The Economics of Sovereign Debt, Bailouts and the Eurozone Crisis

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Motivation

- No Bailout clause: art. 125 of Lisbon Treaty:
  "A Member State shall not be liable for or assume the commitments of central governments, regional, local or other public authorities, ... of another Member State"

- ECB Executive Board member, Jurgen Stark (January 2010):
  "The markets are deluding themselves when they think at a certain point the other member states will put their hands on their wallets to save Greece."

- German finance minister Peer Steinbrueck (February 2009)
  "The euro-region treaties dont foresee any help for insolvent countries, but in reality the other states would have to rescue those running into difficulty."

- Economics Commissioner Joaquin Almunia (January 2010):
  "No, Greece will not default. Please. In the euro area, the default does not exist."
Objectives

- We have seen both some default (Greece) and large loans of EFSF/ESM to Cyprus, Greece, Ireland, Portugal and Spain: transfers/bailouts have materialized
- What is the impact of “no bailout clauses” if they are not fully credible?
- What determines the existence and size of bailouts?
- What consequences on risk shifting, debt issuance and yields?
- Is an ironclad no bailout clause desirable?
Main results

- Estimate of implicit NPV transfers from Europeans to crisis countries: lower bound from 0% (Ireland) to more than 40% of GDP (Greece)
- Theoretical two period model of monetary union with collateral damage of default/exit and ex-post efficient bailouts to prevent default/exit
- Bailouts do not improve welfare of crisis country: creditor countries get entire surplus from avoiding default (Southern view)
- Ex-ante, bailouts generate risk-shifting and over-borrowing (Northern view)
- No-bailout commitment reduces risk-shifting but may be not ex-ante optimal for creditor country, if risk of immediate insolvency: ”kicking the can down the road” optimal?
Relevant Literature – (just a few)

- Sovereign debt crisis: why do countries repay their debt?
  - Eaton and Gersovitz (1981): reputation
  - Cohen and Sachs (1986), Bulow and Rogoff (1989): disruption costs

- Collateral damage of sovereign default in EMU (default + potential exit)
  - Bulow and Rogoff (1989)
  - Tirole (2014) and Farhi and Tirole (2016)

- Self-fulfilling expectations driven crisis (Calvo, 1988)
  - no multiple equilibria but transfers in equilibrium in our paper
Size of implicit transfers during crisis

- Crisis countries (Ireland, Greece, Cyprus, Portugal, Spain, Italy) received funding from GLF/EFSF/EFSM/ESM and IMF.
- Methodology (Zettelmeyer and Joshi, 2005) to estimate NPV of total transfers $Tr_t^{i,j}$ (borrower $i$; creditor $j$ at time $t$)
- Assumption for discount rate: risk of default on European institution loans = IMF ⇒ Lower bound estimate of transfer
- We discount at $irr$ of IMF program for same borrower:

$$Tr_{2010}^{i,j} = \sum_{t=2010}^{T} \frac{1}{(1 + irr^{i,IMF})^t} NT_t^{i,j}$$

- Series of net transfers:

$$NT_t^{i,j} = D_t^{i,j} - R_t^{i,j} - i_{t-1}^{i,j} (D^o)_{t-1}^{i,j} - \cdots - i_{t-\tau}^{i,j} (D^o)_{t-\tau}^{i,j}$$

$R_t^{i,j}$ = repayments; $D_t^{i,j}$ = disbursements; $\tau$ = maturity of each disbursement; $D^o$ = outstanding balance
<table>
<thead>
<tr>
<th>Borrower $i$</th>
<th>Lender $j$</th>
<th>$\text{irr}^{i,j}$</th>
<th>$\text{irr}^{i,j,\text{IMF}}$</th>
<th>$\Delta \text{irr}^{i,j}$</th>
<th>$\sum D^{i,j}$</th>
<th>$\text{Tr}^{i,j} / \text{GDP}^i$</th>
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<td>Cyprus</td>
<td>ESM</td>
<td>0.89</td>
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Theory

