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Safe Public Debt: Towards an Operational Definition

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ABSTRACT

The paper proposes an operational definition of safe public debt levels and discusses various concrete approaches to calculate them. A public debt level is considered safe if it is associated with a low probability of reaching levels likely to generate significant economic costs within a given time frame. Like debt sustainability assessments, implementing such a broad definition requires medium-term projections of the debt-to-GDP ratio. This implies that different sets of plausible assumptions can yield fairly different "safe" debt levels for the same country. However, the proposed framework has the merit to force policymakers and analysts to be explicit about the assumptions underlying their calculations.

Key words: public debt, primary surplus, uncertainty

JEL Classification: E62, H62, H63

1. Introduction

Current public debt levels are largely perceived as excessive in many advanced and emerging economies. The immediate question for policymakers is not whether debt should be reduced but how far they should go in trimming down government liabilities, or equivalently for how long debt reduction should remain a key driver of fiscal policy. Answering that question requires forming a view on the debt level governments could feel comfortable living with on a durable basis.

[♦] The views expressed here are mine and do not necessarily represent the views of the IMF, its Executive Board, or IMF management. Without implication, I am grateful to Andreea Stoian for comments on an earlier draft, and to Constant Lonkeng and Mariusz Jarmuzek for producing the empirical illustrations.

In principle, three important considerations could inform this view: fairness, freedom, and risk aversion. A given debt level could be deemed excessive because (i) it unfairly impinges on future generations' consumption of private and public goods due to punitive tax burdens and debt service costs, (ii) it unduly constrains the current use of fiscal policy to insure individuals against bad states of the economy or more generally to provide an adequate amount of public goods and services, and (iii) it exposes public finances to adverse shocks—e.g. a loss of access to financing—to an extent that risk-averse policymakers want to avoid. While each of these dimensions involves a dose of judgment beyond the scope of this paper, all are linked by a common requirement: public debt should be sustainable at all times.

One frustrating issue inherent to public debt sustainability assessments and the related quest for sensible debt benchmarks is that the very notion of sustainability has no straightforward operational meaning (Chalk and Hemming, 2000; Wyplosz, 2011). Indeed, a government faces no well-defined end-point where obligations must be repaid, making the intertemporal budget constraint a rather elusive concept. In the end, the room for judgment is considerable. Another problem is the lack of normative guidance. Economic theory offers little operational indications on socially optimal debt levels.[1] In my view, the rare normative analyses of public debt are too quickly tainted by oversimplifying modeling assumptions to offer uncontroversial guideposts.

Similar, if not greater, frustration exists for the notion of safe debt, which is not precisely defined and therefore, cannot be assessed with reference to a clear and manageable set of assumptions. As result, virtually anything goes because no rigorous framework exists to discipline one's thinking. This paper aims at filling this gap by articulating the key elements of a definition of safe debt levels. I deliberately write "a" definition because, as I argue later, the notion of safe public debt relevant for a large advanced economy issuing a reserve currency is materially different from the one applying to a small developing economy with only intermittent access to borrowing.

The framework and definitions discussed here map into simple operational algorithms aimed at estimating the upper bound of the safe debt zone. These algorithms could be used to produce useful guideposts to anchor fiscal policy in a specific long-term objective or to pin down the often elusive notion of fiscal space in the short term.[2] They link the definition of safe debt boundaries to explicit assumptions about the extent of risk to debt dynamics, the intensity of risk aversion and the capacity to generate and sustain primary surpluses.

The rest of the paper is structured as follows. Section 2 introduces the concept of safe debt and compares one possible expression of it to the more common notion of debt limit. Section 3 discusses possible operational approaches and illustrations, while Section 4 briefly concludes.

[1] Ostry, Ghosh and Espinoza (2015) propose a normative discussion of the need to actively reduce public debt when public capital matters for growth.

[2] Countries may have good reasons to target lower levels, but they would definitely be hard-pressed to justify neglect for debt levels above the upper bound of the safe zone.

2. Safe Public Debt: The Concept

After providing a heuristic definition of safe public debt levels, this section compares the boundaries of the safe debt zone to the conventional concept of debt limit.

2.1. From Solvency to Sustainability and Safety

In the absence of a general definition of safe public debt, I build from the necessary (and well-researched) condition any safe debt level must fulfill: sustainability. Since debt sustainability has no immediate operational meaning, most frameworks used to assess it rely on *sufficient* conditions to ensure that the government's intertemporal budget constraint, and equivalently, the No-Ponzi condition are satisfied. Wyplosz (2011) provide a comprehensive discussion of existing operational frameworks.

A classic reference in the literature is Bohn (1998) who shows that a systematically positive response of the primary balance to changes in the debt level is sufficient to guarantee solvency.[3] Although the Bohn's principle is simple and intuitive, its operational relevance remain limited. First, any prospective debt sustainability assessment based on that test must assume that future fiscal policy behavior will replicate historical trends. In fact, as Mauro et al (2013) show, countries seem to go through successive periods of "prudence" and "profligacy," limiting the predictive power of the test. Second, the test being defined in marginal terms, the *level* of the primary balance is not bounded, which ultimately imposes very little constraint on debt trajectories.

