Expenditure Consolidation and Sovereign Debt Restructurings: Front- or Back-loaded

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Kyoto University Seminar
July 21, 2022,

Disclaimer

- The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management

Motivation

- Theory – Existing literature
  - Fiscal austerity literature in AMs
    - Front-loaded consolidation & no restructuring
  - Sovereign debt literature
    - Back-loaded consolidation & default/restructuring
- Data – Three strategies
  - Front-loaded consolidation & no restructuring
  - Front-loaded consolidation & preemptive restructuring
  - Back-loaded consolidation & post-default restructuring
- Question – How can we fill a gap between theory and data?

What We Do in This Paper

- Empirical, theoretical, and quantitative paper
- Empirics
  - Data on strategies of expenditure consolidation and restructurings
  - New stylized facts
- Theory
  - Sovereign debt model with preemptive and post-default restructurings and public capital
  - (i) front-loaded & preemptive, (ii) front-loaded & no restructuring
  - Choice between front- and back-loaded expenditure consolidation
- Quantitative analysis
  - Replication of the five stylized facts

Data: Debt Restructurings and Debt Distress

- Debt Restructurings – Asonuma and Trebesch (2016)
  - 197 sovereign debt restructurings in 1975–2020
    - Post-default restructurings: 116 episodes
    - Preemptive restructurings: 81 episodes
- Non-restructuring Debt Distress — New
  - 25 episodes in 1975–2020
    - High likelihood of restructurings
      (i) EMBIG bond spreads
      (ii) Estimated restructuring probability (probit regression)
    - No overlap with restructuring
    - Debt distress being cured (an interval of at least 2 years)

Data: Expenditure Consolidation

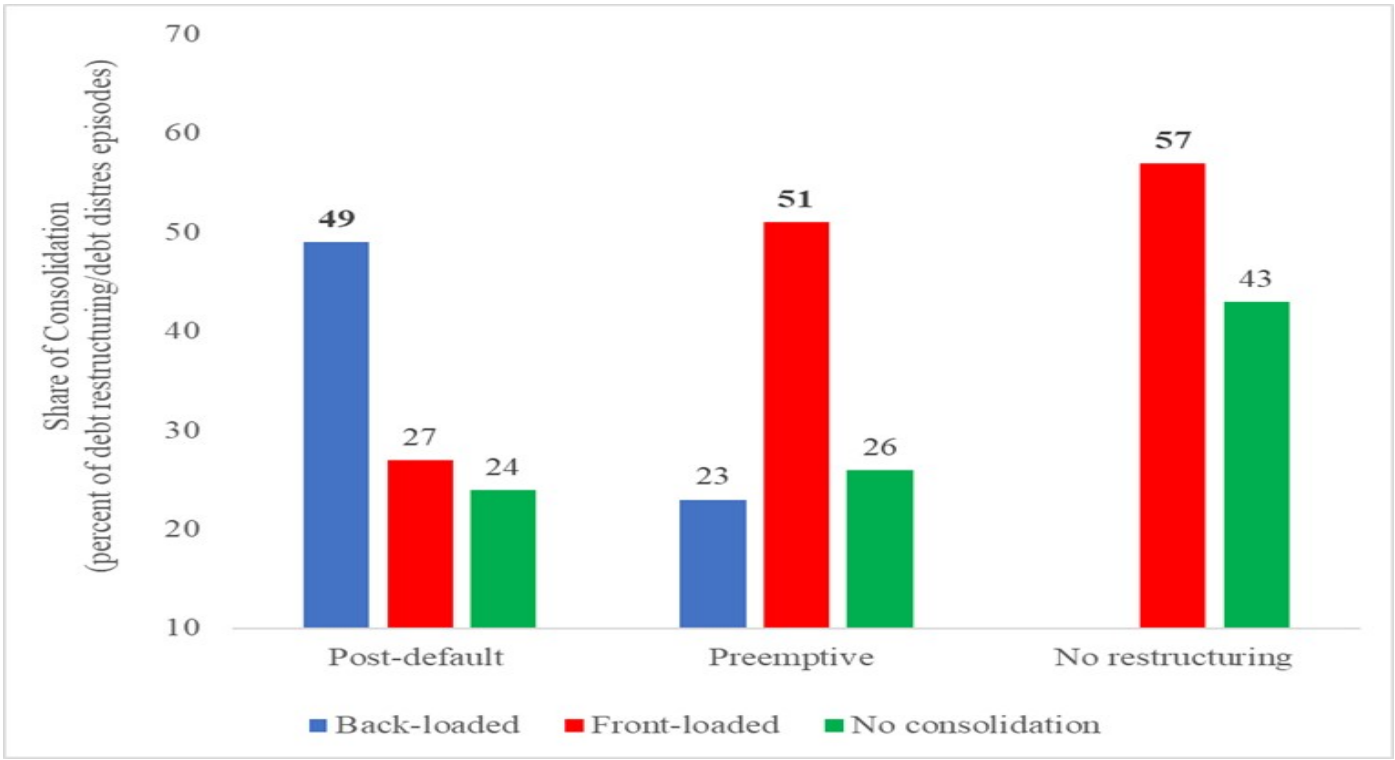
- Public expenditure composition data - Asonuma and Joo (2021)
  - Consumption, transfers, investment and capital in 1975–2020
- Expenditure consolidation:
  - Alesina and Perotti (1997)– *cyclically adjusted* expenditure/GDP
  - Alternative classification – expenditure /*lagged* GDP
  - Criteria:
    1) The indicator falls more than 1.5 percent
    2) It falls at least 1.25 percent a year in two consecutive years
- Front- and back-loaded expenditure consolidation
  - Front-loaded – prior to start of restructuring (year t-2, or t-1)
  - Back-loaded – after start of restructuring (year t, t+1,. . .)

Data: Strategies of Consolidation and Restructurings

- 8 strategies of expenditure consolidation and debt restructuring
  - Post-default + back-loaded consolidation
  - Post-default + front-loaded consolidation
  - Post-default + no consolidation
  - Preemptive + back-loaded consolidation
  - Preemptive + front-loaded consolidation
  - Preemptive + no consolidation
  - Debt distress/no restructuring + front-loaded consolidation
  - Debt distress/no restructuring + no consolidation
- 3 dominant strategies

Stylized Facts on Expenditure Consolidation

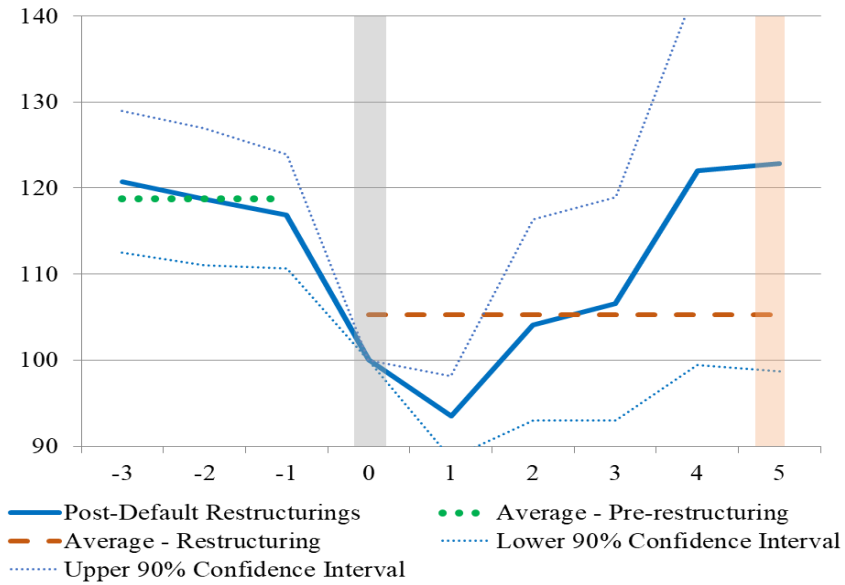
- **Stylized Fact 1**: Three strategies of expenditure consolidation and debt restructuring are dominant



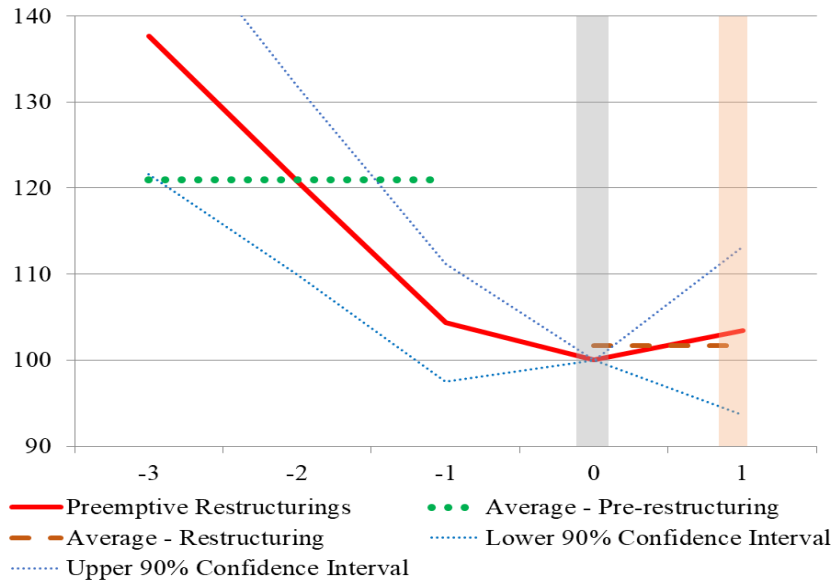
Stylized Facts on Expenditure Consolidation

- **Stylized Fact 2**: Public investment declines sharply ex ante in preemptive cases, while ex post in post-default cases
- **Stylized Fact 3**: Debt settlement takes place before recoveries in public investment in preemptive cases, while after in post-default cases

