Country Solidarity, Private Sector Involvement, and the Contagion of Sovereign Crises

Work in progress

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I. INTRODUCTION

Main focus of academic analysis of sovereign borrowing:

- ✓ sovereign debt level/maturity. Allocation of risk between debtor country and creditors.

Understanding debt sustainability requires considering also:

- ✓ market vs. official sector borrowing. Or flip side: bail-in vs. bail-out
- ✓ solidarity area. Allocation of risk within the official sector
- ✓ pattern of solidarity. Spontaneous (ex post) or contractual (ex ante).

Example: *Eurozone crisis*: Private sector involvement? Bailout by Northern Europe or the rest of the world? And in what form?

Implications for building a formal analysis

This suggests adding to analysis the following ingredients:

- ✓ Introduce potential guarantors
- ✓ Apply to them the same logic (willingness, rather than ability, to pay) as to debtor country:
  - Vulnerability: stand by the distressed country if the latter's private debt is smaller than the collateral damage cost
    [*economic*: reduced trade, subsidiaries and banking exposures, run on other countries;
    other: empathy, European construction, distressed country's nuisance power.]
  - This "pledgeable income" can be increased through joint-and-several liability (JL)

⟹ A country's borrowing capacity depends not only on its own WTP (literature), but also on:

- ✓ collateral damage its default would inflict on other countries;
- ✓ latter's willingness to take on JL.

Two paradigms

(1) *One-way insurance*
International community/debtor country
Northern Europe/Southern Europe

(2) *Mutual insurance*
Europe, IMF..., behind the veil of ignorance

Main results

- ✓ Optimality of debt brakes
- ✓ Mixed public-private financing
- ✓ JL increases borrowing capacity and risk of contagion
- ✓ JL does not emerge under one-way insurance
- ✓ JL emerges behind the veil of ignorance, provided that
  - country shocks are sufficiently independent
  - spillover costs are relatively large relative to default costs.

II. ONE-WAY INSURANCE

- ✓ Three players
  - M (market)
  - P (principal/official sector)
  - A (agent/debtor country)
- ✓ Universal risk neutrality. M and P have deep pockets.
- ✓ Two periods, $t = 1, 2$.

Borrowing & repayment

Date 1

Agent $\begin{cases} \text{borrows } b = b_M + b_P \text{ against debt claims } d_M \text{ and } d_P \\ \text{obtains } Rb \text{ where } R \text{ measures liquidity needs/ investment opportunities} \end{cases}$

Date 2

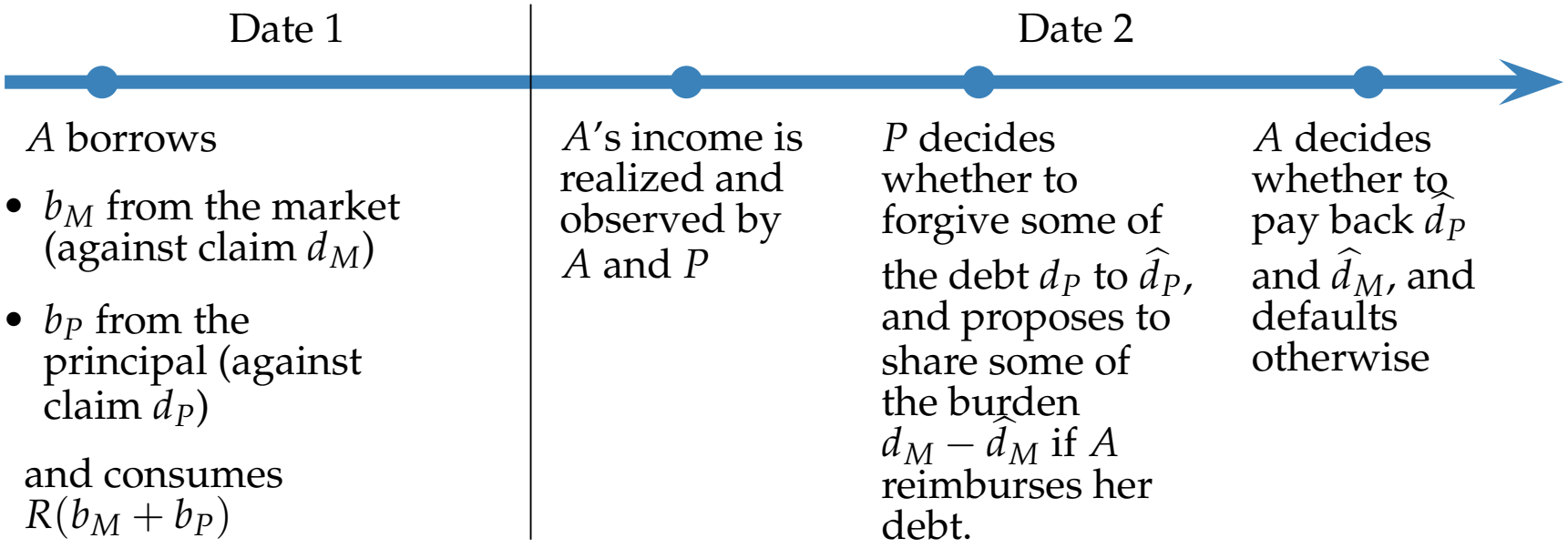
Agent learns income (beyond incompressible consumption)

