Debt Sustainability After the Pandemic: a Rift between the Advanced and Developing Economies?

Paola Subacchi[a)], Paul van den Noord[b)] and Rodrigo Olivares-Caminal[c)]

Draft

Abstract

The (aftermath of the) Covid-19 health crisis is posing significant fiscal challenges to many countries, both advanced as well as developing economies. A key issue being faced by policymakers is the degree of fiscal space given the recent surge in public debt. Exceptional shocks like the one triggered by the pandemic can push countries beyond their limit vis-à-vis debt sustainability. This will inevitably constrain these countries' fiscal space until the level of debt regains sustainability.
In this paper we estimate the public debt limit and ensuing fiscal space for a panel of developed and developing economies for the G20 countries during for the period 1980-2022. For this we devise an analytical framework that expands the methodology of DSA to detect whether a country's debt is on an unsustainable path at prevailing (or projected) rates of economic growth, real interest rates and the primary balance.

Keywords: Fiscal policy, debt sustainability, fiscal space

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a) Global Policy Institute, Queen Mary University of London

b) **Amsterdam School of Economics and ACES, Amsterdam Centre for European Studies**
c) Centre for Commercial Law Studies, Queen Mary University of London

Introduction

The (aftermath of the) Covid-19 health crisis is posing significant fiscal challenges to many countries, both advanced as well as developing economies. A key issue being faced by policymakers is the degree of fiscal space given the recent surge in public debt. The experience during the outbreak of the Covid-19 pandemic has shown the importance of having fiscal space to implement exceptional measures of fiscal policy that are necessary to support people and the economy – "lives and livelihood" – during an emergency, thus keeping societies and economies resilient.

However, exceptional shocks like the one triggered by the pandemic can push countries beyond their limit vis-à-vis debt sustainability. This will inevitably constrain these countries' fiscal space until the level of debt regains sustainability. The trade-off that politicians and policy makers' face is between fiscal expansion to respond to the emergency and fiscal restraint to manage debt sustainability. For a variety of reasons, the terms of this trade-off appear to be more challenging for developing than for developed economies, which gives rise to a fundamental inequality. This is particularly concerning in view of the global climate challenge, which is likely to make a strong call on the available fiscal space, putting additional strain on many economies and widening the gap between developed and developing countries.

In this paper we aim to estimate the public debt limit and ensuing fiscal space for a panel of developed and developing economies for the period 1980-2022. Drawing on Bohn (1998, 2008) we explore how the primary fiscal balance responds to increases in the level of debt as an indicator of whether public debt can be repaid in the long run. Importantly, the relationship between a country's primary balance and debt dynamics is non-linear. Our research question is to what extent this relationship is fundamentally different for advanced economies and developing countries. This is because advanced economies have favourable access to capital markets, have credible institutions, can issue their debt in their own currency, rely on money financing, benefit from zero-bound nominal interest rates below the nominal output growth rates so that "public debt

may have no cost" (Blanchard, 2019). Developing countries, on the other hand, have limited access to capital markets, often have poor institutional governance, cannot issue debt in their own currency nor rely on money financing; therefore facing more constraining credit conditions and higher costs for servicing the debt, and they are often under pressure to implement extraordinary fiscal efforts to restore debt sustainability, especially if they face an increase in risk premium that may make the case for fiscal consolidation more urgent (Andres et al, 2020).

The paper is organised as follows. Part 1 reviews the existing literature on debt sustainability and fiscal space, and sets our contribution in the context of the current debate. Part 2 discusses operational definitions, the methodology and the analytical framework that we employ to estimate the public debt limit and the fiscal space. In Part 3 we present the results for the countries in the Group of 20 (G20) and we discuss three cases – the US, Argentina and Turkey – where the results show that the notion of debt limit, whereas debt has become or is near to become explosive, is less binding for the former than for Argentina and Turkey.

Part 4 discuses policy implications and specifically focuses on how we think about debt sustainability, whereas there are limits to fiscal policy and how to assess these limits. Part 5 concludes.

1. Review of the literature

Within the existing literature there is a broad consensus that considers public debt as being sustainable when the government can manage current and future and future financial obligations without having to resort to unfeasible or undesirable policies. Debrun et al (2020, 153-4) observes that solvency is a prediction about future budget balances over an indefinite horizon without clear operational implication. On the other hand, concrete approaches to assess debt sustainability have focused on sufficient (but by no means necessary) conditions for solvency, but this has resulted in an "eclectic" approach rather than a single operational definition of debt sustainability.

The existing literature is also ambiguous about the definition of fiscal space that is usually considered as equivalent to and synonymous of debt sustainability. Kose et all (2017) broadly define fiscal space as the availability of budgetary resources for a

government to service its financial obligations. Through a comprehensive cross-country database of fiscal space, they show the multiple dimensions of debt service capacity, including financing needs that are related to budget positions, access to liquid markets, resilience to valuation changes, and contingent liabilities (Kose et al., 2017:2). Similarly, Bi (2012) and Bi et al. (2016) define a country's fiscal space or fiscal limit as the maximum amount of public debt relative to GDP that a country can sustain without defaulting on its financial commitments. For Gosh et al. (2013) fiscal space is room for fiscal manouvre. However, both fiscal space and debt sustainability imply the ability of a government to service its debt. Unless debt service capacity is maintained, a government cannot indefinitely finance its operations in a sound manner.

Drawing on Alvarado et al. (2004), Hausmann (2004) and Reinhart et al. (2003), Bi et al. (2016) show the constraints faced by developing countries and their relatively low fiscal limits compared with the developed countries. Their analysis shows that low fiscal limits are largely based on expected future revenue; developing countries have much lower effective tax rates than developed countries due to inefficient tax collection systems, tax evasion and large informal sectors. In addition, these countries are more vulnerable to temporary disturbances in exchange rate because of a change in perceptions of fiscal sustainability. Developing countries that rely heavily on external borrowing are exposed to real exchange rate fluctuations for. Thus, a large real depreciation lowers a country's fiscal limits, constraints the government's ability to service its debt and suddenly raise default probabilities of an economy with large external debt. Bi et al. (2016: 126) conclude that perception about the fiscal solvency can change suddenly even without changes to economic policies or structures.

Developed economies have high fiscal limits; nonetheless they too need to assess their 'debt limit' (Gosh et al., 2013: F4) beyond which fiscal solvency is in doubt. Following Bohn (1998, 2008) who looks at how the primary fiscal balance responds to increases in the level of debt as an indicator of whether public debt can be repaid in the long run, Gosh et al. (2013) develop a framework to assess debt sustainability in developed economies. In their analysis they show that Bohn's sustainability criterion that the primary balance always reacts positively to lagged debt is a weak one. Instead, they adopt a stricter sustainability criterion that public debt should converge to some finite proportion of GDP. In their analysis they also introduce the concept of "fiscal fatigue",

as a slower policy-induced improvement of the primary balance to rising debt than the interest rate-growth rate differential. "Fiscal fatigue" means that fiscal consolidation is stopped in its tracks beyond a certain debt threshold. As debt approached the debt limit, the cost of financing will increase from the risk-free rate to high interest rate within a very narrow range of debt ratios (Gosh et al., 2013: F6).[1]

The model developed by Gosh et al. is helpful to identify cases where fiscal consolidation is urgent to ensure that debt remains on a sustainable path and that shocks do not derail sustainability (Gosh et al., 2013: F23). The model also highlights the fact that the relationship between a country's primary balance and debt dynamics is non-linear and that debt limits and the corresponding fiscal space vary considerably across countries.

