Box III.3.2: Public investments and debt sustainability – QUEST simulations

This box assesses the impact of a public investment stimulus on debt dynamics, based on simulations using the Commission's QUEST model ([1]). Public investment needs are rising in Europe. In a context of elevated public debt, the question arises as to what the implications are for fiscal sustainability of addressing those investment needs. While negative interest-growth differentials over recent years have kept the fiscal costs of public spending low, financing conditions might become less favourable going forward, implying harsher trade-offs between spending needs and debt sustainability. In contrast, a more optimistic viewpoint argues that by boosting economic growth, increased public investment spending can create (some) funding for itself, either via higher tax bases or beneficial denominator effects – even if interest rates are above GDP growth in the long run. This box contributes to this debate by quantitatively assessing the implications of public investment for debt dynamics using QUEST, a rich general equilibrium macro model, calibrated to the German economy.

A temporary six-year rise in public investment, *without offsetting fiscal action*, leads to a sustained increase in the debt-to-GDP ratio under conventional assumptions. Public investment affects debt-to-GDP via two broad channels: the primary balance and the interest-growth differential (r-g or "snowball term") ([2]). Investment spending incurs a direct budgetary cost, but at the same time it also leads to a persistent expansion of real GDP that could endogenously reduce the snowball term (reactions of inflation, monetary policy and other budgetary items also have an influence). Our simulations show that, while higher growth can provide some backing for the additional public debt, the cumulative primary deficits from the stimulus outweigh this denominator effect, leading to rising debt-to-GDP (left panel of Graph 1). In other words, debt stabilisation would eventually require higher primary surpluses, implying that public investments must be paid for by subsequent fiscal adjustments.

The public investment stimulus lowers the primary budget balance (Graph 1, right panel). Additional spending on government investments (pink bars) raises the public expenditures share of GDP. Other non-investment expenditures, such as transfers (e.g., pensions) and government consumption (e.g., public sector wages), are assumed to be indexed to output in our central scenario, implying that their GDP shares remain unchanged and thus they do not contribute to movements in the primary balance-to-GDP ratio. On the revenue side, taxes (from consumption, labour income and corporate profits) grow roughly in line with GDP as tax bases rise with output, implying a relatively stable ratio to GDP ([3]). As a result, the primary balance-to-GDP decreases during the fiscal expansion and returns close to its baseline value thereafter, entailing large cumulative deficits (purple bars in the left panel of Graph 1) that contribute to higher public debt.

([1]) The details of these simulations are published in Motyovszki, Gergő, Philipp Pfeiffer and Jan in 't Veld (2024). The implications of public investment for debt sustainability. *European Economy Discussion Papers*, June 2024, DP 204.

([2]) The snowball effect can be further split into an *endogenous* response to the fiscal shock (i.e. deviations from baseline values) by effective nominal interest rates on outstanding public debt $i^g_{t-1} - i^g$, real GDP growth $\hat{g}_t$ and GDP-deflator inflation $\hat{\pi}_t$ on the one hand, and the contribution of the (exogenous) *steady-state* interest-growth differential $i^g - G$ on the other hand. Accordingly, the dynamics of the cumulative change in the public debt-to-GDP ratio $\hat{d}_T$ can be decomposed (as displayed on the left panel of Graph 1) based on the following equation, where pb_t is the primary budget balance as a percent of GDP, while G is trend nominal growth. The last four terms sum up to the snowball effect, which operates *on top of* the effects of inflation and real growth on the primary balance itself.

$$\hat{d}_T = \sum_{t=2024}^{T} \Delta d_t = -\sum_{t=2024}^{T} (pb_t - pb) + \sum_{t=2024}^{T} \frac{i^g_{t-1} - i^g}{(1+\hat{\pi}_t)(1+\hat{g}_t)(1+\mathrm{G})} d_{t-1} - \sum_{t=2024}^{T} \frac{\hat{g}_t}{(1+\hat{\pi}_t)(1+\hat{g}_t)} d_{t-1} - \sum_{t=2024}^{T} \frac{\hat{\pi}_t}{1+\hat{\pi}_t} d_{t-1} + \sum_{t=2024}^{T} \frac{i^g - G}{(1+\mathrm{G})} \left[\frac{d_{t-1}}{(1+\hat{\pi}_t)(1+\hat{g}_t)} - d \right]$$

([3]) This is consistent with budgetary revenue semi-elasticity estimates of close to zero. The tax-to-GDP ratio declines slightly only while the stimulus lasts, mainly driven by the VAT channel as the GDP share of investments grows at the expense of the consumption share. Shifts in tax-to-GDP could also result from composition effects through varying labour and profit shares to the extent that they are taxed at different rates. This is not the case in the current German calibration of the model.