This is a reason why debt sustainability frameworks rely on a (much) more demanding condition: the stability of the debt-to-GDP ratio over time (Escolano, 2010). The intuitive rationale behind that condition is that nominal debt should not be allowed to grow faster on average than a broad measure of its implicit collateral: the nominal GDP.[4] As discussed in Bartolini and Cottarelli (1994), that condition is robust to cases where the intertemporal budget constraint is not well-defined such as when the economy is dynamically inefficient (i.e. when GDP growth is persistently above the rate of interest).

Ensuring a stable debt-to-GDP ratio restricts not only on the sign of the primary balance response to debt (it must be positive) but also the strength of that response (it must be large enough). As long as the policy response is deemed politically and economically feasible, there is in principle no reason to question debt sustainability, and the probability of ending up into a fiscal crisis—i.e. an incapacity to bring debt dynamics under control through feasible fiscal adjustment—is negligible. The key to understand the notion of safe debt is whether such a benign assessment is robust to most circumstances, including in very turbulent times.

While solvency and sustainability are directly related to the simple arithmetic of the intertemporal budget constraint—which apply similarly to any country—the concept of safe debt is inherently more complex. First, the notion of safety requires a characterization of the

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[3] That condition holds in a full-fledged general equilibrium model under weak technical assumptions. In practice, the empirical validity of the Bohn test rests on the assumption that both debt and the primary balance are stationary.

[4] While the ability to collect taxes is instrumental in a country's capacity to face its financial obligations, the "collateral" argument is of course fairly crude. In principle, debt levels should be assessed in light of the entire public sector balance sheet (stocks should be compared to stocks), not to a flow determining annual tax revenues.

risk one wants to insure against by keeping debt sufficiently low. That risk may vary across governments and economies. Those with a history of sovereign default or distress might primarily want to insure against losing control of the debt trajectory, and with it, market access. By contrast, governments with a robust record of servicing their debt in all circumstances and/or facing no tangible threat of losing market access—including those few countries issuing reserve currencies—may focus on other risks, including reaching public debt levels likely to inhibit economic growth or constrain the room of fiscal policy maneuver. Second, the main sources of uncertainty surrounding public debt must be properly understood and estimated. A general definition of safe debt naturally follows:

Definition. *A public debt level is safe if it is associated with a low probability of reaching levels likely to generate significant economic costs within a given time frame.*

This general definition sets out three basic components of any algorithm aimed at calculating safe debt levels:

- Because the definition is forward-looking, a good understanding of the drivers of debt dynamics over the medium-term is required, including the government's capacity to generate and sustain primary balances and the uncertainty surrounding interest rates, growth, the budget itself, and other relevant variables.

- The link between the public debt level and the specific costs one wants to avoid must be clear and well-grounded empirically. For instance, if the cost is a loss of control of debt dynamics when markets turn against the sovereign (high risk premiums) or growth falter, information on debt thresholds beyond which such events tend to occur is critical.

- The reference to a specific time frame is essential. The assessment of likely policy trajectories cannot extend too far into the future given the rising likelihood of regime shifts or alterations in the patterns of policy behavior.

Clearly, the combination of uncertain debt dynamics and limits to feasible policy response implies that a lower debt ratio is always safer. However, stating that a very low debt level is the best way to avoid the costs associated with high debt is not particularly informative. There is much more value for policymakers in knowing the boundaries of a well-defined safe debt zone. In other words, we want to know how far we can let public debt rise without causing an uncomfortable increase in the probability of bad risk, be it a full-blown fiscal crisis, slowing economic growth, or losing room for policy maneuver.

2.2. Safe Debt Boundary vs. Debt Limit: A Simple Example

To clarify the concept of safe debt boundary (SDB), we build a simple example contrasting the SDB with a common definition of debt limit (DL). So the specific cost/event to avoid is putting public finances on an explosive debt trajectory. Similarly to Ostry et al (2010), the DL is defined as a level of debt beyond which it is unlikely that the government will be able to lower or stabilize the debt ratio using fiscal policy.

Two opposing factors shape public debt dynamics. The first is the "snowball effect" that arises if interest payments are financed with new debt: all else equal, the higher the debt, the stronger the effect. The second is the government's offsetting response to the snowball effect: primary surpluses.[5] According to our definition, a debt level is safe if the second can credibly offset the first in most circumstances, including when interest rates are abnormally high and/or growth is abnormally low for prolonged periods of time. By contrast, a DL is a level beyond which the government cannot be expected to offset the snowball effect unless circumstances are favorable (e.g. high growth and low interest rates compared to their respective averages). Hence at the DL, any positive shock to public debt puts it on an explosive path unless better-than-average conditions exist.

A sufficient condition for the existence of a DL is sometimes known as "fiscal fatigue." Because governments cannot be expected to increase the primary surplus indefinitely (or at an ever increasing speed), there is a point where keeping debt under control requires unfeasibly large surpluses.[6] Beyond that point, debt is not sustainable. Even if only the strength of the primary surplus response is bounded—but not the level—market discipline, in the form of borrowing costs rising with the debt level, would likely ensure that the snowball effect eventually dominates the capacity to generate primary surpluses, making self-fulfilling prophecies possible.