In a controversial paper Reinhart and Rogoff (2010) use a multi-country historical dataset on public debt and estimate the debt limit above which growth rates are lower than otherwise. They empirically determine this debt threshold at around 90% of GDP for both advanced economies and emerging markets. They conclude that debt/GDP levels at or above 90% are associated with lower growth outcomes and highlight the nonlinear response of growth to debt as vulnerabilities associated with debt build up.

Reinhart and Rogoff's paper sparked a strand of literature broadly vindicating their findings despite criticism regarding their methodology (De Rugy and Salmon, 2020). According to Kassouri et al (2021), however, this debt threshold is found to be significantly lower than 90% of GDP in developing economies, of the order of 35% of GDP.

Pappas and Kostakis (2020) identify debt limits with interest rates beyond a certain debt threshold surging due to market perceptions of growing insolvency risk. This literature has so far focused mostly on the eurozone in the wake of the sovereign debt crisis of 2010-2013, but this is likely to be relevant for developing economies relying to a large extent on foreign currency debt as well (Poghosyan, 2012).

[1] Gosh et al. (2013) use the model to analyse the effects of unanticipated fiscal shocks that lower the debt limit. The model also shows the results of "fiscal shocks" with Greece as a case study.

Blanchard's contribution raises the question of what debt policy a government should embrace when interest rates are historically low (Blanchard, 2019; Blanchard, forthcoming). Using the concept of neutral interest rate r*, that is the safe rate needed to maintain output at potential, he observes the steady decline in the neutral rate over the last thirty years. This decline has resulted in r* becoming lower than GDP growth and occasionally running into the effective lower bound constraint. This in turn results in lower fiscal costs of debt and so the welfare costs of debt.

The key question therefore becomes whether countries should reduce their debt and if so, by how much. Blanchard makes the argument that if nominal interest rates are lower than nominal GDP growth rates – and that has been the case in the United States, for instance, on average since 1950, then the intertemporal budget constraint no longer binds. However, rather than advocating for higher debt his purpose is to discuss debt policies and debt rules. Specific cases such as a low neutral rate of interest and a binding effective lower bound on interest rates suggest the use of fiscal policy to support demand.

Blanchard argues that the 'right' fiscal policy is calibrated around relative weights that depend on the strength of private demand. If the latter is strong while debt is deemed too high, then fiscal policy can focus on debt reduction and monetary policy on keeping output at potential. But if private demand is weak and monetary policy is constrained, then fiscal policy needs to provide macro stabilisation. Blanchard concludes that there is no serious risk for debt sustainability currently in the advanced economies. However, he reckons that each case presents specific features that affect the safe level of debt – including different conditions in developed countries and emerging markets.

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Our paper draws from the existing literature and offers a contribution based on the following points. First, combining the findings from Reinhart and Rogoff (2010), Pappas and Kostakis (2020) and Gosh et al. (2013), we develop a model that considers features that are country and time specific. For, instance, "fiscal fatigue" (Gosh et al., 2013) may not be a country's permanent feature and may occur under specific circumstances. It is, however, critical to assess how slower fiscal consolidation than otherwise has on a country's debt limit. Similarly, an increase in a country's risk premium on the back of market perceptions of growing insolvency risk could push debt

above its limit. Thus, our model identifies a single debt threshold, that is country and time specific, above which the debt dynamics become explosive.

Second, drawing on the existing empirical literature, our model considers the (non-linear) feedback effects of debt on each of the following variables – economic growth, the real interest rate and primary balance. Unlike other contributions in this field, our model does not take these variables as exogenous. The core of the model is the usual dynamic relationship between the interest-growth differential and the primary balance on the one hand and the change of the ratio of debt to GDP on the other.

Unlike Blanchard (2019; Blanchard forthcoming) our model takes the interest rate as a measure of the cost of borrowing to estimate the feedback effects of debt and determine the debt threshold. Thus, compared to Blanchard our approach is rather crude, but appropriate to address our research question. However, we reach conclusions similar to Blanchard's when we introduce mitigating factors, such as, for instance, the domestic currency in debt denomination, that expand the fiscal space of advanced countries, notably the United States.

2. The Analytical framework

According to a widely accepted definition of debt sustainability (IMF, 2020), '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 with preserving potential growth at a satisfactory level'. This definition refers not only to the impact of economic and financial shocks on public debt dynamics, but also to its impact on the economic outlook and the ability of governments to take corrective action.

A standard tool to assess the sustainability of public debt is the Debt Sustainability Analysis (DSA) – a helpful signalling device to detect if at prevailing (or projected) rates of economic growth, real interest rates and the primary balance public debt over time converges towards a stable equilibrium or, on the contrary, follows an explosive path. To do justice to the above definition of debt sustainability, however, also the *feedback effects* of public debt on growth, yields and fiscal policy should be considered. Specifically, increases in public debt tend to exacerbate adverse growth or interest rate shocks, while, in contrast, a tightening of fiscal policy induced by an increase in public

debt may serve to mitigate the impact of these shocks. It is the balance between these forces that ultimately determines the path of public debt. The method applied throughout this section incorporates these feedback mechanisms.

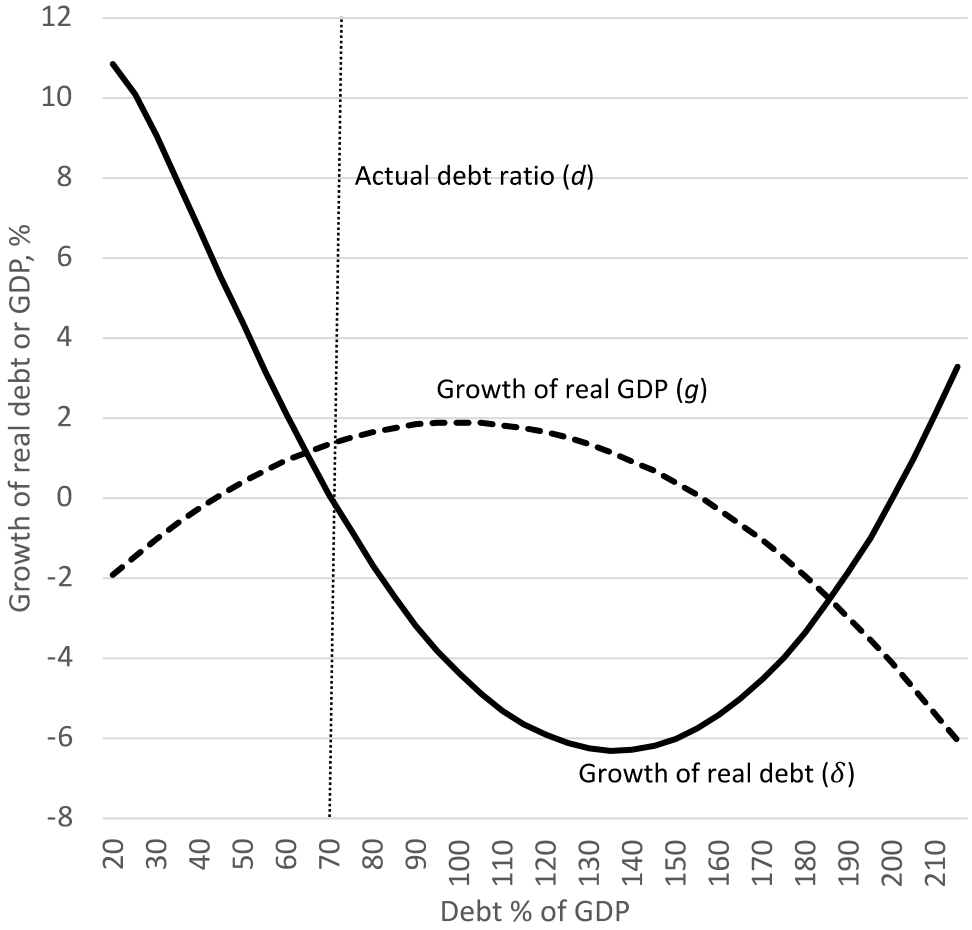
Figure 1 illustrates how these mechanisms jointly determine the sustainability of debt (see the Annex for a more detailed discussion). Specifically,

