Addressing Debt Crises

Giancarlo Corsetti

University of Cambridge

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Introduction

The evidence suggests that sovereign debt crises produce large economic and financial costs. These may spill over across borders from the origin country via trade and financial contagion channels.

International transmission is therefore one argument in favour of creating international institutions to help countries contain and manage the risks associated with sovereign crises.

In these lecture notes, we briefly discuss three types of interventions:

- Backstop policies - which through liquidity support aim to eliminate the risk of belief-driven default.
- Bailout policies - which through loans at below market (concessional) rates and/or transfers aim to enable countries sustain their outstanding debt.
- Debt forgiveness - to address debt overhang problems.
Consider a country with financing needs \( (FN_t) \) in the range where multiple equilibria are possible. We know that, with \( FN_t \) in this range, a low bond price \( Q_{t \text{ Risky}} \) can be an equilibrium since:

\[
B_{t+1} = \frac{FN_t}{Q_{t \text{ Risky}}} > B^{Max}.
\]

This would be a “bad equilibrium”: the economy quickly accumulates debt and faces the possibility of a costly default due to “arbitrary” market beliefs. **Key Question**: How can this bad equilibrium be eliminated? Recall from previous notes that the equilibrium price charged by investors, labelled hereafter \( Q_{t \text{ Market}} \), is:

\[
Q_{t \text{ Market}} = \begin{cases} 
Q_t^{\text{Riskless}} = 1 & \text{if } B_{t+1} \leq B^{Max}, \\
Q_t^{\text{Risky}} = \psi_H & \text{if } B_{t+1} \geq B^{Max}.
\end{cases}
\]
Eliminating Belief-Driven Default: 
An International Fund as ‘Lender of Last Resort’

Suppose that investors coordinate expectations on the “bad equilibrium” and start buying debt at $Q_t^{Risky}$. If all new debt were to be issued at this price, we know that $B_{t+1}$ would rise above the critical threshold, validating ex post the investors’ expectations of default.

In this context, let’s introduce in the model a new agent, an International Fund (IF), which stands ready to buy the country’s debt at some official price $Q^{IF} \geq Q^{Market}$.

Accounting for the debt purchased by this IF, the budget identity is:

$$FN_t = Q^{Market}_t B^{Market}_{t+1} + Q^{IF} B^{IF}_{t+1} = \left( Q^{Market}_t \frac{B^{Market}_{t+1}}{B_{t+1}} + Q^{IF} \frac{B^{IF}_{t+1}}{B_{t+1}} \right) B_{t+1}$$

Purchases by the IF therefore raise the average price (lower the interest rate) at which the country can sell its debt (lower the country’s overall costs of borrowing).
For values of $FN_t$ in the range of equilibrium multiplicity, a sufficiently large $B_{t+1}^{IF}$ can always prevent the overall stock of debt from rising above $B^{Max}$:

$$B_{t+1}^{Market} + B_{t+1}^{IF} = \frac{FN_t - Q_t^{IF}B_{t+1}^{IF}}{Q_t^{Market}} + B_{t+1}^{IF} < B^{Max}.$$

If this condition is satisfied, the equilibrium market price cannot be $Q^{Risky}$.

- Even if market investors continued to buy debt at the low (default-risky) price, $Q^{Risky}$, the total stock of debt, $B_{t+1}$, would remain below the threshold.
- Expectations of default one period ahead would never be fulfilled.

The three graphs to follow depict the effects of IF purchases of debt at a price arbitrarily close to $Q^{IF} = 1$, in response to a looming debt crisis, whereas market investors lose confidence on the country’s creditworthiness.
Firstly recall the situation with medium financing needs from last lecture. The multiplicity of equilibria is of interest here.
Eliminating Belief-Driven Default:
An International Fund as ‘Lender of Last Resort’

- An IF stands ready to purchase debt, $B^{IF}$, at a price $Q_t = 1$.
- From the country’s vantage point, this is a better price than $Q^{Risky}$, so $B^{IF}$ will always be sold at this price.

