Government Budget - Sovereign Debt Crisis

- WEEK EIGHT -

Fatih Kansoy
University of Oxford

https://macroeconomics.info

Hilary Term 2024-2025

– Oxford Saïd Business School –

Introduction

- We have already studied some key issues related to monetary policy - one of the two major branches of macroeconomic policy.
- Today we will focus on the second branch – **fiscal policy**, which is concerned with levels and composition of taxes and gvt. spending.
- Consensus: macro stabilization is best left to monetary policy.
  - ⇒ Central banks are able to react quickly and decisively, whereas fiscal changes typically face significant political barriers.
    - Though massive fiscal stimulus during 2008-9 proves that there are important exceptions to any rule.
- Nevertheless, the features of a country's tax system and government fiscal policy can have significant implications for the economy.
- For example, large budget deficits can be inefficient, and could also lead to defaults and sovereign debt crises.

Game plan

- Fiscal policy is a broad topic.
- We will thus restrict our attention to the issues surrounding the sources and costs of government budget deficits.
- The outline of today's lecture:

  1. Tax smoothing: how should the governments conduct fiscal policy?
  2. Persistent budget deficits and their costs.
  3. Sources of deficits: strategic debt accumulation & delayed stabilization.
  4. Sovereign debt crises.

How does the government finance itself?

- The government needs to finance a large number of different public goods and services: military, healthcare, education etc etc.
- The main source of income for the government is taxation.
- In any given period, the gvt can finance expenditures either through
  1. current tax income, or
  2. by borrowing against future tax incomes.
- **Ricardian equivalence:** in ideal theoretical circumstances, the gvt choice between taxes and borrowing does not affect the economy.
  - Specifically, if taxes are **lump-sum** and households can freely lend/borrow at the same interest rate as the gvt,
  - timing of taxes is irrelevant for households' consumption choices.
  - Intuitively, households can borrow/lend to offset periods of high/low taxes, and thus smooth consumption.

  $\Rightarrow$ Only the present value of all taxes and transfers matters to households.

Distortionary taxes and tax smoothing

- But the real world is not ideal, and gvt financing choices matter.
- In practice, very few taxes could be seen as lump-sum.
- Instead, taxes often **distort behaviour:**
  - E.g. labour income tax reduces people's incentives to work, capital tax discourages investment, and VAT distorts consumption choices.
- This causes inefficiencies, and therefore is costly.
- We will now consider a problem of a government that strives to minimize the costs associated with tax distortions:
  - The government must ultimately finance its expenditures by taxes.
  - But can borrow/lend, and so decide on the timing of taxes.
  - We will see that under plausible assumptions, the government wants to **smooth taxes** over time.

Setup

- A simple 2-period economy, $t = \{1, 2\}$
- The path of output Y_1, Y_2 is exogenously given.
- The government needs to finance expenditures G_1 and G_2.
- It can levy taxes T_1 and T_2 in periods 1 and 2 respectively.
- It can also borrow/lend at the interest rate r between periods.
- The governments taxes cause distortion costs given by:

$$C_t = Y_t f\left(\frac{T_t}{Y_t}\right), \quad f(0) = 0, \quad f'(0) = 0, \quad f''(\cdot) > 0 \tag{1}$$

- I.e. distortion costs relative to output are a function of taxes relative to output, and increase more than proportionally with T_t/Y_t.

The government's problem

- In period 1, the government chooses the path of taxes to minimize the present value of distortion costs:

$$\min_{T_1,T_2} \; Y_1 f\left(\frac{T_1}{Y_1}\right) + \frac{Y_2}{1+r} f\left(\frac{T_2}{Y_2}\right) \tag{2}$$

- The government's budget constraints in periods 1 and 2 are:

$$G_1 = T_1 + D \tag{3}$$

$$G_2 = T_2 - (1+r)D, \tag{4}$$

  where D is the government debt (or **budget deficit**) in period 1.

- Substitute for D from (4) into (3) to get the gvt's **intertemporal BC:**

$$G_1 + \frac{G_2}{1+r} = T_1 + \frac{T_2}{1+r}. \tag{5}$$

$\Rightarrow$ Thus, the present value of current and future government spending must equal the present value of current and future tax revenues.

