The Economics of Sovereign Debt, Bailouts and the Eurozone Crisis

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ECB, November 21 2017

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)
  - role of financial backstop and monetary policy: de Grauwe (2011), Aguiar et al (2015), Corsetti & Dedola (2012)): financial backstop eliminates transfers
  - 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:

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

$R_t^{i,j}$ =repayments; $D_t^{i,j}$ = disbursements; τ = maturity of each disbursement; D^o = outstanding balance

Borrower i	Lender j	$irr^{i,j}$	$irr^{i,IMF}$	$\Delta irr^{i,j}$	$\sum D^{i,j}$	$Tr^{i,j}/GDP^{i}$
Cyprus	ESM	0.89	1.75	0.86	6.30	3.59%
Cyprus	IMF	1.75	1.75		0.95	
Greece	GLF	0.56	3.31	2.76	52.90	8.59%
Greece	EFSF	0.84	3.31	2.47	141.90	28.18%
Greece	ESM	0.59	3.31	2.73	31.70	6.55%
Greece	IMF	3.31	3.31		31.99	
Ireland	EFSF	2.28	2.63	0.35	17.70	0.55%
Ireland	EFSM	3.25	2.63	-0.62	22.50	-0.79%
Ireland	IMF	2.63	2.63		22.61	
Portugal	EFSF	2.08	3.41	1.33	26.02	2.67%
Portugal	EFSM	3.04	3.41	0.37	24.30	0.54%
Portugal	IMF	3.41	3.41		26.39	
Spain	ESM	1.05	2.78	1.73	41.33	0.59%

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: $y_1 = \bar{y}_1^i \epsilon_1$ with $E[\epsilon_1] = 1$, cdf $G(\epsilon_1)$, with bounded support $[\epsilon_{\text{min}}, \epsilon_{\text{max}}]$
- Preferences of country j:

$$U^j = c_0^j + \beta E[c_1^i] + \omega^j \lambda^s \ln b_1^{s,j} + \omega^j \lambda^{i,j} \ln b_1^{i,j}$$

  - Risk neutral over consumption
  - Bonds provide liquidity services (ECB collateral policy): $\lambda^{i,i} > \lambda^{i,g} \geq \lambda^{i,u}$
  - ω^j: country size

Debt portfolios

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

$$\alpha^{i,j} = \frac{b_1^{i,j}}{b_1^i} = \omega^j \frac{\lambda^{i,j}}{\bar{\lambda}^i}$$

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 : $\Phi y_1^i + \tau_1$
  - Φy_1^i: disruption cost of default/exit
  - No bailout
- Benefit to i : $(b_1^{i,i} - \rho y_1^i)(1 - \alpha^{i,i})$
  - $0 \leq \rho \leq 1$: recovery rate
  - $1 - \alpha^{i,i}$: debt held externally.

- Cost to g: $(b_1^i - \rho y_1^i)\alpha^{i,g} + \kappa y_1^g$
  - direct portfolio exposure: $(b_1^i - \rho y_1^i)\alpha^{i,g}$;
  - collateral damage κy_1^g (monetary union)
- Benefit to g: saves bailout τ_1

Default & Bailout at $t = 1$

- i decision: repay if cost of default $\geq$ benefit of default, given τ_1, minimum transfer/bailout to avoid default:

$$\tau_1 \geq b_1^i(1-\alpha^{i,i}) - y_1^i\left[\Phi + \rho(1-\alpha^{i,i})\right] \equiv \underline{\tau}_1$$

  - 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:

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

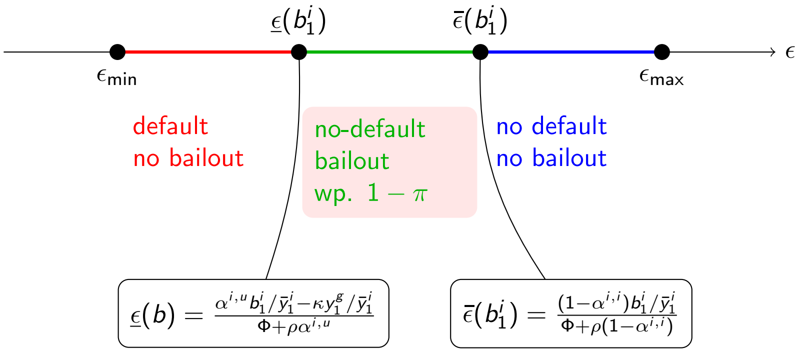
- Threshold for bailout:

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

- If $\epsilon_1^i < \underline{\epsilon}$, g lets i default.