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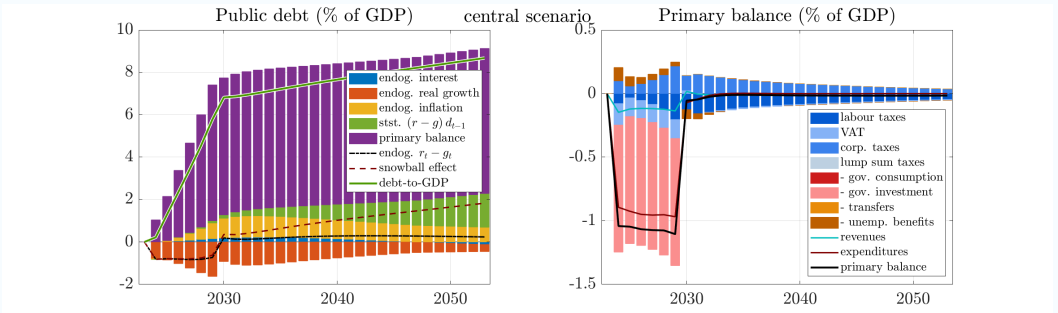
Box (continued)

Graph 1: **Fiscal effects of a public investment stimulus**

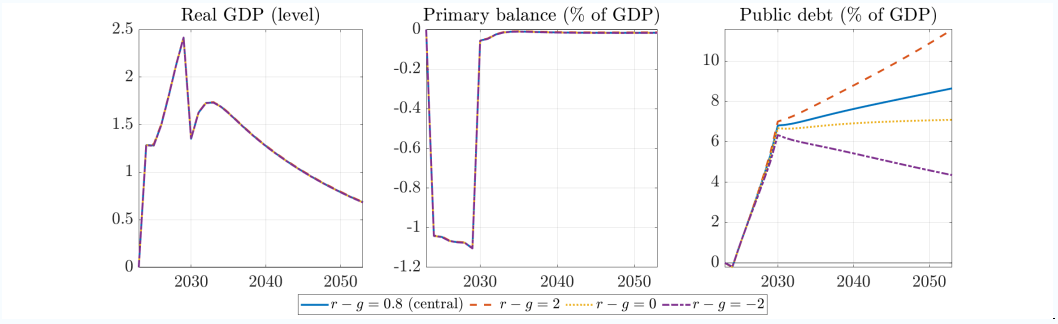


The left panel reports pp deviations of public debt-to-GDP from baseline after raising the GDP-share of public investment by 1 pp for six years. Coloured bars depict cumulative contributions to this deviation based on the decomposition shown before. The endogenous deviation in the interest-growth differential (blue, red, and yellow bars, summing up to the black dash-dotted line) and the term due to the steady-state interest-growth differential (green bars) sum up to the snowball effect (red dashed line). The right panel reports pp deviations of the primary balance-to-GDP ratio from baseline.

Source: European Commission staff calculations - simulations by QUEST, calibrated for Germany.

The snowball effect is a relatively smaller contributor to debt-to-GDP dynamics (Graph 1, left panel). Initially, the snowball term is negative, driven mainly by higher real GDP (red bars). Beyond the Keynesian demand-boosting effects of public spending, government investments augment private sector productivity, crowding in private investments in the medium term, which results in large fiscal multipliers. However, gradually expanding supply capacities also exert a deflationary pressure (yellow bars) which moderates the rise in nominal GDP and weakens the denominator effect in the medium run. Monetary tightening (in response to higher euro area inflation) has a limited effect on government interest expenditures (blue bars) due to long average debt maturities, as is typically observed in the EU. In the long run, as these *endogenous* effects on the interest-growth differential fade, assumptions about the exogenous *steady-state* r-g (green bars) start dominating the dynamics of the snowball term. In our central scenario with a positive long-run r-g ([4]), interest rates compound faster on the additional debt stemming from the stimulus than growth can erode it, putting debt-to-GDP on an increasing trajectory.

Graph 2: **The effect of the steady-state r-g differential**



The panels report pp deviations (% deviations for real GDP level) from baseline after raising the GDP-share of public investment by 1 pp for six years, for different values of the steady-state interest-growth differential r-g.

Source: European Commission staff calculations - simulations by QUEST, calibrated for Germany.

The long-term interest growth differential (r-g) assumption is an important driver of the fiscal outcome (Graph 2). In contrast to our central scenario (blue lines), under the assumption of a negative long-term r-g, debt-to-GDP could converge back to its baseline level in the medium to long run, even without subsequent budgetary adjustments (Blanchard, 2019). As interest payments accumulate relatively slower, it is possible to outgrow debt, independently of the endogenous effects of the fiscal shock. Graph 2 illustrates that these differences stem entirely from the steady-state component of the snowball term,

([4]) The steady-state interest growth differential (r-g=0.8%) assumed in our central scenario is the result of a real growth rate of 1.2% and a real interest rate of 2% for government bonds, which corresponds to long-run assumptions in the Commission's Debt Sustainability Analysis (DSA) framework.