The difference between conventional debt limits and the safe debt boundary is illustrated in the diagram below (Figure 1).[7] It describes possible combinations of positive debt levels (d) and primary surpluses (p). To assess whether these combinations are consistent with falling, stable or rising debt levels, we recall that $\Delta d = (\mathrm{R}(d) - 1)d - p$, where d is the debt-to-GDP ratio, [8] Δ designates the discrete time difference operator, p is the primary balance in percent of GDP, and $R(d) = \frac{1+r(d)}{1+g(d)} > 1$ denotes the growth-adjusted interest factor, with $R'(d) > 0$ and $R''(d) > 0$. These assumptions yield an upward-sloping and convex "demarcation line" along which the primary balance exactly offsets the snowball effect $p^* = (R(d) - 1)d$ to ensure that $\Delta d = 0$. Above the demarcation line, the primary balance is consistent with a falling debt-to-GDP ratio, while below, the debt ratio increases. The solid curve represents the average sensitivity of the growth-adjusted interest rate to the public debt. The dotted curve depicts an alternative state of the world with high realizations of R (say the 95th percentile of the distribution) as a function of d, all else equal.

Fiscal policy behavior can also be represented in Figure 1 using the Bohn (1998) solvency condition of a positive linear response of the primary balance to the debt level up to a point $\bar{p}$ where fiscal fatigue sets in.

$$p = \mathrm{Min}(\kappa + \rho d, \bar{p}), \text{ with } \rho > 0. \qquad (1)$$

Equation (1) is depicted by the PB schedule (thick solid line). The steeper the line (higher ρ), the stronger the stabilizing fiscal policy response to a change in debt. The PB line captures the average fiscal behavior in normal times and it flattens once the upper bound $\bar{p}$ is reached. At $\bar{p}$, fiscal fatigue sets in and the government stops responding to rising indebtedness. Because governments can adjust their behavior to adverse conditions, the diagram allows for a deviation from PB. The broken, dotted line PB' represents a large but plausible departure from normal fiscal behavior showing a greater sensitivity to debt

[5] A primary surplus ensures that at least part of the interest bill is paid with own resources.
[6] See for instance Bi (2012) for a discussion of "fiscal limits." In her model, the key factor is a Laffer curve preventing the government to raise additional revenues through taxation. Similarly, expenditure cuts cannot be sustained if they impinge on the capacity to deliver basic public goods (see e.g. Mendoza and Oviedo, 2004).
[7] See Ostry and others (2010) or Fournier and Fall (2015) for similar diagrams.
[8] For simplicity, we abstract from stock-flow discrepancies, liquid assets and uncertainty.

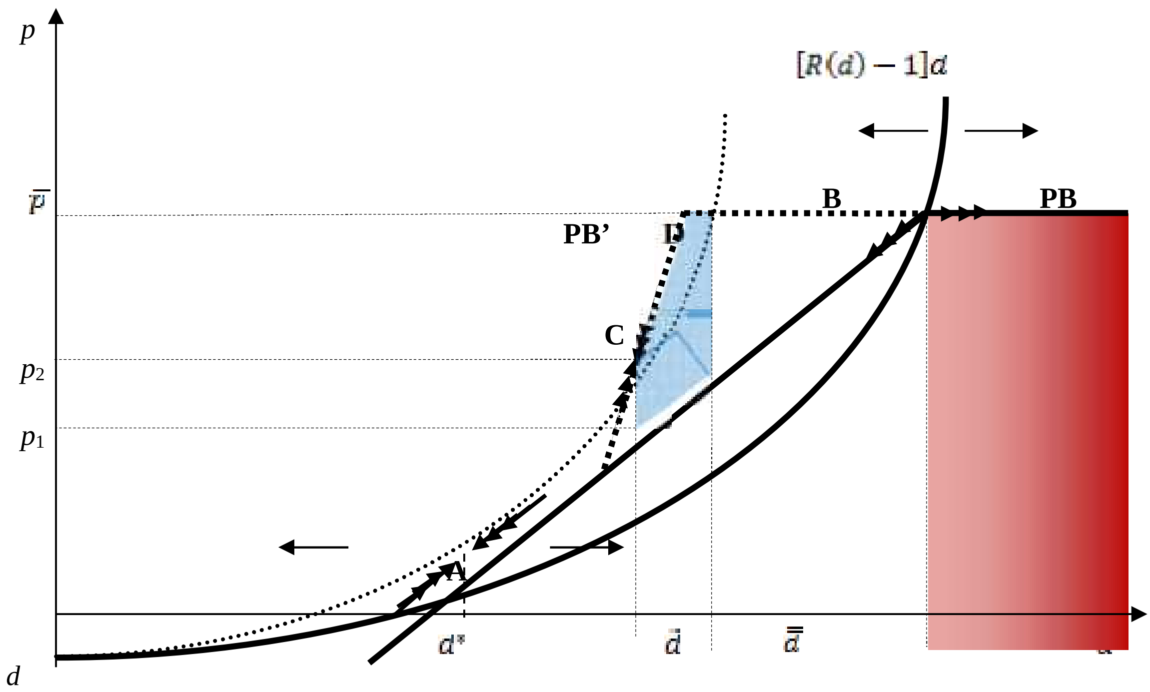
stabilization. Along PB', the primary balance is systematically higher than what PB implies for a given debt level. To keep the graphics manageable, we still assume adjustment fatigue starting at $\overline{p}$.

