History Remembered: Optimal Sovereign Default on Domestic & External Debt

by

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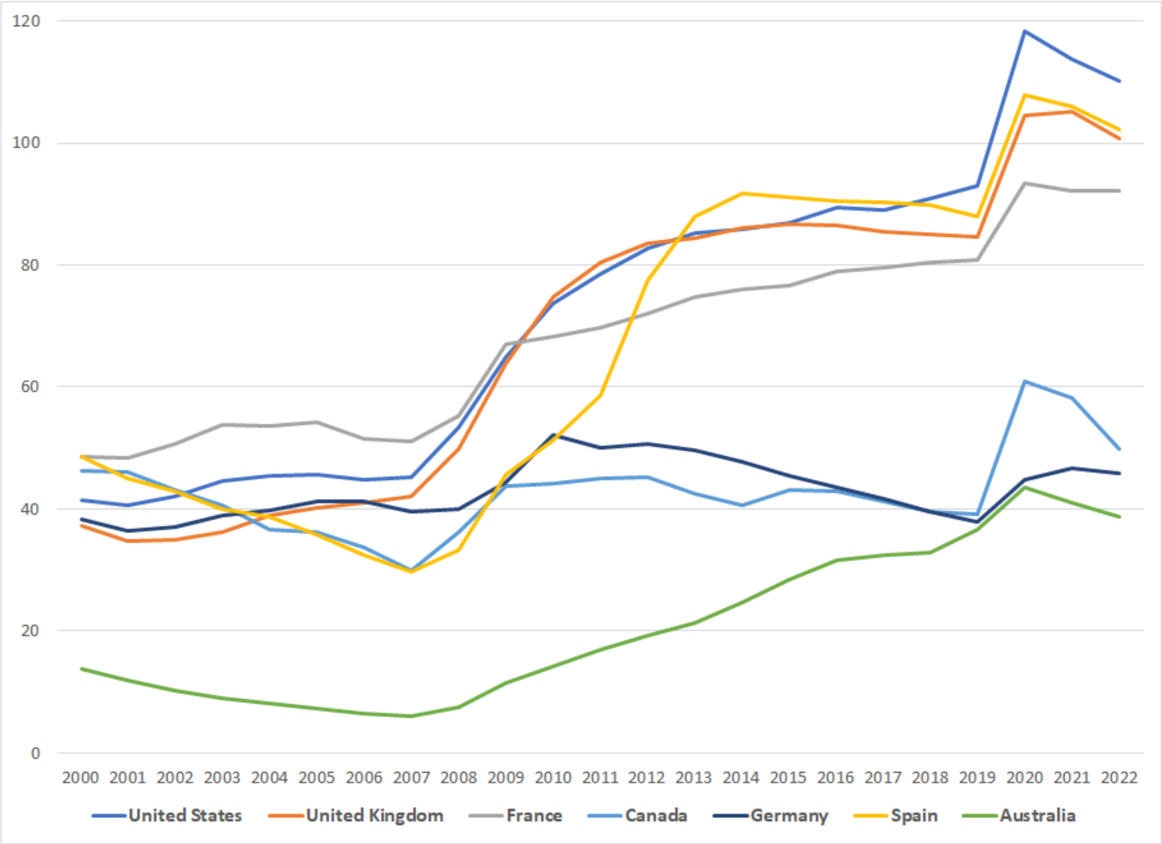
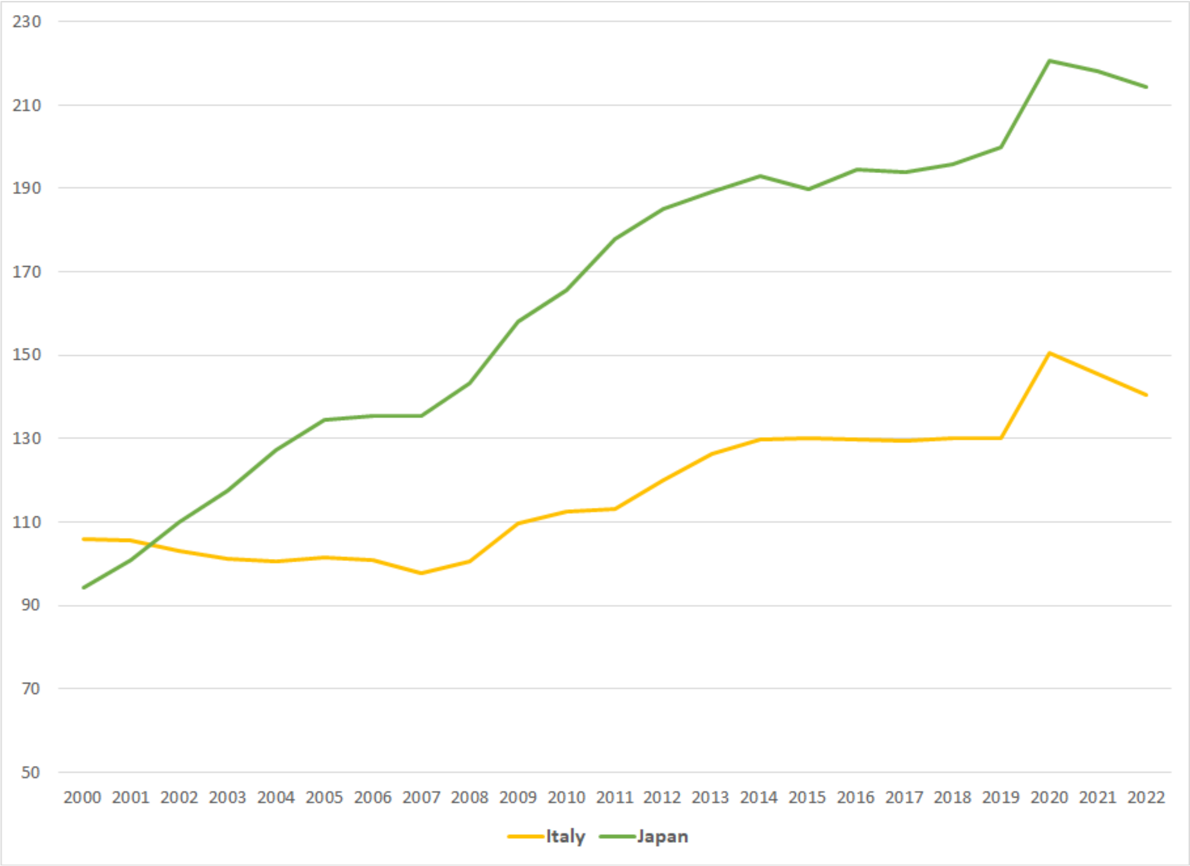
(JME 2021)

