DEBT MANAGEMENT AND FISCAL SPACE

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Views expressed are those of the presenter and should not be attributed to the IMF or the CEPR. This presentation draws on work undertaken for a joint project with the CEPR on sovereign GDP-linked bonds (Benford, Ostry, Shiller, CEPR Press, 2018) and on joint work with Jun Kim (Kim and Ostry, 2019).

Context: Demand-Management Policies are Stressed

- Policy interest rates are low, not far off their lower bounds, and monetary policy normalization seems to have been delayed
- Public debt levels are high in AEs—with limited fiscal space in some of them—especially in relation to large infrastructure gaps; issue also in some large EMs
- Monetary normalization delayed but will come back at some point, and bring to the fore several worries: (1) risk of sovereign crises as R-G rises; (2) impact on private balance sheets, esp. given porous border between public and private sectors; (3) impact on EMEs including capital flow reversals.

Can debt management help to boost fiscal space?

- Helpful if governments could acquire more fiscal space, other than by being more fiscally virtuous: Debt management may help
- State-contingent debt and longer-maturity debt may help to lower default risk, and perhaps allow the sovereign to borrow more cheaply. If so, that would *increase fiscal space for a given path of primary fiscal balances.*
- GDP-linked debt compensates for variations in ability to pay—inoculates debt service from uncertainty, stabilizes debt ratios, lowers default risk and borrowing cost—boosts fiscal space
- Longer-duration debt shares risk-sharing attribute of state-contingent debt through price of LT debt, which imparts greater stability to debt ratios (today's price depends on expected future price, possibility of redemption through good shocks in future)

I. Nominal Debt versus GDP-linked Debt

Assumptions of the Model

- Growth rate (g) is *i.i.d.* around the mean (g^*)
- Constant primary balance/GDP (s^*) and risk-free interest rate (r^*)
- *One-period* debt either in nominal bonds (NBs) or GDP-linked bonds (GLBs) with total payout at maturity (ρ_{t+1}):
  - NB: $\rho_{t+1} = 1$
  - GLB: $\rho_{t+1} = (1 + g_{t+1})/(1 + g^*) \implies E(\rho_{t+1}) = 1$
- Investors are risk neutral and recover nothing upon default
- Bond price: $q_t = E_t[(1 - p_{t+1})\rho_{t+1}]/(1 + r^*)$ where p_{t+1} = default probability
- Debt dynamics equation: $d_{t+1} = \rho_{t+1} d_t / [(1 + g_{t+1}) q_t] - s^*$
  - NB: $\boldsymbol{d_{t+1} = d_t/[(1 + g_{t+1})q_t] - s^*,\quad q_t = \frac{(1-p_{t+1})}{1+r^*}}$
  - GLB: $\boldsymbol{d_{t+1} = d_t/[(1 + g^*)q^*] - s^*,\quad q^* = \frac{1}{1+r^*}}$ $\Leftarrow$ **No uncertainty in debt dynamics!**

Defining fixed-point problem for default probability

- Fixed-point problem for default probability:

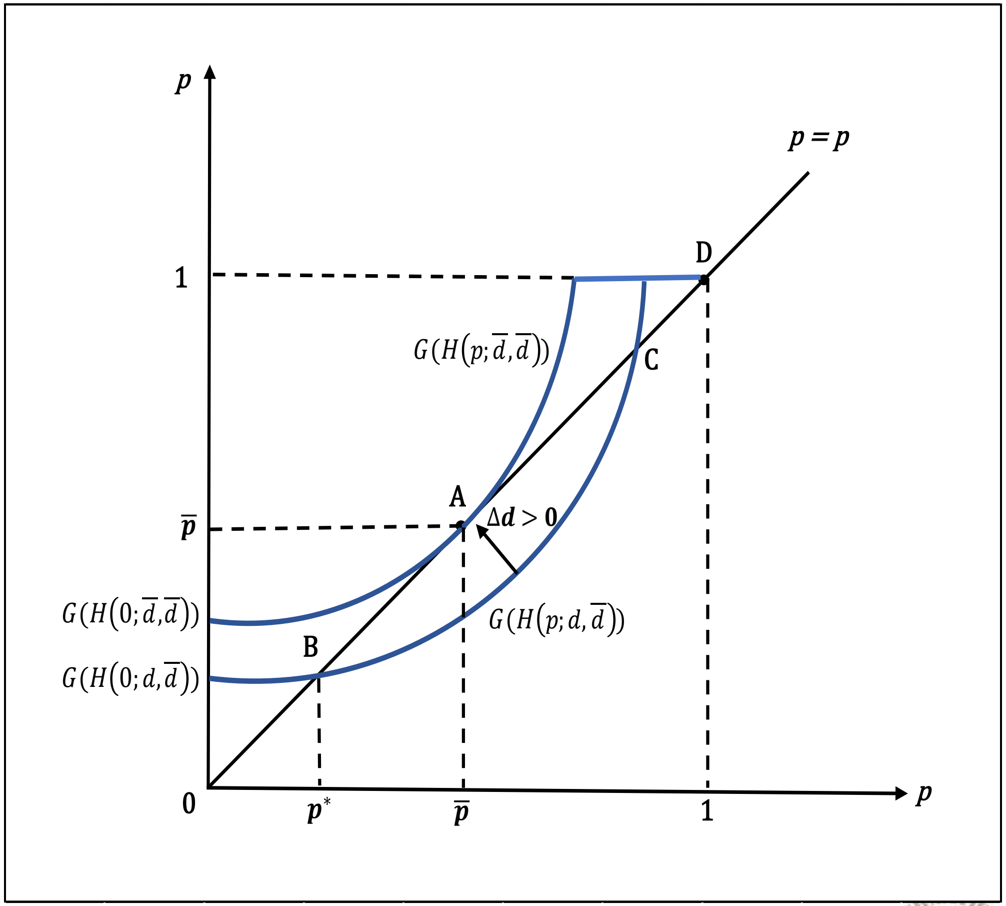
$$p_{t+1} = \Pr[d_{t+1} > \overline{d}] \quad \Leftrightarrow$$

$$p_{t+1} = \Pr[g_{t+1} < H(p_{t+1}; d_t, \overline{d})]$$

- Debt limit is determined by the largest value of $\overline{d}$ for which the fixed-point problem has an interior solution ($p_{t+1} < 1$)

- Debt limit is determined at the tangency point A in the figure at which:

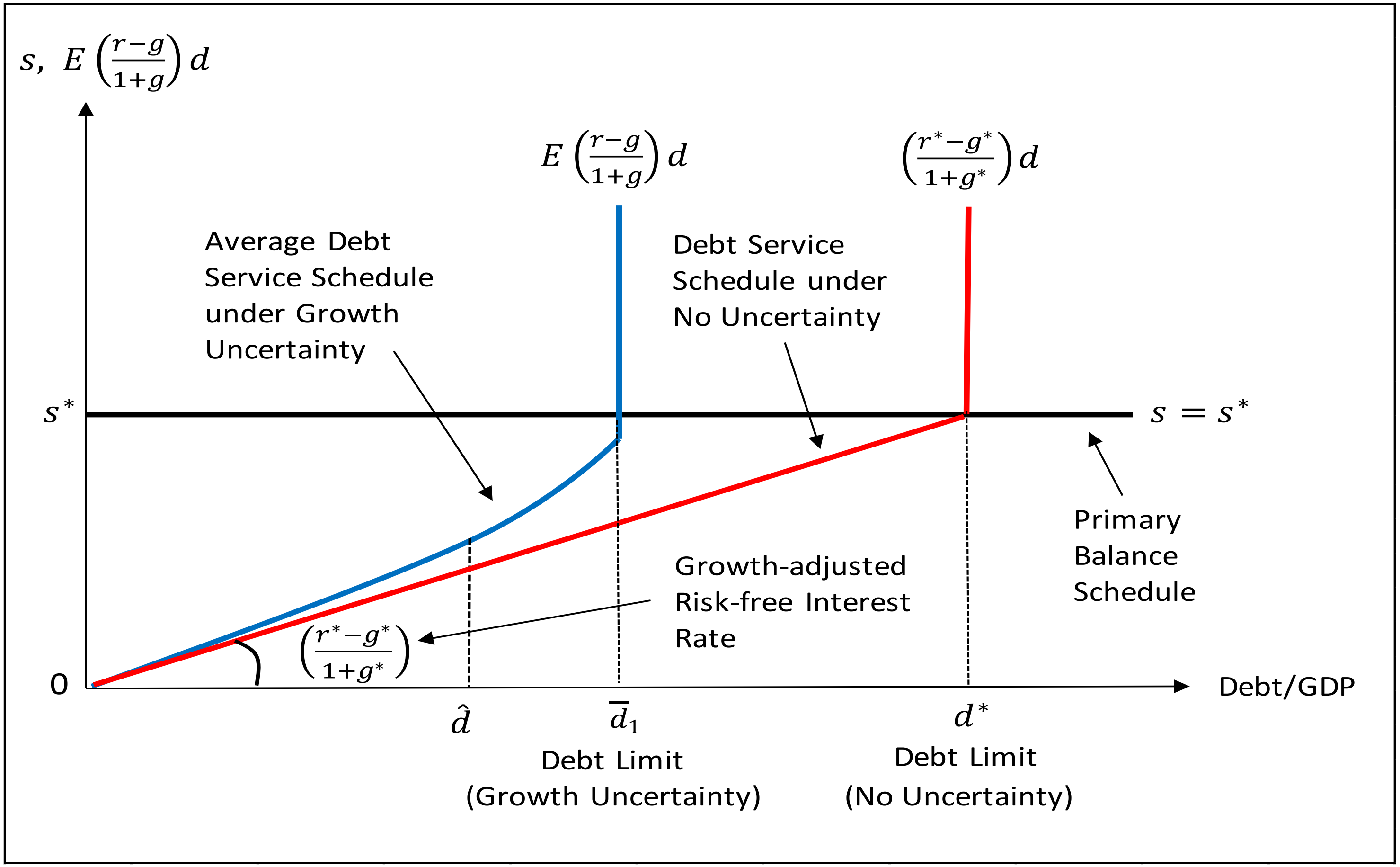
$$\overline{p} = G(\overline{p}; \overline{d}, \overline{d}) \text{ and } \partial G / \overline{\partial p} = 1$$



