

# FISCAL AUSTERITY AND SOVEREIGN DEBT RELIEF

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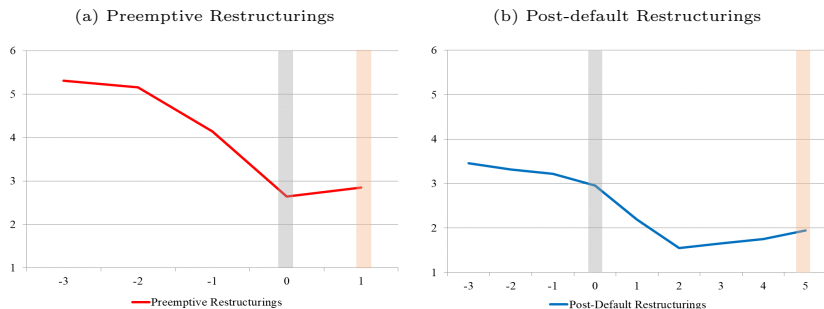
# OVERVIEW OF THE PAPER

- Empirical, theoretical and quantitative analysis of fiscal austerity and sovereign debt
- Two main contributions to the literature on fiscal austerity and sovereign debt:
  - New stylized facts on fiscal consolidation and sovereign debt restructurings
  - New theoretical explanation on the role of two types of fiscal consolidation in sovereign debt crises and resolution

# MOTIVATION

- Public capital dynamics and length of restructurings
  - Sharp declines before restructurings (preemptive) vs. after restructurings (post-default)
  - Short (preemptive) vs. long duration of restructurings (post-default)

FIGURE: Public Capital Growth Rate (percent)



# RESTRUCTURING STRATEGIES

- Asonuma and Trebesch (2016) classification of debt restructuring strategies

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	Post-default	Weakly preemptive	Strictly preemptive
Is the restructuring after a default?	Yes	No	No
Is there any missed payment?	Yes	Yes	No
		Only temporarily (no unilateral default)	

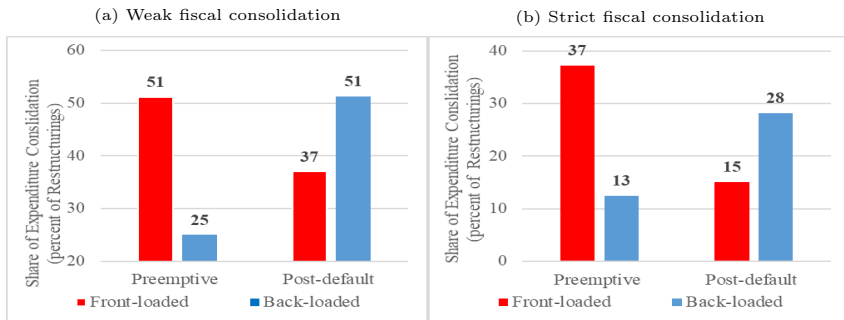
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- 179 sovereign debt restructurings in 1978–2010
  - Post-default restructurings: 111 episodes (62% of total)
  - Preemptive restructurings: 68 episodes (38% of total)

- Asonuma and Joo (2020) public expenditure composition dataset
  - Consumption, transfers, investment and capital
- Front-loaded consolidation
  - *Weak*: reduction in public expenditure-to-GDP ratio from year  $t-3$  to  $t-1$
  - *Strict*: reduction in public expenditure-to-GDP ratio in both years  $t-2$  and  $t-1$
- Back-loaded consolidation
  - *Weak*: reduction in public expenditure-to-GDP ratio from year  $t-1$  to  $t+1$  (from year  $t$  to  $t+2$ ) with no reduction in previous year
  - *Strict*: reduction in public expenditure-to-GDP ratio in both years  $t$  and  $t+1$  ( $t+1$  and  $t+2$ ) with no reduction in previous year

# STYLIZED FACTS ON FISCAL CONSOLIDATION

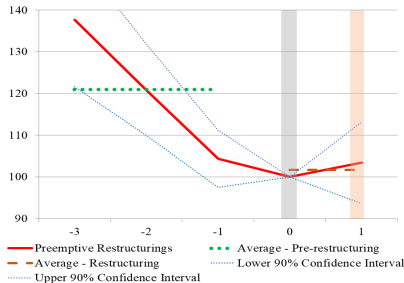
- **Stylized Fact 1:** Front-loaded consolidation is more frequent in preemptive restructurings, while back-loaded consolidation in post-default episodes



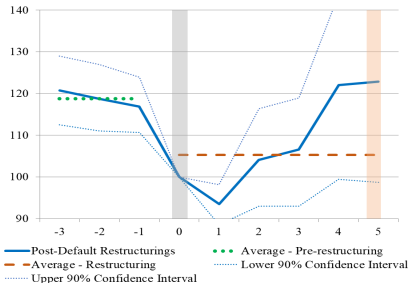
# STYLIZED FACTS ON FISCAL CONSOLIDATION

- **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) Preemptive Restructurings



(b) Post-default Restructurings

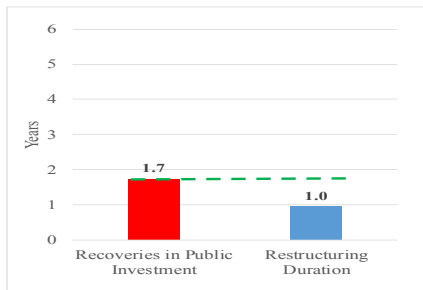




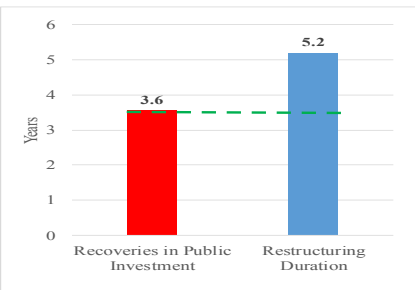
## STYLIZED FACTS ON FISCAL CONSOLIDATION (CONT.)

- **Stylized Fact 4:** Recoveries in public investment are shorter in preemptive cases than in post-default cases
  - Recoveries in public investment are longer than restructuring duration for preemptive cases, while shorter for post-default cases

(a) Preemptive restructurings



(b) Post-default restructurings



## STYLIZED FACTS ON FISCAL CONSOLIDATION (CONT.)

- **Stylized Fact 1:** Front-loaded consolidation is more frequent in preemptive restructurings, while back-loaded consolidation in post-default episodes
- **Stylized Fact 2:** Public investment declines sharply ex ante in preemptive cases, while ex post in post-default case
- **Stylized Fact 3:** Debt settlement takes place before recoveries in public investment in preemptive cases, while after in post-default cases
- **Stylized Fact 4:** Recoveries in public investment are shorter in preemptive cases than in post-default cases

- **Main questions**

- Why front-loaded fiscal consolidation precedes preemptive restructurings, while back-loaded fiscal consolidation comes together with default and post-default restructurings?
- What are consequences of front- and back-loaded fiscal consolidation, respectively?
  - Default / restructuring choice – preemptive, default or repayment
  - Crisis resolution – debt settlement / delay