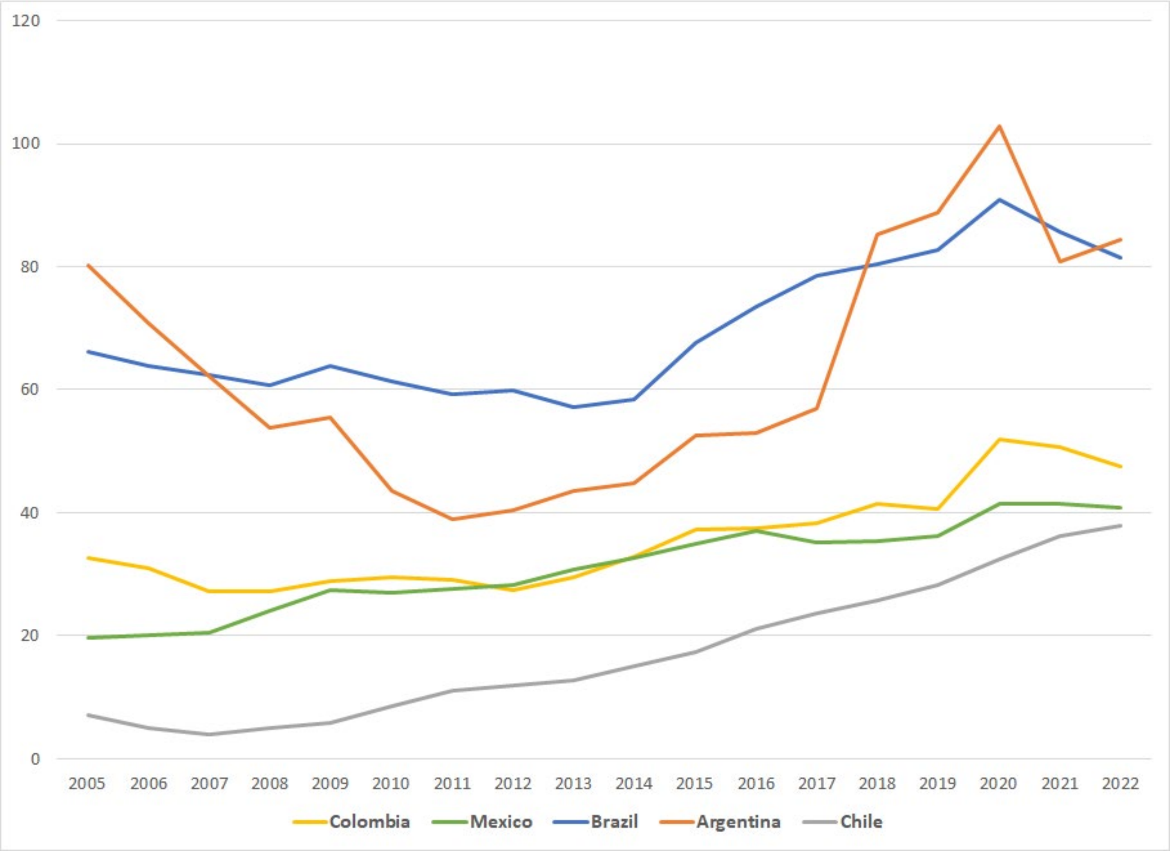
Central government debt ratios: Advanced economies



