Sovereign Risk and Debt Crises
Multiple equilibria and backstops

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The Euro Area has Performed Poorly Since 2010

Unemployment dispersion across states: EA vs US

Interquartile range of the monthly (seasonally adjusted) unemployment rate in the US (BLS data) and EA (Eurostat)
Distinctive Feature of EA Crisis: Country Risk Polarization

Selected Euro Area Bond Spreads relative to German Bunds

(a) Italy and Spain.

(b) Greece and Portugal.

Source and Notes: OECD, Main Economic Indicators. 10-year government bond yields spread to Germany. Monthly.
Risk Polarization Leads to Fragmentation of the EA Financial and Economic Space

(a) Euro area low risk.
(b) Euro area high risk.

Source: Corsetti et al. 2013.
Notes: Blue solid line represents non-financial corporates. Red dashed line represents sovereigns.
Risk Polarization Leads to Fragmentation of the EA Financial and Economic Space

Source and Notes: Eurostat. Based on data for Vulnerable Euro Area Periphery economies (VEAPS) (Ireland, Portugal, Spain, Greece, Italy) and core (all other EA countries).
Introduction Multiple Equilibria Economic Damage Austerity vs. solidarity Eliminating bad equilibria Summing up

...and Prevents Efficient Aggregate Stabilization

- In a situation in which policy rates are constrained at their effective lower bound. Monetary policy may be unable to stabilize the union-wide economy.
- If a sovereign risk crisis develops, independent fiscal authorities are unlikely to provide stimulus on a sufficient scale.
  - High-risk countries have no choice but cutting deficits.
  - Low-risk countries have little or no incentive to expand—if anything they prefer to keep budgets under tight control as a “precautionary measure” to avoid sovereign risk crises.
- With rates at the effective lower bound, to the extent that country risk prevents governments from delivering enough fiscal stimulus, aggregate demand (the macroeconomic stance) in the union may remain too tight, hampering recovery.
The topic and focus of the two lectures

- This is a lecture on risks of disruptive macroeconomic and financial instability—for the lack of a better label, let's define this as “Tail risk”, stressing that, at least for advance economies, it is a low-probability situation.
- My focus will be on the euro area—not because it is the only region of the world vulnerable to Tail Risk, but because its incomplete institutional framework exposes it more than other areas to such risk.
- My focus will be on debt—not because debt is the only root of instability, but because mismanagement of debt crisis can set in motion powerful destabilizing forces and can have strong macroeconomic consequences.
The topic and focus of the two lectures

To be clear: well functioning debt markets are essential to the efficient stabilization of our economies. By way of instance:

- Debt is essential in facilitating consumption smoothing, and the financing of investment and growth, vis-à-vis cyclical fluctuation.
- A financial system that create and allocate debt efficiently is key to stabilization policy. E.g., monetary expansions stimulate spending to a significant extent by fostering borrowing and lending.

However, shocks and ineffective policies may create spiral of debt accumulation that in turn create vulnerabilities and complicate stabilization policies.
“Tail Risk” is characterized by “diabolic loops”.

- Suppose agents develop expectations of low growth, fragile finance and deteriorating fiscal outlook, and start to charge high risk premia on government bonds.
- Sovereign risk transmits to banks (directly, via capital losses in their debt holding, and indirectly, via weaker public sector guarantees on banks) as well as to firms and households (directly, via current or prospective spending cuts and higher taxation, and indirectly, through its effects on bank lending).
- The lower demand creates a downturn that widens deficits and magnifies sovereign risk. Runs and financial instability may further worsens the fiscal outlook both via its effects on the real economy, and the public sector liabilities it creates.
Understanding Sovereign Risk
A Stylized Model

1. Basics: Laffer curve and gov’t financing need
2. Unique vs multiple equilibria
3. The dynamic consequences of self-fulfilling risk crises
Sovereign Risk: A Stylized Model

• To start with, we build a stylized model of fiscal policy where the government sets deficits and decides whether to service or restructure its debt under two realistic assumptions.