Optimal Ex-Post Bailout Policy

Political uncertainty/commitment: probability π that bailout cannot be implemented.



Probability of default:

$$\pi_d = G(\underline{\epsilon}) + \pi(G(\bar{\epsilon}) - G(\underline{\epsilon}))$$

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

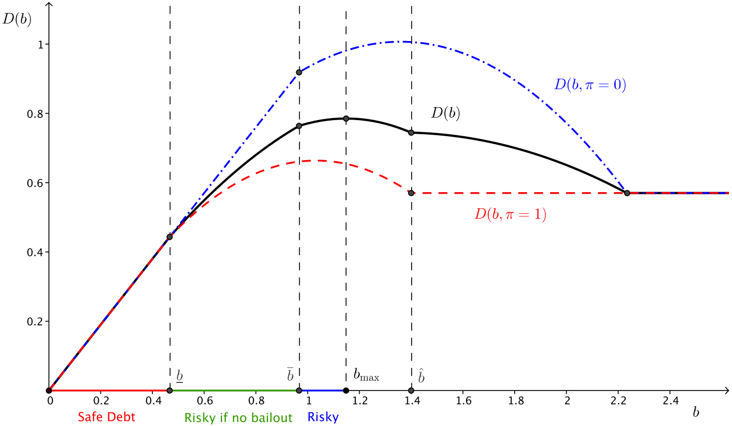
Debt rollover problem at $t = 0$

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

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

- $D(b)$ 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.

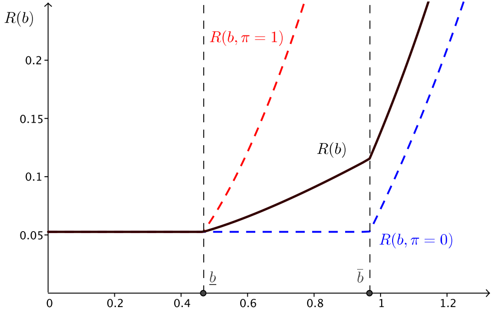
The Debt-Laffer Curve: $D(b)$



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

[Uniform distribution with $\rho = 0.6$, $\Phi = 0.2$, $\kappa = 0.05$, $\epsilon_{\text{min}} = 0.5$, $\beta = 0.95$, $\bar{y}_1^i = 1$, $y_1^g = 2$, $\alpha^{i,i} = 0.4$, $\alpha^{i,g} = \alpha^{i,u} = 0.3$. $\underline{b} = 0.47$, $\bar{b} = 0.97$ 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 $\rho = 0.6$, $\Phi = 0.2$, $\kappa = 0.05$, $\epsilon_{\text{min}} = 0.5$, $\beta = 0.95$, $\bar{y}_1^i = 1$, $y_1^g = 2$, $\alpha^{i,i} = 0.4$, $\alpha^{i,g} = \alpha^{i,u} = 0.3$. $\underline{b} = 0.47$ and $\bar{b} = 0.97$]

Optimal Debt

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

$$D'(b_1^i) = \beta(1 - G(\bar{\epsilon}))$$

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

- Without bailouts, no incentive to issue excessive debt (unconstrained): $0 \leq b_1^i \leq \underline{b}$
- With bailouts, i trades off increased riskiness of the debt (higher yields) against the likelihood of a bailout (risk shifting): $0 \leq b_1^i \leq \underline{b}$ or $b_1^i = b_{opt} > \underline{b}$ (Northern view)
- Characterize the extent of risk shifting

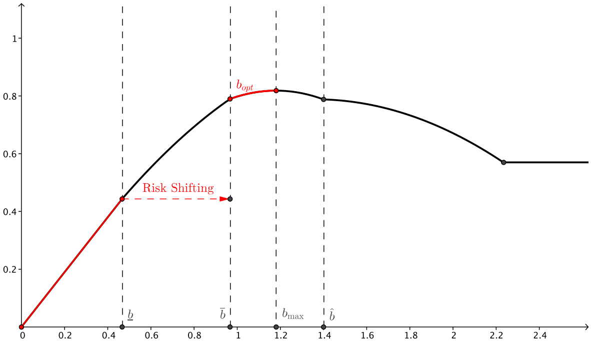
Optimal Debt

Rewrite first-order condition:

$$\left(G(\bar{\epsilon}) - G(\underline{\epsilon})\right)(1-\pi) = (b_1^i - \rho \bar{y}_1^i \underline{\epsilon})(1-\pi) g(\underline{\epsilon}) \frac{d\underline{\epsilon}}{db} + (b_1^i - \rho \bar{y}_1^i \bar{\epsilon}) \pi g(\bar{\epsilon}) \frac{d\bar{\epsilon}}{db}$$