(a) Post-default Restructurings

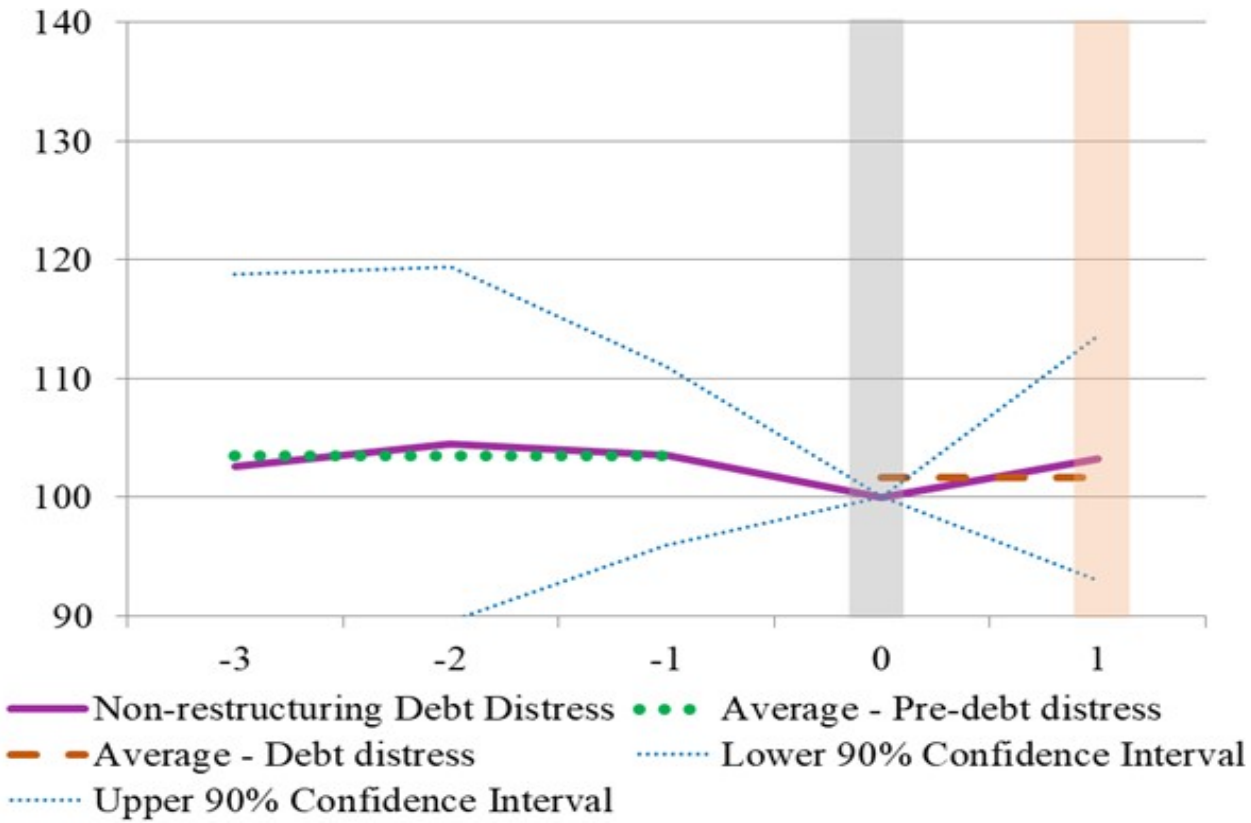


(b) Preemptive Restructurings



Stylized Facts on Expenditure Consolidation

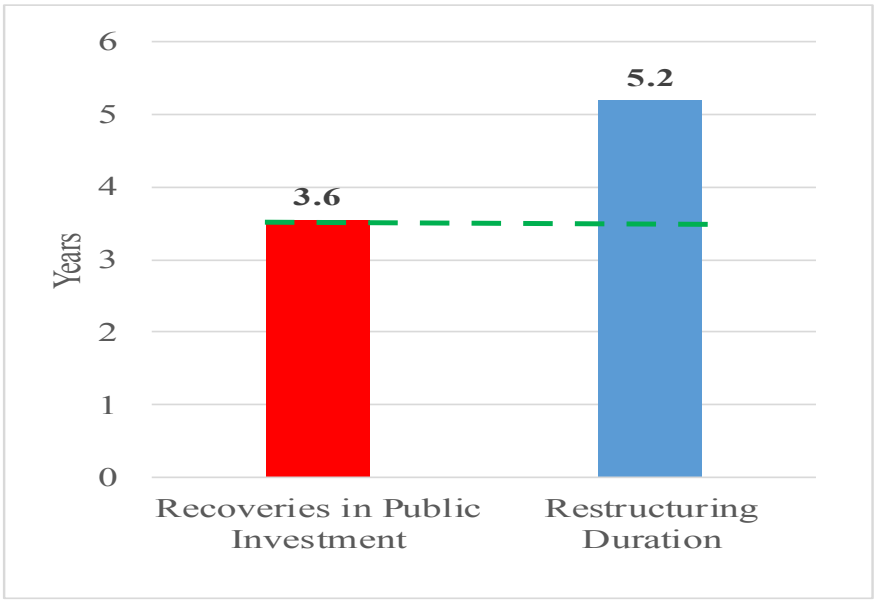
(c) Non-restructuring Debt Distress



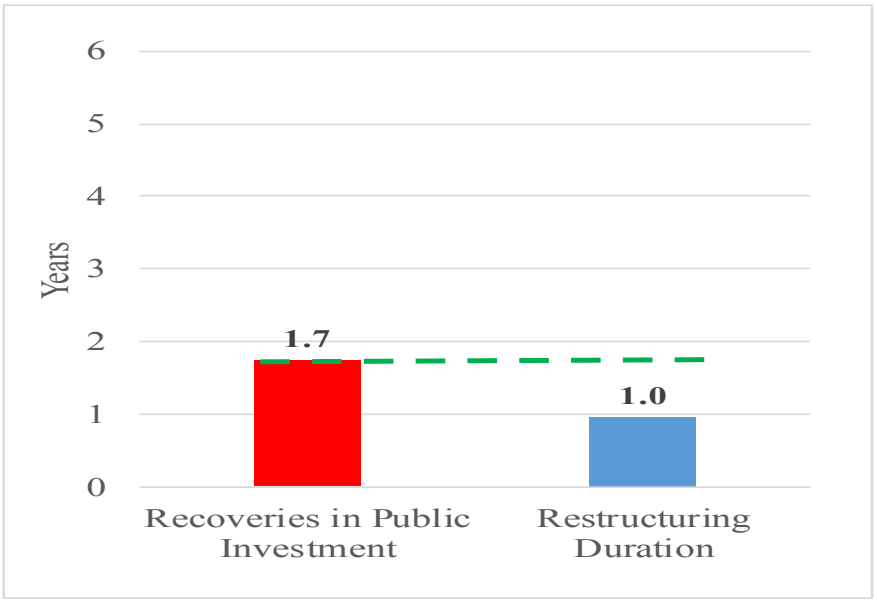
Stylized Facts on Expenditure Consolidation

- **Stylized Fact 4**: Recoveries in public investment are shorter in preemptive cases than in post-default cases

(a) Post-default restructurings



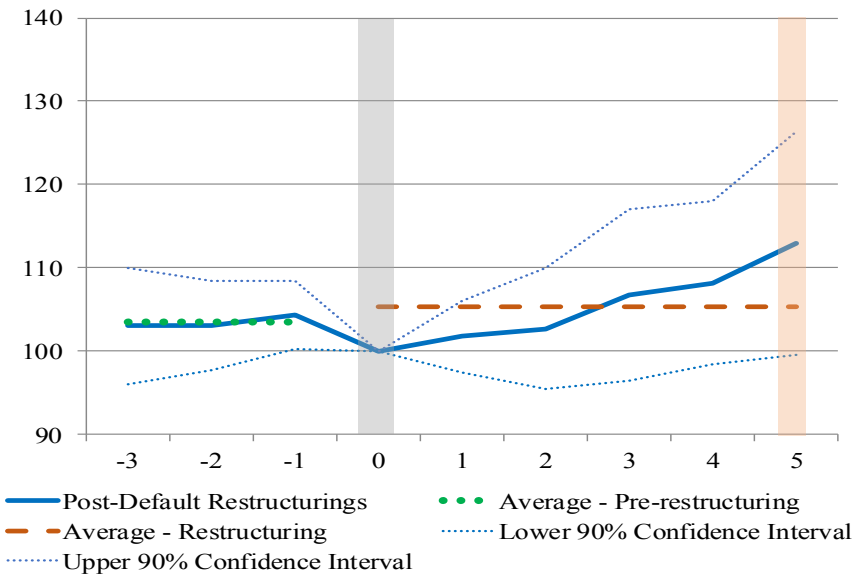
(b) Preemptive restructurings



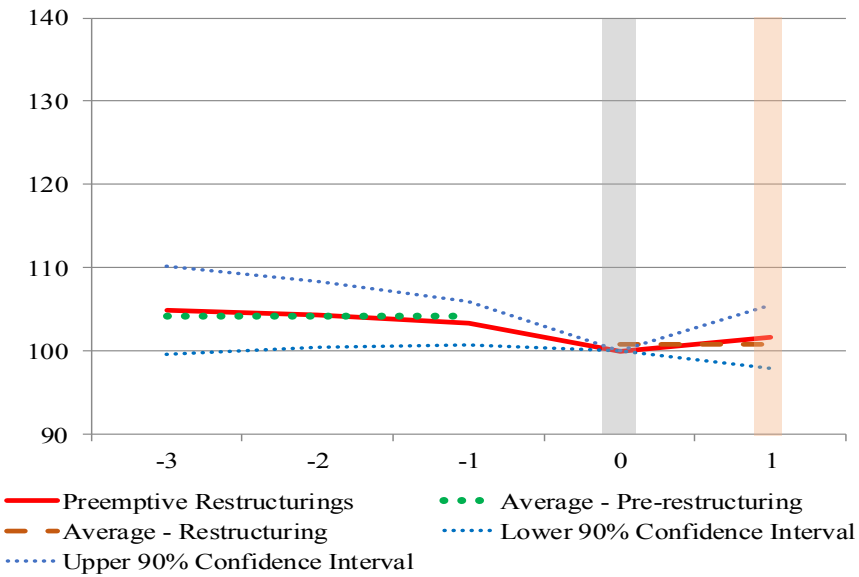
Stylized Facts on Expenditure Consolidation

- **Stylized Fact 5**: Public consumption and transfers decline temporarily ex post and recover quickly in both cases

(a) Post-default restructurings

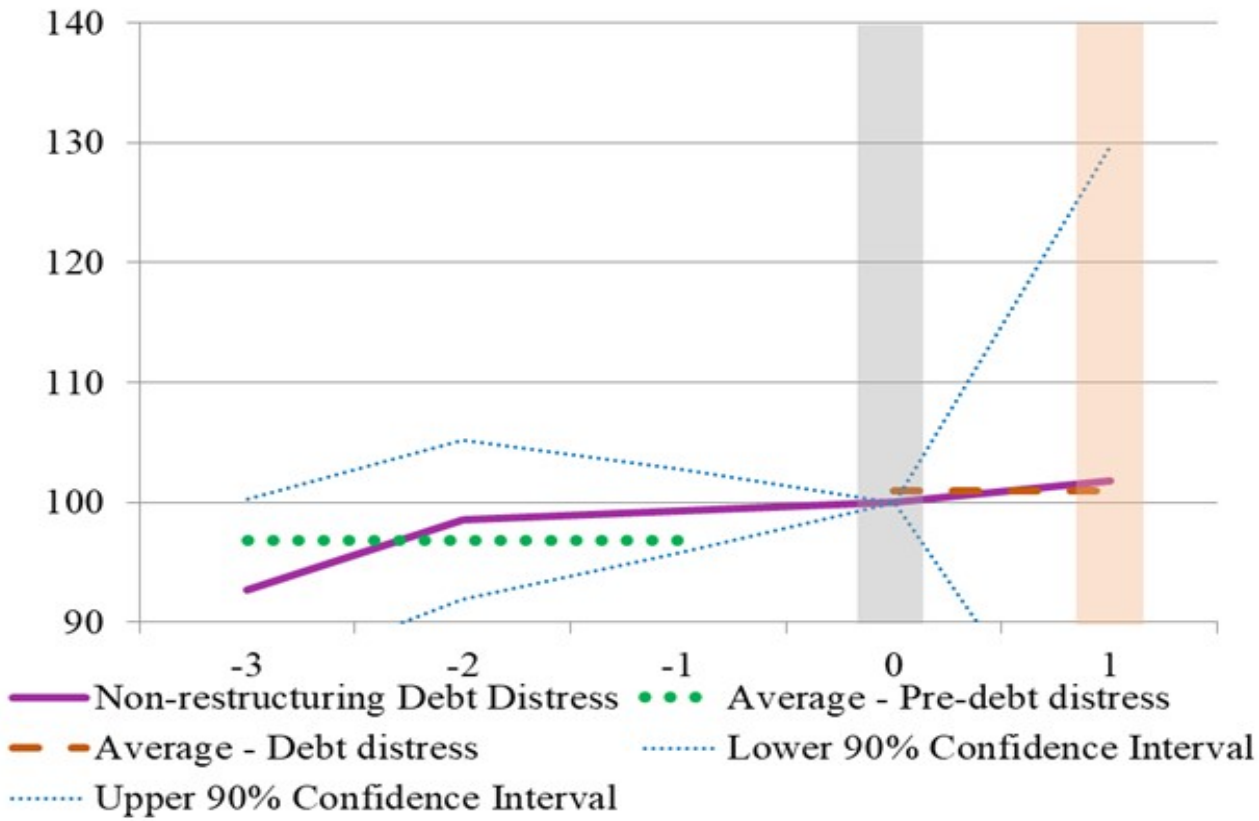


(b) Preemptive restructurings



Stylized Facts on Expenditure Consolidation

(c) Non-restructuring Debt Distress



Main Questions

- Why front-loaded consolidation is associated with a preemptive restructuring, while back-loaded consolidation is associated with a post-default restructuring?
- Why is not more expenditure consolidation front-loaded, if it accompanies with quick debt resolution (i.e., preemptive)?