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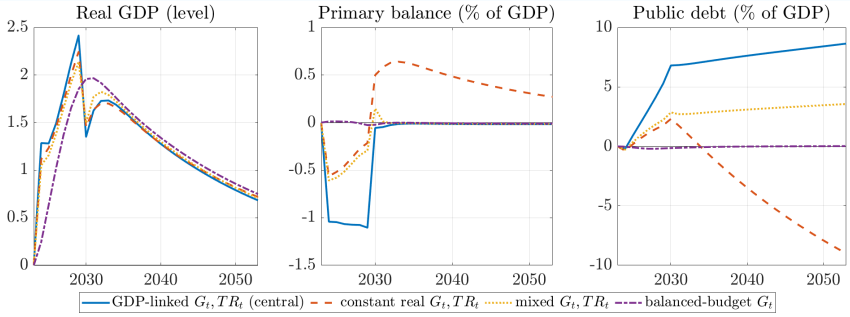
while the endogenous response of the economy to the investment stimulus is otherwise identical across these scenarios ([5]).

Graph 3: **The effect of different expenditure indexation rules**



The panels report pp deviations (% deviations for real GDP level) from baseline after raising the GDP-share of public investment by 1 pp for six years. For GDP-linked expenditure (blue), transfers and government consumption grow in line with GDP, while for constant expenditures (red dashed) they are fixed in real terms at their baseline level permanently. The mixed scenario (yellow dotted) keeps these expenditures constant only while the stimulus lasts (yielding a cyclical response of the primary balance in the short run), which then catch up with GDP-indexation within 3 years (constant structural component). Explicit fiscal adjustments by cutting gov. consumption (purple dash-dotted) ex-ante cover the cost of the investment stimulus.
Source: European Commission staff calculations - QUEST simulations, calibrated for Germany.

Assumptions on the evolution of non-investment spending carry significant implications as well (Graph 3). In our central scenario (blue solid lines), these are assumed to grow in line with additional output, by construction eliminating any endogenous effect on the primary balance-to-GDP beyond the direct impact of the stimulus. Alternatively, keeping non-investment spending constant in real terms (red dashed lines) implies a declining expenditure share within a growing GDP. The resulting higher primary balances contribute to debt stabilisation. Yet, despite being automatic, these increased primary balances reflect the inherent fiscal costs of achieving debt reduction, challenging the notion of a "free lunch". Instead, this scenario represents a form of fiscal *quasi-consolidation*, as the beneficiaries of fixed public spending items (e.g., government employees, pensioners, and other transfer recipients) see their income persistently falling behind the rest of the economy. While often implicitly adopted in short-term analyses, the assumption of falling spending shares for non-stimulus items (i.e., non-investment in the present case) appears less plausible when considering long-term projections. A more plausible combined scenario (yellow dotted lines), that allows for a short-term cyclical increase in the primary balance via non-stimulus spending items while maintaining a constant spending share in the long run, would still lead to an increase in debt-to-GDP.

Explicit fiscal adjustments to cover the cost of public investments and stabilise debt, would maintain most of the GDP gains. We consider a scenario with an ex-ante balanced-budget fiscal shock, where a cut in government consumption exactly offsets the costs of the investment stimulus (purple dash-dotted line on Graph 3). In effect, the government implements a fiscally neutral shift from unproductive towards productive spending ("prioritisation"), such that the net demand-side effect of the stimulus is zero: the macroeconomic responses therefore isolate the supply-side effects of public investments, which feature persistent GDP gains. Behind these aggregate outcomes, however, policymakers might face challenging distributional trade-offs, underscoring the potential costliness of the required fiscal adjustment.

The need for public investments to be eventually paid for in a narrow fiscal sense should also be weighed against their potential to improve societal welfare. The resulting future productivity gains (e.g., by mitigating climate damages) could outweigh the consumption and leisure sacrifices that have to be made in the present to undertake these investments. In addition, financing investments via additional debt issuance (instead of in a budgetary-neutral way) might be advisable for tax-smoothing or "pay-as-you-use" generational fairness.

([5]) Note that the model responses to the public investment shock are set against a *constant* steady state, which features the same *r-g* initially as in the long run. However, in reality, the "no-investment" baseline scenario could look very different in the short run (e.g., featuring lower interest-growth differentials) than in the long run. Our stylised simulations do not capture this variability, but the sensitivity analyses could help to form a more nuanced picture.