- Gain: probability that marginal debt paid by transfer from g
- Costs of higher yields: increases $\underline{\epsilon}$ 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



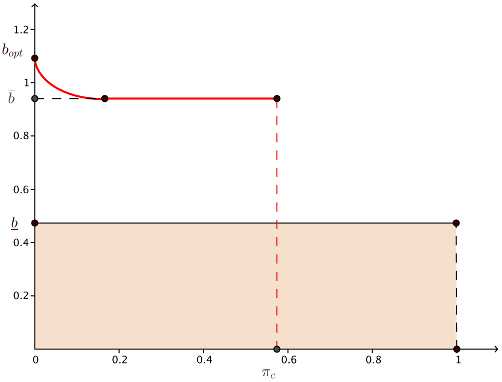
Optimal Debt Issuance for $\pi = 0.5$.
Uniform distribution with $\rho = 0.6$, $\Phi = 0.2$, $\kappa = 0.05$, $\epsilon_{\min} = 0.5$, $\beta = 0.95$, $\bar{y}_1^i = 1$, $y_1^g = 2$, $\alpha^{i,i} = 0.4$, $\alpha_1^{i,g} = \alpha^{i,u} = 0.3$. $\underline{b} = 0.47$, $\bar{b} = 0.97$ and $\hat{b} = 1.4$

Choose safe debt if π high and if $\alpha^{i,i}$ high

Risk shifting and no bailout clauses

- Risk shifting increases with probability of bailout $1 - \pi$: if π 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.

The Effect of No-Bailout Clauses



Plot of the set of unconstrained solutions $0 \leq b \leq \underline{b}$ and b_{opt} as a function of π. There is a critical value π_c above which risk shifting disappears.

Choosing No-Bailout Clauses Commitment level

- Legal institutions, international treaties... may increase π
- b_{opt} decreases with π: g can eliminate risk-shifting by choosing $\pi \geq \pi_c$
- Will g always choose high π (strong no bailout clause)?
- Not necessarily: higher π 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 ε_1^i 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: $\Delta b_1^i \alpha^{ig}$
- Possibility of transfer to avoid exit even with default

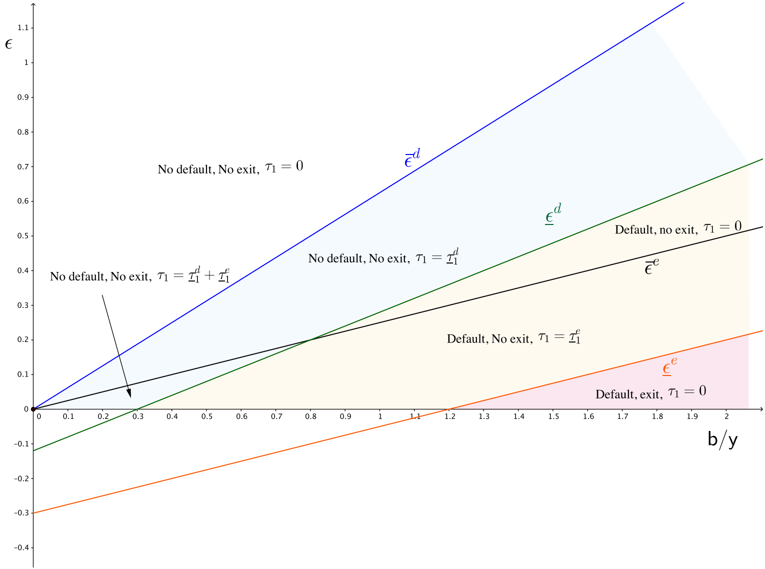


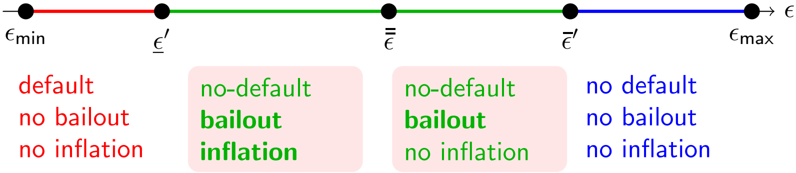
Figure: Optimal Ex-Post Bailout and Default vs. Exit Decisions: Ireland and Greece

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:



- 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

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 κ and Φ): increases likelihood of default and increase transfer size but reduces its likelihood
    - lower risk concentration of banks (doom loop): same effect as orderly restructuring