Debt service schedules under uncertainty

- Debt dynamics equations in difference form:
  - NB: $\Delta d_{t+1} = \left[\frac{r_t - g_{t+1}}{(1+g_{t+1})}\right] d_t - s^*$ where $r_t = (r^* + p_{t+1})/(1 - p_{t+1})$
  - GLB: $\Delta d_{t+1} = \left[\frac{r^* - g^*}{(1+g^*)}\right] d_t - s^*$
- *Expected* debt service schedule of NB bends upward and becomes convex as debt ratio rises (r_t is increasing and convex in p_{t+1})
- Debt service schedule of the GLB is linear (non-stochastic)
- An *equivalence result* obtains for GLB
  - Debt limit of GLB, d^*, is identical to that of the nominal bond in the absence of growth uncertainty

Debt limit under uncertainty: Nominal Bond vs GLB



Simulation for Advanced Economies: NB and GLB

- Fiscal reaction function parameterized following Ostry et al. (2010):

$$s_{t+1} = f(d_t) + \beta(g_{t+1} - g^*) + e_{t+1}$$

  - $f(d)$ is a cubic function reflecting fiscal fatigue
  - β captures cyclical response of fiscal policy ($\beta = 0, 0.4, -0.4$)
  - $e_{t+1} \sim \text{triangular}[-\bar{e},\ \bar{e}]$ is an i.i.d. shock ($\bar{e}$ = 2.16% of GDP)

- Growth uncertainty calibrated using annual data/projections for 23 AEs over 1980-2023 (g^*= 2.4%; σ = 1.3% and 2.4% for low and high growth uncertainty, respectively)

- r^* =1.3% (period average of German bund and US treasury yields for 2000-17, adjusted for inflation)

- θ (recovery rate) = 90% for high and 70% for low

Gains in Fiscal Space: NB versus GLB

Growth Uncertainty	Recovery Rate	Debt Limit		Gains in Fiscal Space
		NB (A)	GLB (B)	B - A
1. Acyclical Fiscal Policy				
High	High	157.8	197.5	39.7
	Low	...	196.8	...
Low	High	178.3	197.5	19.2
	Low	160.5	196.8	36.3
2. Countercyclical Fiscal Policy				
High	High	133.8	193.9	60.1
	Low	...	186.7	...
Low	High	173.1	195.2	22.1
	Low	143.0	191.2	48.2
3. Procyclical Fiscal Policy				
High	High	168.8	188.7	19.9
	Low	...	183.7	...
Low	High	183.1	194.9	11.8
	Low	169.9	193.7	23.8

Source: Authors' calculations.
Note: The fiscal reaction function is specified as $s_{t+1} = f(d_t) + \beta(g_{t+1} - g^*) + e_{t+1}$ where $f(\cdot)$ is a cubic function and e is an *i.i.d.* shock to the primary balance that follows a triangular distribution defined over the interval [-2.16, 2.16]. β is set to 0 (acyclical), 0.4 (counter-cyclical) or -0.4 (pro-cyclical), drawn from the coefficient of the output gap in the estimated primary balance equation in Ostry et al. (2010). All figures are in percent of GDP. In the simulation, growth uncertainty is assumed to be exogenous to fiscal policy.