1. The curve marked '$Growth\ of\ real\ GDP\ (g)$' depicts how economic growth g is affected by the debt ratio to GDP. At low levels, the debt ratio is likely to have a positive impact on growth, reflecting the vital role of public debt in the functioning of the financial system and the economy at large. However, at high levels, public debt tends to exert a negative impact on economic growth, for instance by squeezing private credit or lowering profit expectations as taxes are likely to be raised.
2. The curve marked '$Growth\ of\ real\ GDP\ (\delta)$' indicates how the debt ratio to GDP affects the growth rate of real debt δ. This relationship is based on the dynamic budget constraint, which implies that for a given primary balance position, the growth rate of real debt mechanically gets smaller as the debt ratio increases.[2] Additionally, two feedback channels are at play with an increase in the debt ratio affecting the growth of real debt through:
    a. an increase in the primary balance due to sustainability concerns (fiscal policy reaction function) slowing down the growth of real debt, and
    b. an initial fall and then increase in the real bond yield and an associated acceleration and slowdown of the growth or real debt. This mechanism assumes that at low levels, increases of debt push the real yield down via lower liquidity risk, while above a certain debt threshold growing insolvency risk outweighs the further declines in liquidity risk.

[2] See Annex. For a given primary balance as a per cent of GDP p, the growth rate of real debt δ converges to the real interest rate r for higher levels of the debt ratio as a per cent of GDP d, This can be derived from the familiar dynamic budget constraint $\dot{D} = (r/100)D - P$, where $\dot{D}$ is the absolute change in real debt, D is the absolute level of real debt and P is the absolute level of the primary balance. Dividing the left-hand and right-hand sides by the level of debt D and rearranging yields $100 \cdot \dot{D}\ /D \equiv \delta = r - 100 \cdot p/d$, where p and d are the ratios to GDP of the primary balance and public debt, respectively.

The two curves intersect twice[3], and at these intersections the debt ratio is constant since the growth rate of real debt and the rate of economic growth are the same. However, these intersections have distinct characteristics. Specifically, the first (left) intersection corresponds to the *steady-state equilibrium* for the debt ratio, whereas the second (right) intersection corresponds to the *threshold* above which the debt ratio becomes explosive. The corollary is that, to keep debt sustainable, it would need to be below that threshold. Moreover, if that is the case the debt ratio automatically tends towards its equilibrium level over time. However, as will be discussed below, these conditions are not (always) satisfied.

Figure 1: Stylized debt dynamics



Source: authors' computations, see Annex.

[3] There may be a third intersection located in the second quadrant, which has, however, no economic meaning since the debt ratio can never be negative.

For a proper understanding of the model three important additional observations are in order:

- First, in principle it is possible that the two curves fail to intersect, which means that debt growth δ always exceeds economic growth g, regardless of the actual debt ratio. This means that the debt threshold is effectively nil. As will become clear below this may well be the case in several countries.[4]
- The assessment of debt sustainability is *invariant to inflation* because it is the *differential* between the real bond yield and real economic growth $r - g$ (alongside the initial debt ratio and the primary balance) that matters for public debt dynamics, with the inflation rate canceling out (see Annex).[5]
- If part of public debt is issued in a foreign currency, the yield on the latter may be lower than on domestic currency due to exchange rate risk. However, assuming uncovered interest rate parity holds, the *effective* foreign currency interest rate -- corrected for expected exchange rate depreciation -- is taken to be the same as the domestic currency rate.

3. Empirical implementation

This section applies the model developed in the previous section to the (G20) member states for the period from 1990 to 2022. The G20 provides a sample that covers approximately 85 per cent of the world economy, included the largest advanced economies – the G7 – as well as mid-sized advanced such as Australia and South Korea. It also includes the BRICS – Brazil, Russia, India, China and South Africa – and some large developing countries such as Turkey and Indonesia. Finally, it includes Argentina, a country that repeatedly defaulted on its debt.

To estimate debt sustainability and assess fiscal space for the G20 countries over the period 1990-2023 we use the following indicators: real GDP growth (to calculate 10-year geometric mean of potential growth), debt to GDP ratio, cyclical primary balance,

[4] It may also be that the curves intersect only once in the first quadrant, which means that no feasible equilibrium debt ratio can be identified.

[5] That is, unless inflation affects the real bond yield r. This may well be the case if inflation is more volatile at higher rates of inflation, entailing an inflation risk premium on bonds. Note that higher inflation would make debt therefore *less* sustainable, *not more* sustainable (except in the short run when inflation has yet to feed through into nominal yields and interest expenditure).

inflation, and long-term interest rates (Table 1). These data series come from the IMF and World Bank public databases. For more coverage on data points for long term interest rates, we use OECD and Trading Economics databases. To model an exchange rate shock, we rely on BIS estimates of debt held in foreign currency.

As series on real yields data are patchy, we use instead long-term interest rates minus inflation. Some long-term interest rate data has been pulled from separate databases rather than a cohesive set. Pre-2011 long-term interest rates come from the IMF while those post-2011 come from the OECD and Trading Economics. Inflation rates and long-term interest rates for for Argentina are not publicly available, so we use estimates published by Trading Economics for inflation rates, primary balance and long-term interest rates indicators.