Central government debt ratios: Italy and Japan



Central government debt ratios: Latin America

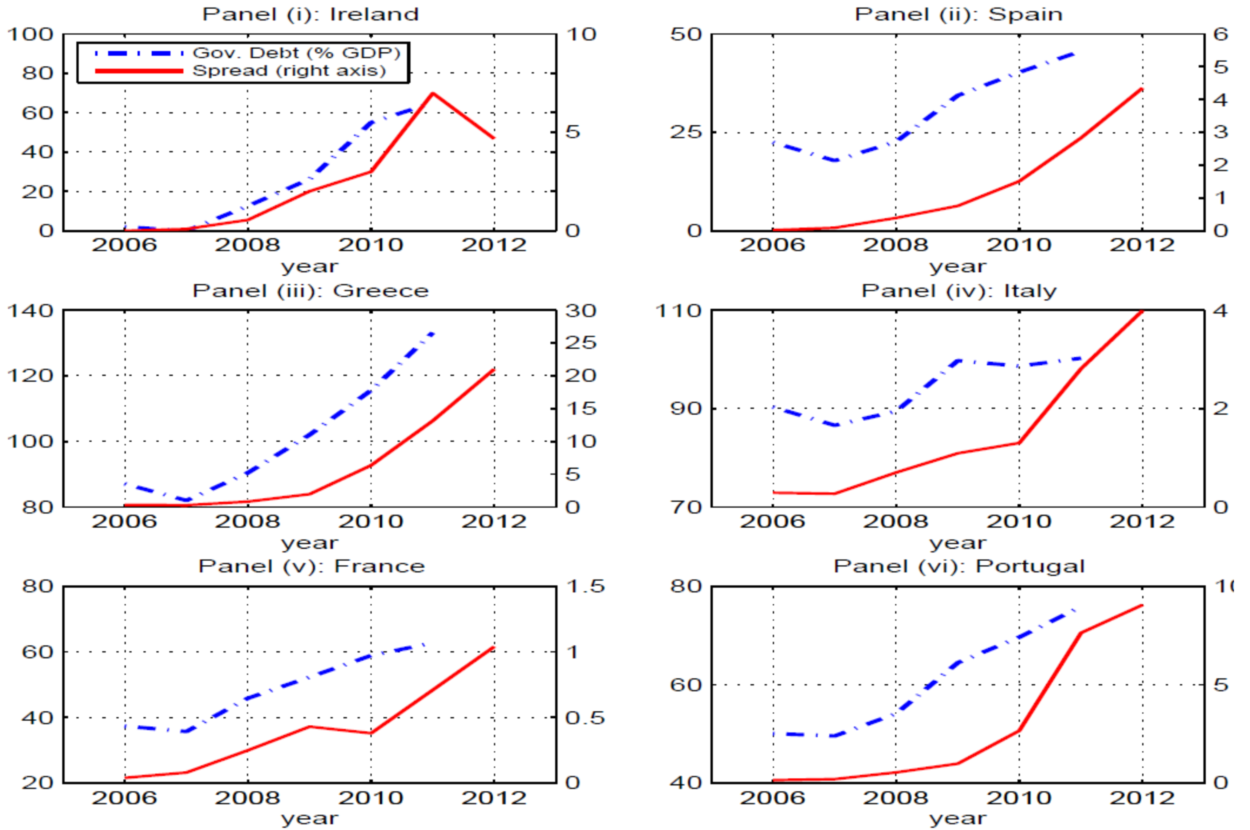


The forgotten history of domestic debt

- **Domestic** public debt viewed as “risk-free asset” despite history of overt defaults and very high debt ratios:
  1. Reinhart & Rogoff (08): 1.1% frequency since 1750, 1/3 ratio v. external defaults, a forgotten history in Macro
  2. Hall & Sargent (14): U.S. default after revolutionary war
  3. European Debt Crisis akin to domestic default: 85% of EU debt stays in Europe, common currency
  4. Record-high U.S. public debt ratio: 100% for net federal debt in 2022, + about 200pp in unfunded entitlement liabilities

- Narratives differ from those for external defaults in highlighting concern of creditors and their institutions for financial/redistributive effects

Debt & spreads in European debt crisis



Presentation layout

1. Propose a framework for explaining domestic defaults: Aiyagari-Bewley meet Eaton-Gersovitz
2. Structure of the model
3. Two specialized cases:
   a) Distributional default incentives in one- and two-period models with two agent types
   b) Social value of debt (social welfare costs of a surprise, one-time default) in a Bewley economy
4. Quantitative analysis of full model (calibration, time-series evaluation, default mechanism)
5. Robustness analysis & conclusions

1. Summary of the framework

Explaining domestic defaults

- **A Bewley-Aiyagari-Eaton-Gersovitz model**: agents are heterogeneous in public debt holdings and income (b, y) , gov. issues debt & has stochastic expenditures (B, g) and is not committed to repay (i.e., defaults optimally)
- Soc. Planner values distributional role of debt: **Issuing** (*repaying*) debt causes **progressive** (*regressive*) redistribution, making default desirable ex-post