Literature Review

- Fiscal austerity (consolidation)
  - Alesina et al. (2019), Vegh et al. (2019), Guajardo et al. (2014)
  - Ours: Outcomes of two types of expenditure consolidation
- Sovereign debt/default and fiscal policy
  - Cuadra et al. (2010), Arellano and Bai (2017), Hatchondo et al. (forthcoming), Bianchi et al. (2020)
  - Ours: Front-loaded expenditure consolidation (i.e., prior to debt crises)
- Different types of sovereign defaults/debt restructurings
  - Arellano et al. (2019), Hatchondo et al. (2014), Asonuma and Trebesch (2016)
  - Ours: Joint choice on expenditure consolidation and restructuring

Theoretical Findings

- Preemptive restructurings take place when probability of future default is high
  - Creditors accept debt relief because it increases expected repayment
  - move to the "good side (upward sloping) of the debt Laffer curve"
- Preemptive restructurings
  - are predictable, so public investment starts falling earlier on (front-loaded) resulting in larger effective costs of default.
  - associate with smaller TFP losses, so public investment does not fall afterward (quick recovery)
- Defaults/post-default restructurings take place when there is a large, unexpected negative TFP shock
  - *Why unexpected?* because otherwise there would have been a preemptive restructuring before the shock
- Defaults/Post-default restructurings
  - are unpredictable, so public investment does not start falling earlier on
  - associate with larger TFP losses, so public investment falls sharply (back-loaded)

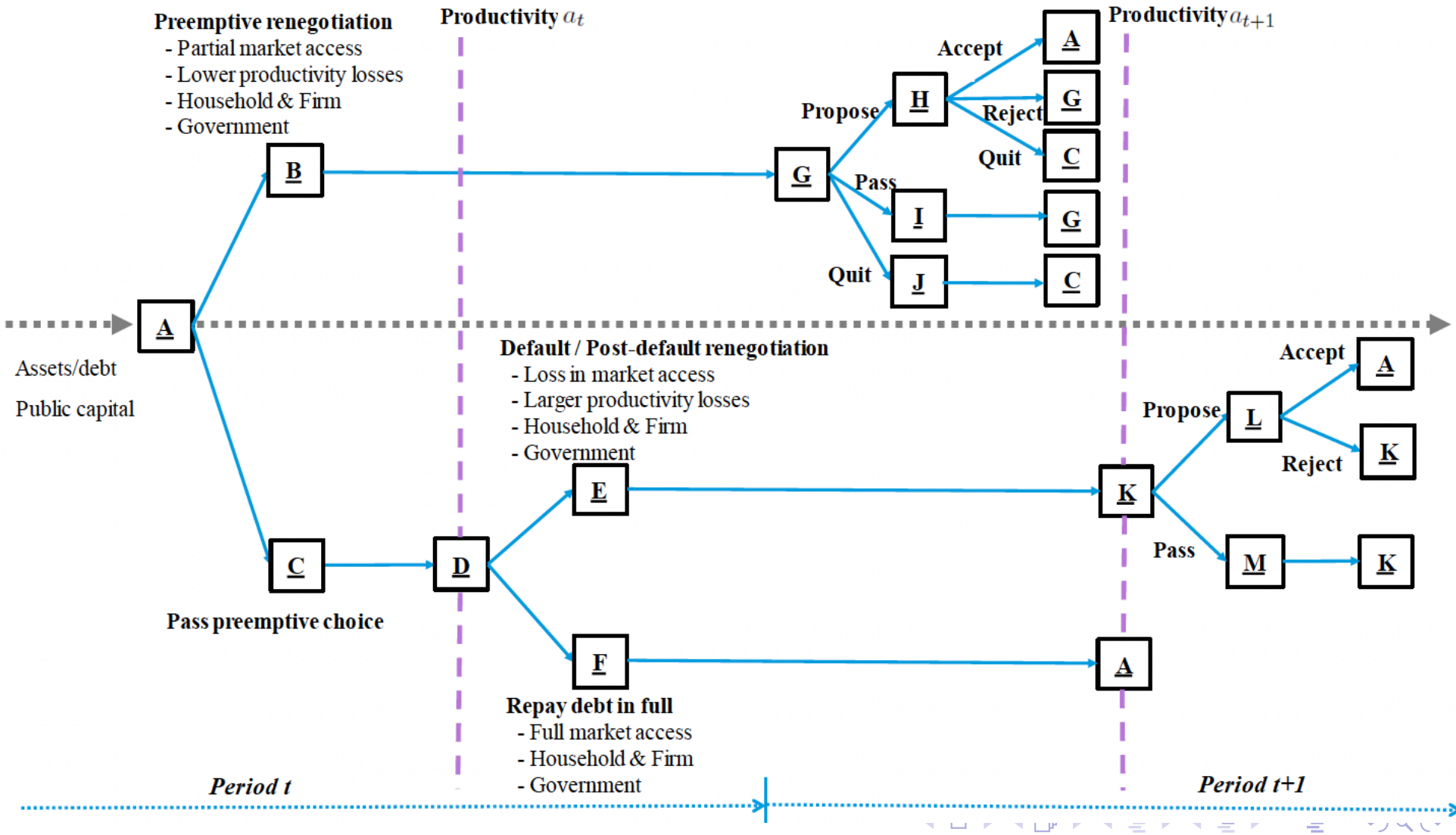
Model: General Features

- Sovereign debt in a dynamic small open economy model:
  - Endogenous ex ante choice of preemptive option and passing it
  - Endogenous ex post choice of default and repayment
  - Endogenous choice of settlement and delays conditional on preemptive option and default
  - Endogenous choice of public expenditure (i.e., consolidation)—public consumption, investment, transfers and debt repayments
  - Endogenous production with labor and public capital

Model: General Features

- A risk averse sovereign debtor, a household, a private firm and risk-neural foreign creditors
- A stochastic TFP shock a_t
- Distortionary consumption tax and no lump-sum tax
- Credit record h_t : indicating status of market access
- Incomplete capital market: one-period zero-coupon bonds
- One-side commitment
- Two types of debt renegotiations:
  - Preemptive - multi-round before TFP realization
  - Post-default - multi-round after TFP realization

Model: Timing



Model: Household's Problem

- Household maximization problem

$$\max_{c_t, l_t} E_0 \sum_{t=0}^{\infty} \beta^t U(c_t, l_t, g_t)$$

$$s.t. \quad (1+\tau)c_t = w_t l_t + \pi_t^F + T_t \tag{1}$$

  where $U(c_t, l_t, g_t) = (1-\omega)u(c_t, l_t) + \omega v(g_t)$

- Optimality condition of household

$$\frac{u_l(c_t, l_t)}{u_c(c_t, l_t)} = \frac{w_t}{1+\tau} \tag{2}$$

Model: Firm's Problem

- Production function

$$y_t = a_t (l_t)^{\alpha_l} (k_t^g)^{\alpha_k} (\bar{k^p})^{1-\alpha_l-\alpha_k} \tag{3}$$

- Private firm's profit maximization problem:

$$\max_{l_t} \pi_t^F = a_t (l_t)^{\alpha_l} (k_t^g)^{\alpha_k} (\bar{k^p})^{1-\alpha_l-\alpha_k} - w_t l_t \tag{4}$$

  - $\bar{k^p}$ is numeraire (Mendoza and Yue 2012)
- Optimality condition of the private firm

$$w_t = \alpha_l a_t (l_t)^{\alpha_l - 1} (k_t^g)^{\alpha_k} (\bar{k^p})^{1-\alpha_l-\alpha_k} \tag{5}$$

Model: Sovereign's Problem - Ex Ante

- Ex ante value of sovereign

$$V^{EXANTE}(b_t, k_t^g, 0, a_{t-1}) = max[V^{PRE}(b_t, k_t^g, 0, a_{t-1}), V^{NON\_PRE}(b_t, k_t^g, 0, a_{t-1})] \quad (6)$$

- Ex ante value of taking a preemptive restructuring

$$V^{PRE}(b_t, k_t^g, 0, a_{t-1}) = \max_{g_t, k_{t+1}^g, T_t} \int_A [(1-\omega)u(c_t, l_t) + \omega v(g_t) + \beta\Psi(b_t, k_{t+1}^g, 1, a_t)]d\mu(a_t|a_{t-1}) \quad (7)$$

$$s.t. \quad g_t + k_{t+1}^g + T_t = \tau c_t + (1-\delta^k)k_t^g - \frac{\Omega}{2}\left(\frac{k_{t+1}^g - k_t^g}{k_t^g}\right)^2 k_t^g \quad (8)$$

$$T_t \geq 0 \quad (9)$$

$$\frac{u_l(c_t, l_t)}{u_c(c_t, l_t)} = \frac{\alpha_l \hat{a}_t (l_t)^{\alpha_l - 1}(k_t^g)^{\alpha_k}(\bar{k^p})^{1-\alpha_l-\alpha_k}}{1+\tau} \quad (10)$$

$$(1+\tau)c_t = \hat{y}_t + T_t \quad (11)$$

Model: Sovereign's Problem - Ex Ante

- Ex ante value of passing a preemptive option

$$V^{NON\_PRE}(b_t, k_t^g, 0, a_{t-1}) = \int_A V(b_t, k_t^g, 0, a_t) d\mu(a_t|a_{t-1}) \tag{12}$$

- Preemptive restructuring choice

$$PRE(b_t, k_t^g, 0) = \{a_{t-1} \in A : V^{PRE}(b_t, k_t^g, 0, a_{t-1}) \geq V^{NON\_PRE}(b_t, k_t^g, 0, a_{t-1})\} \tag{13}$$