Optimal taxes

- Substitute for T_2 from constr. (5) into the obj. function (2) to get:

$$\min_{T_1} \; Y_1 f\left(\frac{T_1}{Y_1}\right) + \frac{Y_2}{1+r} f\left(\frac{(1+r)(G_1 - T_1) + G_2}{Y_2}\right) \tag{6}$$

- The first order condition yields:

$$f'\left(\frac{T_1}{Y_1}\right) = f'\left(\frac{T_2}{Y_2}\right), \tag{7}$$

  i.e. the gvt. equalizes relative marginal distortion costs in two periods.

- Since f is strictly convex, this can only hold if the **tax rate** (i.e. tax as a share of output) is constant across periods:

$$\boxed{\frac{T_1}{Y_1} = \frac{T_2}{Y_2}} \tag{8}$$

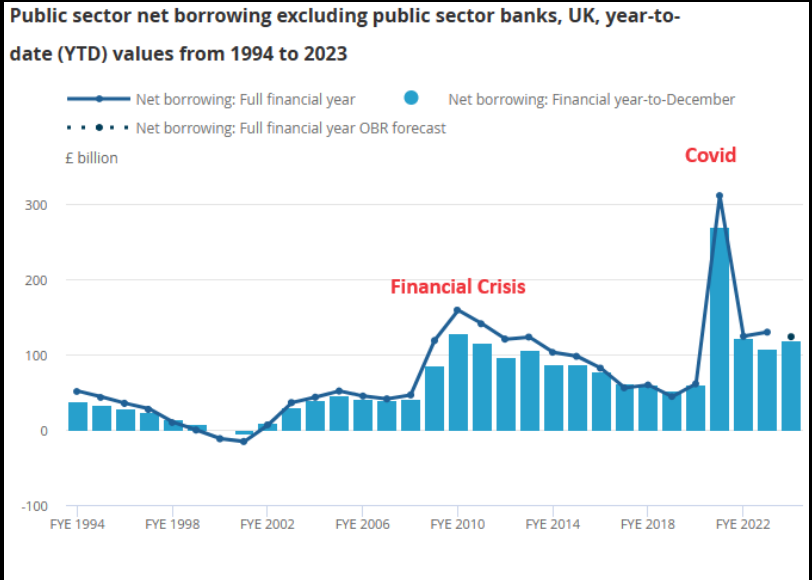
Implications

- To minimize welfare losses associated with distortions, the government thus strives to keep tax rates constant.
- But then how does the government finance abnormally high but temporary expenditures, such as wars?

  $\Rightarrow$ Borrowing!
- Also, how does the government finance its (roughly acyclical) expenditures during recessions when tax revenues are low?

  $\Rightarrow$ Borrowing!
- The model thus predicts that governments run deficits in such times.
- This prediction is consistent with empirical evidence.

UK government net borrowing



Persistent deficits

- The tax-smoothing model provides an explanation for *variations* in budget deficits over time.
- However, many countries run **persistent deficits** over time.
- Moreover, fiscal policies of many countries appear to be unsustainable.
- For example, the US government has run large deficits over the majority of last four decades.
  - Auerbach & Gale (2017) estimate that if the U.S. fiscal policy remains unchanged, taxes would need to be raised by 7.7% of GDP (relative to the current level of 18% of GDP) for gvt to meet its budget constraint.
  - This is an extraordinarily high imbalance!
- Both theory and practice suggest that excessive budget deficits can be very costly.

Costs of sustainable deficits

- Even if a country's fiscal policy is sustainable in the long run, extended periods of excessive deficits can have big welfare costs.
- Most obviously, running excessive deficits over a prolonged time involves departure from tax-smoothing:
  - If current tax rates are below those necessary to satisfy the gvt budget constraint, then tax rates must be expected to rise in the future.
  - But this means larger expected future distortions.
- Costs of short periods of modestly excessive deficits are likely small.
- But persistent and large deficits can lead to substantial distortions:
  - If the US fiscal policy is unchanged in the next two decades, satisfying the government budget constraint may require tax rates over 50%.
  - The distortions from such policy would surely be very large.