- …but default has large **endogenous costs** (debt is useful for **liquidity provision, self-insurance**, **risk-sharing**)
- Ex-ante prog. redistribution is hampered by lower debt prices if default risk rises (**debt Laffer curve**)

Default tradeoffs

- If gov. defaults, public debt is wiped out (totally or partially, with endogenous or exogenous partial default)
- **Benefits**: Avoid regressive redistribution, transfers do not fall to repay gov. bond holders
- **Costs**: Liquidity, self-insurance and risk-sharing benefits of debt are lost to everyone (but valued differently!)
- Government re-enters debt market next period (no exclusion costs)
- Can also include exogenous income cost a'la Arellano

Feedback mechanism

1. Gov. decides to default or repay
2. If it repays, it sells new debt to foreign (risk neutral) & domestic (risk averse) agents
3. Foreigners are marginal buyers. Debt priced by arbitrage condition (def. risk premium ≈ prob. of def)
4. Agents differ in (b, y), respond differently to def. risk
5. Individual valuations of gains from default vary widely across agents and move over time
6. Social gains from default change with dispersion of individual valuations

2. Model structure

Timing of actions & participation

1. Period t begins, $\{y, g\}$ realizations are observed
2. Individual states $\{b, y\}$, distribution of bonds and income $\Gamma_t(b, y)$ and agg. states $\{B, g\}$ are known
3. Income taxes are paid
4. Government makes default decision
   i. Repayment ($\boldsymbol{d_t = 0}$): market for new debt opens, gov. choose supply of debt, domestic and foreign agents buy it at price q_t, gov. sets transfers to satisfy GBC
   ii. Default ($\boldsymbol{d_t = 1}$): market for new debt does not open, domestic agents may face income cost $\phi(g)$, gov. sets transfers to satisfy GBC
5. Agents consume, period ends