![Diagram showing relationship between revenue and debt issuance]
We know that, in a “bad equilibrium”, investors offer the country the low price $Q^{Risky}$ to buy its bonds. Now suppose an amount $B^{IF}$ is financed by the IF at the better price $Q_t^{IF} = 1$.

As IF interventions reduce the amount of debt left to the market to finance, the revenue curve with slope $Q^{Risky}$ no longer originates from zero in the graph. The relevant curve starts from the point $(B^{IF}, Q_t^{IF} B^{IF})$.

Even if the investors buy the share of bonds not purchased by the IF at $Q^{Risky}$ price, the lower (overall) costs of borrowing ensure that the total level of debt remains below the threshold $B^{Max}$.

But if this is the case, $Q_t^{Risky}$ cannot be an equilibrium price in the first place. The IF rules out the bad equilibrium altogether.
Eliminating Belief-Driven Default: An International Fund as ‘Lender of Last Resort’

Graphically we have the following:

- $Q_t B_{t+1}$
- $Q_t = \psi_H < 1$
- $Q_t = 1$
- $B^{IF}$
- $B^{Max}$
- $FN_t$

International Fund

Market
**Key Question:** Are any debt purchases by the IF actually required to rule out self-fulfilling expectations of default?

- If investors expect the IF to intervene on a sufficient scale (if and when markets start pricing debt at $Q^{Risky}$), they also understand that the only equilibrium debt price is the “default-risk free” $Q^{Riskless}$.

- Thus, they will not “run on the country debt”: they would never try to buy debt $Q^{Risky}$.

- Hence no IF intervention will be necessary ex post!

The IF can affect market behaviour by simply **threatening to purchase debt**, without doing so in equilibrium. But for the threat to be effective, it must be **credible**.
Credibility of Backstops

Credibility (hence effectiveness) hinges upon two conditions:

1. The IF must have (access to) sufficient resources to finance its purchases on the required scale (the so called \textit{“big bazooka”}).
   - It is easy to verify that, if $Q^IF_t B^IF_{t+1}$ is not large “enough”, the IF cannot rule out equilibrium multiplicity.
   - In practice the IF must be able to borrow on a large scale without losing its status of low-risk borrower: its own liabilities cannot be at risk of default if it intervenes.

2. The IF must be \textbf{willing} to purchase debt ex post if markets challenge its determination to do so.
   - Ex post, debt purchases must be welfare-enhancing from the IF own vantage point.

Since a credible IF can shield countries from financial instability due to self-validating expectations of default without carrying out ex-post interventions, there are no ex-post transfers, no ex-post costs for the taxpayers!
Open issues with backstops

However there are **at least two concerns** often voiced against setting up such institutions.

1. **Dynamic vulnerability to fundamental crises**: With a large IF in place, countries may have no incentive to keep their debt and financing need in the region where the equilibrium is fundamentally unique and default-free. Instead, the may keep borrowing up to the upper edge of the multiple equilibrium range. Dynamically, high debt may then create vulnerability to adverse fundamental shocks to the country (such as a large recession), causing default or creating the need for an ex-post bailout of the country (see below). Effective cooperation through an IF requires some form of monitoring of countries’ policies, to avoid such outcome.

2. **Institutional distortions**: Once a large IF is in place, countries will exert political pressure for it to buy bonds and finance their deficit, well beyond the objective of ruling out belief-driven crises.

This raises issues in the institutional design of the IF. A key problem is that, in practice, it is very difficult to tell whether a deterioration in market confidence is driven by arbitrary beliefs, as opposed to an assessment of deteriorating fundamentals.
Solidarity and bailout

Countries facing sovereign debt crises often receive financial support and transfers from other countries, either bilaterally or via an international institution, arguably beyond that justifiable by the possibility of belief-driven crises. To understand solidarity, it is useful to point out that this may actually be “self-interested.”

