***	-1.221***	-1.061***	-1.104***	-1.383***	-1.166***	-1.155***
	(0.294)	(0.216)	(0.265)	(0.332)	(0.0573)	(0.0697)	(0.0714)	(0.0593)	-0,068	(0.0818)
Inflation	0.0172**	0.0164*	0.0205	0.0217**	0.0140*	-0.0119	0.00513	0.0501***	0.0146*	0.0131*
	(0.00809)	(0.00965)	(0.0125)	(0.00922)	(0.00799)	(0.0140)	(0.00721)	(0.0185)	-0,00826	(0.00761)
Trade	0.133**	0.183***	0.147**	0.118	-0.140	-0.254	-0.132	-0.124	0.147**	0.144***
	(0.0609)	(0.0370)	(0.0657)	(0.0901)	(0.0957)	(0.212)	(0.0848)	(0.0769)	-0,0612	(0.0540)
Political stability	0.124	-0.106	0.157**	0.140*	-0.481***	0.188*	-0.0500	-0.377***	0,0933	0.0588
	(0.0925)	(0.0994)	(0.0787)	(0.0823)	(0.174)	(0.101)	(0.102)	(0.140)	-0,0772	(0.0815)
Constant	-9.170***	-1.250	-5.212***	-5.704***	4.141	-0.783	-0.733	-3.285*	-4.687***	-7.176***
	(2.881)	(1.067)	(1.438)	(1.862)	(3.724)	(1.311)	(1.063)	(1.897)	-1,277	(1.566)
Estimator	IV-GMM	IV-GMM	IV-GMM	IV-FE	IV-GMM	IV-GMM	IV-GMM	IV-FE	IV-GMM	IV-GMM
Country fixed effects	x	x	x	x	x	x	x	x	x	x
Time fixed effects		x			x					
Crisis Dummies			x			x				
Observations	221	221	221	221	208	208	208	208	377	377

Source: Bruegel based on IMF World Economic Outlook, European Commission AMECO, Bureau of Economic Analysis, and ICRG. Note: Arellano-Bond GMM and FEIV estimates of Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Sweden. Instruments for output gap are the lagged output gap, second lag of the debt ratio, and first and second lag of output growth gap (following Plödt and Reicher 2015, Checherita-Westphal and Žďárek 2017). Irregular expenditures are public annual changes in public expenditures that lie outside 90 percent of the country's sample. Inflation is a 3-year rolling average of the CPI. Trade describes the sum of exports and imports as share of GDP. Political stability is the ICRG Political Risk Index. Significantly negative cubic lagged debt terms indicate fiscal fatigue following Ghosh *et al* (2013). Robust standard errors clustered at country level in parentheses (* p<0.10, ** p<0.05, *** p<0.05).

Table A2: Additional estimates for eastern EU

	1990 – 2007				2008 - 2024				2008 - 2019	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged debt ratio	-0.0362	0.00191	0.00850	-0.0259	-0.0183	0.0316***	0.0178**	0.0442***	0.0333***	0.00562
	(0.0828)	(0.0171)	(0.0144)	(0.0180)	(0.0566)	(0.00715)	(0.00809)	(0.0127)	(0.00922)	(0.0471)
Lagged debt ratio^2	0.00155				0.000416					0.000660
	(0.00177)				(0.00106)					(0.000918)
Lagged debt ratio^3	-0.0000138				-0.000000358					-0.00000419
	(0.0000109)				(0.00000565)					(0.00000525)
Lagged PB	0.536***	0.493***	0.485***	0.521***	0.577***	0.538***	0.632***	0.619***	0.513***	0.514***
	(0.0599)	(0.0631)	(0.0509)	(0.0827)	(0.0818)	(0.0345)	(0.0500)	(0.0684)	(0.0534)	(0.0546)
Output gap	0.151***	-0.00105	0.146**	-0.00363	0.139**	0.153***	0.0580	-0.0353	0.164***	0.164***
	(0.0576)	(0.0680)	(0.0577)	(0.0587)	(0.0556)	(0.0505)	(0.0431)	(0.0811)	(0.0402)	(0.0403)
Irregular expenditure	-0.721***	-0.399**	-0.302	-1.027*	-1.518***	-1.113***	-1.247***	-1.688***	-0.785***	-0.813***
	(0.261)	(0.200)	(0.192)	(0.575)	(0.285)	(0.144)	(0.188)	(0.256)	(0.305)	(0.274)
Inflation	0.00000918	-0.00621	0.00257	0.0370**	0.0113***	0.00775	0.00667*	0.0136	0.0109*	0.00948
	(0.0108)	(0.00783)	(0.00989)	(0.0164)	(0.00426)	(0.00526)	(0.00341)	(0.00998)	(0.00589)	(0.00630)
Trade	0.00523***	0.00397	0.00367*	0.00677***	-0.0662	0.208**	-0.104*	-0.121**	0.00419***	0.00390**
	(0.00181)	(0.00326)	(0.00199)	(0.00242)	(0.0595)	(0.0849)	(0.0532)	(0.0485)	(0.00151)	(0.00159)
Political stability	-0.0548	0.253***	-0.0377	-0.0136	-0.443**	-0.330*	-0.387***	-0.275**	-0.0739	-0.0827
	(0.117)	(0.0800)	(0.114)	(0.216)	(0.177)	(0.175)	(0.149)	(0.112)	(0.132)	(0.141)
Constant	-0.120	-2.755**	-0.724	-2.559	1.442	-2.463	1.312	-1.838**	-2.345	-1.878
	(2.413)	(1.149)	(1.650)	(3.093)	(1.569)	(2.268)	(1.404)	(0.774)	(1.660)	(1.729)
Estimator	IV-GMM	IV-GMM	IV-GMM	IV-FE	IV-GMM	IV-GMM	IV-GMM	IV-FE	IV-GMM	IV-GMM
Country fixed effects	x	x	x	x	x	x	x	x	x	x
Time fixed effects		x			x					
Crisis Dummies			x			x				
Observations	102	102	102	102	192	192	192	192	246	246