## IMPLICATIONS OF THE PAPER

- New stylized facts on fiscal consolidation and sovereign debt restructurings
- New theoretical explanation on sovereign debt crises and resolution:
  - Two types of fiscal consolidation
  - Role of fiscal consolidation in sovereign debt crises and resolution (front-loaded and back-loaded)
- Quantitative analysis of model rationalizes the stylized facts

- **Choice between front- and back-loaded consolidation:**  
“Gambling for resurrection”
  - Ex ante choice between front-loaded and no consolidation
    - Front-load consolidation: Certain on likelihood of default
    - No consolidation: Expecting high TFP shocks (i.e., gambling)
  - Ex post choice: back-loaded consolidation up on low TFP shocks
- **Consequence of front- and back-loaded consolidation:**  
Endogenous fiscal constraint and public capital
  - Front-loaded (ex ante) consolidation
    - Preemptive: Hedging incentive under low public capital (i.e. increases in effective cost of post default)
    - Quick settlement: Relaxation of fiscal constraint
  - Back-loaded (ex post) consolidation
    - Default / post-default: Low TFP shocks
    - Delay: Fiscal constraint and slow capital accumulation

- Fiscal austerity (consolidation)
  - Alesina et al. (2015), Vegh et al. (2019), Guajardo et al. (2014)
  - Ours: Combined fiscal consolidation/debt relief strategies
- Sovereign debt/default and fiscal policy
  - Cuadra et al. (2010), Arellano and Bai (2017), Hatchondo et al. (2019), Bianchi et al. (2020)
  - Ours: Fiscal policy around preemptive restructurings
- Different types of sovereign defaults/debt restructurings
  - Arellano et al. (2019), Hatchondo et al. (2014), Asonuma and Trebesch (2016)
  - Ours: Two different types of fiscal consolidation

## MODEL: GENERAL FEATURES

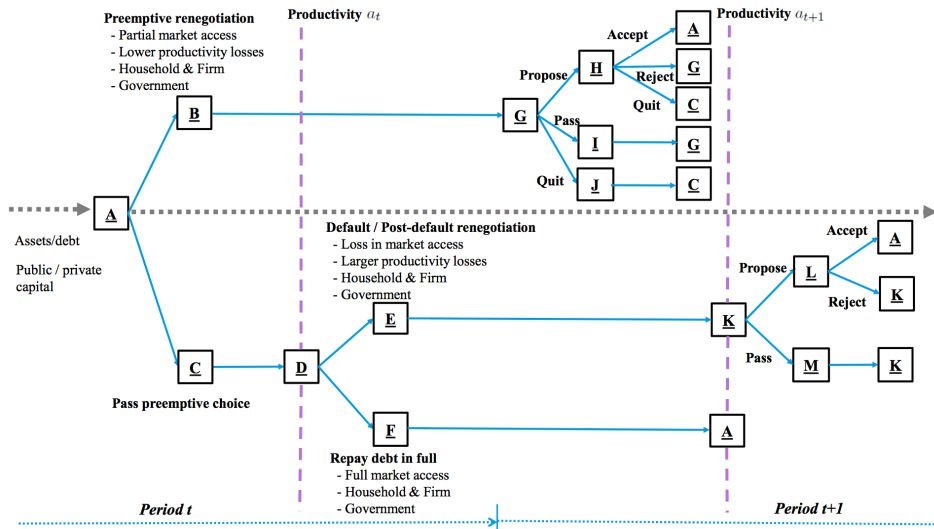
- Sovereign debt in a dynamic small open economy model:
  - Endogenous ex ante choice of preemptive option and passing it
  - Endogenous ex post choice of default and repayment
  - Endogenous choice of settlement and delays conditional on preemptive option and default
  - Endogenous choice of public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

## MODEL: GENERAL FEATURES (CONT.)

- A risk averse sovereign debtor, a household, a private firm and risk-neutral 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

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

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

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

- Optimality condition of household

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

## MODEL: FIRM'S PROBLEM

- Production function

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

- Private firm's profit maximization problem:

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

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

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

# MODEL: SOVEREIGN'S PROBLEM - GOOD CREDIT RECORD

- **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

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

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

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

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

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

## MODEL: SOVEREIGN'S PROBLEM - GOOD CREDIT RECORD

- Ex ante value of passing a preemptive option

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

- Preemptive restructuring choice

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

# MODEL: SOVEREIGN'S PROBLEM - GOOD CREDIT RECORD

- **Ex post** value of sovereign

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

- **Ex post** value of repayment

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

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

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

$$(1 + \tau)c_t = y_t + T_t \quad (11a)$$

## MODEL: SOVEREIGNS EX POST PROBLEM (CONT.)

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

$$V^D(b_t, k_t^g, 0, a_t) = \max_{g_t, k_{t+1}^g, T_t} (1 - \lambda)u(c_t, l_t) + \lambda v(g_t) \\ + \beta \int_A V((1 + r^*)b_t, k_{t+1}^g, 2, a_{t+1})d\mu(a_{t+1}|a_t) \quad (16)$$

s.t. (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

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

# 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

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

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

- Preemptive renegotiations

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

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

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



## MODEL: POST-DEFAULT RENEGOTIATION

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

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

*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,

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

*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

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

- If both parties reach an agreement,

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

- Otherwise,

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

- Settlement set for post-default renegotiation

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

# MODEL: PREEMPTIVE DEBT RENEGOTIATION

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

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

s.t. (9) (10b) (11) and

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

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

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

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

# MODEL: PREEMPTIVE DEBT RENEGOTIATION (CONT.)

- If B passes,

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

s.t. (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

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

- If both parties reach an agreement,

$$\begin{aligned}\Psi^B(b_t, k_t^g, 1, a_{t-1}) &= V^{PRO}(b_t, k_t^g, 1, a_{t-1}) \\ \Psi^{B*}(b_t, k_t^g, 1, a_{t-1}) &= V^{*ACT}(b_t, k_t^g, 1, a_{t-1})\end{aligned}\quad (42)$$

- Otherwise,

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

or

$$\begin{aligned}\Psi^B(b_t, k_t^g, 1, a_{t-1}) &= V^{QUIT}(b_t, k_t^g, 1, a_{t-1}) \\ \Psi^{B*}(b_t, k_t^g, 1, a_{t-1}) &= V^{*REJ-PRE}(b_t, k_t^g, 1, a_{t-1})\end{aligned}\quad (42b)$$

# MODEL: CREDITOR'S PROBLEM

- Expected profit

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

- Equilibrium bond price

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

# QUANTITATIVE ANALYSIS - PARAMETERS

- TFP - AR(1) process:

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

- Household utility function - GHH, CRRA:

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

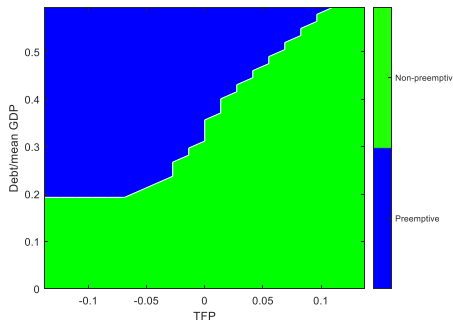
Parameter	Value	Source
Risk aversion for private consumption	$\sigma = 3$	Hatchondo et al. (2017)
Risk aversion for public consumption	$\sigma_g = 3$	Hatchondo et al. (2017)
Risk-free interest rate	$r^* = 0.01$	Aguiar et al. (2016), Yue (2010) - US Treasury bill rate
Labor elasticity	$\psi = 0.455$	Mendoza (1991)
Labor income share	$\alpha^l = 0.64/0.58$	Computed - Argentina/Uruguay
Public capital income share	$\alpha^k = 0.058/0.11$	Computed - Argentine/Uruguay public capital income share
Private and public capital depreciation rate	$\delta^k = 0.04$	US BEA (1999)
Effective consumption tax rate	$\tau = 0.33$	Computed - Argentine tax revenues (IMF WEO)
Auto-correlation of productivity shock	$\rho = 0.85$	Computed - Argentine GDP (MECON)
Standard deviation of productivity shock	$\sigma^a = 0.017$	Computed - Argentine GDP (MECON)
Direct productivity loss – post default	$\lambda_d = 0.05$	Computed - Argentina
Direct productivity loss – preemptive	$\lambda_p = 0.04$	Computed - Uruguay
Weight on public consumption	$\lambda = 0.8$	Computed
Private and public capital adjustment costs	$\Omega = 10$	Computed
Discount rate	$\beta = 0.80$	Computed
Bargaining power	$\phi = 0.93/0.70$	Computed - Argentina/Uruguay



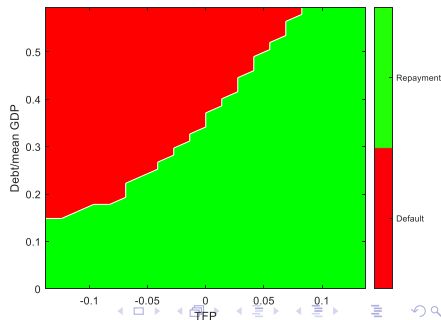
## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- 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) - URY



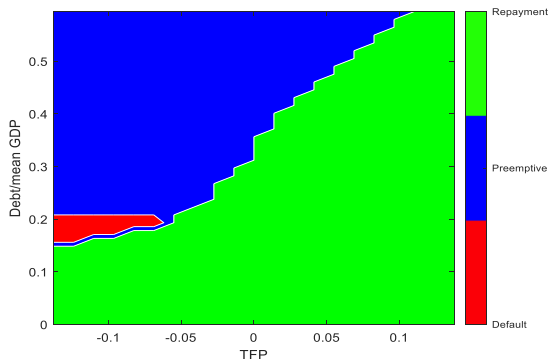
(b) Choice for Default and Repayment  
(ex post) - URY



## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Debtor's choice between preemptive and non-preemptive and between repayment and default - Mean public capital
  - Asonuma and Trebesch (2016)

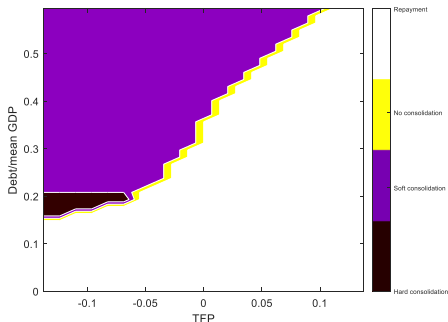
(c) Choice for Preemptive Restructuring,  
Default and Repayment - URY



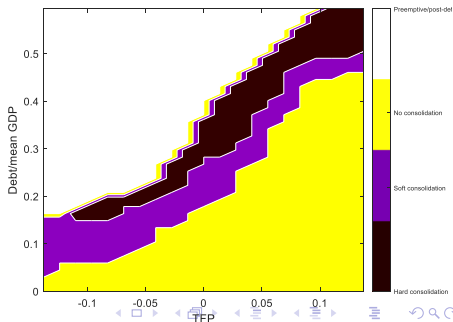
## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Debtor's choice among hard, soft and no fiscal 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 and post-default) - URY



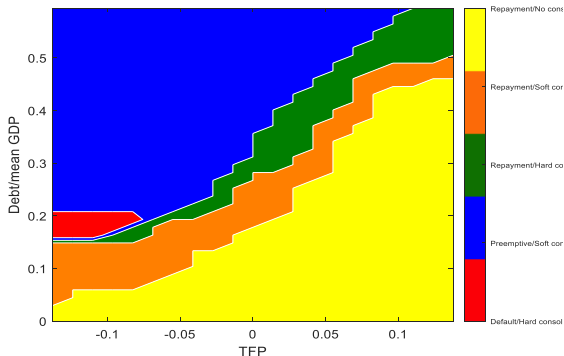
(b) Under Good Credit Record (repayment) - URY



## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Front-loaded fiscal consolidation (hard - green)
- Back-loaded fiscal consolidation (hard/post-default - red)

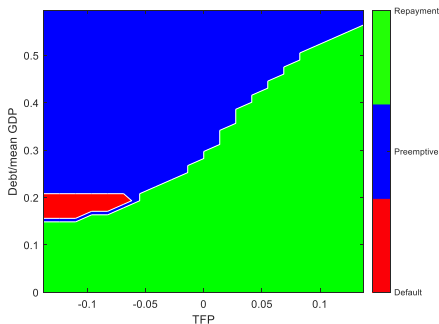
(d) Choice among front-loaded (hard, soft) and back-loaded (hard, soft) fiscal consolidation-URY



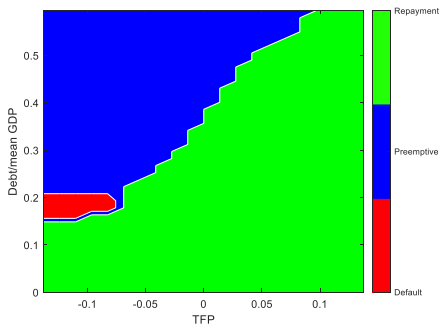
## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Choice of repayment, preemptive and default/post-default next period conditional on front-loaded consolidation

(a) Conditional on Front-loaded Hard Consolidation  
- URY



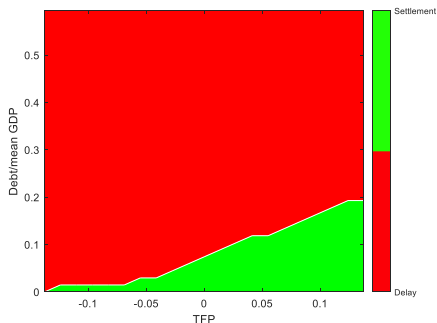
(b) Conditional on No Front-loaded Consolidation  
- URY