- Sovereign defaults are likely to create economic/financial damage abroad. Foreign governments have an economic interest in bailing out the country as long as the required transfer does not exceed the financial costs of these spillovers.

1. Why do countries engage in cross-border ‘solidarity’? What are the consequences of solidarity for international financial markets?
2. If countries do engage in solidarity: Are informal arrangements efficient, or should they be replaced by formal contracts and institutions, in the form of debt resolution mechanisms, stability funds, common liabilities (Eurobonds) and the like?
3. How should the burden of bailout be shared between the official sector and private markets?

What follows will address the first question, building on a recent contribution by Tirole 2015.
Tirole’s Model

Setup

Much of the literature analyzes financial markets in the presence of default risk, building on the notion that debtor countries are reluctant to breach debt contracts because of the economic costs such decision would create in their economies. Tirole analyzes solidarity using the same approach: crisis countries are bailed out because defaults produce negative spillovers in the economy of the lenders.

- Two period (0,1) model, with 3 agents:
  1. the borrowing country (Agent, A),
  2. a lending country/institution (Principal, P) with deep pockets and
  3. international investors (Market, M).

- All agents are risk neutral. P and M do not discount the future. A has extra utility in from consuming in period 0.

- The country A’s output is \( y_{A,0} = 0 \) in period 0. In period 1,

\[
    y_{A,1} = \begin{cases} 
    y > 0 & \text{with prob. } \pi_H \\
    0 & \text{with prob. } 1-\pi_H 
    \end{cases}
\]
The key insight of the model is that a default by \( A \) causes not only costs \( K \) in \( A \), but also costs \( K_P \) in the Principal country (following e.g. the disruption of markets and international intermediaries). Posit:

\[
K > K_P; \quad \text{both costs are measured in (period 1) utility}
\]

1. In period 0, given its endowment, the country would like to borrow from international investors to finance current consumption. Let denote \( B_M > 0 \) total borrowing from markets in period 0. The benefit of borrowing for country \( A \) is \( \Phi \cdot B_M \), where \( \Phi \) indexes utility gains from immediate consumption.

How much the country can borrow depends on the amount of future payment \( x_M \) it can pledge against its future output.

2. In period 1, given the realization of output in \( A \):
   - the deep-pocket Principal \( P \) decides whether to bail out \( A \), subsidizing its debt-related payments.
   - Country \( A \) decides whether to pay its debt (net of bailout), or default.
The model without spillovers, $K_P = 0$

- To appreciate the role of $K_P$, it is useful to analyze the model at first without these costs. With $K_P = 0$, the model is a version of the classical model of sovereign risk studied earlier.

- Investors know that, in period 1, the Agent will pay either 0 (with prob. $1 - \pi_H$) or at most $K$ (with probability $\pi_H$). Hence (risk neutral) investors will be willing to lend at most $B_M \leq \pi_H K$.

- Since the Agent always defaults if output is 0, its utility with $K_p = 0$ is

$$U_{A,K_p=0} = \Phi \pi_H K + \pi_H (y - K) - (1 - \pi_H) (0 + K) = \Phi \pi_H K + \pi_H y$$

- Contrast the above with the Agent's utility in financial autarky (no borrowing), which is (easy to derive and) equal to $\pi_H y$. $A$ will only borrow as long as $U_{A,K=0} \geq \pi_H y$, that is, $\Phi \pi_H \geq 1$; it must be the case that the benefit from period 1 consumption is $\Phi \geq 1/\pi_H$. 

Giancarlo Corsetti (Uni of Cam) 
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The role of spillovers $K_P > 0$

If a default produces cross-border spillovers hurting the Principal, both the Agent and the Market investors will anticipate that the principal will try to avoid default, as long as the costs of interventions will not exceed the spillover costs.

- Market investors will anticipate that the cash flow $x_M$ will include a transfer from $P$. Hence, they may be willing to lend “more.”