- Start with a version of Calvo (1988) model
- 2 periods: \( t = 0, 1 \)
- 3 countries: \( i, g \) (inside monetary union) and \( u \) (rest of the world)
- \( g \) fiscally sound (safe bonds as \( u \)), \( i \) fiscally fragile
- \( i \)'s output is uncertain: \( y_1 = \bar{y}_1 \epsilon_1 \) with \( E[\epsilon_1] = 1 \), cdf \( G(\epsilon_1) \), with bounded support \([\epsilon_{\min}, \epsilon_{\max}]\)
- Preferences of country \( j \):
  \[
  U^j = c_0^j + \beta E[c_1^j] + \omega^j \lambda^s \ln b_1^{s,j} + \omega^j \lambda^{i,j} \ln b_1^{i,j}
  \]
  - Risk neutral over consumption
  - Bonds provide liquidity services (ECB collateral policy):
    \[
    \lambda^{i,i} > \lambda^{i,g} \geq \lambda^{i,u}
    \]
  - \( \omega^j \): country size
Debt portfolios

Pins down portfolio shares, regardless of yields, $\alpha^{i,j}$: share of $i$’s debt held by country $j$:

$$\alpha^{i,j} = \frac{b^{i,j}_1}{b^{i}_1} = \omega^j \frac{\lambda^{i,j}}{\bar{\lambda}^i}$$

with $\bar{\lambda}^i = \sum_k \omega^k \lambda^{i,k}$

- Portfolio shares proportional to relative liquidity benefits of $i$ debt across each class of investors, and size, independent from yields.
Default & Bailout at $t = 1$

- $i$ can strategically default (*pari passu*)
- $g$ can unilaterally offer a bailout $\tau_1 \geq 0$ to avoid default

Cost of default to $i$: $\Phi y^i_1 + \tau_1$
- $\Phi y^i_1$: disruption cost of default/exit
- No bailout

Benefit to $i$: $(b^i_1 - \rho y^i_1)(1 - \alpha^{i,i})$
- $0 \leq \rho \leq 1$: recovery rate
- $1 - \alpha^{i,i}$: debt held externally.

Cost to $g$: $(b^i_1 - \rho y^i_1)\alpha^{i,g} + \kappa y^g_1$
- direct portfolio exposure: $(b^i_1 - \rho y^i_1)\alpha^{i,g}$
- collateral damage $\kappa y^g_1$ (monetary union)

Benefit to $g$: saves bailout $\tau_1$
Default & Bailout at $t = 1$

- $i$ decision: repay if cost of default $\geq$ benefit of default, given $\tau_1$, minimum transfer/bailout to avoid default:

$$\tau_1 \geq b_1^i (1 - \alpha^{i,i}) - y_1^i \left[ \Phi + \rho (1 - \alpha^{i,i}) \right] \equiv \tau_1$$

- Threshold for no default without bailout ($\tau_1 = 0$):

$$\bar{\epsilon} \equiv \frac{(1 - \alpha^{i,i}) b_1^i / \bar{y}_1^i}{\Phi + \rho (1 - \alpha^{i,i})} \leq \epsilon_1^i$$

- if $\epsilon_1^i < \bar{\epsilon}$, $g$ prefers bailout if:

$$\Phi y_1^i + \kappa y_1^g \geq \alpha_1^{i,u} (b_1^i - \rho y_1^i)$$

- Threshold for bailout:

$$\epsilon \equiv \frac{\alpha_1^{i,u} b_1^i / \bar{y}_1^i - \kappa y_1^g / \bar{y}_1^i}{\Phi + \rho \alpha_1^{i,u}} \leq \epsilon_1^i < \bar{\epsilon}$$

- If $\epsilon_1^i < \epsilon$, $g$ lets $i$ default.
Optimal Ex-Post Bailout Policy

Political uncertainty/commitment: probability $\pi$ that bailout cannot be implemented.

$\epsilon(b^i_1) = \frac{\alpha^{i,u} b^i_1/\bar{y}^i_1 - \kappa y^g_1/\bar{y}^i_1}{\Phi + \rho \alpha^{i,u}}$

$\bar{\epsilon}(b^i_1) = \frac{(1 - \alpha^{i,i}) b^i_1/\bar{y}^i_1}{\Phi + \rho (1 - \alpha^{i,i})}$

Probability of default:

$\pi_d = G(\epsilon) + \pi(G(\bar{\epsilon}) - G(\epsilon))$
Ex-post efficiency gains

if $\epsilon_1^i < \bar{\epsilon}$, $g$ prefers bailout if:

$$\Phi y_1^i + \kappa y_1^g \geq \alpha_1^{i,u} (b_1^i - \rho y_1^i)$$

overall loss of default $\geq$ overall gain of default

- Bailout is *ex-post* efficient for $i$ and $g$ jointly
- $g$ makes minimum bailout & captures all the surplus: *Southern view*
- If bailout conditional on reforms that improve $i$ output: again, all surplus captured by $g$
Debt rollover problem at $t = 0$

Fiscal revenues $D(b_1^i) = b_1^i / R^i$ raised by the government of country $i$ in period $t = 0$:

$$D(b_1^i) = \beta b_1^i (1 - \pi_d) + \beta \rho \tilde{y}_1^i \left( \int_{\epsilon_{\min}}^{\epsilon} \epsilon dG(\epsilon) + \pi \int_{\epsilon}^{\tilde{\epsilon}} \epsilon dG(\epsilon) \right) + \bar{\lambda}_i^i$$

- $D(b)$ defines a debt-Laffer curve
- ex-post bailout likelihood affects the shape of the debt-Laffer curve
- under some regularity assumptions, debt-Laffer curve is well behaved (convex over the relevant range) although not continuously differentiable.
The Debt-Laffer Curve: $D(b)$

$D(b)$ for $\pi = 0$ (max bailout), $\pi = 0.5$ and $\pi = 1$ (no bailout).

[Uniform distribution with $\rho = 0.6$, $\Phi = 0.2$, $\kappa = 0.05$, $\epsilon_{\text{min}} = 0.5$, $\beta = 0.95$, $\bar{y}^i_1 = 1$, $\gamma^g_1 = 2$, $\alpha^{i,i} = 0.4$, $\alpha^{i,g} = \alpha^{i,u} = 0.3$. $b = 0.47$, $\bar{b} = 0.97$ and $\hat{b} = 1.4$]
Yields: a Deauville effect (October 2010)?

Yields for $\pi = 0$ (expected bailout), $\pi = 1$ (no expected bailout) and $\pi = 0.2$

[Uniform distribution with $\rho = 0.6$, $\Phi = 0.2$, $\kappa = 0.05$, $\epsilon_{\text{min}} = 0.5$, $\beta = 0.95$, $\bar{y}_1^i = 1$, $\gamma_1^g = 2$, $\alpha^{i,i} = 0.4$, $\alpha^{i,g} = \alpha^{i,u} = 0.3$. $\underline{b} = 0.47$ and $\bar{b} = 0.97$]
Optimal Debt

First-order condition for $i$ (bondless limit, near zero liquidity services):

$$D'(b^i_1) = \beta(1 - G(\bar{\epsilon}))$$

**Interpretation**: marginal gain of issuing debt equals discounted probability of repayment.

- Without bailouts, no incentive to issue excessive debt (unconstrained): $0 \leq b^i_1 \leq b$
- With bailouts, $i$ trades off increased riskiness of the debt (higher yields) against the likelihood of a bailout (risk shifting): $0 \leq b^i_1 \leq b$ or $b^i_1 = b_{opt} > b$ (**Northern view**)
- Characterize the extent of risk shifting
Optimal Debt

Rewrite first-order condition:

\[(G(\bar{\epsilon}) - G(\epsilon))(1 - \pi) = (b_1^i - \rho \bar{y}_1^i \epsilon)(1 - \pi)g(\epsilon)\frac{d\epsilon}{db} + (b_1^i - \rho \bar{y}_1^i \bar{\epsilon})\pi g(\bar{\epsilon})\frac{d\bar{\epsilon}}{db}\]

- **Gain**: probability that marginal debt paid by transfer from \( g \)
- **Costs of higher yields**: increases \( \epsilon \) and \( \bar{\epsilon} \) which makes default more likely
- If \( \pi = 1 \) (commitment for no bailout) \( g(\bar{\epsilon}) = 0 \) no incentive to issue excessive debt
Optimal Debt Issuance: Risk Shifting

Optimal Debt Issuance for $\pi = 0.5$.
Uniform distribution with $\rho = 0.6$, $\Phi = 0.2$, $\kappa = 0.05$, $\epsilon_{\text{min}} = 0.5$, $\beta = 0.95$, $\bar{y}_1^i = 1$, $y_1^g = 2$, $\alpha_i^i, i = 0.4$, $\alpha_1^i, g = \alpha_i^i, u = 0.3$. $b = 0.47$, $\bar{b} = 0.97$ and $\hat{b} = 1.4$