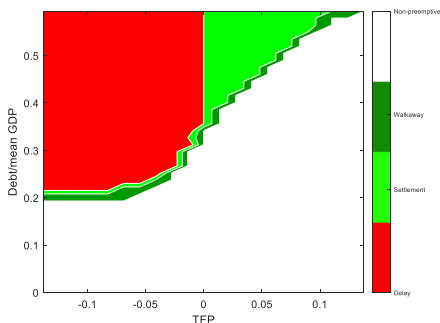
## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Choice of settlement and delay conditional on front-loaded and back-loaded consolidation

(a) Conditional on back-loaded consolidation (post-default) - URY

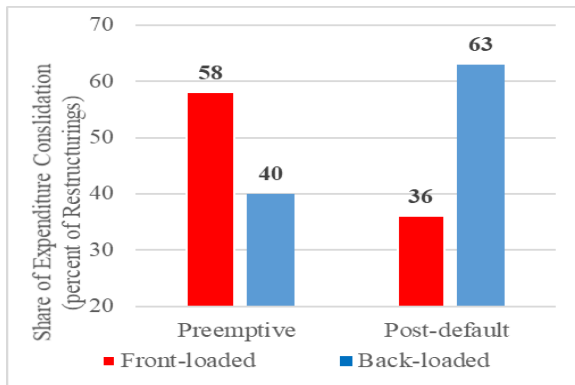


(b) Conditional on front-loaded consolidation (preemptive) - URY



# QUANTITATIVE ANALYSIS - SIMULATION

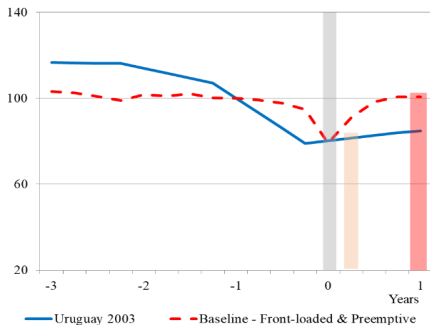
- Share of fiscal consolidation



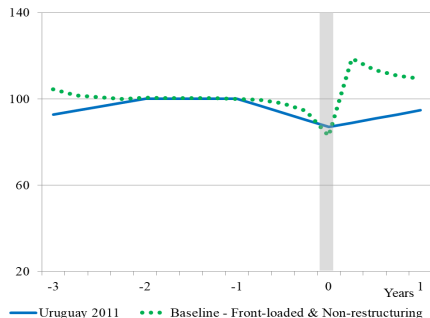
# QUANTITATIVE ANALYSIS - SIMULATION

## Public investment around debt restructuring and debt distress

(a) Front-loaded & Preemptive—URY

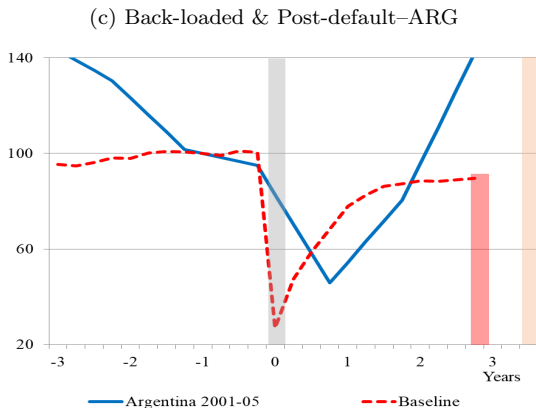


(b) Front-loaded & No restructuring—URY





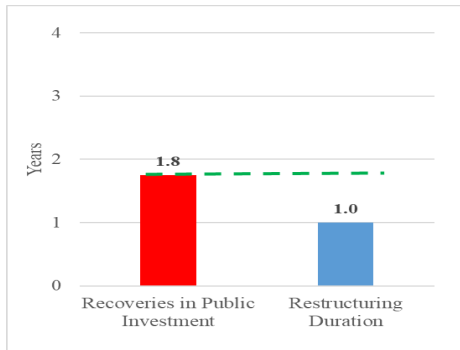
- Public investment around debt restructuring and debt distress



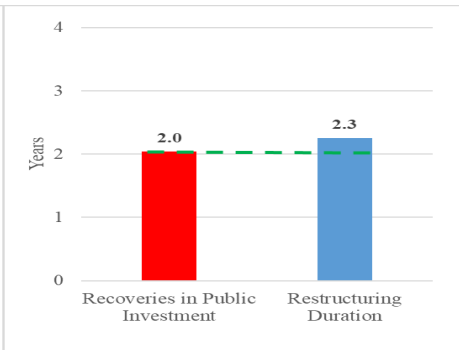
# QUANTITATIVE ANALYSIS - SIMULATION

- Recoveries in public investment and restructuring duration

(a) Preemptive Restructurings—URY



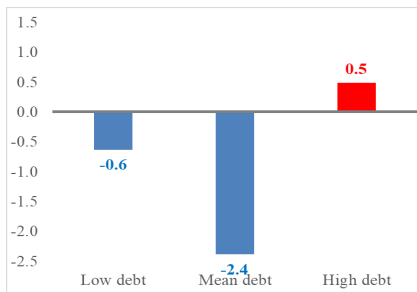
(b) Post-default Restructuring—ARG



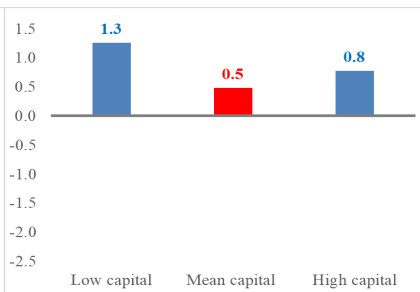
## WELFARE ANALYSIS—SIMULATION

- Average welfare gains in terms of consumption equivalent net of disutility of labor (%): Durdu et al. (2013)
- Two models:
  - Baseline with preemptive
  - Model without preemptive—only post-default

(a) Mean public capital



(b) High debt



# CONCLUSION

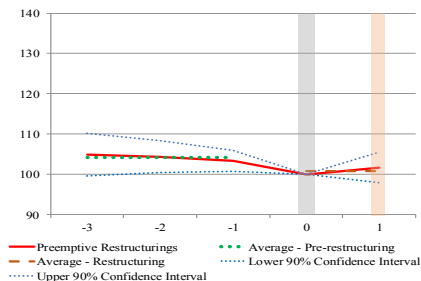
- New stylized facts on fiscal expenditure consolidation and sovereign debt restructurings
- New theoretical explanation on sovereign debt crises and resolution:
  - Two types of fiscal expenditure consolidation
  - Role of fiscal expenditure consolidation in sovereign debt crises and resolution (front-loaded and back-loaded)
- Quantitative analysis of model rationalizes the stylized facts

- Data
  - *Debt distress event*: High restructuring probability but no actual restructuring
  - Fiscal consolidation/debt restructuring strategies: definition and classification
- Stylized fact
  - Option C: Front-loaded consolidation & **Non-restructuring**
- Quantitative analysis
  - Welfare analysis

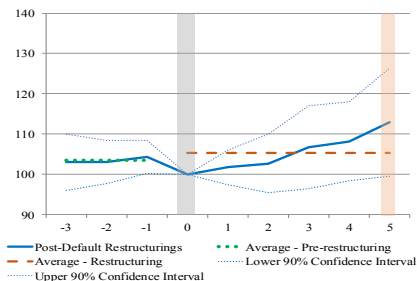
## STYLIZED FACTS ON FISCAL CONSOLIDATION (CONT.)