Intersections between these two loci characterize equilibria where the primary balance exactly offsets the snowball effect (debt is constant unless it is hit by a shock). To establish the stability condition for each equilibrium, we use (1) to substitute for the primary balance in the debt dynamics equation:

$$\Delta d = \left(\frac{r(d) - g(d)}{1 + g(d)} - \rho\right) d - \kappa. \tag{2}$$

The stability condition directly follows from observing that the debt-to-GDP ratio converges to some finite level (mean-reversion) if and only if the term in brackets is strictly negative. Therefore, a given equilibrium debt level d_0 will be stable if the marginal response of the primary balance to public debt exceeds the growth-adjusted interest rate prevailing at that equilibrium debt level $\left(\rho > \frac{r(d_0) - g(d_0)}{1 + g(d_0)}\right)$. In Figure 1, an equilibrium debt level is stable if the PB or PB' locus is steeper than the demarcation line at the intersection of the two.

Figure 1 Public Debt Dynamics: Limits vs. Safe Debt Boundaries



Point A denotes a stable low-debt equilibrium: fiscal policy ensures that even after large deviations from d^*, the debt ratio converges back to that level. By contrast, point B determines a debt level $\bar{d}$ that is fundamentally unstable: a negative deviation from $\bar{d}$ pushes public debt toward d^*, but a positive deviation leads to an explosive path as market concerns amplify the snowball effect beyond the government's capacity or willingness to generate higher primary surpluses.

In a deterministic setting, Point B is a debt limit in the sense of Ostry and others (2010). However, in an uncertain environment, it is intuitively clear that any notion of *safe* debt boundary should be well below $\bar{d}$.

Point C illustrates our notion of safe debt. Unlike the debt limit, it is a stable equilibrium. It corresponds to the debt level a government could credibly commit to under an "adverse-environment" (high growth-adjusted interest factor) and a "crisis-mode" policy regime depicted by PB'. It is clear from the diagram that in the event of a permanent shift to an adverse environment for debt dynamics (high growth-adjusted interest rate), the policy regime PB' would guarantee convergence to $\tilde{d}$. In light of our definition and the specific definition of risk to be avoided, $\tilde{d}$ is the upper bound of the safe debt zone: even under adverse circumstances, policymakers can be expected to steer public debt back to a stable level.

In reality, the shift to a crisis-mode policy regime might not happen overnight as a discrete jump from p_1 to p_2 may not be feasible. The diagram suggests that a gradual shift to the new policy regime remains possible provided that during the transition, the debt level is not allowed to rise beyond $\bar{\bar{d}}$, the debt limit that would prevail under the highly adverse environment for the growth-adjusted interest rate. The blue-shaded polygon delineates the space in which adjustment trajectories (possibly leading to $\bar{p}$) could ultimately ensure a return to the safe debt level. While unsafe, the interval $]\tilde{d}, \bar{\bar{d}}]$ contains debt levels that remain sustainable with a high probability. So public debt could rise significantly beyond the safe debt level without being at high risk of explosive dynamics.

Overall, four broad levels of alert for public debt sustainability can be derived from this simple example: safe, sustainable with high probability, elevated risk of unsustainability, and unsustainable (Figure 2). The precise boundaries of these zones are country-specific and depend on:

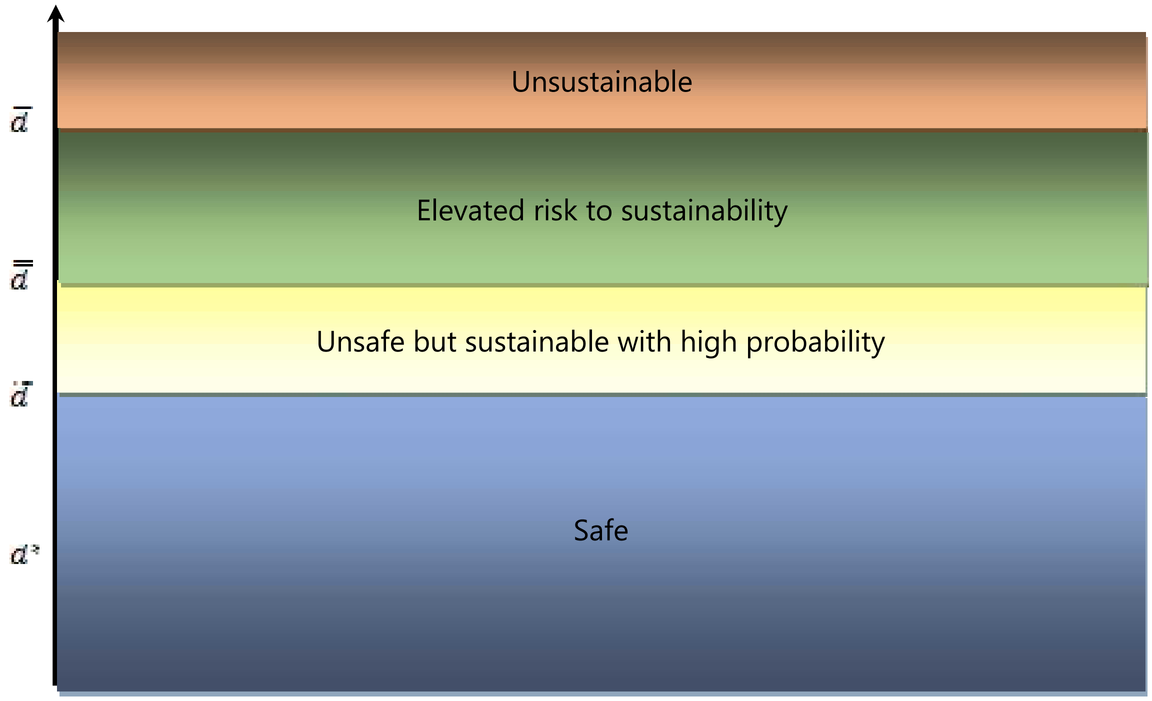
- The joint distribution of shocks that could lead a country to a fiscal crisis: interest rates, exchange rate, growth, contingent liabilities.