Individual optimization problem

- Payoff before default decision is made:

$$V(b,y,B,g) = (1-d(B,g))V^{d=0}(b,y,B,g) + d(B,g)V^{d=1}(y,g)$$

- Optimization problem under repayment:

$$V^{d=0}(b,y,B,g) = \max_{\{c\geq 0, b'\geq 0\}} \{u(c) + \beta E_{(y',g')|(y,g)}[V(b',y',B',g')]\}$$

$$\text{s.t.} \quad c + q(B'(B,g),g)b' = b + y(1-\tau^y) + \tau^{d=0}(B,g)$$

- Payfoff Under default:

$$V^{d=1}(y,g) = u(y(1-\tau^y) - \phi(g) + \tau^{d=1}(g)) + \beta E_{(y',g')|(y,g)}[V^{d=0}(0,y',0,g')]$$

Government's default decision

$$\max_{d \in \{0,1\}} \left\{ W^{d=0}(B,g), W^{d=1}(g) \right\}$$

– Bergson-Samuelson SWF with exogenous weights:

$$W^{d=0}(B,g) = \int_{\mathcal{Y}\times\mathcal{B}} V^{d=0}(b,y,B,g)\,d\omega(b,y)$$

$$W^{d=1}(g) = \int_{\mathcal{Y}\times\mathcal{B}} V^{d=1}(y,g)\,d\omega(b,y)$$

– Welfare weights:

$$\omega(b,y) = \sum_{y_i \le y} \pi^*(y_i)\left(1 - e^{-\frac{b}{\bar{\omega}}}\right)$$

creditor bias

Debt issuance decision & foreign lenders

- Government debt issuance choice under repayment:

$$\max_{\tilde{B}'} \int_{\mathcal{Y}\times\mathcal{B}} \tilde{V}(b, y, B, g, \tilde{B}')d\omega(b, y).$$

$$\tilde{V}(b, y, B, g, \tilde{B}') = \max_{\{c\geq 0, b'\geq 0\}} u(c) + \beta E_{(y',g')|(y,g)}[V(b', y', \tilde{B}', g')]$$

$$\text{s.t.} \begin{cases} c + q(\tilde{B}', g)b' = y(1-\tau^y) + b + \tau \\ \tau = \tau^y Y - g - B + q(\tilde{B}', g)\tilde{B}'. \end{cases}$$

- Foreign creditors' no arbitrage condition:

$$q(B', g) = \frac{(1 - p(B', g))}{(1+\bar{r})} \qquad p(B', g) = \sum_{g'} d(B', g')F(g', g)$$

Social value of debt

- Use $\tilde{b} = (b - B)$ to transform individual agents' budget and liquidity constraint under repayment:

$$
\begin{aligned}
c &= y + \tilde{b} - q(B', g)\tilde{b}' - \tau^y (y - Y) - g \\
\tilde{b}' &\geq -B'
\end{aligned}
$$

1. Liquidity: Issuing debt relaxes no-borrowing constraint
2. Self-insurance: Low (high) income agents draw from (add to) precautionary savings by selling (buying) debt
3. Risk-sharing: Debt sales (purchases) by low (high) income agents reduce consumption dispersion

- Income tax also provides income risk-sharing, but limited because calibrated taxes are well below 100%

Default risk widens dispersion in bond holdings

- FOC for debt demand (assuming differentiability):

$$u'(c) \geq \beta E_{(y',g')|(y,g)}\left[(1-d(B',g'))\frac{u'(c')}{q(B',g)}\right]$$

- How does default risk widen dispersion in bond holdings?
  1. Bonds yield zero marginal benefit in default states
  2. Larger default set lowers expected marginal benefit of holding bonds (given q), weakening incentives to demand bonds and proportionally more for low (b,y) types
  3. …but it also increases prob. of default and risk premium (reduces q), incentivizing high (b,y) types to buy more

Dispersion in bond holdings alters government default incentives

- Differences in individual consumption across default and repayment states (consumption gap):

$$\Delta c \equiv c^{d=0} - c^{d=1} = \tilde{b} - q(B', g)\tilde{b}' + \phi(g)$$

- Cross-sectional dispersion in consumption gap: Given q, issuing new debt favors agents with $\widetilde{b'} < 0$, but it requires repaying outstanding debt, which hurts agents with $\tilde{b} < 0$

- Effects of dispersion in bond holdings on def. incentives:
  1. Larger mass with $\tilde{b} < 0$ at low qs imply more agents with negative gap, which strengthens default incentives (prevent **regressive redistribution**)
  2. Larger mass with $\widetilde{b'} < 0$ implies more agents with positive gap, which weakens defaults incentives (**progressive red.**)
  3. Caveat: Applies to date-t, not expected lifetime utility