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

(a) Consolidation with preemptive restructurings



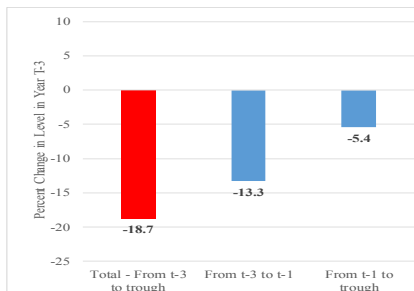
(b) Consolidation with post-default restructurings



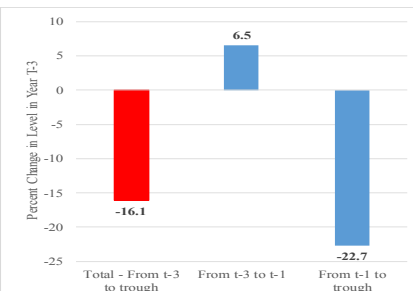
## STYLIZED FACTS ON FISCAL CONSOLIDATION (CONT.)

- Ex ante (front-loaded) declines in public investment are dominant in preemptive cases, while ex post (back-loaded) declines in public investment in post-default cases

(a) Preemptive Restructurings



(b) Post-default Restructurings



# PUBLIC EXPENDITURE COMPOSITION

- Asonuma and Joo (2020) public expenditure composition dataset covering 179 debt restructurings in 1978–2010

**TABLE:** Public Consumption, Investment, Transfers and Capital for Preemptive and Post-default Restructurings in 1978–2010

	Observation	Mean	Median	Std. Dev.	Observation	Mean	Median	Std. Dev.
<b>Restructuring Episodes</b>	<b>68</b>	<b>Preemptive restructurings</b>			<b>111</b>	<b>Post-default restructurings</b>		
		<i>Percent of GDP</i>						
		<b>Pre-restructuring periods</b>				<b>Pre-restructuring periods</b>		
Public Consumption, average	49	12.7	11.8	5.3	75	12.1	10.3	8.8
Public Investment, average	59	5.9	4.0	5.0	100	4.2	3.2	3.6
Public Transfers, average	49	6.3	5.0	5.5	75	4.5	1.8	6.6
Public Capital, average	57	83.0	74.2	48.0	99	71.4	51.5	49.8
		<b>Restructuring periods</b>				<b>Restructuring periods</b>		
Public Consumption, average	57	11.1	10.5	4.3	80	12.1	10.5	7.9
Public Investment, average	64	4.8	3.7	3.4	100	3.6	2.9	3.3
Public Transfers, average	57	5.3	3.4	5.0	80	3.7	2.1	4.5
Public Capital, average	63	85.3	77.0	49.2	99	72.2	53.4	51.0



# STYLIZED FACTS ON FISCAL CONSOLIDATION (CONT.)

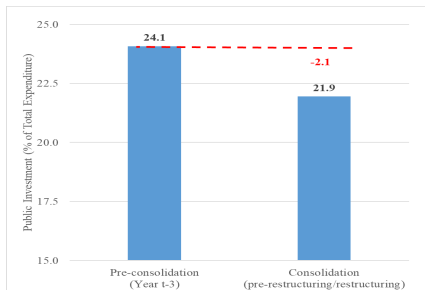
TABLE: Public Expenditure Composition around Restructurings

	Preemptive restructurings	Post-default restructurings
	Public investment	Public investment
	Percent of expenditure, current (1)	Percent of expenditure, current (2)
	coef/se	coef/se
Pre-restructuring year (-2) (current, dummy) <sup>1/</sup>	-2.19** (1.02)	-1.36 (1.04)
Pre-restructuring year (-1) (current, dummy) <sup>1/</sup>	-4.46*** (1.03)	-1.45 (1.02)
Pre-restructuring year (0) (current, dummy) <sup>1/</sup>	-4.54*** (1.00)	-2.54*** (1.00)
Pre-restructuring year (+1) (current, dummy) <sup>1/</sup>	-5.36*** (1.15)	-3.86*** (1.00)
Pre-restructuring year (+2) (current, dummy) <sup>1/</sup>	-5.42*** (1.73)	-3.62*** (1.13)
Pre-restructuring year (+3) (current, dummy) <sup>1/</sup>	-	-3.27*** (1.17)
Pre-restructuring year (+4) (current, dummy) <sup>1/</sup>	-	-2.69** (1.19)
GDP deviation from trend (end, percent) <sup>2/</sup>	0.30*** (0.10)	0.16** (0.08)
Constant	26.46*** (0.75)	22.03*** (0.49)
Episode-specific fixed effect	Yes	Yes
Number of restructurings/non-debt crisis recession	52	95
Number of observation	224	693
F-statistics	8.60	3.81
R <sup>2</sup>	0.237	0.049

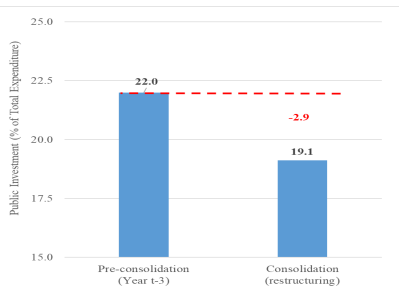
# STYLIZED FACTS ON FISCAL CONSOLIDATION (CONT.)

- Public expenditure skews heavily towards consumption and transfers under fiscal consolidation in both preemptive and post-default cases

(a) Preemptive Restructurings: Public Investment (percent of public expenditure)



(b) Post-default Restructurings: Public Investment (percent of public expenditure)



# SOVEREIGN'S PROBLEM - INTERMEDIATE AND BAD CREDIT RECORD

- Intermediate credit record ( $h_t = 1$ )
  - **Ex ante** value of sovereign

$$V(b_t, k_t^g, 1, a_{t-1}) = \Psi(b_t, k_t^g, 1, a_{t-1}) \quad (18)$$

- Bad credit record ( $h_t = 2$ )
  - **Ex post** value of sovereign

$$V(b_t, k_t^g, 2, a_t) = \Gamma(b_t, k_t^g, 2, a_t) \quad (19)$$

## MODEL: POST-DEFAULT RENEGOTIATION

- Case when the lender L is the proposer
- If L proposes and the proposal is accepted,

$$V^{*PROP}(b_t, k_t^g, 2, a_t) = -\alpha_t^L b_t \quad (29)$$

$$\begin{aligned} V^{ACT}(b_t, k_t^g, 2, a_t) = & \max_{g_t, k_{t+1}^g, T_t} (1 - \lambda)u(c_t, l_t) + \lambda v(g_t) \\ & + \beta \int_A V(0, k_{t+1}^g, 0, a_{t+1}) d\mu(a_{t+1} | a_t) \end{aligned} \quad (30)$$

s.t. (9) (10b) (11b) and

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

## MODEL: POST-DEFAULT RENEGOTIATION

- Expected payoff at post-default debt renegotiations

$$\Gamma(b_t, k_t^g, 2, a_t) = \phi \Gamma^B(b_t, k_t^g, 2, a_t) + (1 - \phi) \Gamma^L(b_t, k_t^g, 2, a_t)$$

$$\Gamma^*(b_t, k_t^g, 2, a_t) = \phi \Gamma^{*B}(b_t, k_t^g, 2, a_t) + (1 - \phi) \Gamma^{*L}(b_t, k_t^g, 2, a_t) \quad (20)$$