- The plausible fiscal policy response of a government to stabilize debt after the materialization of a shock (or a combination of them).

- The probability of fiscal crisis one is ready to tolerate ex-ante.

The challenge is now to provide an operational meaning to the debt thresholds defining these four areas. Among them, the determination of debt limits has already received considerable attention. In particular, the studies estimating sustainability thresholds such as $\bar{d}$ in Figure 1 have exploited non-linearities in fiscal behavior occurring at certain debt levels (e.g. IMF, 2003; Ostry and others, 2010, Mendoza and Ostry, 2008 and Fournier and Fall, 2015) as well as empirical frameworks (parametric or not) explaining debt distress events (e.g. IMF, 2011).

Figure 2   Public Debt Alert Levels



3. Safe Debt Boundaries: Operational Options

As the size of safety margins below the debt limit is typically left to judgment, this section articulates sensible approaches to their determination. The safe debt boundary is obtained as the difference between the limit and the safety buffer. One problem, however, is that the very notion of a debt limit can be quite elusive for countries that have not experienced meaningful sovereign stress in a long time, including most advanced economies in the post-World-War-II period. In the absence of data showing debt distress, the estimation of a debt limit for these countries is bound to be a controversial exercise. I therefore make a distinction between cases where a debt limit à la $\bar{d}$ is known from those where such limit cannot be easily pinned down.

3.1. Approach #1: Deduct a Safety Margin From a Known Debt Limit

If reasonable priors or credible estimates of the debt limit are available, the safe debt boundary can simply be obtained by subtracting a safety margin from the limit. One practical issue in estimating the safety buffer is that public debt is typically subject to two very different types of shocks.

The first type is the high-frequency (annual or higher) disturbances affecting GDP growth, borrowing costs and nominal exchange rates (which is relevant if part of government liabilities are denominated in foreign currency). With enough data, empirical joint distributions of such shocks are straightforward to estimate and can be used to produce stochastic simulations. These give an idea of the distribution of future debt trajectories over a certain time horizon reflecting constellations of shocks consistent with history. Concretely, the width of a public debt "fan chart"—say the difference between the initial debt level used for the forecast and the 95^{th} percentile of debt forecasts N years into the projection—could be the first main component of the safety margin.[9] This would mean that all else equal, more volatile economies would face lower safe debt boundaries.

The second type of disturbance is low-frequency but large shocks. In practice, they are related to the realization of contingent liabilities (banking crises, natural disasters, bail out of subnational governments or state-owned enterprises,…). Because these events are usually infrequent and highly country-specific, it is not possible to estimate an empirical distribution for each country. In this case, the usual approach is to devise a stress scenario that would assume the realization of a certain fraction of a country's contingent liabilities.

A potentially tricky issue is the correlation between high and low frequency shocks. Event studies proposed by Bova, Toscani and Ture (2016) show that such episodes tend to coincide with bad economic and financial conditions. This coincidence of adverse high- and low-frequency shocks to debt dynamics suggests defining the safety buffer as the simple sum of a margin determined by the width of the fan chart (high-frequency shocks) and the fiscal costs of contingent-liability stress. Hence, the safe debt boundary would be calculated as:

$\tilde{d} = d_0 - \overline{C}$, with d_0 is such that $Q(\pi: d_0 : d_\theta^f) = \bar{d}$ (3)

where $Q(\pi: d_0 : d_\theta^f)$ denotes the quantile function for the projected public debt ratio θ years forward at a probability π and a starting value d_0. For instance, we can set $\pi = 0.95$ and $\theta = 6$. Of course, π can be adjusted upward (downward) for higher (lower) degrees of safety (risk aversion). The 6-year horizon for the debt forecast reflects a common practice in sustainability assessments, reflecting projections for the current and 5 additional years. Opting for longer horizons provides additional insurance.