1. The government in office has limited capacity to commit itself or future governments to future policies; it decides current policies taking the debt price (that is, market expectations) as given.

2. Default (restructuring, break up of a currency union) entails large costs, reflecting macroeconomic, financial, social and political disruption.

• The model draws on Calvo (1988), Lorenzoni and Werning (2014), Corsetti and Dedola (2016), Corsetti, Erce and Uy (2017, 18) and Corsetti (2018). We will use it to survey different theories and issues discussed in the literature.
Main assumptions
Domestic

For simplicity, assume:

- No distinction between domestic and external, private and public debt — we will simply refer to the overall level of ‘debt.’
- A small open economy integrated in the world capital markets.
- The business cycle is exogenous.

In each period, the country:

- Has an outstanding stock of liabilities inherited from the past.
- May enter a recession with probability $1 - \psi_H$, where $H$ stands for “high output.”
- Decides whether to service its debt, or restructure.
Main assumptions

International context

Residents and international investors can invest in:

1. An international one-period discount bond, free of default risk, traded at the riskless price $Q^* = \frac{1}{R_{\text{world}}}$. 
2. One-period bonds issued by the country at the market price $Q$, which may be lower than $Q^*$ because of default risk. 

Recall that the interest rate is

$$R_t = \frac{1}{Q_t}.$$ 

To simplify the algebra, we posit that:

1. $R_{\text{world}} = 1$, such that $Q^* = 1$ also.
2. International investors are risk neutral and do not have any time preference, hence the price of any asset is equal to the expected cash flow from the asset.
Debt Sustainability

The price at which investors are willing to finance the government depends on their assessment of how much debt is “sustainable”.

- Let’s conjecture that sustainability is more likely to be at stake in bad economic times, rather than in good economic times.
- Specifically, looking at economic and political fundamentals, investors understand that the government will not be able/willing to honour its debt obligations if both:
  1. The economy is in a recession and
  2. Debt is above some critical “threshold”, denoted with $B_{t+1}^{Max}$
- For simplicity, posit that:
  - If the government defaults, the haircut on bond holders will be $(1 - \rho)\%$, that is, they will only recover $\rho\%$ of the face value of the bonds in their portfolio.
**Recession risk**

- **No recession**
- **Recession**

Initial state (recession or no)

Recession risk model:

\[ \psi_H \]

\[ 1 - \psi_H \]

\[ t \quad t + 1 \]
Debt Issuance and Repayment Schedule

Recall: debt is short-term (one period)

Issue debt, $B_{t+1}$

- Full Repayment iff $B_{t+1} \leq B_{t+1}^{\text{Max}}$
- Repay a fraction $\rho$ iff $B_{t+1} > B_{t+1}^{\text{Max}}$

$t \quad t + 1$
Debt Tolerance Threshold

- Think of $B_{t+1}^{Max}$ as an unobservable ‘latent variable’, deriving from a multi-dimensional forward-looking assessment by market participants.
- Beware: $B_{t+1}^{Max}$ is NOT a constant. It depends on many considerations including the current and prospective state of the economy, government type, international context and solidarity, etc.. It may even vary with the regime of expectations.
- For didactical purposes, I will posit that $B_{t+1}^{Max}$ is known by all the agents in the economy. But see Corsetti (2018) for a discussion.
Equilibrium Bond Pricing $Q_t$

The tolerance threshold is critical to understand how investors price debt. Intuitively, when $B_{t+1} > B_{t+1}^{\text{Max}}$:

- Government bonds are no longer free of default risk.
  - Hence the bond price cannot be $\frac{1}{R_{\text{world}}} = 1$.
- Investors anticipate that, when they buy a bond, they will be paid back only if the economy is not in a recession.
- In expectation, the cash flow from a bond will be:

$$\rho \ast (1 - \psi_H) + 1 \ast \psi_H = f(\rho, \psi_H) \leq 1$$

- Hence, the bond price will be equal to the probability that the economy will not be in a recession, times the recovery rate.
  - Due to risk neutrality.