3. Specialized Cases: Distributional Incentives & Social Value of Debt

Distributional default incentives in a one-period model

- Two types of agents: Fraction γ hold less debt, b^L, fraction $1-\gamma$ hold more, b^H.
- Exogenous supply of public debt B
- Exogenous distribution of ownership given by $0 \leq \epsilon \leq B$ (no self-insurance, risk-sharing or liquidity benefits)
  - L-types holdings: $b^L = B - \epsilon$
  - H-types holdings: $b^H = B + \gamma\epsilon/(1-\gamma)$ (by market clearing)
- Government Bergson-Samuleson payoffs:

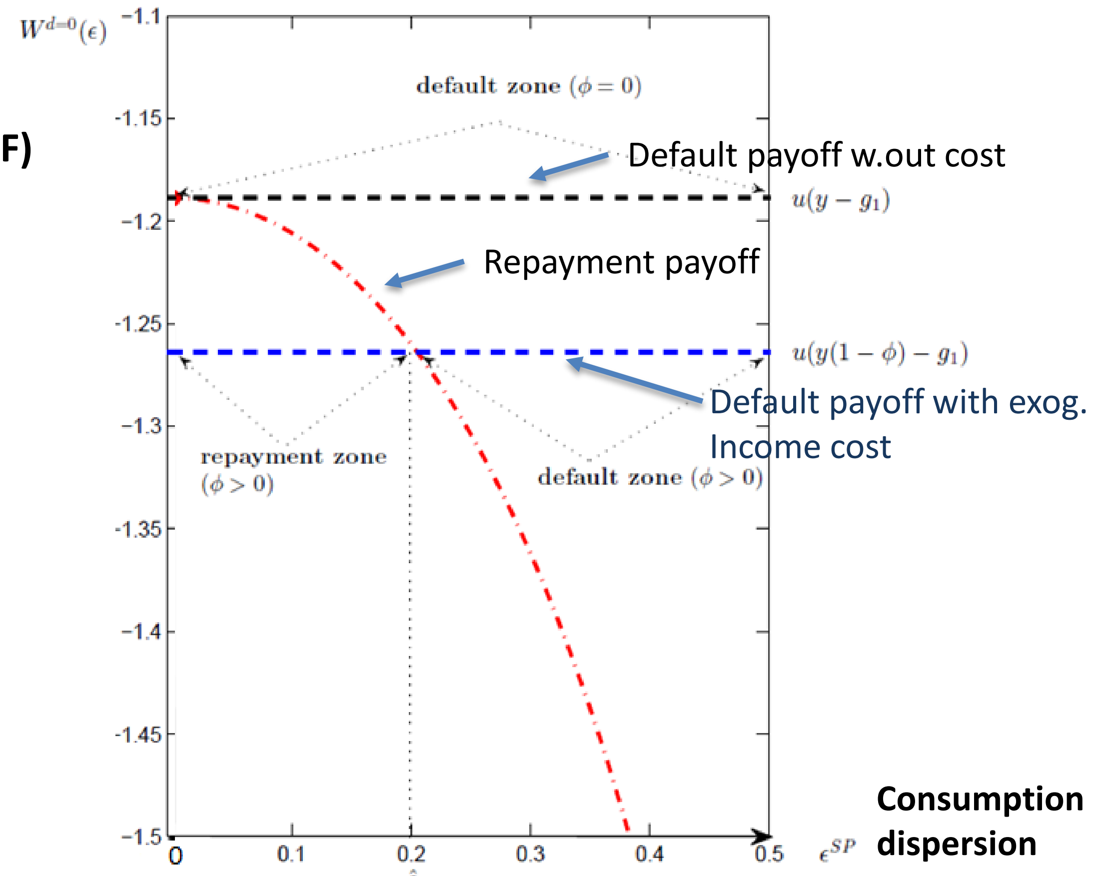
$$W^{d=0}(\epsilon) = \omega u(y-g+\epsilon) + (1-\omega)u\left(y-g+\frac{\gamma}{1-\gamma}\epsilon\right)$$