Costs of unsustainable deficits

- Unsustainable fiscal policies (e.g. an ever rising ratio of debt-to-GDP) cannot continue indefinitely.
- The stop, however, can be sudden and unexpected: it is likely to take the form of a **sovereign debt crisis** rather than a smooth transition.
  - ⇒ sharp contractions in fiscal policy, large decline in aggregate demand, major repercussions in capital markets, government default...
- It can trigger a financial crisis, as falling output and asset prices + disrupted capital markets can hit many firms and fin. institutions.
- Low foreign demand for country's assets can also lead to a large depreciation of the exchange rate.
  - ⇒ Increases prices of foreign goods, and leads to high inflation.
  - ⇒ Hits firms and banks whose debt is denominated is foreign currency, making fin. crisis even more likely (aka **twin crisis**).
- After the sharp contraction, the recovery is likely to be only gradual.

Deficit bias: an overview

- Many countries run large and persistent deficits despite these costs.
- What is the source of this **deficit bias**?
- The answer to a large extend must lie within the political process.
- We will consider two simple **political-economic models** that illustrate how political process can produce inefficient outcomes.
- We begin with a highly simplified version of Tabellini and Alesina's (1990) **strategic debt accumulation** model.
- The idea is an elected policymaker may accumulate an inefficient amount of debt to restrain his (opposition) successor's spending.
- For simplicity, we will focus on the case of diametrically opposed preferences, and leave out the election process.

Setup

- The economy lasts two periods: 1 and 2.
- Gvt spending can be devoted to two types of public goods: M or N.
  - Think, for example, 'military' and 'healthcare'.
- Each period, the government receives endowment W.
- The period-1 policymaker chooses spending levels M_1 and N_1, as well as debt D subject to the period-1 budget constraint:

$$M_1 + N_1 = W + D \tag{9}$$

- The period-2 policymaker chooses M_2 and N_2 s.t.

$$M_2 + N_2 = W - D \tag{10}$$

- Therefore, $D > 0$ increases period-1 gvt purchases, but reduces resources available in period 2.

Extreme preferences

- There are two types of policymakers:
  - **Type-1** only cares about military, and has per-period utility $U(M)$.
  - **Type-2** only cares about healthcare, and has per-period utility $U(N)$.
- Standard assumptions about U: $U' > 0$, $U'' < 0$.
- Each type only spends resources on public goods they care about, and is unable to commit to a different policy.
- Suppose that a type-1 policymaker is in office in period 1.
- Naturally, he maxes out on military spending:

$$M_1 = W + D \quad \text{and} \quad N_1 = 0. \tag{11}$$

- Suppose the policymaker elected in period 2 is either type-1 with probability π, or type-2 with probability $1 - \pi$.
  - Thus, with probability π, we have $M_2 = W - D$ and $N_2 = 0$,
  - with probability $1 - \pi$, we have $M_2 = 0$ and $N_2 = W - D$.

The choice of government debt

- The period-1 type-1 policymaker chooses government debt D to maximize his expected utility over both periods:

$$\max_{D} \; U(W+D) + \pi U(W-D) + (1-\pi)U(0) \tag{12}$$

- The FOC implies:

$$\frac{U'(W+D)}{U'(W-D)} = \pi \tag{13}$$

- When $\pi = 1$ and the period-2 policymaker is also type-1 for sure, the period-1 policymaker chooses $D = 0$ to smooth military expenditure.
- However, when $\pi < 1$, $U'(W+D) < U'(W-D)$, and so $D > 0$.
- This is because there is a chance $1-\pi$ that the period-2 policymaker will not share the period-1 policymaker's preferences.
- Moreover, $D \uparrow$ as $\pi \downarrow$.

Intuition and implications

- The intuition is straightforward:
  - From the point of view of the period-1 policymaker, there is a positive risk of period-2 policymaker devoting resources to a 'wasteful' activity.
  - Period-1 policymaker thus borrows in order to transfer resources from period 2 to period 1, when he can devote them to the 'useful' activity.
- **Strategic debt accumulation**: period-1 policymaker accumulates debt strategically to constrain the period-2 policymaker.
- The resulting budget deficit is **inefficient:** all parties would benefit from a smoother expenditures of M and N.
- The mechanism is realistic: for example, a desire to restrain future spending is often cited in the debates over U.S. fiscal policy.
- The model thus provides one plausible explanation of why governments accumulate sizeable debt and budget deficits.