When we combine this with the price of debt below the critical threshold we can determine a price schedule.
Bond Pricing as a Function of Debt Issuance

Note the discontinuity! Bonds sells at:

\[ Q_t = \begin{cases} 
\frac{1}{R_{world}} = 1 & \text{if } B_{t+1} \leq B_{t+1}^{\text{Max}}, \\
F(\rho \psi_H) < 1 & \text{if } B_{t+1} > B_{t+1}^{\text{Max}}.
\end{cases} \]
Revenue as a function of debt issuance: Laffer Curve

Using the bond price schedule, we can draw a Laffer Curve, showing how much revenue the government is able to obtain ($Q_t B_{t+1}$), as a function of how much debt it issues ($B_{t+1}$).

\[ Q_t = f(q, \psi_H) < 1 \]

\[ Q_t = 1 \]
Government Financing Need

Given the Laffer Curve depicted above, to solve for the equilibrium debt issuance and bond price, we need to know the government financing need (FN). Each period this is the sum of the primary deficit (spending, G, minus tax revenue, T), plus all maturing debt and interest payment due in the period.

- Under our assumption that the government only issues one-period discount bonds, from the budget identity:

\[
Q_t B_{t+1} = G_t - T_t + B_t = FN_t \text{(financing need)}.
\]

where \( B_t \) denotes the stock of outstanding bonds maturing in period-\( t \), and \( Q_t \) is the price at which the government is able to issue new bonds, \( B_{t+1} \).

- Given \( FN_t \), the lower the price \( Q_t \) that markets are willing to pay for the new bonds, the higher the stock of new bonds \( B_{t+1} \) that the government needs to issue.
Unique vs. Multiple Equilibria

Because of the discontinuity highlighted in the graph, it is easy to see that we can have:

1. A unique equilibrium with riskless bond pricing with sufficiently low FN.
2. A unique equilibrium with risky bond pricing with sufficiently high FN.
3. Two equilibria (where bonds can be priced either riskless or risky) for intermediate levels of FN.
   - For intermediate FN, the FN lines crosses the Laffer Curve twice, for $B_{t+1}$ that can be above or below $B_{t+1}^{\text{Max}}$. 

Unique Equilibrium with Low Financing Needs (FN)

- With low FN, the only equilibrium price is $Q_t = 1$.
- Debt remains low enough that no default occurs in $t + 1$. 

![Image of graph showing revenue, $Q_t B_{t+1}$, against debt issuance, $B_{t+1}$, with the line $Q_t = f(q, \psi_H) < 1$ and the point $Q_t = 1$ on the FN axis.]
Unique Equilibrium with High Financing Needs (FN)

- With high FN, the only equilibrium price is \( Q_t = \psi < 1 \): interest rates are high, reflecting default risk.
- Investors anticipate default in \( t + 1 \) with probability \( 1 - \psi_H \).

\[ FN_t = G_t - T_t + B_t \]

\[ Q_t = f(\psi, \psi_H) < 1 \]

\[ Q_t = 1 \]
Intermediate Levels of FN: Multiple Equilibria

- Both the riskless and the risky price are possible: in both equilibria market expectations are **self-fulfilling**.
- Markets may coordinate their expectations on either.
Region of Multiple Equilibria

$Q_t = f(q, \psi_H) < 1$

$Q_t = 1$

Revenue, $Q_t B_{t+1}$

$FN_t$ with Multiple Equilibria

$B_{t+1}^{Max}$

Debt issuance, $B_{t+1}$
The Logic of Belief-Driven Crises.

Investors anticipate $B_{t+1} < B^\text{Max}_{t+1}$

*FN* satisfied issuing $B_{t+1} < B^\text{Max}_{t+1}$  →  They offer high price $Q_t^\text{Safe} = 1$

Investors anticipate $B_{t+1} > B^\text{Max}_{t+1}$

*FN*$_t$ satisfied issuing $B_{t+1} > B^\text{Max}_{t+1}$  →  They offer a low price $Q_t^\text{Risky} = \psi_H$
Sovereign Risk Creates ‘Slow Moving’ Debt Crises
Dynamics of Self-Fulfilling Crises

• If markets coordinate expectations on the bad equilibrium, and the government cannot increase primary surpluses, high risk premia will start to ignite an increase in debt.