- The Agent will take advantage of the prospects of being bailed out, borrowing more at the expense of the foreign taxpayers. Collateral damage translates into a ‘soft-budget constraint’ for the Agent.
The model with spillovers $K_P > 0$

Anticipations of optimal bailout ex post

A and M anticipate the Principal will bail out the Agent:

1. **in the bad state only**, whereas output in $A$ is zero, if debt-payments are relatively low
   
   $$x_M \leq K_P$$

2. **in the good state only**, whereas $y > 0$, if debt payments are relatively high
   
   $$K \leq x_M \leq K + K_P$$

Note that in the good state, the bailout transfer amounts to $x_M - K$.

Furthermore: no bailout is necessary if $x_M \leq K$, and no bail out is provided if $x_M > K + K_P$.
Bailouts enhance borrowing
Two possible debt strategies in equilibrium

How much debt will the agent issue?
The choice is between two possible strategies

Knowing the ‘optimal’ bailout criteria by the Principal, the Agent will try to extract maximum resources from it.
But the previous slide makes it clear that the country A cannot count on a bailout in both states of nature.
Rather the country can either choose to borrow $x_M \leq K_P$ and be bailed out in the bad state of nature, or choose to borrow more, up to $K_P < x_M \leq K + K_P$, and be bailed out only in the good state of nature—and default in the bad state of nature.

The choice is thus between:

- Low debt/low risk (no default, bailout only if output is low)
- High debt/high risk (default when output is low, bailout when output is high).
1. **Low debt (low risk) strategy**
   - No default occurs, since the Agent is bailed out in the bad state of nature.
   - Market investors lend $B_M = K_P < K$ in period 0, since they receive $K_P$ for sure in period 1 —if the country output is zero, the Principal will nonetheless pay the bill.
   - the Agent only pays $K_P < K$ when $y > 0$.
   - The Principal transfers $K_P$ to the Agent only when output is zero.

2. **High debt (high risk) strategy**
   - Country A defaults in the bad state of nature, but is bailed out in the good state of nature.
   - Market investors lend $B_M = \pi_H (K + K_P)$; receive $K + K_P$ with prob. $\pi_H$, and 0 with prob. $(1 - \pi_H)$.
   - the Agent pays $K$ to foreign investors if $y > 0$, and default (suffering a cost $K$) when output is zero.
   - The Principal transfers $K_P$ only when $y > 0$. 
The optimal debt strategy

The conditions for the agent to prefer one strategy over the other can be summarized as follows:

\[
U_A = \max \left\{ \begin{array}{l}
\Phi \pi_H (K + K_P) + \pi_H (y - K) - (1 - \pi_H) K; \\
\Phi K_P + \pi_H (y - K_P)
\end{array} \right\}
\]

i.e., the agent will decide by comparing the benefits from the low and high debt issuance.

- We may note that, given that autarky utility is \( \pi_H y \), it is easy to verify that \( A \) prefers borrowing to autarky as long as

\[
\Phi \geq \min \left\{ \frac{K}{\pi_H (K + K_P)}; \pi_H \right\}
\]

To satisfy this condition, \( \Phi \) need not be very high: the agent may want to borrow even when current benefits from borrowing are low (i.e. it is a social waste!). The reason is that, by borrowing, \( A \) can extract a gift from \( P \), i.e., extra (bailout) resources.
The optimal debt strategy

By comparing the two strategies, the Agent will choose the high-debt/risk if

\[ \Phi \pi_H (K + K_P) + \pi_H (y - K) - (1 - \pi_H) K - \Phi K_P - \pi_H (y - K_P) \geq 0, \]  

that is

\[ \Phi \pi_H (K + K_P) + \pi_H (y - K) - (1 - \pi_H) K \geq K - \pi_H K_P > 0 \]  

(1)

\[ \Phi \pi_H K - (1 - \pi_H) K_P \geq 0 \]