Choose safe debt if $\pi$ high and if $\alpha_i^i$ high
Risk shifting and no bailout clauses

- Risk shifting increases with probability of bailout $1 - \pi$: if $\pi$ very low, $b_{opt} > \bar{b}$
- $i$ chooses risky debt: risk shifting is maximal.
- Reconciles the ‘Northern’ and ‘Southern’ views: two sides of the same coin.
- The possibility of a transfer induces risk shifting by $i$ but $g$ captures all the surplus from the transfer.
Plot of the set of unconstrained solutions $0 \leq b \leq \bar{b}$ and $b_{opt}$ as a function of $\pi$. There is a critical value $\pi_c$ above which risk shifting disappears.
Choosing No-Bailout Clauses Commitment level

- Legal institutions, international treaties... may increase $\pi$
- $b_{opt}$ decreases with $\pi$: $g$ can eliminate risk-shifting by choosing $\pi \geq \pi_c$
- Will $g$ always choose high $\pi$ (strong no bailout clause)?
- Not necessarily: higher $\pi$ could force $i$ to default in period 0 because it reduces resources available in period 0 if high initial debt in $t = 0$
- Option value to wait or ”kicking the can down the road” by $g$: what if $\varepsilon_i^1$ high?
- Optimal choice of $\pi < \pi_c$ if $i$ has high initial level of debt
Default vs. Exit

- Greece defaulted in 2012, received a transfer and did not exit
- Extension: differentiate
  - default:
    - $i$: cost: $\Phi_d y_1^i$
    - $g$: cost: $\kappa_d y_1^g$
  - exit:
    - $i$: cost: $\Phi_d y_1^i$ and extra benefit: $\Delta b_1^i (1 - \alpha_{ii})$
    - $g$: cost: $\kappa_d y_1^g$ and extra cost: $\Delta b_1^g \alpha_{ig}$

- Possibility of transfer to avoid exit even with default
Figure: Optimal Ex-Post Bailout and Default vs. Exit Decisions: Ireland and Greece
Debt monetization

- Debt monetization $\neq$ transfers
- with $\rho = 0$ and either $\pi = 0$ or 1
- inflation rate $z$ with distortion cost $\delta z y_1^i$ for $i$ and $\delta z y_1^g$ for $g$
- maximum inflation rate $\bar{z}$
Pecking order of bailout and debt monetization

Transfers are possible:

- $\epsilon_{\text{min}}$ to $\epsilon'$:
  - default
  - no bailout
  - no inflation

- $\bar{\epsilon}$ to $\bar{\epsilon}':$
  - no-default
  - bailout
  - inflation
  - no inflation

- $\epsilon_{\text{max}}$:
  - no default
  - no bailout
  - no inflation

- Debt monetization allows to reduce the transfer
- ECB debt monetization, if it takes place, reduces the likelihood of default
- The whole benefit of debt monetization, if it occurs, is captured by $g$
Overburdened Central Bank

Transfers are not possible

\[ \epsilon_{\text{min}} \rightarrow \tilde{\epsilon} \rightarrow \epsilon' \rightarrow \epsilon_{\text{max}} \]

- default
- no inflation
- no default
- inflation
- no default
- no bailout
- no inflation

- Debt monetization without transfers (stronger commitment for no bailout)
  - generates distortion costs
  - increases likelihood of default
Conclusion

- Reconcile "Northern" and "Southern" views of crisis: two sides of the same coin
  - Incentive to overborrow by fiscally fragile countries because of imperfect commitment of no bailout clause
  - Efficiency gains of transfers and debt monetization to prevent default entirely captured by creditor country (no solidarity)
  - In our model, very large transfer to Greece (more than 40% of GDP) did not improve Greece welfare

- Current policy discussions
  - Strengthening the no-bailout commitment should be done with prudence:
    - may precipitate immediate insolvency
    - may overburden ECB (debt monetization less efficient than transfers)
  - Lowering the cost of default:
    - orderly restructuring in case of default (lower $\kappa$ and $\Phi$): increases likelihood of default and increase transfer size but reduces its likelihood
    - lower risk concentration of banks (doom loop): same effect as orderly restructuring