Labour will find it difficult to spend after the election

Labour cuts £28bn green investment pledge by half

Keir Starmer announces party will now spend less than £15bn on green projects a year if it wins election

UK politics live – latest updates

Keir Starmer blames Tory 'recklessness' for Labour slashing green investment pledge – video

Delayed stabilization: an overview

- A related issue: why do sizeable deficits persist over time?
- We saw that deficits can cause large costs to the society both through distorting taxation and, at the extreme, causing sovereign debt crises.
- Thus, a timely fiscal reform to avoid these could benefit most people.
- Yet in practice reforms are often delayed as interest groups struggle over how to divide the burden of the reform.
  - E.g. even during very costly post-WW1 hyperinflation, policymakers could not agree if higher taxes should be levied on capital or labour.
  - In modern times, disagreements are usually over whether the deficit should be closed by tax increases, or by reductions in gvt spending.
- Alesina and Drazen (1991) model: the reform may fail and inefficient deficits may persist because each party tries to get a better deal.
- We now consider a simple model of bargaining based on this idea.

Setup

- There are two groups: capitalists and workers, all risk-neutral.
- Must agree to reform fiscal policy and how to divide tax burden $T > 0$.
- Otherwise, deep fiscal crisis and both groups receive zero payoff.
- If there is a reform, workers receive pre-tax income W (assume $W > T$) and capitalists receive pre-tax income $R \geq 0$.
- Capitalists' pre-tax income R is random, distributed uniformly on $[A, B]$, with $A \geq 0$, and its realisation is known only to capitalists.
- If capitalists pay X out of the total tax T necessary for the reform, the after-tax incomes are $R - X$ for capitalists and $W - T + X$ for workers.
- Note that since $W > T$, the reform is strictly desirable, and any X between 0 and A makes both groups better off.

Bargaining

- Simple bargaining: workers make a **take-it-or-leave-it** proposal X.
  - If capitalists agree, they pay tax X and reform is implemented.
  - If capitalists reject the proposal, the reform fails, and payoffs are 0.
- Capitalists accept the proposal as long as $R \geq X$.
- Thus, the probability $P(X)$ that the proposal is accepted is the probability that $R \geq X$, which is

$$P(X) = \begin{cases} 1 & \text{if } X \leq A \\ \frac{B-X}{B-A} & \text{if } A < X < B \\ 0 & \text{if } X \geq B, \end{cases} \tag{14}$$

  using the uniform distribution of R on $[A, B]$.
- Workers do not know R when they make the proposal, but they can figure out the probability of acceptance $P(X)$.

Workers' problem

- Workers only receive $W - T + X$ if their proposal is accepted.
- Their expected payoff is $V(X) = P(X)(W - T + X)$, or, using (14):

$$V(X) = \begin{cases} W - T + X & \text{if } X \leq A \\ \frac{(B-X)[W-T+X]}{B-A} & \text{if } A < X < B \\ 0 & \text{if } X \geq B \end{cases} \tag{15}$$

- This is a *continuous* function: there are no jumps at e.g. $X = A$ or B.
- Clearly, the workers will never offer $X \geq B$.
- The workers effectively have two options:
  1. Offer the largest X that is accepted for sure, namely $X = A$
     $\Rightarrow$ in which case their payoff is $V(A) = W - T + A$.
  2. Offer $X \in (A, B)$ and accept a risk of rejection.

Workers' problem (cont.)