• In a sovereign risk crisis, the government may still be able to rollover its debt for quite some time (as long as economic conditions remain good). However, if not adjustment takes place, there will be a default as soon as the economy suffers a large bad shock.

• Moreover, absent a correction of primary surpluses, larger and larger stocks of debt over time will increase the financing need of the government, up to a point in which debt becomes unsustainable for fundamental reasons.
Sovereign Risk Crises Cause Debt Accumulation

\[ Q_t = f(q, \psi_H) < 1 \]

\[ Q_t = 1 \]
Why are Belief-Driven Sovereign Risk Crises so Disruptive?

- It is didactically and analytically convenient to explain belief-driven crises as distinct from fundamental crisis. Yet they cannot be separated, neither in theory nor in practice.
- On the one hand, for a belief-driven (‘bad’) equilibrium to exist, the fundamentals of the economy cannot be too strong, e.g., the equilibrium is unique for a sufficiently low FN. On the other hand, self-fulfilling expectations of default typically cause the fundamentals of the economy to deteriorate: high risk premia not only drive up public debt, but also spill over onto private borrowing costs and cause market disruption, discouraging investment and lowering demand.
- Once this process is set in motion, the economy becomes fundamentally weaker and, at some point, the equilibrium may become unique with unsustainable debt.
A Steady Deterioration of the State of the Economy

• In our stylized model, we treated output as exogenous to fiscal conditions as a simplifying assumption. Yet, the evidence shows that high sovereign risk premia and a high accumulation of debt tends to have quite strong and pervasive effects on economic activity and growth.

• Self-fulfilling expectations of default can rapidly translate into losses of productive capacity, unemployment, rising income risk and dissipation of human capital (as many firms close down, implying a waste of firm specific skills accumulated by workers). All these effects endogenously reduce the debt threshold and/or increase government financing needs.

• Again, while conceptually distinct in our stylised model, fundamental and self-fulfilling debt crisis cannot be kept apart when interpreting reality.
Contagion

- With multiple equilibria, interest rates hike (and typically become volatile) when investors coordinate their expectations away from a ‘good’ equilibrium, on a ‘bad equilibrium’.

- Social sciences have not come up with a convincing model of how this switch occurs. We know that they may be very sudden. We typically attribute it to exogenous ‘sunspot’ variables.

- But we also know that sovereign risk crises are typically correlated across border—have a systemic nature.
  - In our stylized model, we may think that both the state of the economy and the coordination of investors’ expectations are driven by global/regional drivers.

- A key lesson from economics is that multiple equilibria exist only to the extent that the economy does not have policy and institutional safeguards.
Austerity vs. Solidarity
Can they be the solution?
Austerity unlike a solution: high fiscal multipliers

- One may argue that, in response to a shift in expectations, a country could eliminate the bad equilibrium by drastically reducing its FN—via “austerity.
- But empirical evidence suggests that the output multiplier of contractions at times of crises tends to be very high (see my own work with Meier and Mueller in Economic Policy 2012).
- This is very bad news: in a sovereign risk crisis, austerity may be at the same time forced on the country (markets are unwilling to finance deficits) and self-defeating (the endogenous fall in output worsens deficits).
- “What did we learn Palmer? ... That we do not want to be in this situation again”
Solidarity

- Another possible solution is relying on the ‘kindness’ of strangers.

- A sovereign risk crisis in a region typically have adverse real and financial spillovers abroad, which may motivate “self interested solidarity”.
  - Foreign governments have an economic interest in bailing out a country in trouble and prevent a sovereign risk crisis, as long as the required transfer does not exceed the financial costs of the spillovers from this crisis.