Table 1: Indicators and sources

Indicator	Source
Debt to GDP ratio	IMF, World Bank
Cyclical Primary Balance	IMF, World Bank
Potential Growth	IMF, author's own calculations
Inflation	IMF, World Bank
Long term interest rates	IMF, OECD, Trading Economics
General government debt held in foreign currency (except China: central government debt)	BIS

3.1. The G20 economies

Figure 2 depicts the current situation regarding debt sustainability in the G20 in 2022, based on estimates or projections for the debt to GDP ratio, potential economic growth, real bond yields and the cyclically adjusted primary balance as a per cent of GDP. The following features emerge:

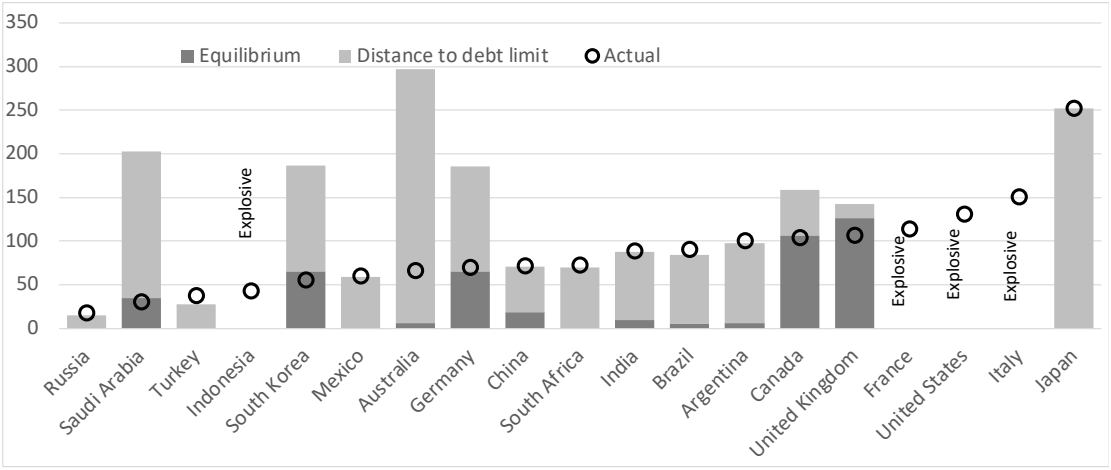
1. In the United States, France and Italy, the debt threshold is effectively nil, meaning that the debt ratio is bound to rise at an accelerating pace if the primary balance is not raised (or the primary deficit cut) by the required amount. This means that in these countries fiscal consolidation is urgently needed to achieve

debt sustainability. Among the developing G20 economies only Indonesia was in the same situation though obviously, the situation in Russia may be similar if the expected collapse of GDP this year materializes as the sanctions work their way through.

2. By contrast, public debt in Saudi Arabia, South Korea, Australia, Germany, Canada and the United Kingdom in 2022 look sustainable on our metric. Hence these countries would dispose of 'fiscal space', here defined as the distance from the actual debt ratio to the debt limit, shown in Figure 4.

3. In Mexico, China, India, Brazil, Argentina, and Japan debt sustainability can be characterized as 'border line', in the sense that the current debt to GDP ratio is very close to, or slightly exceeding, the debt limit above which it becomes explosive. This implies that a minor (permanent) shock to real interest rates, economic growth or the primary balance position would suffice to result in debt becoming explosive. In Argentina the underlying situation would likely have been much worse than depicted if not for the ongoing efforts to qualify for (yet another) IMF program, as discussed in more detail below. Indeed, Argentina, and to a lesser extent Turkey, is particularly vulnerable given its extraordinarily large call on foreign currency debt (see Figure 3).

Figure 2: Debt sustainability analysis – situation in 2022
(% of GDP)

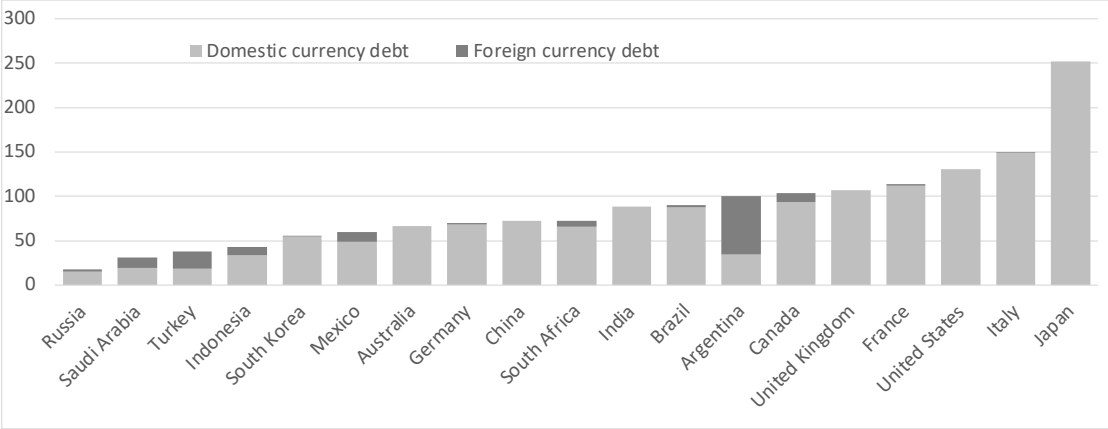


Sources: IMF, OECD, World Bank, Trading Economics, authors' computations.

The bottom line is that in the majority of G20 countries – advanced and emerging alike – public debt is either explosive or borderline, hence without any fiscal space

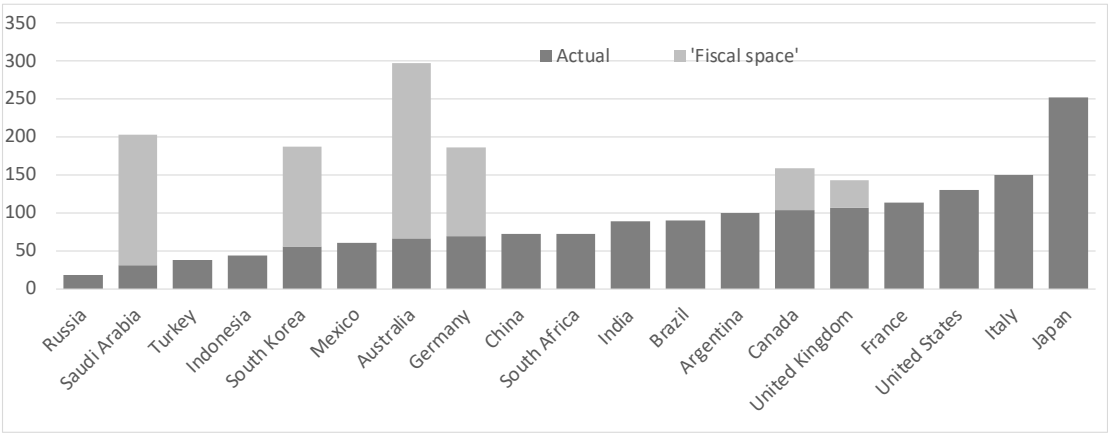
left. Among those with significant fiscal space are the usual suspects, with the situation being particularly comfortable in Germany, Australia, and South Korea among the advanced economies. Meanwhile, aside from Saudi Arabia, among the emerging G20 economies there is none in a situation with abundant if any fiscal space.

Figure 3: Home versus foreign currency public debt – situation in 2022
(% of GDP)



Sources: IMF, OECD, World Bank, Trading Economics, authors' computations.

Figure 4: Public debt and fiscal space – situation in 2022
(% of GDP)



Sources: IMF, OECD, World Bank, Trading Economics, authors' computations.

Results are consistent with Gosh et al. (2013) insofar that more open economies and countries with strong institutions exhibit, on balance, better fiscal performance. South Korea, Australia, Germany and Canada are part of this group (Figure 4). Oil and commodities exporters, when oil and commodities prices rise, also exhibit good fiscal performance. In our example, Saudi Arabia belongs to this group (Figure 4). These

results are also consistent with the 'original sin' that forces developing countries to borrow in dollars or (to less extent) euros. However, it is important to note that the sources of domestic financing have increased in many developing countries, reducing the need to issue debt denominated in foreign currencies (World Bank, 2022: 18-19).