Gains in fiscal space from GLB are significant

- Larger gains in fiscal space under higher uncertainty and lower recovery rate
  - A decrease in the recovery rate weighs more on NB than GLB (because default probability is higher for NB for any given level of debt)
- Counter-cyclical fiscal policy ($\beta > 0$) strengthens benefits of GLBs for given growth uncertainty
  - Counter-cyclical fiscal policy tends to increase variability of the debt ratio if debt is issued in NB

What if investors are risk averse?

- Simulate maximum premium sovereign would be willing to pay to compensate investors for return volatility of GLBs

Growth Uncertainty	Recovery Rate	Maximum Risk Premium	Sharpe Ratio
High	High	256	1.04
	Low	…	…
Low	High	157	1.16
	Low	221	1.64

Source: Authors' calculations.
Note: Maximum premiums are calculated as the hypothetical change in the risk-free interest rate that would bring the debt limit of the GLB down to that of the NB. Sharpe ratio is the ratio of the risk premium to the standard deviation of the bond yield. Risk premiums are simulated assuming countercyclical fiscal policy, and measured in basis points.

- Sharpe ratios (higher than empirical norms for equity return) suggest room for risk-sharing unless investors are exceptionally risk averse or constrained in diversification

II. Short-term Debt versus Long-term Debt

Debt maturity: How does it affect the debt limit?

- Long-maturity (nominal) debt is not a state-contingent instrument, but its market price exhibits an equity-like feature
- Asymmetry in market pricing:
  - One-period debt: Both upside potential and downside risks (of default) are priced symmetrically
  - Long-maturity debt: Future upside potential is priced continuously while downside risks (of default) are censored
- As a result, the price of long-maturity debt is more stable than the price of one-period debt for given uncertainty
- This greater price stability leads to greater stability in debt ratios and a lower average borrowing cost, yielding a higher debt limit

Assumptions of the Model

- Sovereign issues nominal debt either in (one-period) short-term bonds (STBs) or long-maturity bonds

- Long-maturity bond modeled as *long-duration* bond (LDB) which promises to pay an infinite stream of coupons which decay geometrically at the rate $0 < \delta \leq 1$

  - LDB issued at time t pays from t+1 onwards:

$$(1-\delta)^{s-t-1} \text{ for } s \geq t+1$$

  - STB is a special case of LDB with $\delta = 1$

- Remainder of the model is same as before (e.g., constant primary balance, investor risk neutrality)

Debt dynamics and bond price of LDB

- For LDB, it is the gross financing need (GFN)—not the entire debt—that needs to be rolled over in each period
- Law of motion for the GFN (denoted by x):

$$x_{t+1} = x_t/[(1+g_{t+1})q_t] + (1-\delta)b_t/(1+g_{t+1}) - s^*$$

where b is aggregate coupon payment obligation

- Bond price: $q_t = (1-p_{t+1})[1+(1-\delta)q_{t+1}^E]/(1+r^*)$
  - Total return consists of the coupon receipt and the market value of the same bond in the next period
  - $q_{t+1}^E = E_t[q_{t+1}|q_{t+1} > 0]$ is the expected bond price in the next period conditional on no default, which is a summary statistics for all expected future prices beyond time t+1

What is the debt limit of LDB?

- As in the case of STB, fixed-point problem for default probability determines **GFN** limit ($\overline{x}$) of LDB:

$$p_{t+1} = \Pr[x_{t+1} > \overline{x}] = \Pr[g_{t+1} < Z(p_{t+1}; x_t, \overline{x}, q_{t+1}^E)]$$

where Z is the threshold growth rate below which default occurs (it depends on the expected bond price)

- **Debt ratio** for LDB obtains as the PV of current and future coupon payments from the outstanding debt, net of the primary balance:

$$d_t = b_t + PV\{(1-\delta)b_t,\ (1-\delta)^2 b_t,\ (1-\delta)^3 b_t, \dots\} - s^*$$
$$= [1 + (1-\delta)q_t]b_t - s^* = [1 + (1-\delta)q_t]x_t + (1-\delta)q_t s^*$$