- While this consideration may help explaining while “no bail out” rules lack credibility, our question of interest is: Would solidarity may eliminate self-fulfilling crises.

- As shown in the following graphs, the problem with solidarity is that, as long as bailouts are limited by the intensity and motivation of solidarity, per se they cannot eliminate multiplicity.
Effects of a bailout in our model

- Prospective bailouts raise the debt threshold: investors expect that, in a recession, the country will be able to avoid default by using financial help $B_{t+1}^{\text{Max}'} - B_{t+1}^{\text{Max}}$. 

\[ Q_t = f(q, \psi_H) < 1 \]

\[ Q_t = 1 \]
Effects of a bailout in our model

- If anything prospective bailouts may create multiplicity.
Issues with bailouts (a memo for a different lecture)

• In addition to being ineffective in eliminating multiple equilibria, bailouts raise a number of issues in financial and macroeconomic instability and welfare, e.g.:
  • Ex ante, prospective bailouts may encourage excessive risk taking and borrowing;
  • Ex post, self-interest bailouts tend to serve mainly the interests of the creditors.

See Tirole AER 2015.
Addressing Destabilizing Self-fulfilling Sovereign Risk Crises: The Logic of Backstops

1. Official Lender (of last resort)
2. Credibility of backstops
Eliminating Belief-Driven Crises

• Recall that the equilibrium price at which investors are willing to buy debt, labelled hereafter $Q^\text{Market}_t$, is:

$$Q^\text{Market}_t = \begin{cases} Q^\text{Riskless}_t = 1 & \text{if } B_{t+1} \leq B^\text{Max}_{t+1}, \\ Q^\text{Risky}_t = \rho \psi H & \text{if } B_{t+1} \geq B^\text{Max}_{t+1}. \end{cases}$$

• Let’s focus on a country with financing needs ($FN_t$) in the range where multiple equilibria are possible. A low bond price $Q^\text{Risky}_t$ can be an equilibrium when simultaneously:

$$B_{t+1} = \frac{FN_t}{Q^\text{Risky}_t} > B^\text{Max}_{t+1} \text{ and } B_{t+1} = \frac{FN_t}{Q^\text{Riskless}_t} \leq B^\text{Max}_{t+1}$$

• When investors coordinate expectations on a “bad equilibrium”, they are willing to buy debt only at the $Q^\text{Risky}_t$ prices. If all new debt were to be issued at this price, $B_{t+1}$ would rise above the critical threshold, validating ex post investors’ expectations.
The Model with an Official Lender

**Key Question:** How can this bad equilibrium be eliminated?

Consider an institution, labelled Official Lender (OL), which stands ready to buy the country’s debt at some official price $Q_{t}^{OL} \geq Q_{t}^{Market}$. Accounting for the debt purchased by the OL, the budget identity is:

$$FN_{t} = Q_{t}^{Market}B_{t+1}^{Market} + Q_{t}^{OL}B_{t+1}^{OL} = \left(Q_{t}^{Market}\frac{B_{t+1}^{Market}}{B_{t+1}} + Q_{t}^{OL}\frac{B_{t+1}^{OL}}{B_{t+1}}\right)B_{t+1}$$

Purchases by the OL raise the average price (lower the interest rate) at which the country can sell its debt (lower the country’s overall costs of borrowing). Provided the FN is in the region of multiple equilibria, a sufficiently large $B_{t+1}^{OL}$ can always prevent the overall stock of debt from rising above $B_{t+1}^{Max}$. 
An Official Lender can Eliminate Bad Equilibria

If $B_{t+1}^{OL}$ satisfies the following condition

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

the equilibrium market price cannot be $Q_t^{Risky}$.