A necessary condition for \( A \) to choose the high risk/debt strategy is

\[ \pi_H K - (1 - \pi_H) K_P \geq 0 \]

This is equivalent to saying that \( B_M \) (hence period 0 consumption) is higher with a high-debt strategy than with the low-debt strategy:

\[ \pi_H (K + K_P) \geq K_P. \]

Otherwise, the low-debt strategy will be preferable, as it would produce more immediate benefits and no default costs.
The optimal debt strategy

- What matters in the choice between the two strategies is the “debt laffer curve”. Namely, how fast debt prices fall when the country raises its issuance of bonds. When pursuing the high debt strategy, the country ends up generating expectations of default (in the bad state).
- Holding the above condition, we can re-arrange (1) as follows

$$\Phi \geq \frac{K - \pi_H K_P}{\pi_H K - (1 - \pi_H) K_P} = \Phi^*$$

where $\Phi^*$ is defined as the minimum utility benefit from borrowing at which the country selects the high risk strategy.

- $\Phi^*$ is decreasing in $\pi_H$, the prob. of the good state. If the bad state is very unlikely, the country does not care too much about defaulting in that state.
- For $\pi_H$ large enough, $\Phi^*$ is increasing in $K$ (other things equal, higher own costs of default discourage the choice of high debt), and decreasing in $K_P$ (higher spillovers encourage high debt).
Lessons for policy design

1. Solidarity and bailout follows the same logic as the choice of default: it hinges on default costs hitting the lending country.
   - Cross-border spillovers from default effectively play the role of ‘collateral’ the borrowing country can use to soften its budget constraint.

2. The equilibrium analyzed above is inefficient.
   - The Principal would like to avoid the negative spillovers from default, hence would like $A$ to pursue a low-debt strategy.
   - But the low-risk strategy suboptimally constrains the agent’s borrowing capacity. $A$ can commit to repay up to $K$ in the good state of nature, but its borrowing capacity is constrained by the fact that investors only get $KP$ in the bad state.

3. A ‘contract’ between the Principal and the Agent can indeed improve upon the allocation above—see the discussion in Tirole.
   - Only under particular circumstances, the optimal contract may be implemented by holding the Principal responsible for the liabilities of the Agent—a sort of “eurobond,” arrangement in the euro area. Generally other institutional arrangements are required: rules capping debt issuance (as implied by the stability and growth pact), a stabilization fund with limited financial firepower.
The motivation for solidarity however need not be strictly utilitarian.

- The international community may be concerned with the effects of default on global efficiency and income/wealth distribution within and across countries.

Default costs are a waste. Sovereign default crises are usually accompanied by hikes in unemployment, declines in individual incomes, as well as deteriorating living standards. Investment and growth drop as firms’ face high borrowing costs and difficulties in obtaining credit.

Official support by international institutions usually takes the form of loans rather than outright transfers. In what follows we will briefly study how official support works.
How Does Official Lending Work?

- Official lenders provide loans issued at a “concessional” interest rate such that $Q^{Official} > Q^{Market}$.

- To be effective, these loans must make the country at least indifferent between repaying and defaulting in the current period as well as in (the worst circumstances in) the future. In each period, it must be the case that

  $$B_t = (B_t^{Market} + B_t^{Official}) \leq \mathcal{P}S^L + Q^{Official}B^{Official} + Q^{Safe}B^{Market}$$

  where $\mathcal{P}S^L$ is the max primary surplus the country can sustain in bad times.

- The IF must set $B^{Official}$ and $Q^{Official}$, with the goal of keeping the flow of current and future liabilities in line with the maximum adjustment the country can sustain over time.

Note that official lenders can help a country not only by charging low rates (effectively a transfer), but also by lengthening the maturity of debt—as longer maturities help smoothing the flow of payments on debt obligation over time.
An Example: Official Lending to euro-area countries

Official loans to countries in the euro area have been provided by the IMF and European institutions—the leading one being the European Stability Mechanism (ESM). The table is taken from Corsetti et al. 2019.