As indicated above, distributions of public debt forecasts over the medium-term can be obtained through stochastic simulations. As Figure 3 shows, d_0 is the initial public debt level such that 95 percent of projected trajectories originating in d_0 are at or below the debt limit at the end of the forecasting horizon. The fan charts in Figure 3 are constructed with the simulation tool of Celasun, Debrun and Ostry (2006) which relies on an estimated conditional variance-covariance matrix of macroeconomic shocks and an estimated fiscal reaction function describing a countercyclical fiscal response in bad times, a procyclical response in good times[10], and a stabilizing response to public debt—that is a positive response of the primary balance to an increase in debt, as in Bohn (1998).

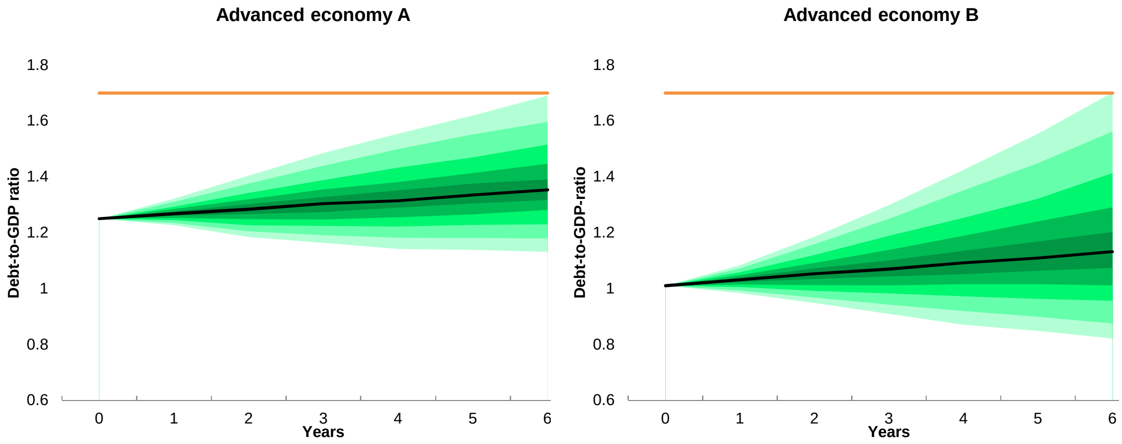
Both countries depicted in the chart are advanced European economies. In line with Ostry et al' (2010) estimates, a debt limit of 170 percent of GDP has been assumed for both. The charts show how different degrees of exposure to macroeconomic shocks can affect the safe debt boundary, which in the absence of any buffer for contingent liabilities, is the starting point of the simulations. The safe debt level is slightly above 100 percent of GDP for country B (meaning a safety buffer of about 70 percent of GDP). By contrast, country A, which exhibits less volatility than country B has a safe debt boundary exceeding 120 percent of GDP. Note that I used a forecasting horizon of 6 years instead of the more conventional 5

[9] Note that one can economize on the need to build an explicit empirical model of the drivers of debt dynamics and base stochastic simulations on the distribution of past forecast errors of public debt.

[10] This asymmetry in the fiscal policy response to good and bad shocks is the main reason for the asymmetry in the distribution of debt projections. The function is estimated on a panel of advanced economies to capture the average fiscal behavior. Country-specific reactions functions can also be used if data availability allows.

years to show that shifting the forecasting horizon by only one year can have a meaningful impact on the calculation of d_0.

Figure 3 Drivers of safety margins: macroeconomic shocks

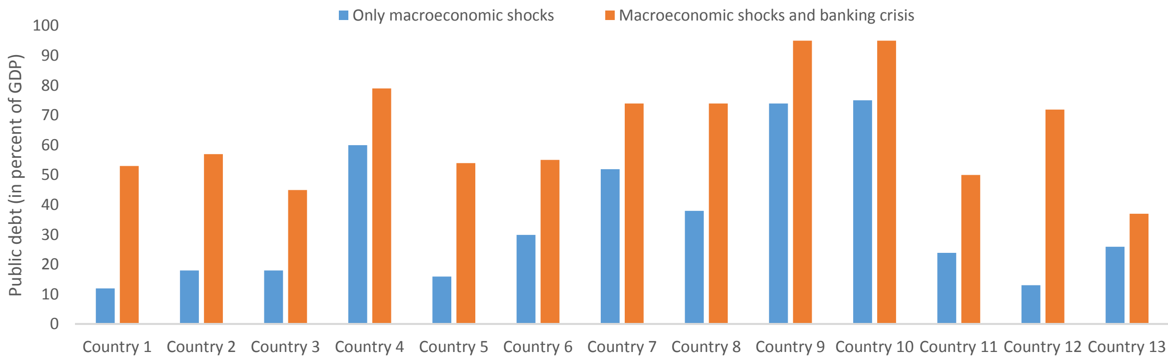


Source: Debrun, Jarmuzek and Shabunina (2016)

The calibration of $\bar{C}$ (the additional buffer for infrequent shocks such as banking crises) is less straightforward and depends on the availability of information on the stock of contingent liabilities in the public sector. As a first pass, Debrun, Jarmuzek and Shabunina (2016) propose using a fixed percentage (in their case, 10 percent) of the total bank assets in the country.[11] Figure 4 shows how the safety margin below the debt limit increases as a result of that adjustment for a sample of 13 advanced economies.