$\begin{cases} y \text{ with prob. } \alpha \text{ (Good state)} \\ 0 \text{ with prob. } 1-\alpha \text{ (Bad state)} \end{cases}$

α is exogenous (easy to add *MH*: agent chooses α at date 1)

✓ Market does not observe income shock. Principal does, and forms a coalition with agent (similar insights if principal does not observe shock).

- ✓ *Debt forgiveness and bailout?* Principal can forgive to $\widehat{d}_P \leq d_P$ and offer support conditional on private debt being repaid: $\widehat{d}_M \leq d_M$.
- ✓ *Repayment decision*: Agent repays $\widehat{d}_P$ and $\widehat{d}_M$ or defaults.



Default costs

Agent's default cost: Φ_A

[Standard motivation: interruptions in trade patterns, denial of trade credit, seizure of assets & other retaliatory moves, internal cost of default, FDI interruptions, alliance shifts...]

Collateral damage/spillover cost: ϕ_P

[economic and political costs mentioned above]

Principal's own default cost: Φ_P

only if (a) takes on joint liability, (b) agent defaults, and (c) principal does not honor resulting liability.

Assume $y > \Phi_A$.

No-principal benchmark

If agent decides to borrow:

$$d_M = \Phi_A \qquad \text{(maximal credible reimbursement)}$$

and so

$$b_M = \alpha\Phi_A$$

$$\Longrightarrow U_A = R\big(\alpha\Phi_A\big) + \alpha\big(y - \Phi_A\big) - (1-\alpha)\Phi_A$$

Absence of borrowing yields αy.

Borrows iff $\alpha R > 1$

Then defaults in Bad state.

Principal: Date-2 debt forgiveness and bailouts

Agent: Agent reimburses iff $\widehat{d} \equiv \widehat{d}_M + \widehat{d}_P \leq \Phi_A$.

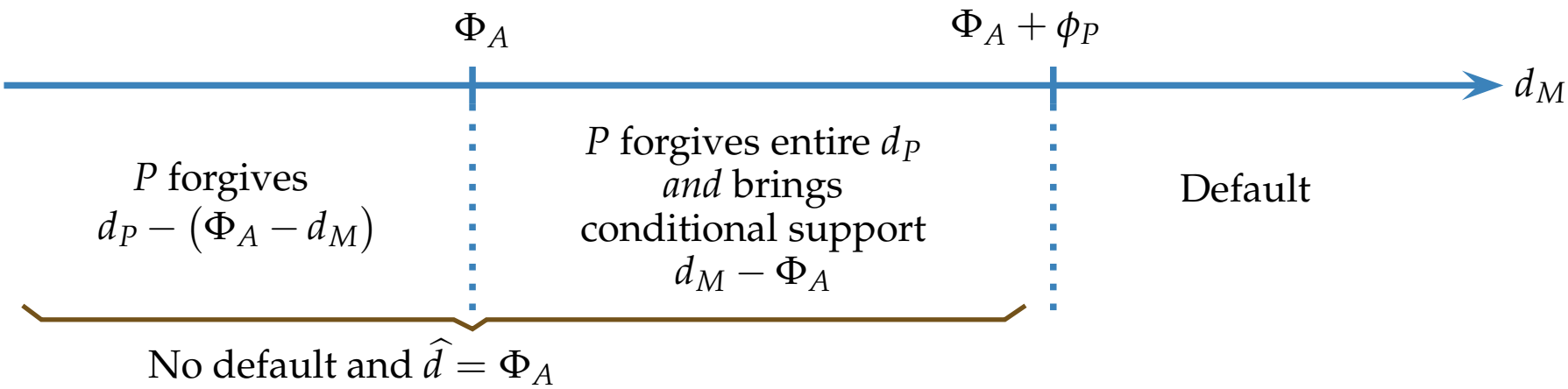
Principal:

Bad state (no income):

Principal forgives: $\widehat{d}_P = 0$. Furthermore

$$\begin{cases} \text{if} \quad d_M \leq \phi_P, & \text{bailout} \\ \text{if} \quad d_M > \phi_P, & \text{default.} \end{cases}$$

Good state:



Date 1: Laissez-faire (borrow from market only)

Optimum for agent (if borrows, i.e., $R \geq R_0$ for some $R_0 < 1$):

Low debt (no default): borrows $b_M = \phi_P$.
Agent reimburses $d_M = \phi_P$ in good state, is rescued in bad state.

High debt (default in bad state): debt $d_M = \Phi_A + \phi_P$.

Agent chooses risky policy if R or α are "large enough":

$$\underbrace{R\big(\alpha\Phi_A - (1-\alpha)\phi_P\big)}_{\substack{\text{increase in borrowing} \\ \big(\alpha\big(\Phi_A + \phi_P\big) - \phi_P\big) \\ \text{if positive}}} \geq \underbrace{\Phi_A - \alpha\phi_P}_{\substack{\text{reduction in date-2} \\ \text{expected welfare}}}.$$

or $R \geq R^*$ (where R^* may be $+\infty$)

$$U_P^* = \begin{cases} -\phi_P & \text{if} \quad R \geq R^* \\ -(1-\alpha)\phi_P & \text{if} \quad R < R^* \end{cases}$$

Optimal contract with official sector

At date 1, agent makes offer to principal. Mechanism design.

Contract:
$$\begin{cases} b = b_M + b_P \\ d^\omega = d_M^\omega + d_P^\omega \qquad (\textit{actual} \text{ payments}) \end{cases}$$

Note: d_P^ω can be negative (bailout)

Proposition (optimal contract) When the agent contracts with the principal at date 1 and $R \geq 1$,
(i) an upper bound on the agent's utility is

$$\widehat{U}_A = R(\alpha\Phi_A - U_P^*) + \alpha(y - \Phi_A);$$

Derivation of upper bound

$$\max \left\{ U_A = Rb + \alpha(y - d^G) + (1-\alpha)(-d^B) \right\}, \qquad \text{(I)}$$

where

$$b = b_M + b_P,$$

the participation constraints are satisfied:

$$\begin{aligned} -b_P + \alpha d_P^G + (1-\alpha) d_P^B &\geq U_P^* \\ -b_M + \alpha d_M^G + (1-\alpha) d_M^B &\geq 0, \end{aligned}$$

and the incentive constraints are satisfied:

$$\begin{aligned} d^G &\leq \Phi_A \\ d^B &\leq 0 \\ -d_P^\omega &\leq \phi_P + \Phi_P \quad \text{for} \quad \omega \in \{G, B\}. \end{aligned}$$

Ignoring latter (principal IC) constraints,

$$U_A \leq R\left[\alpha d^G + (1-\alpha) d^B - U_P^*\right] + \alpha(y - d^G) + (1-\alpha)(-d^B).$$

Proposition (optimal contract)

(ii) this upper bound is reached through the following contract:

- ✓ the agent borrows $b_M = d_M^G = d_M^B = \phi_P$ from the market; the principal monitors this cap on market financing (debt brake) and spontaneously bails out the agent in the bad state of nature;

- ✓ the agent borrows $b_P = \alpha\Phi_A - \phi_P - U_P^*$ from the principal, repays the principal $d_P^G = \Phi_A - \phi_P$ in the good state of nature, and receives bailout money $-d_P^B = \phi_P$ in the bad state of nature from the principal to repay its private creditors.