3.2. Some specific cases

The central tenet of our paper is that advanced and developing economies face entirely different conditions concerning the possibility to conduct independent fiscal and monetary policies to address major shocks. Among the G20 economies, the United States – as the issuer of the main global reserve currency (the US dollar) and the main global safe financial asset (Treasury bonds) – enjoys full sovereignty in both policy domains. It can therefore pursue full employment and price stability with relative ease (though if the zero lower bound on interest rates is binding the emphasis necessarily shifts towards fiscal policy as argued by Blanchard 2022). At the other extreme, Argentina and Turkey stand out as G20 economies where the terms of the trade-off between fiscal and monetary policy sovereignty are particularly harsh. We illustrate this empirically using our debt sustainability metric presented in section 3.

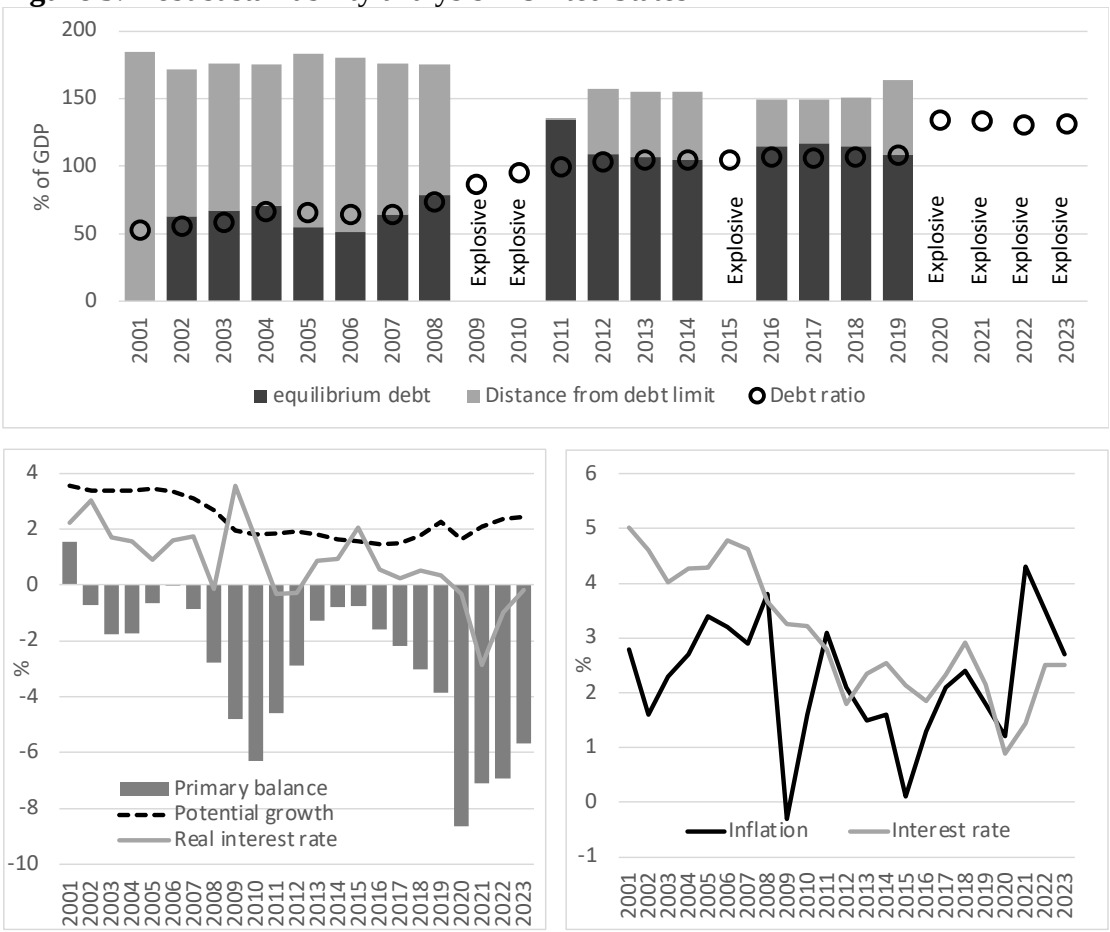
Figure 5 depicts the development of relevant variables over the last two decades or so for *the United States*. It shows that up to the financial crisis in 2009, the US public debt ratio to GDP was comfortably below a comparatively high estimated limit of roughly 180% of GDP. As a matter of fact, at around 60% of GDP, the debt ratio stayed close to its estimated steady state equilibrium, reflecting the favourable differential between interest and growth rates and the modest primary deficit. Not surprisingly, this changed with the financial crisis because of a soaring primary deficit and an increase in real interest rates as inflation stalled. However, the previous favourable situation of debt comfortably below the limit was quickly restored thereafter – albeit at a higher level of the debt ratio at around the new steady state equilibrium of 100% of GDP.[6]

This all changed again when the pandemic hit in 2020 and beyond, due to a massive increase in the primary deficit. And although this deficit is officially projected to fall in 2022 and 2023, the debt ratio at around 130% of GDP remains explosive. Yet real

[6] With the exception of 2015, due to a sudden drop in inflation and an associated surge in the real interest rate – which proved transitory.

interest rates have remained relatively low, indicating that market confidence in the solvency of the US public sector has remained intact. This clearly illustrates our point that – while in a mechanical sense the United States has used up all its fiscal space during the pandemic – it seems poised to rebuild it in the years ahead. More fundamentally, in a longer-term sense the United States disposes of more fiscal space than our metric suggests owing to the international demand for risk-free dollar-denominated assets.