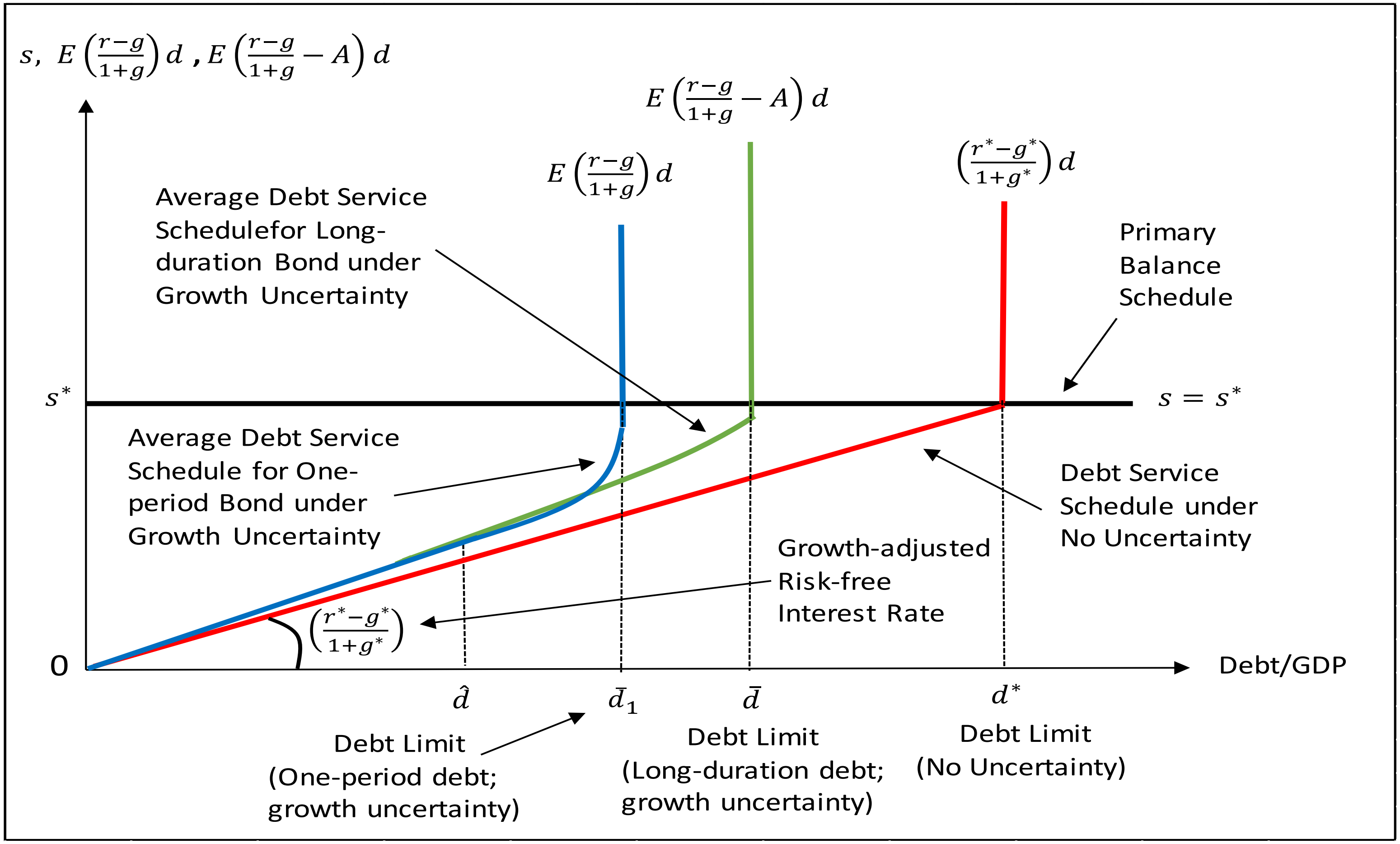
- Debt limit of LDB obtains from GFN limit ($\overline{x}$):

$\overline{d} = [1 + (1-\delta)\overline{q}]\overline{x} + (1-\delta)\overline{q}s^*$ where $\overline{q}$ is the bond price at $\overline{x}$

Debt service increases with debt more slowly for LDB

- Once default risk begins to emerge, debt service tends to increase with debt, on average, more slowly for LDB than for STB
  - The term denoted by $A > 0$ in the figure represents the benefit from risk sharing "across states and time"
  - The possibility of "redemption through good future shocks" helps boost the current price of LDB (and hence reduce borrowing costs) for a given path of primary fiscal balances
- Debt duration (or maturity) does not matter for the debt limit in the absence of growth uncertainty