  The agent never defaults.

Discussion

- ✓ *Debt brake requirement*

  Agent otherwise may overborrow from market (negative externality on P).

  Seniority rule does not solve problem.

- ✓ *No need for JL*

  JL would allow agent to borrow more, so surplus would be higher; but the agent would have to borrow more to compensate the principal (utility is non-transferable)

- ✓ *Mixed financing*.

III. CONTRACTUAL SOLIDARITY

- ✓ Symmetric two-country version (behind veil of ignorance). Borrowing b_i yields Rb_i.
- ✓ Probability p_k that k countries have income y (with $\Sigma_0^2 p_k = 1$) Arbitrary pattern of correlation.
- ✓ Default costs: $\begin{cases} \text{own cost} & \Phi \\ \text{collateral damage cost} & \phi \end{cases}$

Let $\widehat{\Phi} \equiv \Phi + \phi$ (upper bound on WTP).

Notation: In "state" k

$d_k \equiv$ expected per-country repayment ($d_0 = 0$ obviously)

$x_k \equiv$ expected number of defaults ($x_k \in [0, 2]$)

$\widehat{\Phi}_k \equiv$ expected per-country total cost of default

[example: $\widehat{\Phi}_k = \widehat{\Phi}$ if both countries default]

Let $2\widehat{\Phi}_1 \equiv \widehat{\Phi}_1^y + \widehat{\Phi}_1^0 = x_1\widehat{\Phi}$

Payoff: $\max\left\{R\left[\Sigma_{k=0}^2 p_k d_k\right] - \Sigma_{k=0}^2 p_k\left(d_k + \widehat{\Phi}_k\right)\right\}$

Assume $R > \dfrac{1+p_0}{1-p_0} \geq 1$. Then borrowing is optimal and

- no default when both are intact $\left(\widehat{\Phi}_2 = 0\right)$
- full default when both are distressed $\left(\widehat{\Phi}_0 = \widehat{\Phi}\right)$.

Furthermore, *binding constraints* are:

$$d_2 \leq d_1 + \frac{x_1}{2}\widehat{\Phi}$$

and

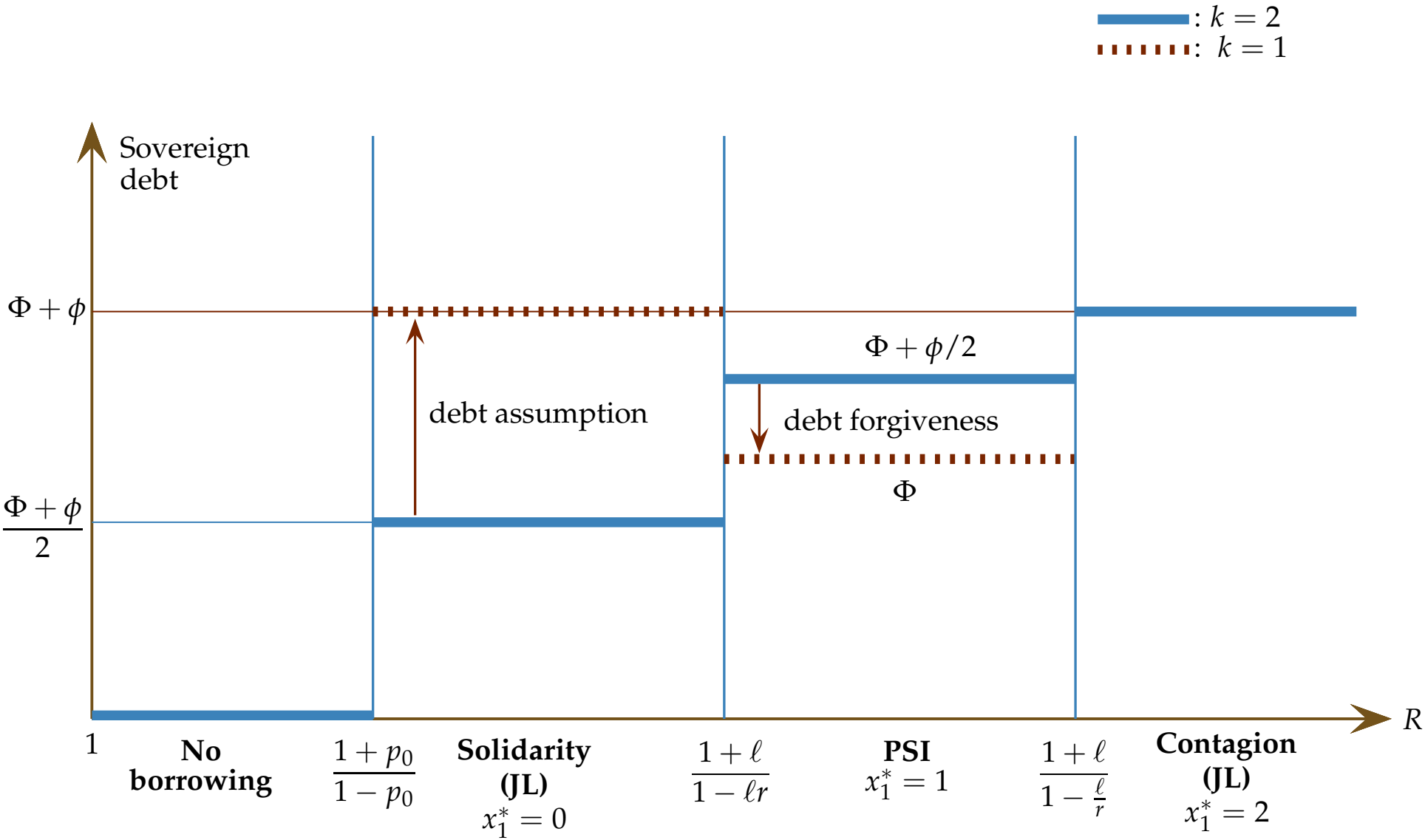
$$2d_1 + \widehat{\Phi}_1^y \leq \widehat{\Phi}$$