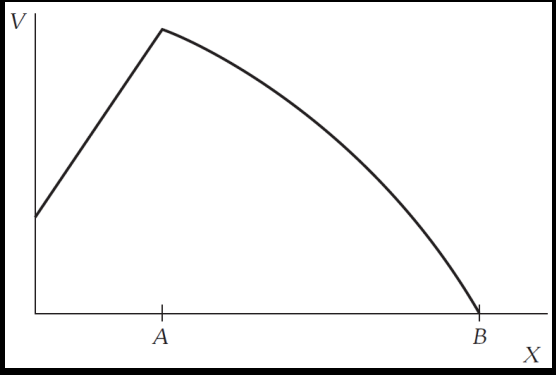
- Workers would pick option #2 iff $V(X) > V(A)$ for some $X \in (A, B)$
- The derivative of $V(X)$ on (A, B) is

$$V'(X) = \frac{B - (W - T) - 2X}{B - A} \tag{16}$$

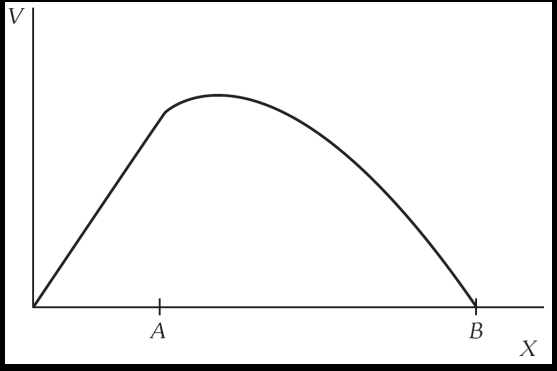
- Note that $V'(X)$ is decreasing in X, so if it is negative at $X = A$ (i.e. $B - (W - T) - 2A \leq 0$), it is negative on the entire range $X \in (A, B)$.
- But then $V(X)$ is decreasing on (A, B), and workers pick $X = A$.
- Otherwise, workers pick $X \in (A, B)$ that satisfies the FOC: $V'(X) = 0$.
- Putting this all together, the workers optimally choose:

$$X^* = \begin{cases} A & \text{if } B - (W - T) - 2A \leq 0 \\ \frac{B-(W-T)}{2} & \text{if } B - (W - T) - 2A > 0. \end{cases} \tag{17}$$

Examples: workers' expected payoff as a function of X



Workers pick $X^* = A$



Workers pick $X^* > A$

Equilibrium probability of reform

- Combining workers' optimal choice of X in (17) with the probability that capitalists accept in (14), the equilibrium probability of reform is:

$$P(X^*) = \begin{cases} 1 & \text{if } B-(W-T)-2A \leq 0 \\ \frac{B+(W-T)}{2(B-A)} & \text{if } B-(W-T)-2A > 0. \end{cases} \tag{18}$$

- Thus $P(X^*) < 1$ when $B-(W-T)-2A > 0$.
- The reform is less likely to pass when $B-A$ is large, i.e. there is a larger uncertainty about capitalists (pre-tax) income.

Implications

- **Key implication:** the two sides can fail to agree on the necessary reform, even though there are packages that make everyone better off.
- Specifically, when $B - (W - T) - 2A > 0$, workers make a proposal less generous than the one that would be accepted for sure.
- Their motive is improve their expected outcome at the expense of the opposition.
- The model predicts that countries with **weak governments**, where no single interest party is setting policy, are the least likely to implement reforms, and so are more likely to run large deficits.
  - This is intuitive, although the empirical evidence is mixed.
- Another implication is that crises (when failure to agree is very costly) can sometimes be beneficial by spurring essential reforms (homework)

Sovereign debt crises

- Our last topic for today (and for the course!) is sovereign debt crises.
- A fully fledged theory of such crises is beyond the scope of this course.
- We will instead focus on a simple model of a government attempting to issue debt that sheds light on some of the key issues:
  1. Why investors refuse to buy debt at any interest rate?
  2. Why can crises occur suddenly and unexpectedly?
- We will see that modest changes in a country's fundamentals can cause dramatic shifts in outcomes.
- And that self-fulfilling crises are likely to be a big part of the story.

Setup

- A government has quantity of debt D coming due.
- It has no funds immediately available $\Rightarrow$ wants to roll over the debt.
- The government needs investors to hold the debt until the following period, when it will be obtaining tax revenues.
- Investors are risk neutral, with required rate of return $\bar{r}$, or $\bar{R} \equiv 1 + \bar{r}$.
- Government offers them (endogenous) interest rate r, or $R \equiv 1 + r$.
- The following period's tax revenue T is a continuous random variable, with cumulative distribution function $F(\cdot)$ (i.e. $\Pr(T \leq x) = F(x)$).
- If $T \geq R\,D$, the government pays the debtholders.
- If $T < R\,D$, the government defaults $\Rightarrow$ **debt crisis.**
- Default is **all or nothing:** if defaults, the gvt. repudiates debt entirely.