Model: Sovereign's Problem - Ex Post

- Ex post value of sovereign

$$V(b_t, k_t^g, 0, a_t) = max[V^R(b_t, k_t^g, 0, a_t), V^D(b_t, k_t^g, 0, a_t)] \tag{14}$$

- Ex post value of repayment

$$V^R(b_t, k_t^g, 0, a_t) = \max_{g_t, b_{t+1}, k_{t+1}^g, T_t} (1-\omega)u(c_t, l_t) + \omega v(g_t)$$
$$+\beta \int_A V(b_{t+1}, k_{t+1}^g, 0, a_{t+1}) d\mu(a_{t+1}|a_t) \tag{15}$$

$$s.t.\ (9)\ and\ g_t + k_{t+1}^g + T_t + q(b_{t+1}, k_{t+1}^g, 0, a_t)b_{t+1} = \tau c_t + (1-\delta^k)k_t^g - \frac{\Omega}{2}\left(\frac{k_{t+1}^g - k_t^g}{k_t^g}\right)^2 k_t^g + b_t \tag{8a}$$

$$\frac{u_l(c_t, l_t)}{u_c(c_t, l_t)} = \frac{\alpha_l a_t (l_t)^{\alpha_l - 1} (k_t^g)^{\alpha_k} (\bar{k^p})^{1-\alpha_l-\alpha_k}}{1+\tau} \tag{10a}$$

$$(1+\tau)c_t = y_t + T_t \tag{11a}$$

Model: Sovereign's Problem - Ex Post

- Ex post value of defaulting (post-default restructuring)

$$V^D(b_t, k_t^g, 0, a_t) = \max_{g_t, k_{t+1}^g, T_t} (1-\omega)u(c_t, l_t) + \omega v(g_t)$$

$$+\beta \int_A V((1+r^*)b_t, k_{t+1}^g, 2, a_{t+1}) d\mu(a_{t+1}|a_t) \quad (16)$$

$$s.t. \quad (8),\ (9)\ and$$

$$\frac{u_l(c_t, l_t)}{u_c(c_t, l_t)} = \frac{\alpha_l \tilde{a}_t (l_t)^{\alpha_l - 1} (k_t^g)^{\alpha_k} (\bar{k^p})^{1-\alpha_l-\alpha_k}}{1+\tau} \quad (14a)$$

$$(1+\tau)c_t = \tilde{y}_t + T_t \quad (15a)$$

- Default/post-default restructuring choice

$$D(b_t, k_t^g, 0) = \{a_t \in A : V^R(b_t, k_t^g, 0, a_t) < V^D(b_t, k_t^g, 0, a_t)\} \quad (17)$$

Model: Renegotiation Problem

- Preemptive vs. post-default renegotiations
  - Symmetric in bargaining game and power
  - Timing: Prior to vs. after TFP realization
  - Sovereign's outside options: Non-preemptive option vs. permanent autarky
  - Creditors' outside options: Ex ante expected return vs. zero recovery rates
- Strategies of the proposer i and the other party j (for $i, j = B, L$) depending on state, current offer and types of debt renegotiations:
  - Post-default renegotiations

$$\theta_i = \{1 \quad (propose)\} \quad \& \quad \theta_j = \{1 \quad (accept)\}$$

$$\theta_i = \{0 \quad (pass)\} \quad \& \quad \theta_j = \{0 \quad (reject)\}$$

  - Preemptive renegotiations

$$\theta_i = \{1 \quad (propose)\} \quad \& \quad \theta_j = \{1 \quad (accept)\}$$

$$\theta_i = \{0 \quad (pass)\} \quad \& \quad \theta_j = \{0 \quad (reject)\}$$

$$\theta_i = \{-1 \quad (quit)\} \quad \& \quad \theta_j = \{-1 \quad (quit)\}$$

Model: Post-default Renegotiation

- Case when the borrower B is the proposer
- If B proposes and the proposal is accepted,

$$V^{PRO}(b_t, k_t^g, 2, a_t) = \max_{g_t, k_{t+1}^g, T_t} (1-\omega)u(c_t, l_t) + \omega v(g_t) + \beta \int_A V(0, k_{t+1}^g, 0, a_{t+1}) d\mu(a_{t+1}|a_t) \quad (22)$$

$$s.t.\ (9),\ (10b),\ (11b)\ and$$

$$g_t + k_{t+1}^g + T_t = \tau c_t + (1-\delta^k)k_t^g - \frac{\Omega}{2}\left(\frac{k_{t+1}^g - k_t^g}{k_t^g}\right)^2 k_t^g + \alpha_t^B b_t \quad (8b)$$

$$V^{*ACT}(b_t, k_t^g, 2, a_t) = -\alpha_t^B b_t \quad (23)$$

Model: Post-default Renegotiation (cont.)

- If B passes,

$$V^{PASS}(b_t, k_t^g, 2, a_t) = \max_{g_t, k_{t+1}^g, T_t} (1-\omega)u(c_t, l_t) + \omega v(g_t) + \beta \int_A V((1+r^*)b_t, k_{t+1}^g, 2, a_{t+1}) d\mu(a_{t+1}|a_t) \quad (24)$$

$$s.t.\ (8),\ (9),\ (10b),\ and\ (11b)$$

$$V^{*REJ}(b_t, k_t^g, 2, a_t) = \frac{1}{1+r^*} \int_A \Gamma^*((1+r^*)b_t, k_{t+1}^g, 2, a_{t+1}) d\mu(a_{t+1}|a_t) \quad (25)$$

Model: Post-default Renegotiation (cont.)

- Equilibrium

$$\alpha_t^{B*} = argmax V^{PRO}(b_t, k_t^g, 2, a_t)$$
$$s.t. \quad V^{PRO}(b_t, k_t^g, 2, a_t) \geq V^{PASS}(b_t, k_t^g, 2, a_t)$$
$$V^{*ACT}(b_t, k_t^g, 2, a_t) \geq V^{*REJ}(b_t, k_t^g, 2, a_t) \tag{26}$$

- If both parties reach an agreement,

$$\Gamma^B(b_t, k_t^g, 2, a_t) = V^{PRO}(b_t, k_t^g, 2, a_t)$$
$$\Gamma^{B*}(b_t, k_t^g, 2, a_t) = V^{*ACT}(b_t, k_t^g, 2, a_t) \tag{27}$$

- Otherwise,

$$\Gamma^B(b_t, k_t^g, 2, a_t) = V^{PASS}(b_t, k_t^g, 2, a_t)$$
$$\Gamma^{B*}(b_t, k_t^g, 2, a_t) = V^{*REJ}(b_t, k_t^g, 2, a_t) \tag{27a}$$

- Settlement set for post-default renegotiation

$$R^B(b_t, k_t^g, 2) = \left\{ \begin{array}{c} a_t \in A : V^{PRO}(b_t, k_t^g, 2, a_t) \geq V^{PASS}(b_t, k_t^g, 2, a_t) \\ V^{*ACT}(b_t, k_t^g, 2, a_t) \geq V^{*REJ}(b_t, k_t^g, 2, a_t) \end{array} \right\} \tag{28}$$

Model: Preemptive Debt Renegotiation

- Case when the borrower B is the proposer
- If B proposes and the proposal is accepted,

$$V^{PRO}(b_t, k_t^g, 1, a_{t-1}) = \max_{g_t, k_{t+1}^g, T_t} \int_A [(1-\omega)u(c_t, l_t) + \omega v(g_t) + \beta \int_A V(0, k_{t+1}^g, 0, a_t)] d\mu(a_t|a_{t-1}) \quad (33)$$

$$s.t. \quad (9)\ (10b)\ (11)\ and$$

$$g_t + k_{t+1}^g + T_t = \tau c_t + (1-\delta^k)k_t^g - \frac{\Omega}{2}(\frac{k_{t+1}^g - k_t^g}{k_t^g})^2 k_t^g + \delta_t^B b_t \quad (8d)$$

$$V^{PRO}(b_t, k_t^g, 1, a_{t-1}) \geq V^{NON-PRE}(b_t, k_t^g, 0, a_{t-1}) \quad (34)$$

$$V^{*ACT}(b_t, k_t^g, 1, a_{t-1}) = -\delta_t^B b_t \quad (35)$$

$$s.t.\ V^{*ACT}(b_t, k_t^g, 1, a_{t-1}) \geq (1 - p^D(b_t, k_t^g, 0, a_{t-1})) + p^D(b_t, k_t^g, 0, a_{t-1})\gamma(b_t, k_t^g, 2, a_{t-1})) \quad (36)$$

Model: Preemptive Debt Renegotiation

- If B passes,

$$V^{PASS}(b_t, k_t^g, 1, a_{t-1}) = \max_{g_t, k_{t+1}^g, T_t} \int_A [(1-\omega)u(c_t, l_t) + \omega v(g_t) + \beta \int_A \Psi(b_t, k_{t+1}^g, 1, a_t)] d\mu(a_t|a_{t-1}) \quad (37)$$

$$s.t. \quad (8)\ (9)\ (10)\ (11)\ and$$

$$V^{PASS}(b_t, k_t^g, 1, a_{t-1}) \geq V^{NON-PRE}(b_t, k_t^g, 0, a_{t-1}) \quad (34a)$$

$$V^{*REJ}(b_t, k_t^g, 1, a_{t-1}) = \frac{1}{1+r^*} \int_A \Psi^*(b_t, k_t^g, 1, a_t) d\mu(a_t|a_{t-1}) \quad (38)$$

$$s.t.\ V^{*REJ}(b_t, k_t^g, 1, a_{t-1}) \geq (1 - p^D(b_t, k_t^g, 0, a_{t-1})) + p^D(b_t, k_t^g, 0, a_{t-1})\gamma(b_t, k_t^g, 2, a_{t-1})) \quad (36a)$$

- If B quits,

$$V^{QUIT}(b_t, k_t^g, 1, a_{t-1}) = V^{NON\_PRE}(b_t, k_t^g, 0, a_{t-1}) \quad (39)$$

$$V^{*REJ\_QUIT}(b_t, k_t^g, 1, a_{t-1}) = (1 - p^D(b_t, k_t^g, 0, a_{t-1})) + p^D(b_t, k_t^g, 0, a_{t-1})\gamma(b_t, k_t^g, 2, a_{t-1})) \quad (40)$$

Model: Preemptive Debt Renegotiation

- Equilibrium

$$\delta_t^{B*} = argmax V^{PRO}(b_t, k_t^g, 1, a_{t-1})$$
$$s.t. \quad V^{PRO}(b_t, k_t^g, 1, a_{t-1}) \geq V^{PASS}(b_t, k_t^g, 1, a_{t-1})$$
$$V^{*ACT}(b_t, k_t^g, a_{t-1}) \geq V^{*REJ}(b_t, k_t^g, a_{t-1}) \tag{41}$$

- If both parties reach an agreement,

$$\Psi^B(b_t, k_t^g, 1, a_{t-1}) = V^{PRO}(b_t, k_t^g, 1, a_{t-1})$$
$$\Psi^{B*}(b_t, k_t^g, 1, a_{t-1}) = V^{*ACT}(b_t, k_t^g, 1, a_{t-1}) \tag{42}$$