where cost to intact country when other is distressed is minimized conditional on number of defaults x_1:

$$\widehat{\Phi}_1^y = \begin{cases} x_1\phi & \text{if} \quad x_1 \leq 1 \\ \phi + (x_1 - 1)\Phi & \text{if} \quad 1 \leq x_1 \leq 2. \end{cases}$$

Optimal contract

Let $\ell \equiv \dfrac{p_1}{p_2}$ (likelihood ratio) and $r \equiv \dfrac{\phi}{\Phi}$ (spillover-default cost ratio)



IV. ENDOGENOUS SPILLOVERS

- ✓ Spillover costs are in part endogenous
  - Mengus (2012), Gennaioli et al (2011): Part of ϕ depends on country's banks' investment in other country.
  - Unilateral incentive to reduce exposure so as to strengthen one's position?
  - Collective incentive (behind veil of ignorance)?

- ✓ We here focus on choice of spillovers by principal (in fact, both the principal and the agent impact spillovers)
  - Some spillovers cannot be controlled by country: ϕ_0
  - Others can be controlled: $z_i \in [0,1]$ = exposure

$$\phi_i = \phi_0 + z_i(\phi - \phi_0)$$

[example: investment in other country's debt.]

(1) *One-way insurance*

- Intuition: should choose $z_P = 0$ (i.e., $\phi_P = \phi_0$) so as to contain soft-budget-constraint exposure.
- Broadly correct, but may choose $z_P > 0$ in order to incentivize agent to choose the safe policy.

(2) *Two-way insurance*: In solidarity region (no default), countries jointly decide to maximize their cross exposure: $\phi_i = \phi$.

V. SUMMARY AND APPLICATIONS

Summary

(1) *Collateral damage is collateral*

- Bailouts driven by fear of externalities.
- We have provided formal content to notion that a country's debt capacity depends on spillovers associated with its default.

(2) *Joint liability requires being behind veil of ignorance*

- Joint liability increases total surplus, creates domino effects
- Risky countries cannot compensate safe ones for accepting joint liability (would have to borrow more: compensation in funny money).

(3) *Endogenous spillovers.*

Many possible extensions, including:

- ✓ Extended solidarity (inner/outer solidarity area, Eurozone/ international community)
- ✓ Asymmetric information about spillovers and posturing.