- Even if market investors continued to buy debt at the low (default-risky) price, $Q_t^{Risky}$, 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 OL purchases of debt at a price $1 \geq Q_t^{OL} > Q_t^{Risky}$ in response to investors losing confidence on the country’s creditworthiness.
Let’s start from a situation where multiple equilibria exist. An OL stands ready to purchase debt up to $B_{t+1}^{OL}$, at $Q_t^{OL}$. Official Lending Eliminates Bad Equilibrium
Official Lending Eliminates Bad Equilibrium

- $Q_{t}^{OL}$ is a better price than $Q_{t}^{Risky}$, so in investors coordinate on a bad equilibrium, $B_{t}^{OL}$ will always be sold at this price.
- Even if the rest of the $FN_{t}$ were to be financed by investors at the price $Q_{t}^{Risky}$, the new issuance would remain below $B_{t+1}^{Max}$.
Official Lending Eliminates Bad Equilibrium

- We know that, in a “bad equilibrium”, investors offer the country the low price $Q_t^{Risky}$ to buy its bonds. Now suppose an amount $B_t^{OL}$ is financed by the OL at the better price $Q_t^{OL}$.
- As OL interventions reduce the amount of debt left to the market to finance, the revenue curve with slope $Q_t^{Risky}$ no longer originates from zero in the graph. The relevant curve starts from the point $(B_t^{OL}, Q_t^{OL}B_t^{OL})$.
- Even if the investors buy the share of bonds not purchased by the OL at $Q_t^{Risky}$ price, the lower (overall) costs of borrowing ensure that the total level of debt remains below the threshold $B_{t+1}^{Max}$.
- But if this is the case, $Q_t^{Risky}_{t+1}$ cannot be an equilibrium price in the first place. The OL rules out the bad equilibrium altogether.
Official Lending Eliminates Bad Equilibrium

- The existence of an OL ready to purchase debt up to $B^{OL}$, at a price $Q^{OL}$, is enough to ensure that the equilibrium is unique at $Q^{Riskless} = 1!$
An OL does not need to purchase debt to be effective

- If investors expect the OL to intervene on a sufficient scale (if and when markets start pricing debt at $Q_t^{Risky}$), they also understand that the only equilibrium debt price is the “default-risk free” $Q_t^{Riskless}$.
- Thus, they will not “run on the country debt”: they would not try to buy debt $Q_t^{Risky}$.
- Hence no OL intervention will be necessary ex post!

The OL can affect market behaviour by simply threatening to purchase debt, without doing so in equilibrium. But for the backstop to be effective, it must be credible.
But the backstop must be credible: two conditions

1. The OL must have access to sufficiently large financial resources (the so called "big bazooka").
   - It is easy to verify that, if $Q_t^{OL}B_{t+1}^{OL}$ is not large "enough", the OL cannot rule out equilibrium multiplicity.
   - The OL 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.
   - The OLS must be able to leverage issuing bonds at a price $Q \geq Q_t^{OL} > Q_t^{Risky}$

2. The OL must be ready to purchase debt ex post if markets challenge its determination to do so.
   - The OL objective function and institutional constraint must be such that investors do not doubt the backstop.
In this lecture, we have seen that

- Countries are inherently exposed to sovereign risk, depending on markets assessment of debt sustainability—we think of this assessment in terms of latent debt tolerance thresholds.
- Debt thresholds are extremely forward looking, multidimensional and sensitive to switch expectations (a country with low debt may be in trouble if investors expect, say, a bank crisis).
- Investors confidence may suddenly shifts away from optimistic to pessimistic equilibria. If there are not policy/institutional safeguards in place, a crisis occurs.
- Once erupted, a sovereign risk crisis tends to activate vicious spirals that deteriorate the state of the economy and cause debt to accumulate.
The above is the bad news. Now, the good news

- An official lender may be able to eliminate the bad equilibrium, by simply ‘threatening’ to buy debt at the near riskless price if markets are unwilling to do so.
- For the OL to be effective, its threat must be credible.

In the next lecture, we will discuss issues in implementation. I will bring to your attention how, in most advanced countries, the role of a OL is played by the central bank, and this gives the country an important advantage in dealing with large shocks. We will then discuss the experience of the euro area, and how European Monetary Union could be completed to benefit fully from this advantage.