Figure 5: Debt sustainability analysis – United States

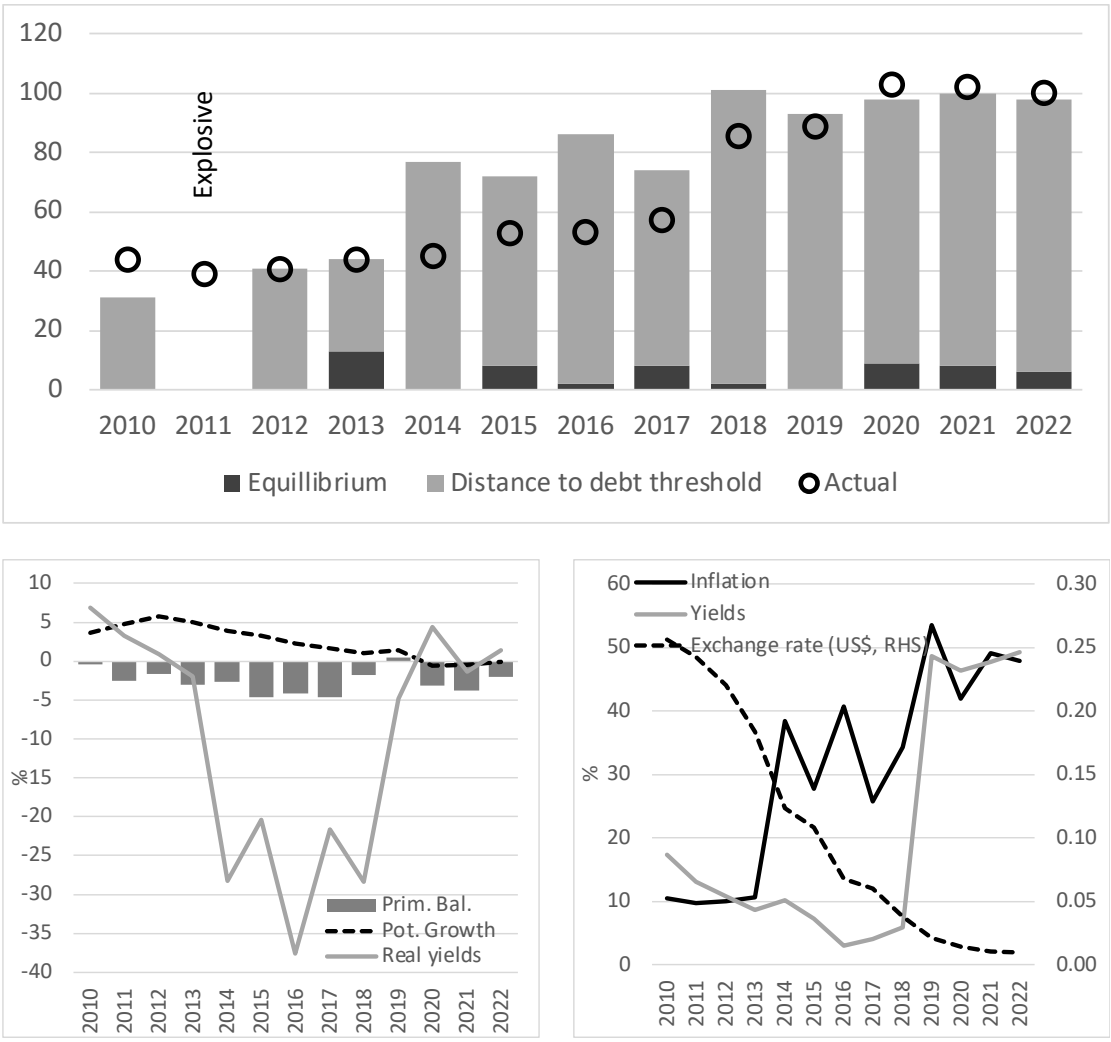


The situation in *Argentina* could not be more contrasting. In the period 2014-2017 the fiscal situation in Argentina looked still relatively comfortable, with the actual debt ratio well below the debt threshold, as shown in Figure 6 below. However, things went sour from 2018 onwards when debt rose beyond the debt threshold. Why might that have happened?

Taking a closer look at the underlying data, the following emerges (see the second and third panels of Figure 6 below). In the period 2014-2018 Argentina enjoyed a hugely favourable *r-g* differential, mostly because real yield plummeted to negative two-digit

territory (left panel). However, this was almost entirely driven by massive inflation (see right-panel). That, in turn, was the result of a steep depreciation of the exchange rate. This also explains the upward trend in the debt ratio in this period, given that more than half of debt is foreign currency (mostly USD) denominated.

Figure 6: Debt sustainability analysis – Argentina



Sources: authors' computations, IMF WEO, Trading Economics.

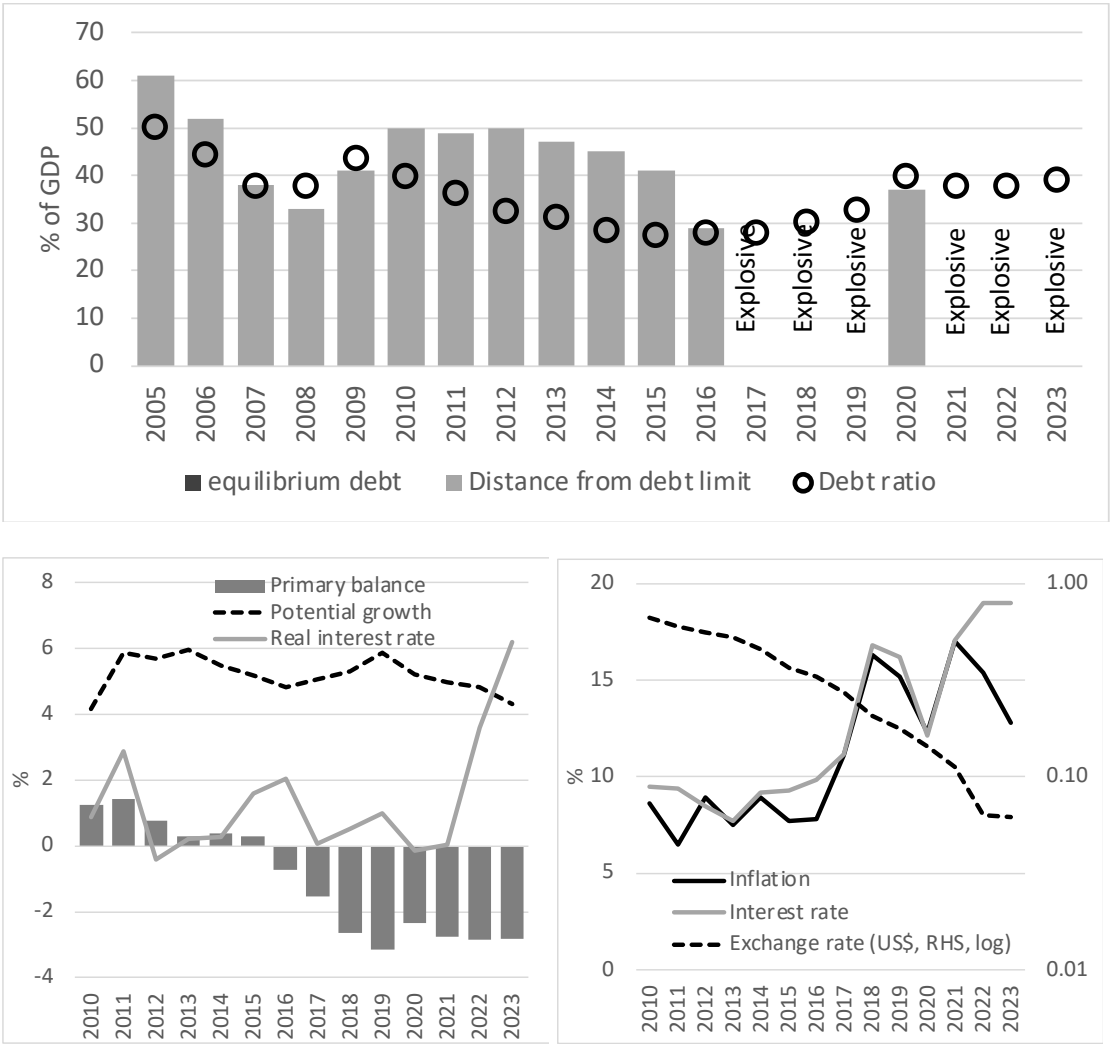
So, this was a crisis in the making, and it came. In 2018 Argentina got a bail-out from the IMF, but this failed as capital stampeded out of the country. In 2019 bond yields caught up with inflation and the favourable *r-g* differential disappeared. Currently Argentina is in talks with the IMF on another bail-out.