- Otherwise,

$$\Psi^B(b_t, k_t^g, 1, a_{t-1}) = V^{PASS}(b_t, k_t^g, 1, a_{t-1})$$
$$\Psi^{B*}(b_t, k_t^g, 1, a_{t-1}) = V^{*REJ}(b_t, k_t^g, 1, a_{t-1}) \tag{42a}$$

or

$$\Psi^B(b_t, k_t^g, 1, a_{t-1}) = V^{QUIT}(b_t, k_t^g, 1, a_{t-1})$$
$$\Psi^{B*}(b_t, k_t^g, 1, a_{t-1}) = V^{*REJ\_PRE}(b_t, k_t^g, 1, a_{t-1}) \tag{42b}$$

Model: Preemptive Debt Renegotiation

- Settlement set for preemptive renegotiation

$$R^B(b_t, k_t^g, 1) = \left\{ \begin{array}{r} a_{t-1} \in A : V^{PRO}(b_t, k_t^g, 1, a_{t-1}) \geq V^{PASS}(b_t, k_t^g, 1, a_{t-1}) \\ V^{*ACT}(b_t, k_t^g, 1, a_{t-1}) \geq V^{*REJ}(b_t, k_t^g, 1, a_{t-1}) \end{array} \right\} \quad (43)$$

Model: Creditor's Problem

- Expected profit

$$\pi^c(b_{t+1}, k^g_{t+1}, 0, a_t) = \begin{cases} q(b_{t+1}, k^g_{t+1}, 0, a_t)b_{t+1} - \frac{1}{1+r^*} b_{t+1}, & \text{if } b_{t+1} \geq 0 \\ \frac{\delta(b_{t+1}, k^g_{t+1}, 0, a_t)}{1+r^*}(-b_{t+1}) - q(b_{t+1}, k^g_{t+1}, 0, a_t)b_{t+1} & \text{if } b_{t+1} < 0 \text{ and } a_{t-1} \in PRE(b_t, k^g_t, 0) \\ [\frac{1-p^D(b_{t+1}, k^g_{t+1}, 0, a_t)}{1+r^*} + \\ \frac{p^D(b_{t+1}, k^g_{t+1}, 0, a_t) \int_A \gamma(b_{t+1}, k^g_{t+1}, 1, a_t) d\mu(a_{t+1}|a_t)}{1+r^*}] \\ \times(-b_{t+1}) - q(b_{t+1}, k^g_{t+1}, 0, a_t)(-b_{t+1}), & \text{otherwise} \end{cases} \quad (50)$$

- Equilibrium bond price

$$q(b_{t+1}, k^g_{t+1}, 0, a_t) = \begin{cases} \frac{1}{1+r^*} & \text{if } b_{t+1} \geq 0 \\ \frac{\delta(b_{t+1}, k^g_{t+1}, 0, a_t)}{1+r^*} & \text{if } b_{t+1} < 0 \text{ and } a_{t-1} \in PRE(b_t, k^g_t, 0) \\ \frac{1-p^D(b_{t+1}, k^g_{t+1}, 0, a_t)}{1+r^*} + & \\ \frac{p^D(b_{t+1}, k^g_{t+1}, 0, a_t) \int_A \gamma(b_{t+1}, k^g_{t+1}, 1, a_t) d\mu(a_{t+1}|a_t)}{1+r^*} & \text{otherwise} \end{cases} \quad (53)$$

Quantitative Analysis - Parameters

- TFP - AR(1) process:

$$\log(a_t) = \rho \log(a_{t-1}) + \epsilon_t, \tag{54}$$

- Household utility function - GHH, CRRA:

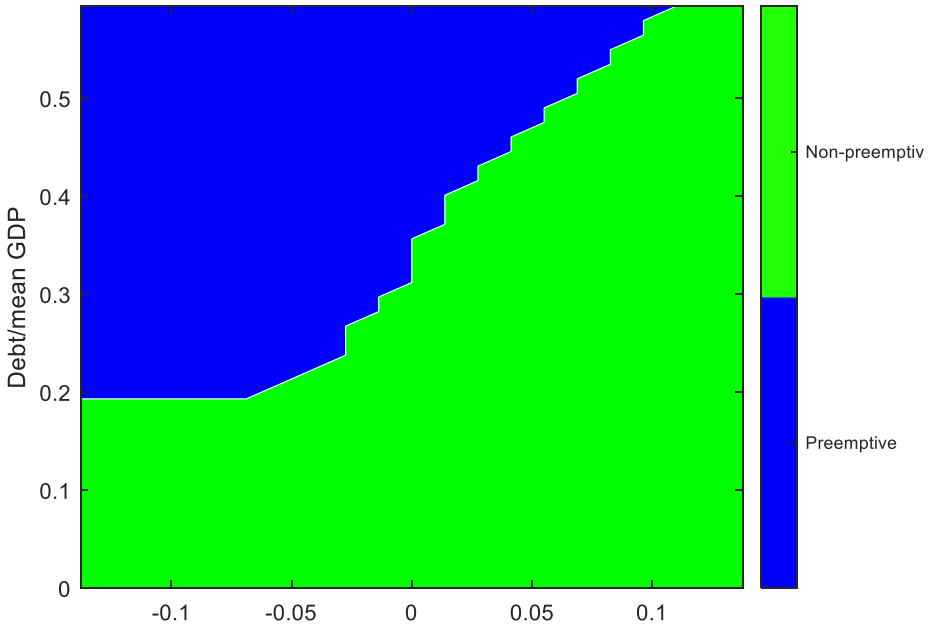
$$u(c_t, l_t) = \frac{(c_t - \frac{l_t^{1+\psi}}{1+\psi})^{1-\sigma}}{1-\sigma}, \qquad v(g_t) = \frac{g_t^{1-\sigma_g}}{1-\sigma_g} \tag{55}$$

Parameter	Value	Source
Risk aversion for private consumption	$\sigma = 3$	Hatchondo et al. (forthcoming)
Risk aversion for public consumption	$\sigma_g = 3$	Hatchondo et al. (forthcoming)
Labor elasticity	$\psi = 0.48$	Mendoza (1991)
Risk-free interest rate	$r^* = 0.01$	Aguiar et al. (2016), Yue (2010) - US Treasury bill rate
Public capital depreciation rate	$\delta^k = 0.04$	US BEA (1999)
Direct productivity loss (post-default)	$\lambda_d = 0.05$	Asonuma and Trebesch (2016) - Computed (ARG)
Direct productivity loss (preemptive)	$\lambda_p = 0.04$	Asonuma and Trebesch (2016) - Computed (URY)
Country-specific parameters		
Weight on public consumption	$\omega = 0.80$ (ARG)/0.80 (URY)	Computed (ARG/URY)
Labor income share	$\alpha^l = 0.64$ (ARG)/0.58 (URY)	Gordon and Guerron-Quintana (ARG)/Computed (URY)
Public capital income share	$\alpha^k = 0.058$ (ARG)/0.11 (URY)	Computed (ARG/URY)
Effective consumption tax rate	$\tau = 0.33$ (ARG)/0.33 (URY)	Computed - IMF WEO (ARG/URY)
Public capital adjustment costs	$\Omega = 10$ (ARG)/10 (URY)	Computed (ARG/URY)
Auto-correlation of productivity shock	$\rho = 0.85$ (ARG) /0.90 (URY)	Computed - MECON (ARG)/ BCU (URY)
Standard deviation of productivity shock	$\sigma^a = 0.017$ (ARG) /0.015 (URY)	Computed - MECON (ARG)/ BCU (URY)
Bargaining power	$\phi = 0.93$ (ARG)/0.70 (URY)	Computed (ARG/URY)
Discount rate	$\beta = 0.80$ (ARG)/0.80 (URY)	Computed (ARG/URY)

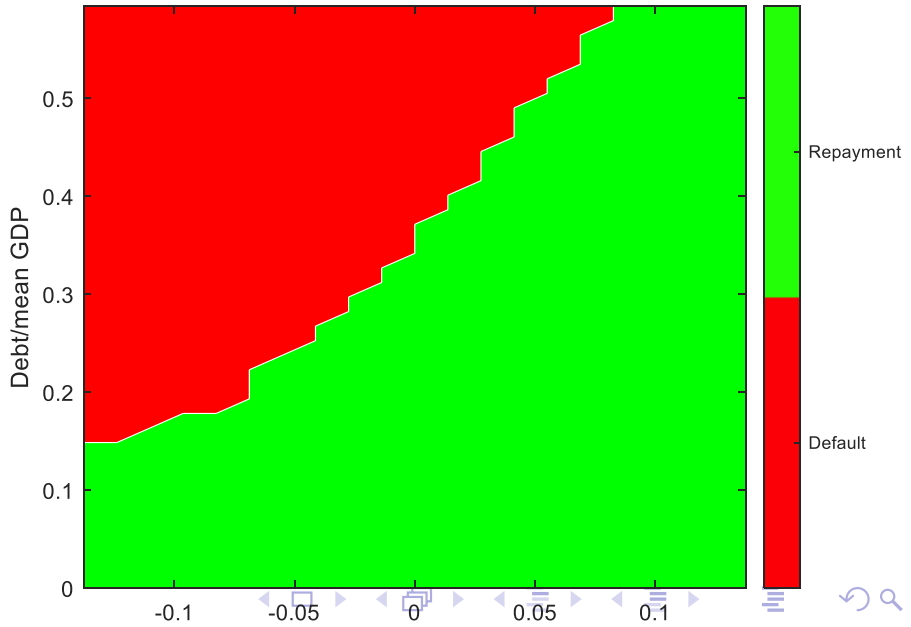
Quantitative Analysis - Ergodic dist.