- Expected payoff at preemptive debt renegotiations

$$\Psi(b_t, k_t^g, 1, a_{t-1}) = \phi \Psi^B(b_t, k_t^g, 1, a_{t-1}) + (1 - \phi) \Psi^L(b_t, k_t^g, 1, a_{t-1})$$

$$\Psi^*(b_t, k_t^g, 1, a_{t-1}) = \phi \Psi^{*B}(b_t, k_t^g, 1, a_{t-1}) + (1 - \phi) \Psi^{*L}(b_t, k_t^g, 1, a_{t-1}) \quad (21)$$

## MODEL: POST-DEFAULT RENEGOTIATION (CONT.)

- If L passes,

$$V^{*PASS}(b_t, k_t^g, 2, a_t) = \frac{1}{1+r^*} \int_A \Gamma^*((1+r^*)b_t, k_{t+1}^g, 2, a_{t+1}) d\mu(a_{t+1}|a_t) \quad (31)$$

$$\begin{aligned} V^{REJ}(b_t, k_t^g, 2, a_t) = & \max_{g_t, k_{t+1}^g, T_t} (1-\lambda)u(c_t, l_t) + \lambda v(g_t) \\ & + \beta \int_A V((1+r^*)b_t, k_{t+1}^g, 2, a_{t+1}) d\mu(a_{t+1}|a_t) \end{aligned} \quad (32)$$

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

# MODEL: POST-DEFAULT RENEGOTIATION (CONT.)

- Equilibrium

$$\begin{aligned}
 & \alpha_t^{L*} = \operatorname{argmax} V^{*PRO}(b_t, k_t^g, 2, a_t) \\
 \text{s.t. } & V^{*PRO}(b_t, k_t^g, 2, a_t) \geq V^{*PASS}(b_t, k_t^g, 2, a_t) \\
 & V^{ACT}(b_t, k_t^g, 2, a_t) \geq V^{REJ}(b_t, k_t^g, 2, a_t)
 \end{aligned} \tag{26a}$$

- If both parties reach an agreement,

$$\begin{aligned}
 \Gamma^{L*}(b_t, k_t^g, 2, a_t) &= V^{*PRO}(b_t, k_t^g, 2, a_t) \\
 \Gamma^L(b_t, k_t^g, 2, a_t) &= V^{ACT}(b_t, k_t^g, 2, a_t)
 \end{aligned} \tag{27b}$$

- Otherwise,

$$\begin{aligned}
 \Gamma^{L*}(b_t, k_t^g, 2, a_t) &= V^{*PASS}(b_t, k_t^g, 2, a_t) \\
 \Gamma^L(b_t, k_t^g, 2, a_t) &= V^{REJ}(b_t, k_t^g, 2, a_t)
 \end{aligned} \tag{27c}$$

- Settlement set for post-default renegotiation

$$R^L(b_t, k_t^g, 2) = \left\{ a_t \in A : \begin{aligned} & V^{*PRO}(b_t, k_t^g, 2, a_t) \geq V^{*PASS}(b_t, k_t^g, 2, a_t) \\ & V^{ACT}(b_t, k_t^g, 2, a_t) \geq V^{REJ}(b_t, k_t^g, 2, a_t) \end{aligned} \right\}. \tag{28a}$$

# MODEL: PREEMPTIVE DEBT RENEGOTIATION

- Settlement set for preemptive renegotiation

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



# MODEL: PREEMPTIVE DEBT RENEGOTIATION

- Settlement set for preemptive renegotiation

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

# MODEL: PREEMPTIVE DEBT RENEGOTIATION

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

$$V^{*PRO}(b_t, k_t^g, 1, a_{t-1}) = -\delta_t^L b_t \quad (44)$$

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

$$\begin{aligned} V^{ACT}(b_t, k_t^g, 1, a_{t-1}) = & \max_{g_t, k_{t+1}^g, T_t} \int_A [(1-\lambda)u(c_t, l_t) + \lambda v(g_t) \\ & + \beta \int_A V(0, k_{t+1}^g, 0, a_t)] d\mu(a_t | a_{t-1}) \end{aligned} \quad (45)$$

s.t. (9) (10b) (11) and

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

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

# MODEL: PREEMPTIVE DEBT RENEGOTIATION (CONT.)

- If L passes,

$$V^{*PASS}(b_t, k_t^g, 1, a_{t-1}) = \frac{1}{1+r^*} \int_A \Psi^*(b_t, k_t^g, 1, a_t) d\mu(a_t|a_{t-1}) \quad (46)$$

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

$$\begin{aligned} V^{REJ}(b_t, k_t^g, 1, a_t) = & \max_{g_t, k_{t+1}^g, T_t} \int_A [(1-\lambda)u(c_t, l_t) + \lambda v(g_t) \\ & + \beta \int_A \Psi(b_t, k_{t+1}^g, 1, a_t)] d\mu(a_t|a_{t-1}) \end{aligned} \quad (47)$$

s.t. (8) (9) (10) (11) and

$$V^{REJ}(b_t, k_t^g, 1, a_{t-1}) \geq V^{NON-PRE}(b_t, k_t^g, 0, a_{t-1}) \quad (47)$$

- If L quits,

$$V^{*QUIT}(b_t, k_t^g, 1, a_{t-1}) = (1 - p^D(b_t, k_t^g, 0, a_{t-1})) + p^D(b_t, k_t^g, 0, a_{t-1})\gamma(b_t, k_t^g, 2, a_{t-1}) \quad (48)$$

$$V^{REJ-QUIT}(b_t, k_t^g, 1, a_{t-1}) = V^{NON-PRE}(b_t, k_t^g, 0, a_{t-1}) \quad (49)$$

# MODEL: PREEMPTIVE DEBT RENEGOTIATION

- Equilibrium

$$\begin{aligned} \delta_t^{L*} &= \operatorname{argmax} V^{*PRO}(b_t, k_t^g, 1, a_{t-1}) \\ \text{s.t. } V^{*PRO}(b_t, k_t^g, 1, a_{t-1}) &\geq V^{*PASS}(b_t, k_t^g, 1, a_{t-1}) \\ V^{ACT}(b_t, k_t^g, a_{t-1}) &\geq V^{REJ}(b_t, k_t^g, a_{t-1}) \end{aligned} \quad (41a)$$