<table>
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<tr>
<th></th>
<th>EFSF/ESM Support</th>
<th>IMF Support</th>
<th>Market yields</th>
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<tr>
<td></td>
<td>Maturity</td>
<td>Interest rate</td>
<td>Maturity</td>
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<td>Greece</td>
<td></td>
<td></td>
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<tr>
<td>May-10</td>
<td>5 years</td>
<td>4.041</td>
<td>3 years</td>
</tr>
<tr>
<td>June-2011</td>
<td>10 years</td>
<td>3.78</td>
<td>3 years</td>
</tr>
<tr>
<td>March-2012</td>
<td>20 years</td>
<td>2.07</td>
<td>8 years</td>
</tr>
<tr>
<td>December-2012</td>
<td>30 years</td>
<td>0.93</td>
<td>8 years</td>
</tr>
<tr>
<td>Ireland</td>
<td>December-2010</td>
<td>7.5 years</td>
<td>7 years</td>
</tr>
<tr>
<td>July-2011</td>
<td>15 years</td>
<td>2.74</td>
<td>7 years</td>
</tr>
<tr>
<td>June-2013</td>
<td>22 years</td>
<td>2.32</td>
<td>7 years</td>
</tr>
<tr>
<td>Portugal</td>
<td>May-2011</td>
<td>7.5 years</td>
<td>7 years</td>
</tr>
<tr>
<td>July-2011</td>
<td>15 years</td>
<td>3.15</td>
<td>7 years</td>
</tr>
<tr>
<td>June-2013</td>
<td>22 years</td>
<td>2.19</td>
<td>7 years</td>
</tr>
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<td>Spain</td>
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<td>12.5 years</td>
<td>-</td>
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<td>Cyprus</td>
<td>May-13</td>
<td>15 years</td>
<td>4 years</td>
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</tbody>
</table>

Sources: International Monetary Fund, European Commission, European Financial Stability Facility, European Stability Mechanism and Bloomberg. * Refers to 4 years maturity
A Glossary of International Lending
Moral Hazard, Surveillance and Conditionality

Official lending works if:

- Its availability does not provide ex-ante incentives to countries to issue excessive debt.
- Once a crisis erupts, official loans help the country to implement policies and reforms by which it can restore debt sustainability, return to market borrowing, and address the macroeconomic imbalance (unemployment, inflation, domestic and external deficit, income and wages) at the root of the sovereign crisis.

In the practice of the IMF and other institutions, possible adverse “moral hazard” implications of official lending are addressed via (ex ante) “surveillance” and (ex post) “conditionality.”
Countries receiving assistance must agree on a programme detailing policies and reforms. Disbursement is made conditional on a positive assessment of the progress in implementing such program.

Conditionality has two key objectives:

1. The country’s “fundamentals” improve upon receiving assistance, sufficiently so to ensure that the outstanding debt is sustainable.

2. Official lenders recover their money (with high probability).
A Glossary of International Lending
Seniority & Stigma

IMF loans have **senior debt** status. That is, in case of default, the IMF is paid first, before private creditors, as opposed to be treated “pari passu” with other lenders.

- Seniority is justified by pointing out that IMF interventions avoid a deepening of the country’s economic and financial crisis, thereby enhancing its capacity to pay investors. To the extent that its interventions increase “the size of the pie”, the IMF should be entitled to get the first slice.

However, seniority can have adverse effects on market access. As in some circumstances, it may amount to lower payments to investors, seniority may end up discouraging private lending to the country.

In contrast to the IMF, the ESM may wave seniority.

A related problem is the potential **stigma** of official lending. Countries may be reluctant to request help because this may signal to investors that their financial and economic conditions are exceptionally bad. Hence a programme may worsen and/or precipitate a sovereign crisis.
Debt Forgiveness

In the process of resolution of default crises, official lenders and international institutions often forgive part of the debt, and/or help crisis countries to target a reduction in the face value of the outstanding liabilities.