Debt limit under uncertainty: STB vs LDB



Simulation: STBs vs GLBs

- Model is parameterized by using data of 23 AEs over 1985-2023 (WEO projections for 2018-23)
- $g \sim$ truncated normal over $[\, g^* - 3\sigma,\ g^* + 3\sigma]$
- $g^* = 2.4\%$
- $\sigma = 2.4\%$ for high uncertainty and 1.3% for low uncertainty
- $s^* = 1.7\%$ (one STDEV above cross-country average)
- $r^* = 3.4\%$ (average of German bund and US treasury yields for 1985-2006, adjusted for inflation)
- θ (recovery rate) = 90% for high and 70% for low (Benjamin and Wright, 2009)

Finding unique debt limit for LDB

- Multiple equilibria exist given the feedback from future prices to the current price (Lorenzoni and Werning, 2013)
- Assume sensible equilibrium selection rule (which ensures that the bond price declines with the debt ratio)
- Given this equilibrium selection rule, unique solutions for the debt limit and bond prices are obtained as the limiting values of their respective horizon-T solutions when T goes to ∞
- The model is solved for the GFN limit which is then converted into the debt limit by using the relationship between GFN and the stock of LDB
- Two valuations for LDB possible: Book Value ($\overline{d}_B$) and Market Value ($\overline{d}_M$)

  $\overline{d}_B = \left[1 + (1-\delta)q^f\right]\overline{x} + (1-\delta)q^f s^*$ where q^f is the risk-free price

  $\overline{d}_M = [1 + (1-\delta)\overline{q}]\overline{x} + (1-\delta)\overline{q}s^*$ where $\overline{q}$ is the bond price at $\overline{x}$

Gains in fiscal space from LDBs are significant: Book Value

- Larger gains in fiscal space for longer durations, higher uncertainty, and ***higher*** recovery rate
- Debt limits less sensitive to growth uncertainty than in case of STB

Growth Uncertainty	Recovery Rate	Debt Limit			Gains in Fiscal Space	
		STB (A)	LDB		B - A	C - A
			10 years (B)	20 years (C)		
High	High	32.5	78.0	104.7	45.5	72.2
	Low	25.9	51.4	73.4	25.5	47.5
Low	High	46.5	84.6	108.9	38.1	62.4
	Low	39.9	62.9	81.1	23.0	41.2

Source: Authors' calculations.

Note: See Table 1 for the underlying assumptions of the model. All figures are in percent of GDP.

Policy Implications

- GLBs and LDBs could be attractive to both EMs and AEs
  - Gains in fiscal space are larger, the higher is growth uncertainty (EMs) and the higher is actual debt (AEs)
  - GLBs could be attractive to countries where counter-cyclical MP is constrained (e.g., CU members)
- On the investor side, GLBs could be attractive to defined-benefit pension funds as they provide a natural hedge against GDP-induced variation in their liabilities
- Fiscal policy may need to be sufficiently counter-cyclical in the first place in order to reap the benefits from GLBs

Conclusions

- Debt management policy can help to increase fiscal space under uncertainty, *for a given path of primary balances*
  - Possible gains in fiscal space on the order of 20-70 percent of GDP
- For GLBs and LDBs, policy challenge may arise with regard to risk migration from sovereign to private investors
  - Conventional wisdom: government is a better risk absorber than private investors given its taxation powers
  - But the shock-absorbing capacity of the government depends on the sovereign retaining sufficient fiscal space
  - Financial stability can be underpinned by the stronger insurance that a sovereign with additional fiscal space can provide

Thank you!

Gains in fiscal space from LDBs are significant: Market Value

Growth Uncertainty	Recovery Rate	Debt Limit			Gains in Fiscal Space	
		STB (A)	LDB		B - A	C - A
			10 years (B)	20 years (C)		
1. Debt limit based on maximum sustainable debt service						
High	High	32.5	64.6	65.7	32.1	33.2
	Low	25.9	42.4	45.6	16.5	19.7
Low	High	46.5	76.7	84.5	30.2	38.0
	Low	39.9	57.4	63.0	17.5	23.1
2. Debt limit based on maximum sustainable debt						
High	High	32.5	74.0	93.6	41.5	61.1
	Low	25.9	49.4	68.5	23.5	42.6
Low	High	46.5	82.7	104.2	36.2	57.7
	Low	39.9	61.8	78.8	21.9	38.9

Source: Authors' calculations.

Note: See Table 1 for the underlying assumptions of the model. All figures are in percent of GDP.