- If both parties reach an agreement,

$$\begin{aligned} \Psi^{L*}(b_t, k_t^g, 1, a_{t-1}) &= V^{*PRO}(b_t, k_t^g, 1, a_{t-1}) \\ \Psi^L(b_t, k_t^g, 1, a_{t-1}) &= V^{ACT}(b_t, k_t^g, 1, a_{t-1}) \end{aligned} \quad (42c)$$

- Otherwise,

$$\begin{aligned} \Psi^{L*}(b_t, k_t^g, 1, a_{t-1}) &= V^{*PASS}(b_t, k_t^g, 1, a_{t-1}) \\ \Psi^L(b_t, k_t^g, 1, a_{t-1}) &= V^{REJ}(b_t, k_t^g, 1, a_{t-1}) \end{aligned} \quad (42d)$$

or

$$\begin{aligned} \Psi^{L*}(b_t, k_t^g, 1, a_{t-1}) &= V^{*QUIT}(b_t, k_t^g, 1, a_{t-1}) \\ \Psi^L(b_t, k_t^g, 1, a_{t-1}) &= V^{REJ-PRE}(b_t, k_t^g, 1, a_{t-1}) \end{aligned} \quad (42d)$$

# EQUILIBRIUM

## DEFINITION

A recursive equilibrium is defined as a set of functions for (a) the sovereign's ex-ante and ex post value functions, public consumption, capital, transfers, assets/debt, two sets of preemptive restructuring and default, (b) the household's private consumption and labor supply, (c) the firm's labor demand and private capital, (d) the sovereign's and the foreign creditors' decision functions, payoffs, recovery rates, settlement sets (all depending on who is the proposer), (e) sovereign bond price and wage such that

- [1]. sovereign government's value function, public consumption, capital, transfers, assets/debt position and default set satisfy its optimization problem (6)–(19);
- [2]. the households consumption and labor supply satisfy his optimization problem (1)–(2);
- [3]. the firm's labor demand and private capital satisfies his optimization problem (3)–(5);
- [4]. both parties' decisions, payoffs and recovery rates solve the multi-round preemptive and post-default debt renegotiation problems (20)–(49);
- [5]. The foreign creditors' assets and bond prices satisfy their optimization problem (50)–(51).

- Default probability

$$p^D(b_{t+1}, k_{t+1}^g, 0, a_t) = \int_{D(b_{t+1}, k_{t+1}^g)} d\mu(a_{t+1}|a_t), \quad (52)$$

- Expected recovery rates

$$\begin{aligned} \alpha(b_{t+1}, k_{t+1}^g, 2, a_t) = & \\ \int_A \left[ \begin{aligned} & \phi 1_{a_{t+1} \in R^B(b_{t+1}, k_{t+1}^g, 2)} \alpha^{B*}((1+r^*)b_{t+1}, k_{t+1}^g, a_{t+1}) \\ & + (1-\phi) 1_{a_{t+1} \in R^L(b_{t+1}, k_{t+1}^g, 2)} \alpha^{L*}((1+r^*)b_{t+1}, k_{t+1}^g, a_{t+1}) \\ & + \left( \begin{aligned} & \phi 1_{a_{t+1} \notin R^B(b_{t+1}, k_{t+1}^g, 2)} \\ & + (1-\phi) 1_{a_{t+1} \notin R^L(b_{t+1}, k_{t+1}^g, 2)} \end{aligned} \right) \alpha((1+r^*)b_t, k_{t+1}^g, a_{t+1}) \end{aligned} \right] d\mu(a_{t+1}|a_t) \\ \delta(b_{t+1}, k_{t+1}^g, 1, a_{t-1}) = & \\ \int_A \left[ \begin{aligned} & \phi 1_{a_{t+1} \in R^B(b_{t+1}, k_{t+1}^g, 1)} \delta^{B*}(b_{t+1}, k_{t+1}^g, a_t) \\ & + (1-\phi) 1_{a_{t+1} \in R^L(b_{t+1}, k_{t+1}^g, 1)} \delta^{L*}(b_{t+1}, k_{t+1}^g, a_t) \\ & + \left( \begin{aligned} & \phi 1_{a_{t+1} \notin R^B(b_{t+1}, k_{t+1}^g, 1)} \\ & + (1-\phi) 1_{a_{t+1} \notin R^L(b_{t+1}, k_{t+1}^g, 1)} \end{aligned} \right) \delta(b_t, k_{t+1}^g, 1, a_t) \end{aligned} \right] d\mu(a_t|a_{t-1}) \quad (54) \end{aligned}$$

- Probability of settling the deal

$$p^{POST}(b_{t+1}, k_{t+1}^g, a_t) = \phi \int_{RB(b_{t+1}, k_{t+1}^g, 2)} d\mu(a_{t+1}|a_t) + (1-\phi) \int_{RL(b_{t+1}, k_{t+1}^g, 2)} d\mu(a_{t+1}|a_t)$$

$$p^{PRE}(b_{t+1}, k_{t+1}^g, a_t) = \phi \int_{RB(b_{t+1}, k_{t+1}^g, 1)} d\mu(a_{t+1}|a_t) + (1-\phi) \int_{RL(b_{t+1}, k_{t+1}^g, 1)} d\mu(a_{t+1}|a_t) \quad (53)$$

- Sovereign bond spreads

$$s(b_{t+1}, k_{t+1}^g, 0, a_t) = \frac{1}{q(b_{t+1}, k_{t+1}^g, 0, a_t)} - (1 + r^*)$$

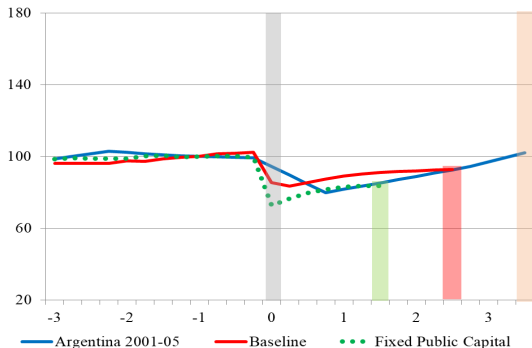
- **Finding 1:** Choice of front- and back-loaded consolidation  
—“Gambling for resurrection”
  - Front-loaded consolidation: Certain on likelihood of default ex ante
  - Back-loaded consolidation: Low TFP shocks ex post after passing front-loaded consolidation ex ante
- **Finding 2:** Consequence of front-loaded consolidation (ex ante)
  - Preemptive restructuring: Hedging incentive
  - Quick settlement: Relaxation of fiscal constraint
- **Finding 3:** Consequence of back-loaded consolidation (ex-post)
  - Default / post-default: Low TFP shocks
  - Delay: Fiscal constraint / slow capital accumulation