What follows discusses the rationale for forgiveness, and the pros and cons of different implementation strategies:

- Forgiveness: Debt Overhang and Free-riding.
- Debt Buybacks vs. Debt Swaps.

We will draw on a numerical example by Paul R. Krugman (Financing vs. Forgiving a Debt Overhang Journal of Development Economics, 1988, 29 253-268.)
Forgiveness: A Simple Model

Consider a one period economy, starting with a stock of debt with face value equal to 100. During the period the economy can be in two states, good or bad, occurring with probability 1/3 and 2/3 respectively.

Investors anticipate that, in the ‘good state of nature’, occurring with probability 1/3, the country will pay the full amount. In the bad state of nature, with probability 2/3, the country will only be able to pay 25.

The expected repayment will therefore be:

\[ 100 \cdot \frac{1}{3} + 25 \cdot \frac{2}{3} = 50 \]

What happens if the country is forgiven 20 of its 100 debt? In the bad state of the economy, the country can still pay at most 25. Hence, the reduction is only relevant in the good state of nature. The expected repayment becomes

\[ (100 - 20) \cdot \frac{1}{3} + 25 \cdot \frac{2}{3} = 43.33 \]

In expectation, the gain for the debtor country is \( 20 \cdot \frac{1}{3} = 6.67 \), which is what the creditors lose.
This type of intervention does not produce any advantage for the creditors. It does not improve the country's ability to pay in the bad state. It only produces benefits in the good state, when the country can afford to pay its debt back entirely. So why is debt forgiven?

A key reason for debt relief is that the expected repayment is likely to depend on the size of the debt. Namely, when debt is large, the benefits of any reforms and investment just increases the resources that go to the creditors. The incentives for the country to undertake reforms and investment are thus severely weakened. Specifically, to the extent that the debt burden ultimately translates into higher taxes and administrative distortions, these reduce the incentives for private firms to produce and build capital.

To gain insight on the argument, let’s modify our example assuming that the probability of the good state, $\pi$, is a function of the stock of liabilities, $B$, i.e., $\pi = \pi (B)$ with $\pi' < 0$. Under this assumption, we obtain a **debt Laffer curve**

$$\text{Expected Repayment} = \pi (B) \cdot L + (1 - \pi (B)) \cdot 25$$
Debt Overhang and the Debt Laffer Curve

The above expression is non-linear. For a low level of initial debt, expected repayments fall with debt reduction. But when the initial $B$ is very high, $\pi$ can be so low that expected repayments rise with debt reduction. To the “right side” of the debt Laffer curve, forgiveness is in the very interest of creditors.

Using our numerical example: if forgiving 20 increases the probability of the good state from $1/3$ to $1/2$, expected repayments accruing to investors actually rise above 50 (instead of falling to 43.33):

$$
(100 - 20) \cdot \frac{1}{2} + 25 \cdot \frac{1}{2} = 52.5
$$

Although the country now pays more, it is plausible that the country derives direct benefits from a higher probability of the good state, in terms of higher output and consumption. To assess these benefits, we would need to specify a model of the economy and a welfare function. In reduced form we can posit that the expected social benefits are increasing in the probability of the good state:

$$
\text{Expected Social Benefits} = \alpha(\pi(B)), \alpha' > 0
$$
The Laffer curve may also be studied graphically. Consider initially the case in which lower debt has no impact on the ability to repay—so that expected repayments fall following debt forgiveness.
In contrast, consider the case when the probability of repayment is a function of the level of debt issuance, $\pi(B_{t+1})$.

Expected repayments may increase following debt forgiveness.
Free Riding

Given that other investors agree on forgiving debt, however, from an individual investor perspective it is profitable **not to do so**. To the extent that forgiveness raises the country’s capacity to pay, a single investors may benefit from it without paying any cost.