In *Turkey*, the fiscal situation looked manageable until 2017. When the financial crisis hit in 2008-2009, the public debt ratio to GDP temporarily exceeded the debt threshold, but this was quickly corrected in 2010, with the primary balance in comfortable surplus

and the interest-growth differential very favourable (Figure 7). However, in 2017 Turkey adopted on a looser fiscal policy stance as the primary balance turned negative on a sustained basis. In its wake, the real interest rate versus growth differential deteriorated significantly while the debt ratio drifted up and the debt limit was effectively nil. Meanwhile also large contingent liabilities were built up related to COVID-19 support (credit guarantees).

Both the cases of Argentina and Turkey show the adverse impact of inflation on the debt dynamics. In both cases, it is inflation that makes the differential *r-g* favourable, making debt manageable, at least in principle. Our debt sustainability analysis shows debt be close to or over the limit before it feeds into real interest rates. This is mainly due to the lagged response of monetary policy to inflation. This points to another feature that gives the US an extended fiscal space, that is historical low inflation in the last due decades. Low inflation has consistently kept real interest rates below the GDP growth rates in the US (Figure 5).

Figure 7: Debt sustainability analysis – Turkey

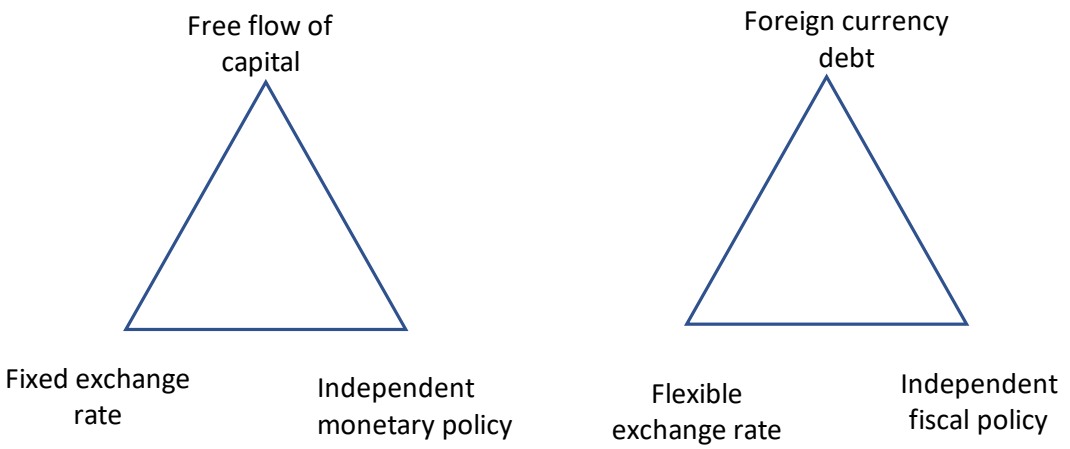


4. Policy implications

We think the findings of our paper can be reflected in a "dual trilemma". Usually, the trilemma is applied as a visual device to demonstrate that countries cannot have all three of the following features: free flow of capital, fixed exchange rate and independent monetary policy. We would argue that – as depicted below – countries face another trilemma as well, according to which they can only opt for two of the

following three: flexible exchange rate, foreign currency public debt and an independent fiscal policy.

Figure 8: Dual trilemma



Advanced economies generally combine free flow of capital with independent monetary policy, so their exchange rate is floating. According to the dual trilemma they can also combine flexible exchange rates with independent fiscal policy as long as their debt is not foreign currency denominated (since they issue the reserve currency they are in little need of foreign currency reserves).

The European Monetary Union (EMU) is a special case. EMU countries combine a fixed exchange rate with free flow of capital, so cannot have independent monetary policy. Since their exchange rate is irrevocably fixed, they can issue 'foreign currency' debt (i.e. debt in euros) in combination with independent fiscal policy (which is then coordinated to avoid spillovers).

Among the developing economies, major oil exporters form another special case. They own large sovereign wealth funds, so their governments are international creditors/investors. They can combine a flexible exchange rate with independent fiscal policy.

Other developing economies can be in various situations:

- Free flow of capital and fixed exchange rate, so no independent monetary policy. They can combine foreign currency debt with independent fiscal policy. A case in point is for instance Indonesia.

- Free flow of capital and floating exchange rate, so independent monetary policy. They have two options:
    - Foreign currency debt, but then no fiscal sovereignty (either because they maintain strict fiscal rules or go in and out of IMF programmes -- Argentina)
    - Independent fiscal policy, but then no foreign currency debt (a case in point is India)

5. Conclusions

In this paper we estimate the public debt limit and ensuing fiscal space for a panel of developed and developing economies for the period 1980-2022. For this we devise an analytical framework that expands the methodology of DSA to detect whether a country's debt is on an unsustainable path at prevailing (or projected) rates of economic growth, real interest rates and the primary balance. Our analytical framework includes the *feedback effects* of public debt on growth, yields and fiscal policy. Using this methodology, we assess whether increases in public debt tend to exacerbate adverse growth or interest rate shocks, while, in contrast, a tightening of fiscal policy induced by an increase in public debt may serve to mitigate the impact of these shocks. It is the balance between these forces that ultimately determines the path of public debt.

The application of our model to the G20, from 1990 to 2022, shows three groups of results that we describe as following: 1. countries with explosive debt; 2. countries with borderline debt; 3. countries with balanced debt. However, a more detailed analysis of three countries – the US, Argentina and Turkey – shows that the debt limit is less binding for the US than it is for the other two. Being the issuer of the main global reserve currency and the main global safe financial asset means that the US can enjoy full sovereignty in both fiscal policy and monetary policy. It can therefore pursue full employment and price stability with relative ease. Argentina and Turkey, on the other hand, stand out as G20 economies where the terms of the trade-off between fiscal and monetary policy sovereignty are particularly harsh.

These results from our analysis are consistent with the central tenet of our paper, ie advanced and developing economies face entirely different conditions concerning the

possibility to conduct independent fiscal and monetary policies to address major shocks. In the paper we provisionally draw some policy implications and indicate a 'dual' policy trilemma for developing countries that have their debt (or part of it) denominated in foreign currency. As well as the trilemma around free flow of capital, fixed exchange rate and independent monetary policy, they also face one around the denomination of their debt, flexible exchange rates and an independent fiscal policy. Countries with foreign denominated debt need to choose beween flexible exchange rates and an independent fiscal policy.

This leaves developing countries limited instruments to expand their fiscal space at the time of shocks such as the Covid-19 pandemic, especially if they are already close to the limit of debt sustainability, exacerbating the risk of falling into a 'debt trap'. As a result of the 'dual trilemmas' these countries are often pushed to tackle the debt before it gets to the point where it may be difficult to generate a primary balance that is sufficient to ensure sustainability, even if fiscal consolidation may run against the need to provide macro stabilisation when private demand is weak and monetary policy is constrained.

Methodological annex

This Annex discusses the formal model that underpins the results presented in the main text. Starting point is the government's long-run dynamic budget constraint, formulated as:

$$\frac{\dot{D}}{D} = \frac{r}{100} - \frac{P}{Y}\Big/\frac{D}{Y} \qquad (1)$$

where a dot indicates a change in the variable over time, $\dot{D}/D$ is the growth rate of real public debt, r is the real bond yield, P/Y is the primary balance as a share of GDP and D/Y is the ratio of debt to GDP. This indicates that as the debt ratio to GDP D/Y increases, for a given primary balance as a share of GDP P/Y, the growth rate of real debt will fall asymptotically towards the real bond yield r.