## QUANTITATIVE ANALYSIS - SIMULATION (CONT.)

- Public consumption and transfers around debt restructurings

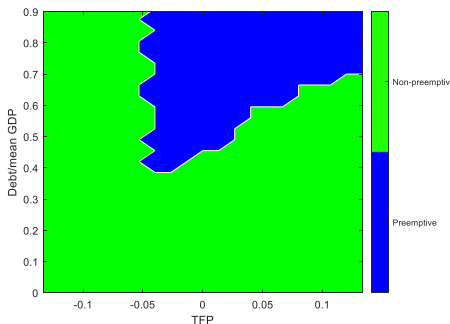
(a) Public Consumption and Transfers–Post default - ARG



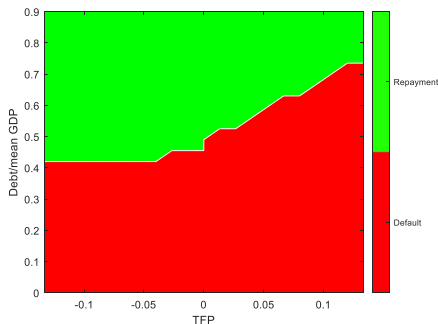
## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Debtor's choice between preemptive and non-preemptive and between repayment and default - Mean public capital

(a) Choice for Preemptive Restructuring  
(ex ante)



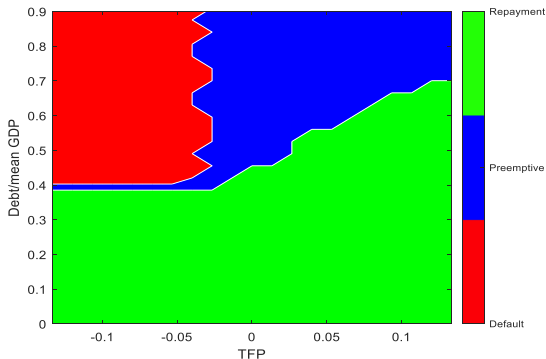
(b) Choice for Default and Repayment  
(ex post)



## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Debtor's choice between preemptive and non-preemptive and between repayment and default - Mean public capital

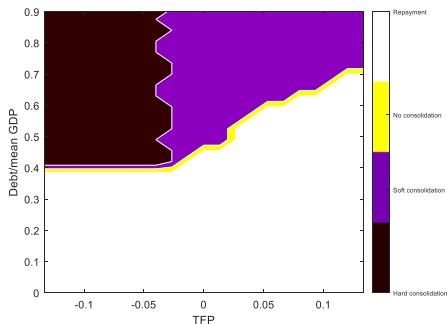
(c) Combining the Choice for  
Preemptive Restructuring, Default and Repayment



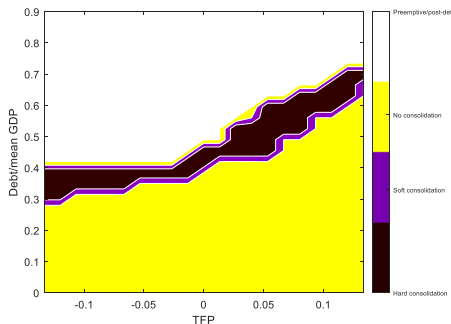
## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Debtor's choice among hard, soft and no fiscal consolidation - mean public capital

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



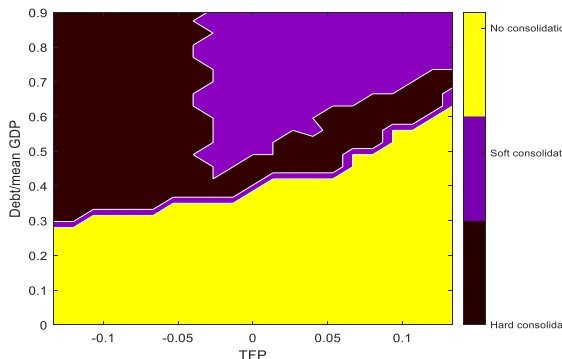
(b) Under Good Credit Record  
(repayment)



## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Debtor's choice among hard, soft and no fiscal consolidation - mean public capital

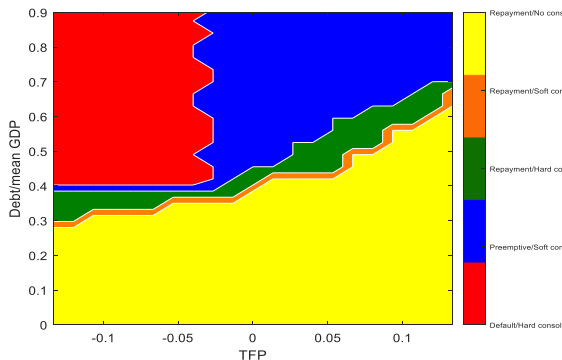
(c) Choice for Fiscal Consolidation under Good, Intermediate and Bad Credit Records



## QUANTITATIVE ANALYSIS - ERGODIC DIST.

- Front-loaded fiscal consolidation and back-loaded fiscal consolidation - mean public capital

(d) Choice among front-loaded (hard, soft) and bank-loaded (hard, soft) fiscal consolidation

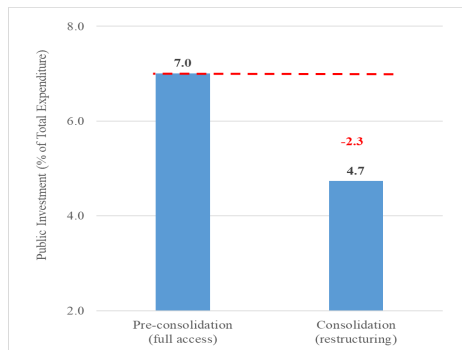


**TABLE:** Non-business Cycle Statistics

	Data	Model	Model with Fixed Public Capital	Model without Separation of Public/Private Sectors	Model with Fixed Capital and No Separation of Public/Private Sectors
<b>Target statistics</b>					
Default probability (%)	3.26	3.51	3.65	3.62	3.02
Average recovery rate (%)	25.0	25.2	30.5	36.1	31.4
Average debtor output deviation during debt renegotiation (%)	-4.45	-5.1	-7.1	-6.9	-9.0
<b>Pre-default periods</b>					
Average debt/GDP ratio (%)	45.4	41.7	23.0	41.0	40.0
Bond spreads: average (%)	9.4	1.70	2.20	1.60	1.50
Bond spreads: std dev. (%)	7.6	2.30	3.03	1.39	1.60
Corr.(spreads, output)	-0.88	-0.10	-0.36	-0.26	-0.48
Corr.(debt/GDP, spreads)	0.92	0.27	0.34	0.32	0.35
Corr.(debt/GDP, output)	-0.97	-0.41	-0.40	-0.10	-0.33
<b>Renegotiation periods</b>					
Average debt/GDP ratio (%)	130.5	49.9	29.5	51.4	51.3
Corr.(debt/GDP, output)	-0.95	-0.99	-0.99	-0.99	-0.99
Duration of renegotiation/ exclusion (quarters)	14.0	9.1	6.2	5.6	4.7
Duration of investment recovery (quarters)	12.0	8.5	-	-	-

# QUANTITATIVE ANALYSIS - SIMULATION (CONT.)

(a) Data – ARG 2001-05 Post-default



(b) Simulation – ARG Post-default