Source: Bruegel based on IMF World Economic Outlook, European Commission AMECO, Bureau of Economic Analysis, and ICRG. Note: Arellano-Bond GMM and FEIV estimates of Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Sweden. Instruments for output gap are the lagged output gap, second lag of the debt ratio, and first and second lag of output growth gap (following Plödt and Reicher 2015, Checherita-Westphal and Žďárek 2017). Irregular expenditures are public annual changes in public expenditures that lie outside 90 percent of the country's sample. Inflation is a 3-year rolling average of the CPI. Trade describes the sum of exports and imports as share of GDP. Political stability is the ICRG Political Risk Index. Significantly negative cubic lagged debt terms indicate fiscal fatigue following Ghosh *et al* (2013). Robust standard errors clustered at country level in parentheses (* p<0.10, ** p<0.05, *** p<0.05).

Table A3. Additional estimates for EU13, UK and US

	1990 - 2007				2008 - 2024				2008 - 2019	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Lagged debt ratio	0.250**	0.0271***	0.0455***	0.0514***	-0.123	0.00888**	0.0126***	0.0271***	0.0370***	0.163***
	(0.0985)	(0.00834)	(0.00972)	(0.0146)	(0.0886)	(0.00360)	(0.00319)	(0.00547)	(0.00508)	(0.0485)
Lagged debt ratio^2	-0.00257*				0.00148*					-0.00142***
	(0.00132)				(0.000761)					(0.000515)
Lagged debt ratio^3	0.00000933*				-0.00000447**					0.00000464***
	(0.00000548)				(0.00000191)					(0.00000165)
Lagged PB	0.652***	0.704***	0.617***	0.633***	0.746***	0.842***	0.795***	0.798***	0.803***	0.808***
	(0.0456)	(0.0446)	(0.0384)	(0.0435)	(0.0582)	(0.0671)	(0.0530)	(0.0800)	(0.0409)	(0.0489)
Output gap	0.322***	0.327***	0.349***	0.326***	0.120**	0.000567	0.0225	-0.00759	0.186***	0.190***
	(0.0818)	(0.0883)	(0.0844)	(0.0956)	(0.0536)	(0.0160)	(0.0229)	(0.0524)	(0.0669)	(0.0734)
Irregular expenditure	-0.775***	-0.813***	-0.833***	-0.895***	-1.191***	-1.042***	-1.070***	-1.357***	-1.195***	-1.181***
	(0.288)	(0.221)	(0.260)	(0.331)	(0.0570)	(0.0697)	(0.0631)	(0.0456)	(0.0673)	(0.0723)
Inflation	0.0174*	0.0179*	0.0227	0.0217**	0.0279***	0.00458	0.0186**	0.0520***	0.0170*	0.0154*
	(0.0102)	(0.0107)	(0.0147)	(0.0102)	(0.0102)	(0.0108)	(0.00912)	(0.0163)	(0.00907)	(0.00846)
Trade	0.157***	0.203***	0.169***	0.118	-0.226**	-0.369*	-0.202**	-0.172**	0.148**	0.150***
	(0.0569)	(0.0516)	(0.0627)	(0.0881)	(0.0933)	(0.193)	(0.0846)	(0.0674)	(0.0613)	(0.0539)
Political stability	0.131	-0.0398	0.175**	0.123	-0.444**	0.163	-0.0605	-0.339**	0.0926	0.0616
	(0.0840)	(0.0933)	(0.0792)	(0.0753)	(0.178)	(0.107)	(0.0914)	(0.136)	(0.0745)	(0.0781)
Constant	-10.02***	-3.894***	-6.050***	-5.802***	3.672	-1.597*	-1.335	-3.444*	-4.752***	-7.599***
	(2.942)	(0.812)	(1.509)	(1.862)	(3.984)	(0.928)	(0.863)	(1.934)	(1.262)	(1.498)
Estimator	IV-GMM	IV-GMM	IV-GMM	IV-FE	IV-GMM	IV-GMM	IV-GMM	IV-FE	IV-GMM	IV-GMM
Country fixed effects	x	x	x	x	x	x	x	x	x	x
Time fixed effects		x			x					
Crisis Dummies			x			x				
Observations	255	255	255	255	240	240	240	240	435	435

Source: Bruegel based on IMF World Economic Outlook, European Commission AMECO, Bureau of Economic Analysis, and ICRG. Note: Arellano-Bond GMM and FEIV estimates of Austria, Belgium, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Netherlands, Portugal and Sweden. Instruments for output gap are the lagged output gap, second lag of the debt ratio and first and second lag of output growth gap (following Plödt and Reicher 2015, Checherita-Westphal and Žd'árek 2017). Irregular expenditures are public annual changes in public expenditures that lie outside 90 percent of the country's sample. Inflation is a 3-year rolling average of the CPI. Trade describes the sum of exports and imports as share of GDP. Political stability is the ICRG Political Risk Index. Significantly negative cubic lagged debt terms indicate fiscal fatigue following Ghosh *et al* (2013). Robust standard errors clustered at country level in parentheses (* $p<0.10$, ** $p<0.05$, *** $p<0.05$).

bruegel

Bruegel, Rue de la Charité 33, B-1210 Brussels
(+32) 2 227 4210
info@bruegel.org
www.bruegel.org