The condition for investors to hold government debt

- Let π be the (endogenous) probability of default.
- For investors to be willing to hold debt *given* the prob. of default π, interest R must be such that they break-even in equilibrium, i.e.

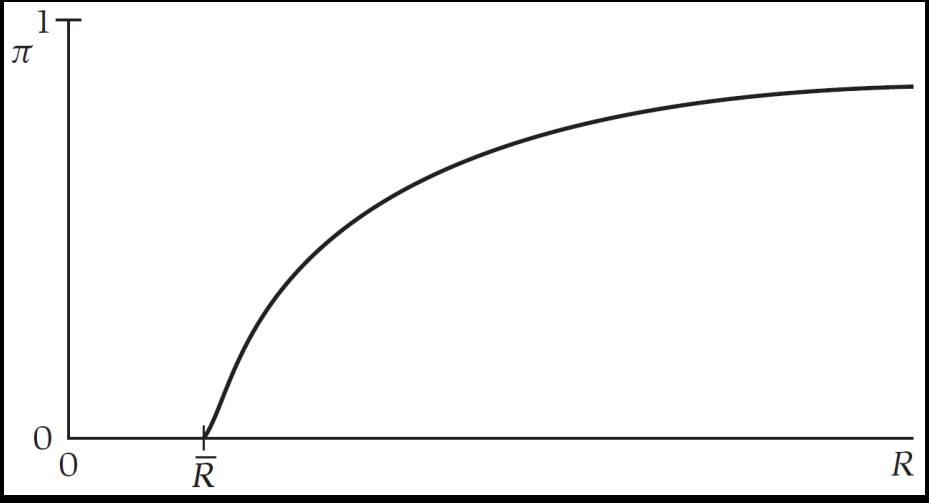
$$(1-\pi)R = \bar{R} \tag{19}$$

- When the government is certain to repay and $\pi = 0$, we have $R = \bar{R}$.
- As $\pi \to 1$, $R \to \infty$.
- Rearrange to get an expression for π as an (increasing) function of R:

$$\pi = 1 - \frac{\bar{R}}{R} \tag{20}$$

- **'Debt demand' curve:** # 1 of the 2 key equilibrium conditions.

The debt demand curve



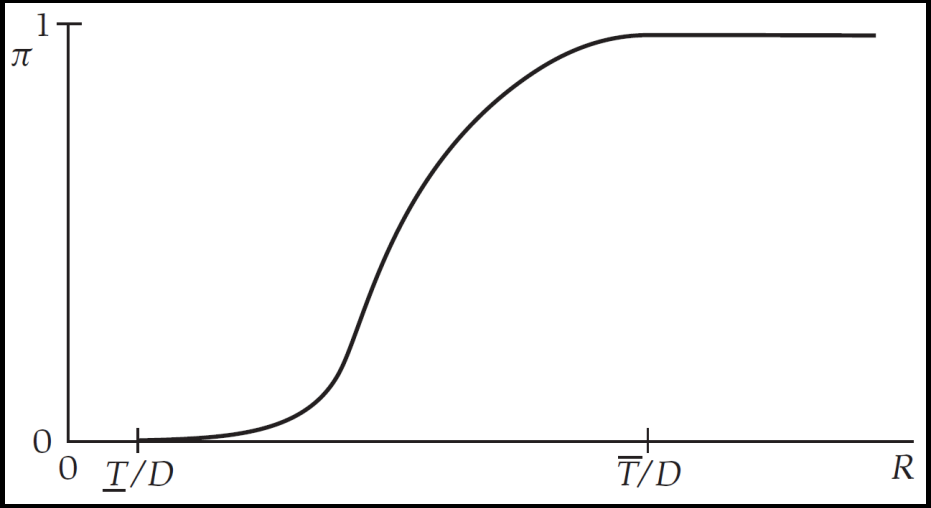
The probability of default

- The probability of default = probability that tax revenues are insufficient to pay off debt *given* the interest rate.
- That is, π equals the probability that T is less than $R\,D$, implying

$$\begin{aligned} \pi &= \Pr(T < R\,D) \\ &= F(R\,D) \end{aligned} \tag{21}$$

- **'Default probability' curve:** # 2 of the 2 key equilibrium conditions.
- If the probability density function of T is bell-shaped (e.g. normal distribution), then the default probability curve is S-shaped.
- There may be a minimum and maximum values of T, $\underline{T}$ and $\overline{T}$.
  - In which case $\pi = 0$ for $R < \underline{T}/D$ and $\pi = 1$ for $R > \overline{T}/D$