In practice, for debt forgiveness to be successful, there must be robust mechanisms and incentives in place such that all (or the vast majority of) creditors are involved.

- **Collective Action Clauses (CAC)** entitle a supermajority of bond holders to agree on a debt-restructuring deal which becomes binding for all holders of the bond.

In what follows we consider two alternatives to outright forgiveness. We will do so abstracting from debt overhang and free riding problem (you will be ask to redo the analysis allowing for the debt Laffer curve as a homework).
Implementation
(Third-Party) Debt Buy-Backs

Since the market price of debt issued by a country in distress is cheap, one may argue there is a straightforward way for a crisis country to reduce its debt burden: it can buy back its liabilities at the low price prevailing in the (secondary) market.

It sounds too good to be true. Indeed, there is a key problem with this at the announcement of the buy-back, the market price of debt will not remain the same. It will jump to its new (after buy-back) equilibrium value.

To wit: In our first example above, suppose an international institution decides to finance the country to “buy back” debt up to a face value of 20. Assuming risk neutral investors and keeping probabilities constant, the price of outstanding debt before the announcement is:

\[
\frac{\text{expected repayment}}{\text{face value}} = \frac{100 \cdot \frac{1}{3} + 25 \cdot \frac{2}{3}}{100} = 0.5
\]

At this initial price, the cost of the buyback would be \(20 \cdot 0.5 = 10\).
At the announcement, however, the market price of the country’s debt cannot be 0.5. Instead, it will jump up - reflecting the fact that the expected repayment after the buyback will be higher:

$$\frac{\text{expected repayment}}{\text{outstanding debt}} = \frac{(100 - 20) \cdot 1/3 + 25 \cdot 2/3}{100 - 20} = \frac{130/3}{80} = 0.541$$

The actual cost of the buy back will therefore be $20 \cdot 0.541 = 10.82$.

As a result of investing 10.82 extra cash in the debt buyback:

- The gain for the debtor is the same as with debt forgiveness:
  $50 - 43.33 = 6.67$.

- Creditors get an extra 10.82, in addition to expected repayment for 43.33. So, overall they get $10.82 + 43.33 - 50 = 4.15$ more than the pre-buy-back situation.

Creditors are clearly the winner!
A much preferred strategy by debtors is one in which the country proposes a swap (an exchange) of old debt for new debt, giving the new debt the status of senior debt: it will be paid first, before any old debt is honoured.

Consider our first numerical example. Since the country can at most pay 25 in the bad state of the world, this is also the maximum amount of new (senior) debt that the country can issue default free.

What would the swap rate be? In other words, how many units of old debt will investors have to give back in exchange for a unit of the new, senior and safe, debt?

Observe that the old debt is worthless in the bad state (since all revenue will go to pay the senior debt). Hence the price of old debt will depend on the net expected payment in the good state.

In expectations, one unit of old debt will pay $1 \cdot (1/3) = 1/3$. It follows that the swap rate between new senior debt (paying in all states of nature) and the old debt (paying only in the good state, with probability $1/3$) must be 1 to 3.
Debt Swaps

At the equilibrium swap rate, the country exchanges 3 units of outstanding debt for each unit of new senior debt. If the swap scheme succeeds in full, 75 units of the old debt are taken off the market, 25 units of old debt remain in the hand of investors.

The expected repayment after the swap is:

$$(25 \text{ old debt} + 25 \text{ new debt}) \cdot \frac{1}{3} + (25 \text{ new debt}) \cdot \frac{2}{3} = \frac{100}{3} = 33.33$$

The government gains $50 - 33.33 = 16.7$ from the swap, entirely at the expense of the creditors.

However, note that the incentives for single investors to free ride are strong. A well-known problem with debt swaps is the holdout problem, whereas non-consenting bondholders retain their legal right to demand repayment of their bonds at the full face value.

Homework: reconsider the two strategies above allowing for a debt Laffer curve (a lower outstanding debt raises the probability of the good state).