[11] Banking crises typically generate the largest shocks to the public sector balance sheet (Bova, Toscani and Ture, 2016). Data on banking crises collected by Laeven and Valencia (2013) indicate that the average effect of such a crisis on public debt is about 10 percent of the total bank assets in the country.

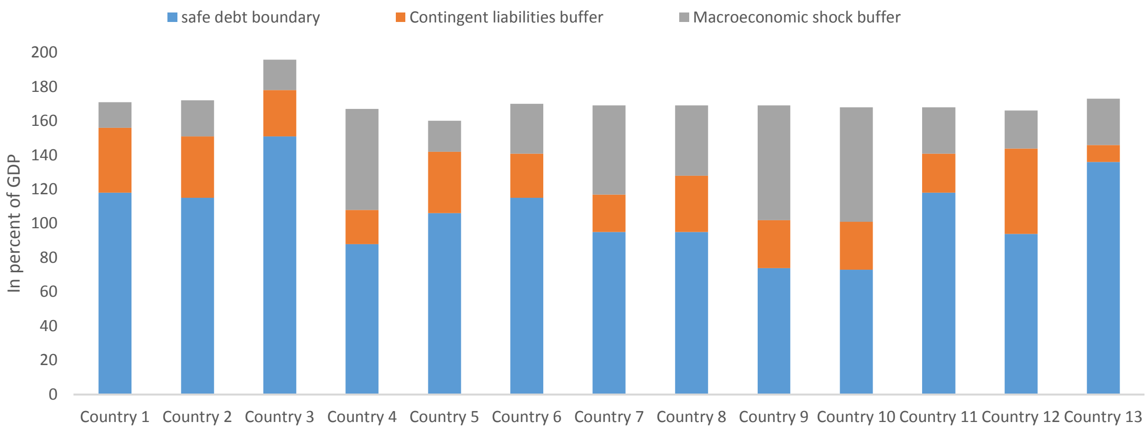
Figure 4 Drivers of safety margins: extra insurance against contingent liabilities



Source: Debrun, Jarmuzek and Shabunina (2016)

Applying these buffers to the debt limits estimated by Ostry et al (2010) for the above sample of advanced economies, Debrun, Jarmuzek and Shabunina (2016) find safe debt boundaries ranging between 73 and 136 percent of GDP (Figure 4).

Figure 5 Selected advanced economies: safe debt boundaries with known debt limit



Source: Debrun, Jarmuzek and Shabunina (2016)

3.2. Approach #2: Finding Safe Debt Boundaries When the Limit is Unknown

When debt limits are unknown or unreliable, several options can be considered. The first is simply to adopt another definition of the risk one wants to insure against through precautionary debt buffers. Two recent attempts to pin down safe debt boundaries in this way are worth noting. Lukkezen and Suyker (2013) and Fall and Fournier (2015) both derive "prudent" debt levels for advanced economies by deducting a safety margin from a debt threshold beyond which the costs to economic growth are estimated to turn significant. The two methods differ in the way the authors estimate the safety margin. While Fall and Fournier (2015) use stochastic simulations of the debt-to-GDP ratio over a fixed time horizon (as discussed above), Lukkezen and Suyker (2013) rely on model simulations. They find the safe debt boundary by equalizing the benefits from larger buffers—in terms of higher growth—with the costs of bringing down the debt to safe levels.

Debrun, Jarmuzek and Shabunina (2016) propose to directly pin down $\bar{d}$ by focusing strictly on fiscal behavior and debt dynamics in highly adverse conditions. In terms of Figure 1, they try to locate point C without having to rely on a predetermined debt limit. The idea is to identify the highest debt level a government could commit to maintain over a given time frame under persistent persistently bad circumstances (strong snowball effect). Under that "stress testing" approach, a public debt level is considered safe as long as the surpluses generated under the "crisis-mode" policy regime suffice to prevent explosive debt trajectories after adverse conditions emerge. The underlying stress-with-strong-policy-response scenario is built on tail realizations of the relevant variables—including the growth-adjusted interest rate, the primary balance, and the size of fiscal adjustments—in light of their historical distributions. The range of safe debt boundaries found through that approach spans over a narrower interval of 75 to 100 percent of GDP.