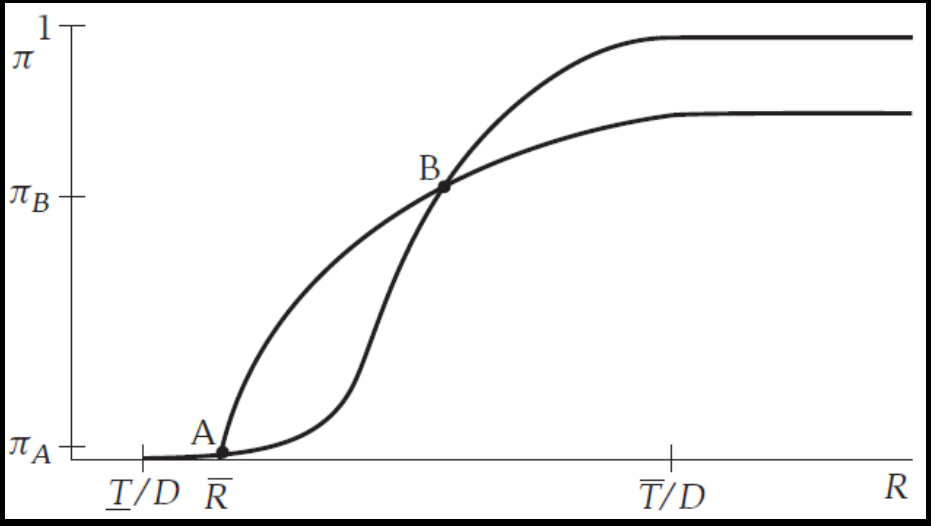
The default probability curve



Equilibria

- An equilibrium is a pair (π, R) s.t. both (20) and (21) are satisfied.
  - $\Rightarrow$ I.e. where the debt demand and the default probability curves intersect.
- Due to the S-shape of the default probability curve, there can be **multiple equilibria:**
  - E.g. point A on the graph next slide is an equilibrium with low probability of default π, and interest rate R only slightly above $\bar{R}$.
  - Equilibrium at point B features large probability of default and high R.
- In addition, there is *always* an equilibrium in which default is certain:
  - Investors are unwilling to purchase debt at any interest rate: $R \to \infty$.
  - Which implies that the probability of default is indeed $\pi = 1$ by (21).

Equilibria



Stable and unstable equilibria

- Are any of these equilibria more plausible then others?
- Turns out, equilibrium at B is **unstable** with respect to small changes in beliefs, and hence is unlikely to materialise:
  - $\Rightarrow$ If investors believe that π is slightly below π_B, lower interest R is needed to induce them to hold debt, given their belief.
    - But at lower R the actual π is even less than what investors conjecture (since now the default prob. curve is below the debt demand curve).
    - Investors' estimate of π is thus likely to fall lower, further reducing R.
    - The process continues, until point A is reached.
    - Similarly, if investors believe π is slightly above π_B, R diverges to ∞.
- Therefore, the two *stable* equilibria more likely to materialise are:
  1. Eq-m at point A with low interest rate and low likelihood of default
  2. Eq-m with certain default and investors not buying debt at any R.
- We are thus unable to get rid of the multiplicity completely.