By equating the growth rate of real debt in equation (1) to the growth rate of real output $\dot{Y}/Y \equiv g/100$ – a necessary condition for a sustainable debt ratio – one obtains the familiar condition:

$$p = \frac{r-g}{100}\, d \qquad (2)$$

where lower-case characters are used to denote ratios to GDP in per cent – hence $d \equiv 100 \cdot D/Y$ and $p \equiv 100 \cdot P/Y$. From equation (2) the primary balance required to maintain a stable long-run debt ratio at a given level d can be solved for a given interest rate/growth differential $r - g$.

A crucial shortcoming of this formula, however, is that it is not obvious what target for the debt ratio d should be adopted and whether it represents a stable equilibrium (the formula describes a *necessary* condition for debt sustainability but not a *sufficient* condition). Moreover, as stated, the formula ignores that the variables g, r and p may all in turn depend on the debt ratio d. This is what is meant by the feedback mechanisms discussed in the main text.

The three feedback mechanisms of debt via g, r and p are incorporated as follows.

First, the following stylized relationship between long-run economic growth g and the debt ratio d is adopted:

$$g = g^* + a_1\, d - a_2\, d^2 \qquad (3)$$

where g^* is the component of long-run economic growth unrelated to public debt. The remainder of the equation therefore describes the feedback of public debt on economic growth. This feedback is conventionally formulated as a quadratic relationship, with growth rising with debt up to a certain threshold after which the relationship turns negative. The debt threshold where the negative impact of debt on growth overtakes the positive one is equal to $\frac{1}{2} a_1/a_2$.

The numerical values for the parameters are derived as follows:

- *High-income countries*. We use as our source Checherita -Westphal and Rother (2011), who find $a_1 = 0.1198$ and - $a_2 = -0.0006$ for their baseline model to $\frac{1}{2} a_1/a_2 = 100\%$. Although their estimate is for the 19 countries of the Euro Area, we use this estimate for all high-income countries given that the implied debt threshold is in the ballpark of the consensus.

- *Middle-income countries*. We use as our source Kassouri et al (2021)[7], who find $a_1 = 0.0867$ and -$a_2 = -0.00125$. They present three estimates for each, but we pick the version for which the coefficients are significant at the 1% level and ignore results for larger samples but with less significant results. This yields a debt threshold of $\frac{1}{2}a_1/a_2 = 35\%$.
- *Low-income countries*. We use again Kassouri et al (2021), who find $a_1 = 0.0059$ and -$a_2 = -0.00008$.[8] This yields a debt threshold of $\frac{1}{2}a_1/a_2 = 37\%$.

Note that for each point in time g^* can be computed as $g^* = g - a_1\, d + a_2\, d^2$.

Second, in a similar fashion the real bond yield r is assumed to depend on the debt ratio d, as follows:

$$r = r^* - b_1\, d + b_2\, d^2 \qquad (4a)$$

or

$$r = r^* + b_1\, d \qquad (4b)$$

Hence according to specification (4a) at low levels of the debt ratio d increases thereof push the real yield down (owing to a lower liquidity risk premium), while above the debt threshold $\frac{1}{2}b_1/b_2$ the impact of debt on real yields turns positive (when solvency risk outweighs liquidity risk). Alternatively, a linear specification as in (4b) can be adopted, depending on the country in question. As to the numerical parameters:

- *United States.* We use the linear specification (4b) based on findings by Laubach (2009), with in his baseline model $b_1 = 0.039$, so roughly four bps per percentage point of public debt.

[7] We use the results from their Table 1. There seems to be a typo in their tables, however, as the values of a_2 they report all appear to be a factor 10 too high. Fortunately, they also report the debt thresholds which seems to be consistent with our interpretation of the numerical values of the parameters.

[8] See previous footnote.

- *Other high-income countries*. We use as our source Pappas and Kostakis (2020), who find for their baseline model $-b_1 = -0.108$ and $b_2 = 0.000555$. This yields a debt threshold of $\frac{1}{2}b_1/b_2 = 97\%$. Their results are based on data for the euro area, but we assume this result to apply to all advanced economies other than the United States.
- *Other countries*. Studies for developing economies do not generally estimate a non-linear yield equation but assume a positive relationship between the yield and the level of the debt to GDP ratio in equation (2b). A good study is Naidu et al (2016) who find $b_1 = 0.24$.

Again, r^* is computed as $r^* = r + b_1\, d - b_2\, d^2$ if specification (4a) is used and as $r^* = r - b_1\, d$ for the other cases.

Third, the primary balance position p is assumed to depend on the debt ratio d via a fiscal policy reaction function of the flowing stylised form see Ghosh et al (2013):

$$p = p^* - c_1 d + c_2 d^2 - c_3 d^3 \qquad (5)$$

The idea is that as debt increases its impact on the primary balance wanes as a result of 'consolidation fatigue'. The baseline estimates in Ghosh et al (2013) are $-c_1 = -0.208$, $c_2 = 0.0032$ and $-c_3 = -0.00001$. However, to keep things simple for now

Finally, incorporating equations (4) and (5) in the debt-growth equation (1) yields:

$$\delta = r^* - b_1\, d + b_2\, d^2 - 100\, p^*/d + 100c_1 - 100c_2 d + 100c_3 d^2 \qquad (6)$$

where $\delta \equiv 100 \cdot \dot{D}/D$.[9] In equilibrium the growth rate of debt and output must be equal, so $\delta = g$. Making use of the growth equation (1) and the real debt growth equation (6) this condition can be reformulated as a cubic equation of the following form:

$$-(a_2 + b_2 + 100c_3)\, d^3 + (a_1 + b_1 + 100c_2)d^2 + (g^* - r^* - 100c_1)d + 100p^* = 0 \qquad (7)$$

[9] This is the curve marked 'δ' in Figure 1. By way of example, the curves depicted in Figure 1 are based on the numerical values thus derived for the euro area as a whole, with $g^* = -1.4$, $r^* = -0.1$ and $p^* = -6.5$.

This equation potentially has three roots. However, one root is effectively meaningless because, at the above assumptions of the parameters, it would imply negative gross debt. As discussed in the main text, there are therefore two feasible roots, here labelled $\bar{d}$ and $\bar{\bar{d}}$, which have distinct characteristics. Specifically, $\bar{d}$ corresponds to the *steady-state equilibrium* for the debt ratio, whereas $\bar{\bar{d}}$ is the *threshold* above which the debt ratio becomes explosive. If the cubic equation has no roots, it means that debt is always explosive, regardless of its in initial level. As discussed in the main text this means that the debt threshold $\bar{\bar{d}}$ is effectively nil. In some cases, a root for the debt threshold $\bar{\bar{d}}$ exists, but no root is found for the steady state equilibrium $\bar{d}$. This means that if the debt ratio is smaller than the threshold $\bar{\bar{d}}$, debt will shrink until it is nil, which would then be the effective steady state equilibrium as again debt cannot be negative.

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