- Debtor's choice between preemptive and non-preemptive and between repayment and default - Mean public capital
  - Preemptive - when debt is high and TFP is low
  - Default - when debt is high and TFP is low

(a) Choice for Preemptive Restructuring (ex-ante, Uruguay)



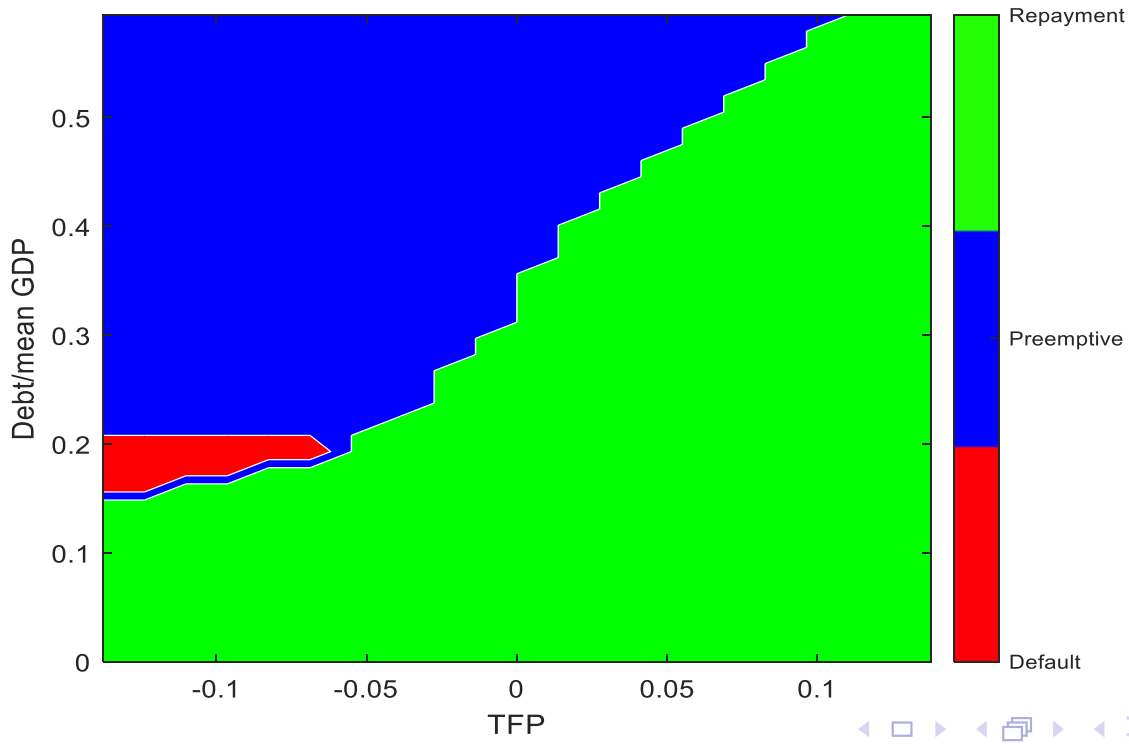
(b) Choice for Default and Repayment (ex post, Uruguay)



Quantitative Analysis - Ergodic dist.

- Debtor's choice among preemptive, default and repayment - Mean public capital
  - Replication of Asonuma and Trebesch (2016)

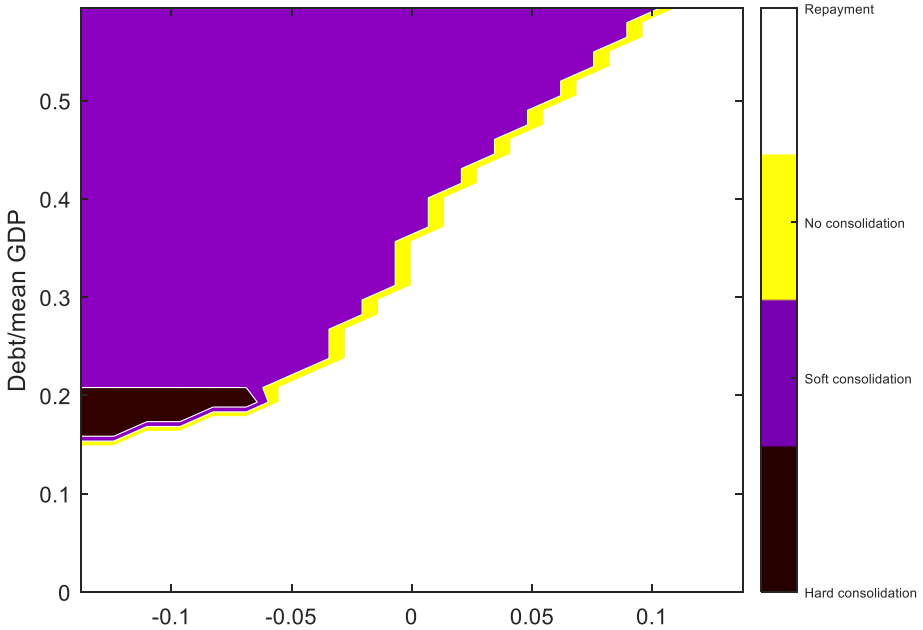
(c) Choice for Preemptive Restructuring, Default and Repayment (Uruguay)



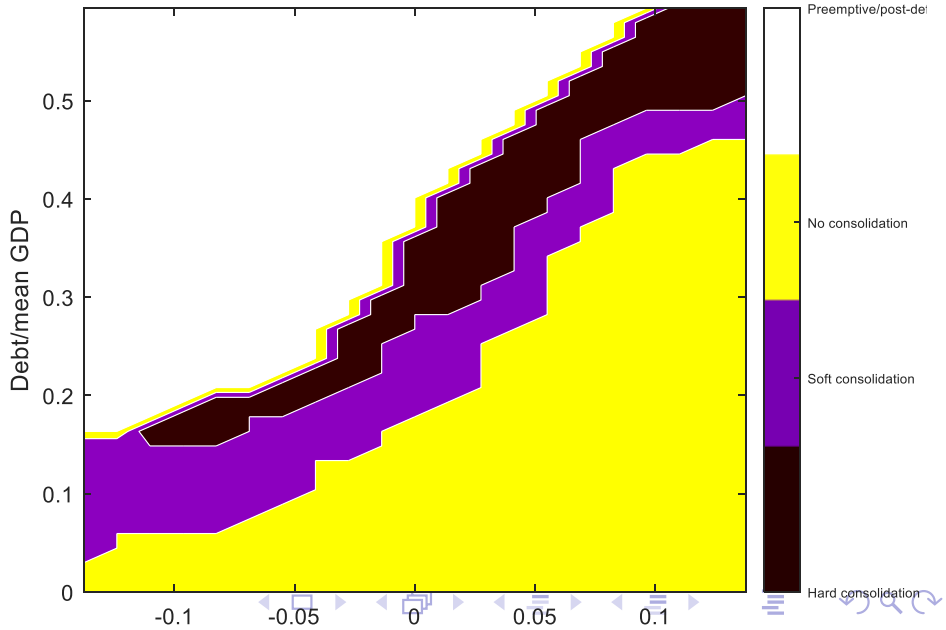
Quantitative Analysis - Ergodic dist.

- Debtor's choice among hard, soft and no expenditure consolidation - Mean public capital
  - Hard consolidation under post-default, soft under preemptive
  - Hard, soft and no consolidation under repayment

(a) Under Intermediate and Bad Credit Records (preemptive/post-default, Uruguay)



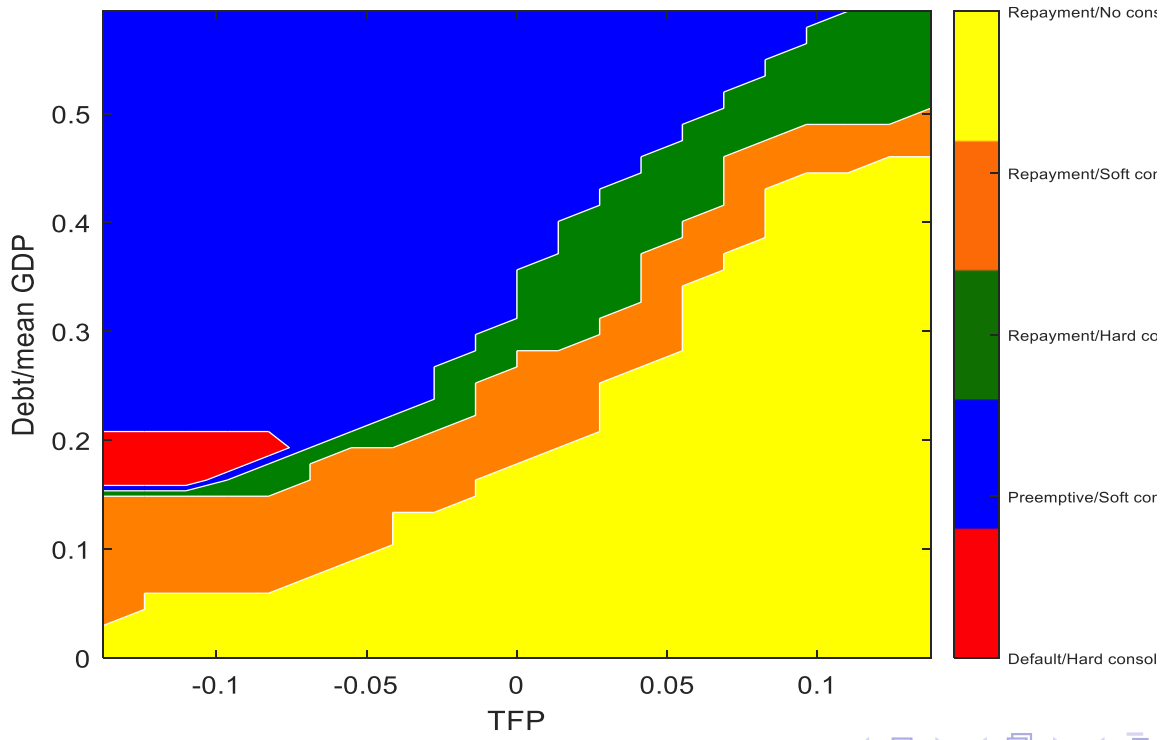
(b) Under Good Credit Record (repayment, Uruguay)



Quantitative Analysis - Ergodic dist.

- Front-loaded (hard) expenditure consolidation & no restructuring (green)
- Back-loaded (hard) expenditure consolidation & post-default (red)

(c) Choice among strategies of expenditure consolidation and restructuring (Uruguay)



Quantitative Analysis - Simulation

(i) Business Cycle Statistics

	Uruguay 2003		Argentina 2001-2005	
	Data	Baseline Model	Data	Baseline Model
Target statistics				
Pre-restructuring period				
Average public consumption & transfers/GDP ratio (%)	19.4	20.5	20.0	22.9
Public investment (std. dev.)/output (std. dev.)	5.8	3.04	5.1	5.9
Restructuring period				
Average output deviation during debt renegotiations (%)	-2.28	-3.0	-3.47	-4.50
Non-target statistics				
Pre-restructuring period				
Public sector				
Public consumption & transfers (std. dev.)/output (std. dev.)	1.09	1.00	1.26	1.23
Corr.(public consumption & transfers, output)	0.35	0.74	0.52	0.85
Average public investment/GDP ratio (%)	4.18	3.70	1.31	1.60
Average public expenditure/GDP ratio (%)	23.5	24.2	21.3	23.5
Average public investment/public expenditure ratio (%)	16.9	14.7	6.2	6.4
Restructuring period				
Public sector				
Public consumption & transfers (std. dev.)/output (std. dev.)	$2.0^{1/}$	0.78	0.99	2.36
Corr.(public consumption & transfers, output)	$1.0^{1/}$	0.89	0.99	0.77
Average public consumption & transfers/GDP ratio (%)	25.2	20.7	20.2	23.3
Average public investment/GDP ratio (%)	3.20	3.25	1.19	1.47
Average public expenditure/GDP ratio (%)	28.4	23.9	21.3	24.7
Average public investment/public expenditure ratio (%)	11.2	15.8	5.7	5.9
Expenditure consolidation choice	front-loaded	front-loaded	back-loaded	back-loaded