Implications

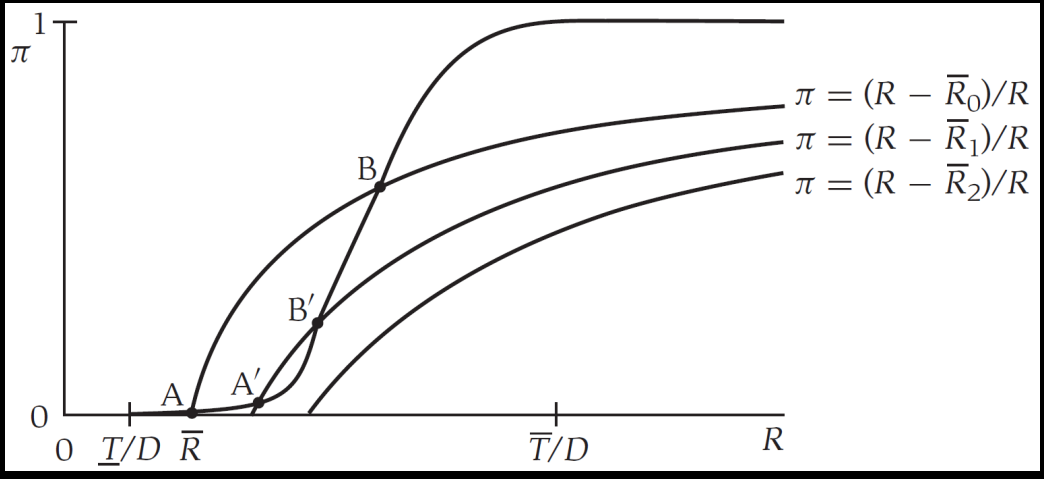
1. Default and debt crises can be **self-fulfilling**
   - Which equilibrium materialises depends on investors' expectations.
   - If they do not expect default, R is low, and so π is indeed low.
   - If they expect default, R is very high, and default is certain.
   - Similar in spirit to the Diamond-Dybvig model that we saw last week.
2. Though **fundamentals matter** too:
   - A rise in $\bar{R}$ shifts the debt demand curve to the right
   - A rise in D or a fall in the expected tax income T shift the default probability curve to the left.
   - Such developments increase equilibrium π.
   - Thus high debt, high required rate of return, and low future revenues all make default more likely.

Implications (cont.)

3. Modest changes in fundamentals can have **dramatic consequences:**
   - Suppose a country is in a low R/low π equilibrium (point A).
   - A small increase in the safe rate from $\bar{R}_0$ to $\bar{R}_1$ leads to a smooth increase in equilibrium R and π (point A$'$ on the next slide).
   - Yet after another similar increase from $\bar{R}_1$ to $\bar{R}_2$, the two curves no longer intersect at low levels of π and R at all.
   - The only equilibrium now is the certain default!

4. When default occurs, it may often be quite **unexpected:**
   - As we saw above, an unexpected increase in interest rates can quickly tip a country with apparently well-managed sovereign debt into a crisis.
   - The economy starts at point A with a *low* probability of default π.
   - Yet the increase in $\bar{R}$ completely eliminates that equilibrium, leading to a discontinuous jump.
   - Thus, the resulting default is unexpected: it is not preceded by high π.

The effect of an increase in the safe interest rate $\bar{R}$



Conclusions (for the course)

- This is the end of the course.
- We have studied a large number of topics, ranging from issues of economic growth to financial and sovereign debt crises.
- Modern macroeconomics does not end here: there are many more important and interesting issues, and a lot more depth to each topic.
  - ⇒ The researchers never sleep (literally)!
- Still, I hope this course has equipped you with a useful toolbox of classic models to help you think about the complex world.
  - ⇒ Next time you read an FT article about central banks' limited options to respond to a crisis due to low nominal rates, think liquidity trap.
    - Or when unemployment raises and wages appear to fail to adjust down, remember that there may be good reasons for that.

Thank you!

HT24 Economics evaluation

- Oxford Saïd Business School takes student evaluation very seriously.
- The entire content of student feedback on all components of the Programmes are considered by the Programme Directors, Course Committee, Dean and Deputy Dean. Feedback on individual courses is also examined by the Course Teacher and relevant Academic Area Head.
- Constructive feedback and suggestions for improvement will be reviewed and where relevant taken forward for future planning of the course; decisions will be reported via the Course Committee minutes and Course Representatives.
- Responses are anonymous.
- $> 75\%$ Response Rate = Unlock an extra £2,000 for the student social budget.
- Scan this QR Code to provide your feedback.