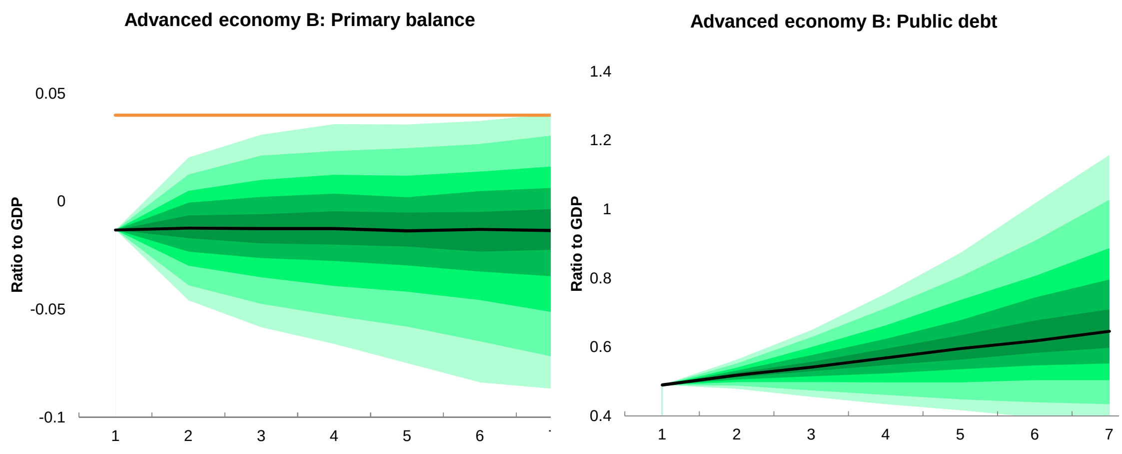
A third option would be to focus on the notion of a policy limit as the main determinant of the safe debt boundary.[12] Under that approach, the probability that securing an appropriately mean-reverting debt trajectory would require a primary balance that exceeds some feasible upper bound by the end of a given time horizon would form the basic mechanism to search for the safe debt boundary. The reason is that selecting a higher debt level at the beginning of the projection horizon increases the likelihood that the primary balance required to guarantee a mean-reverting debt path at the end of the forecasting horizon would be unfeasible. Hence, by setting a maximum tolerance level for unfeasible primary balances (say a 5 percent probability), one could pin down a starting public debt level consistent with that probability, and that level would qualify as the safe debt boundary.

Figure 6 below illustrates how such an approach could work in the case of the "advanced economy B" referred to in Figure 3. The simulation tools and the underlying data used to produce the fan charts below are similar. The policy limit is formulated as an upper bound of 4 percent of GDP on the primary balance. It corresponds to the 75th percentile of the historic distribution of 5-year moving averages of positive primary balances observed in a panel of 29 advanced economies over 1985 to 2014. The primary balance fan chart on the left panel of Figure 6 shows that the binding constraint is the 95 percent probability of not exceeding the 4 percent limit by the end of the 6-year forecasting horizon. That fan chart maps into the debt fan chart on the right.

The starting public debt level captures the safe debt boundary consistent with the primary-balance limit, the volatility of the snowball effect determinants, and the primary balance required to secure a mean-reverting debt level even in very adverse circumstances when severe cyclical revenue losses complicate the task of raising the primary balance. The fact that the debt fan chart shows many growing trajectories over the forecasting horizon is due to the tension between the need to raise the primary balance to stabilize the debt and the fact that highly negative shocks to output and revenues and undermine consolidation and debt-stabilization objectives. As a result the safe debt boundary is a third lower than under the other two approaches for that country and it does not exceed 50 percent of GDP.

[12] See Bi (2012) for such an approach in the context of a standard macroeconomic model.

Figure 6 Policy limits to pin down the safe debt boundary: an illustration



4. Conclusions

The paper provides a general definition of safe debt as well concrete options to implement the concept. It discusses alternative methods to calculate public debt levels beyond which unforeseen shocks affecting economic activity, borrowing costs and the government budget itself can push public debt into undesirable territories. (By undesirable, I mean levels associated with tangible economic costs or uncomfortably high sovereign crisis risk.) The general idea is to quantify safety margins allowing the budget to buffer a plausible range of economic, financial and fiscal shocks over a given time horizon.

Policymakers can greatly benefit from frameworks quantifying precautionary buffers. For instance, they can use safe debt boundaries as a clear and sensible medium-term objective for debt reduction strategies. Knowledge of the safe debt territory can also help them define desirable long-term "anchors" for rules-based fiscal frameworks; and for those countries with low public debt and large development needs—such as low-income countries—these tools can be used to inform policymakers of the risk-return trade-off they face when devising a debt-financed expenditure scaling up.

That said, these tools must be handled with care. Many parameters enter into the proposed algorithms for safe debt computation, creating a sense of opacity that immediately raises the question of potential manipulations. This is even more the case that, as shown in the some of the illustrations above, different sets of plausible assumptions can yield fairly different results. Using these tools thus requires the greatest transparency in formulating the modeling assumptions and a great deal of pedagogy in discussing the results and formulating policy recommendations. This suggests that the development and use of these tools should ideally be placed in the hands of politically independent institutions, such as central banks, audit courts, and independent fiscal institutions (fiscal councils and parliamentary budget offices). In no way can these tools remove judgment, but they should at least discipline it in a sensible way.

One lesson from the simulation exercises performed here is that divergences in safe debt boundaries obtained from different algorithms concern less the estimation of the safety margin than the determination of the debt threshold beyond which unpleasant outcomes are likely. It is therefore critically important to define as precisely as possible the risk one wants to mitigate through buffers, and to clarify the empirical link between that risk and public indebtedness.

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