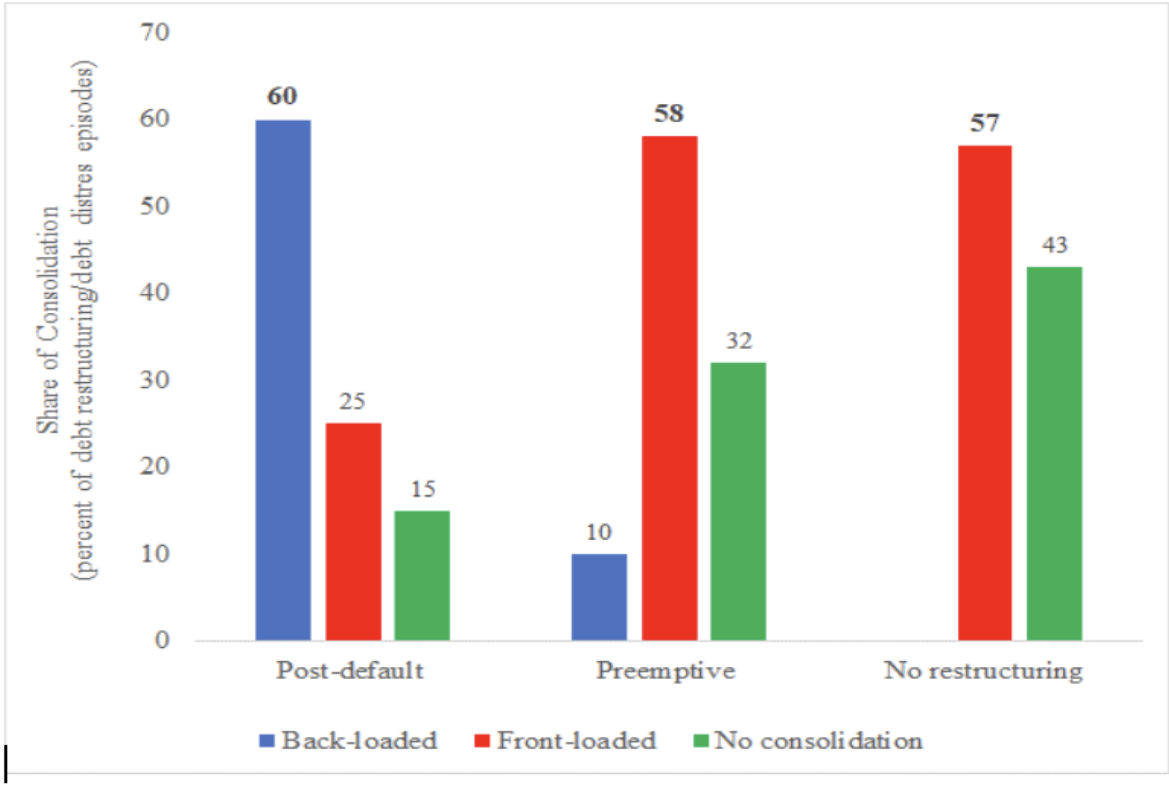
Quantitative Analysis - Simulation

(ii) Non-business Cycle Statistics

	Uruguay 2003		Argentina 2001-2005	
	Data	Baseline Model	Data	Baseline Model
Target statistics				
Default probability (%)	3.26	3.03	3.26	3.05
Average recovery rate (%)	87.1	83.0	25.0	27.1
Pre-restructuring period				
Average debt/GDP ratio (%)	59.1	48.0	45.4	44.7
Bond spreads: average (%)	7.7	1.03	9.4	1.65
Bond spreads: std. dev. (%)	5.1	1.50	7.6	2.25
Corr.(debt/GDP, spreads)	1.00	0.11	0.92	0.18
Restructuring period				
Restructuring strategy	preemptive	preemptive	post-default	post-default
Average debt/GDP ratio (%)	130.5	51.6	130.5	50.7
Duration of renegotiations/ exclusion (quarters)	1.0	4.3	14.0	11.2
Average public investment recovery (quarterly) from t-1 to pre-restructuring level	10.3	7.5	12.0	8.5

Quantitative Analysis - Simulation

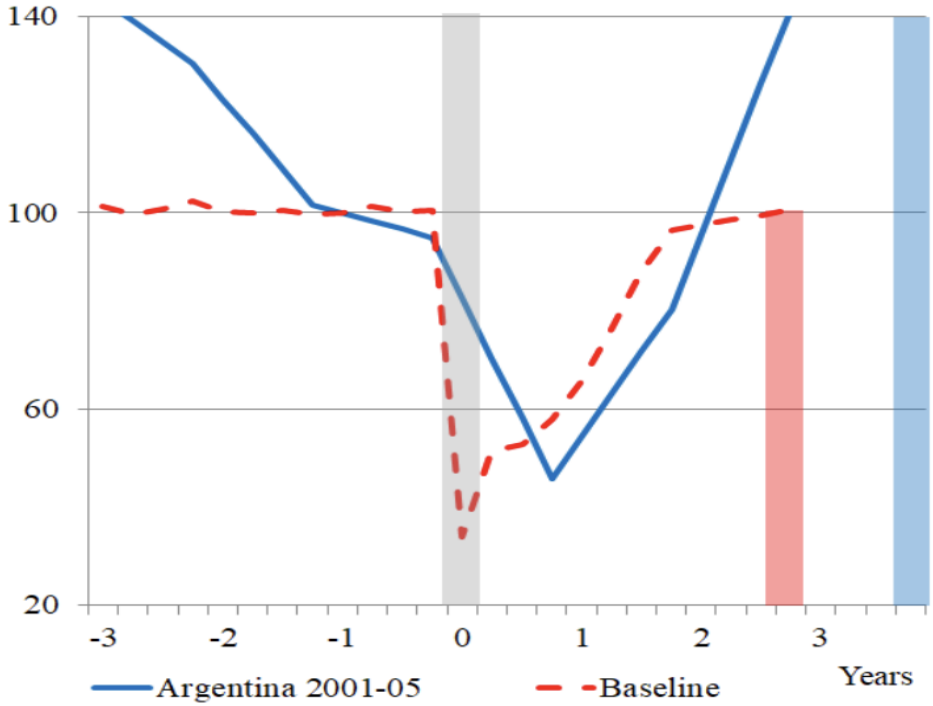
- Strategies of expenditure consolidation and debt restructuring



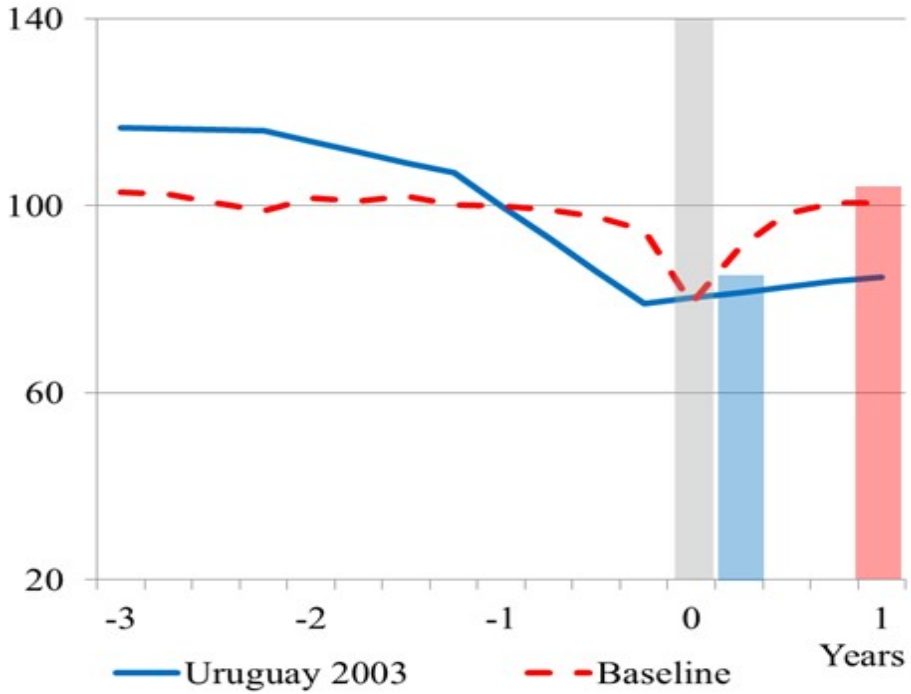
Quantitative Analysis - Simulation

- Public investment around debt restructuring and debt distress

(a) Post-default Restructuring (Argentina)



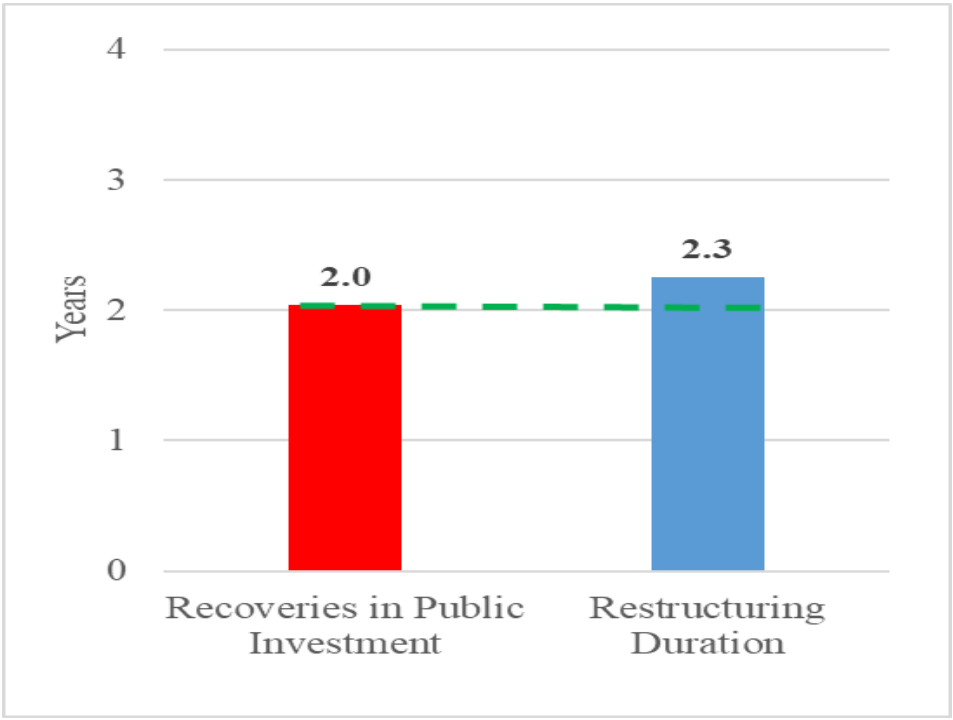
(b) Preemptive Restructuring (Uruguay)



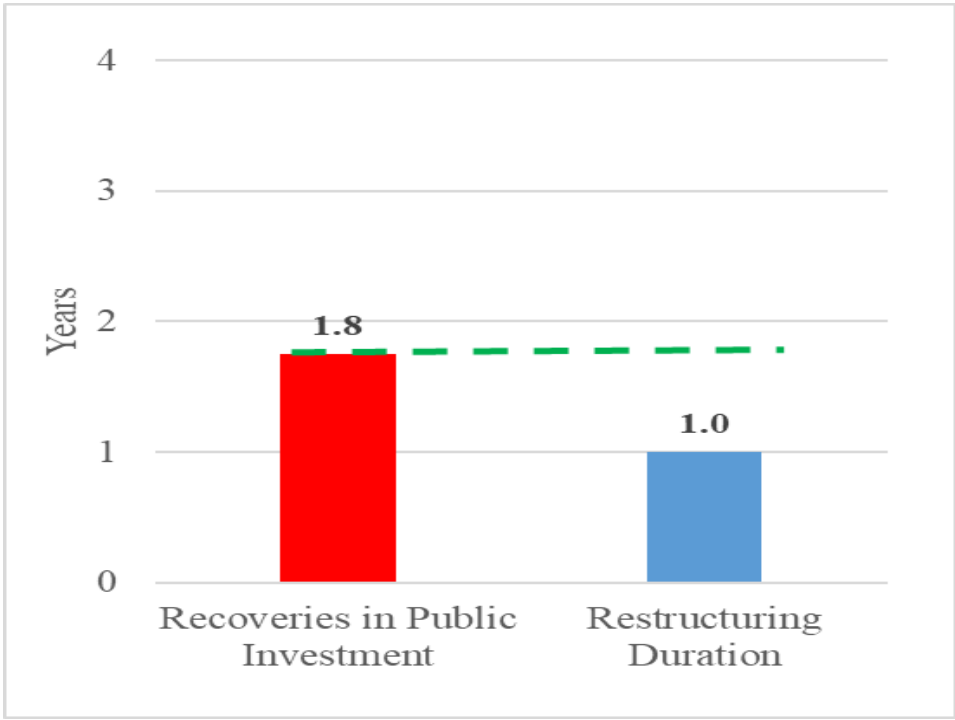
Quantitative Analysis - Simulation

- Recoveries in public investment and restructuring duration

(a) Post-default Restructuring (Argentina)



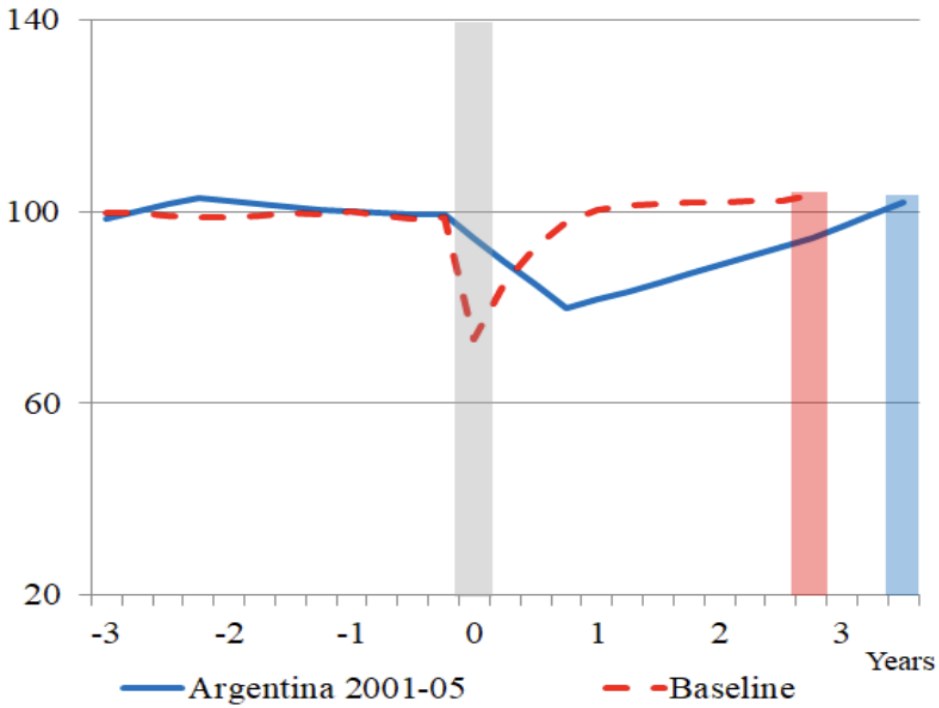
(b) Preemptive Restructurings (Uruguay)



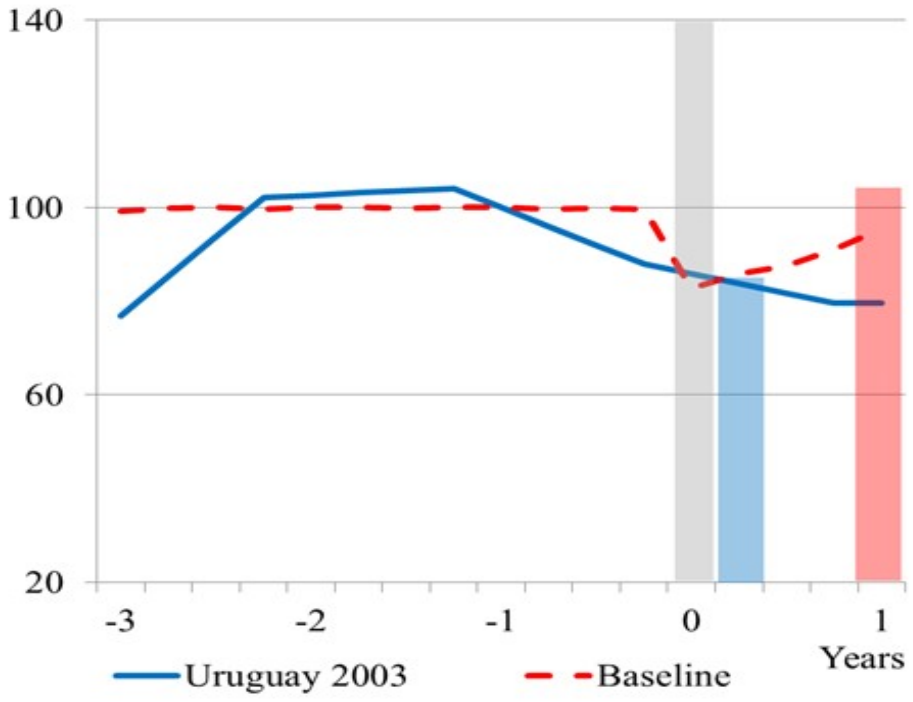
Quantitative Analysis - Simulation

- Public Consumption and Transfers around Restructurings and Debt Distress

(a) Post-default Restructuring (Argentina)



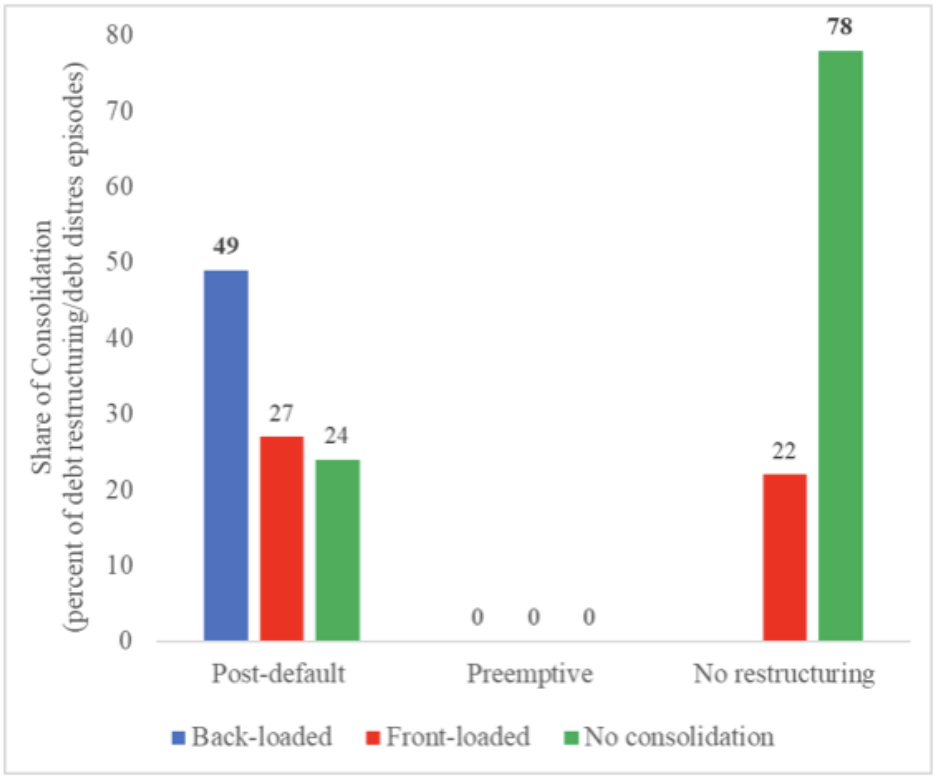
(b) Preemptive Restructuring (Uruguay)



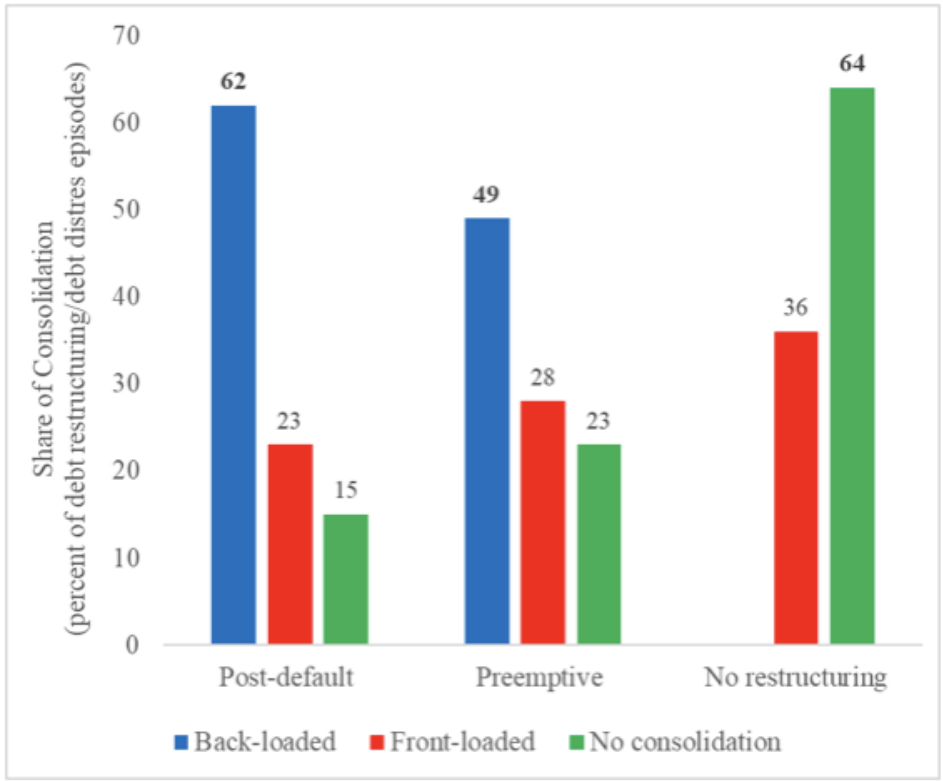
Two Key Determinants

- Role of preemptive restructuring choice and public capital

(i) No Preemptive Restructuring Choice



(ii) Fixed Public Capital



Conclusion

- New data and stylized facts on expenditure consolidation and debt restructurings
- New theoretical explanation on sovereign debt crises and resolution
  - Choice between front- and back-loaded consolidation
  - Role of two types of expenditure consolidation in sovereign debt crises and resolution
- Quantitative analysis of model rationalizes the stylized facts