$$W_1^{d=1}(\phi) = u(y(1-\phi)-g)$$

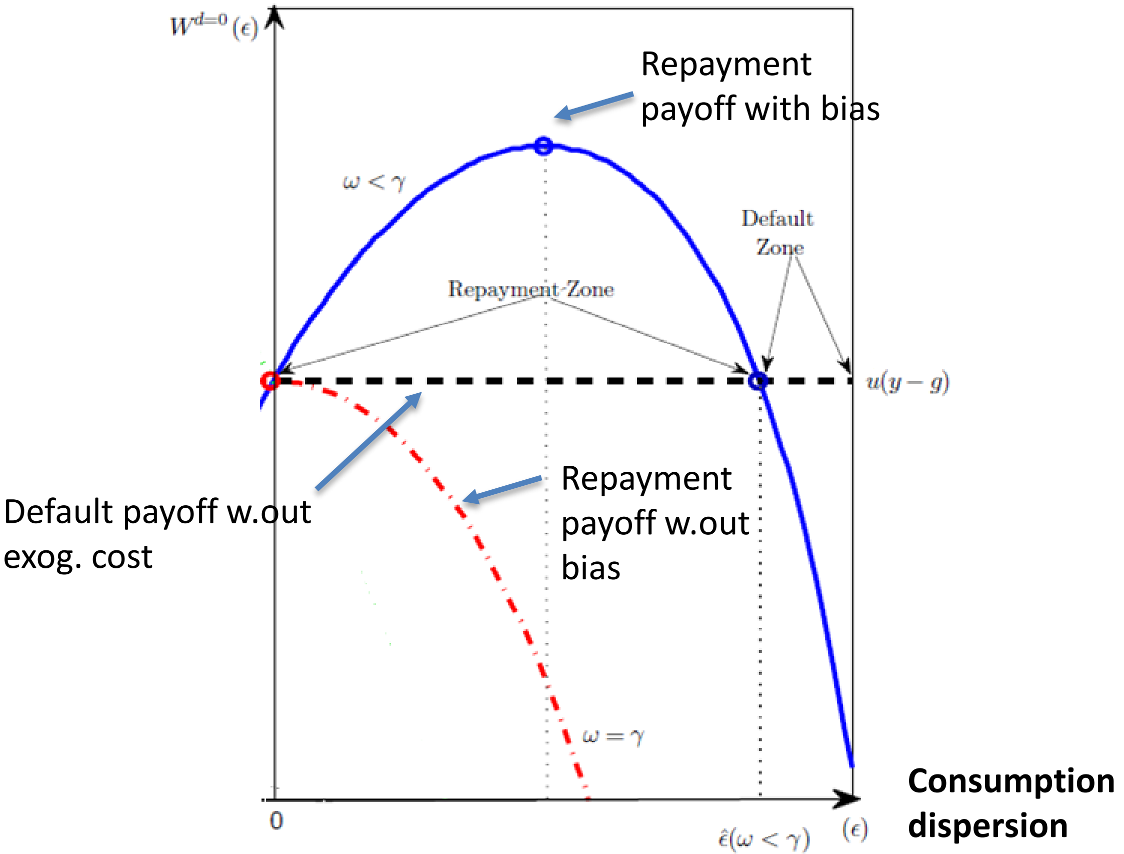
Redistribution alone cannot sustain debt

No creditor bias (Benthamite SWF)

$\omega = \gamma$



Sustaining debt with creditor bias



Two-period general equilibrium extension

(D'Erasmo & Mendoza, JEEA 2016)

- Two types of risk-averse agents (*L*, *H*), with fraction γ of L-types ($b_0^L < b_0^H$)
- Gov. collects lump-sum taxes τ, faces stochastic *g*, issues bonds B (*g* and default are non-insurable aggregate risks)
- Default is costly as a fraction $\phi(g)$ of income that rises as *g* falls (higher cost in good times a'la Arellano (2008))

$$\phi(g_1) \geq 0, \text{ with } \phi'(g_1) \leq 0 \text{ for } g_1 \leq \overline{g}_1, \ \phi'(g_1) = 0 \text{ otherwise}$$

- Gov. attains 2nd-best deviation from equal mg. utilities by redistributing via debt & default (debt has *some* social value because of two-period horizon)

Private Agents

Preferences:

$$u(c_0) + \beta E[u(c_1)], \qquad u(c) = \frac{c^{1-\sigma}}{1-\sigma}$$

Date-0 budget constraints and initial wealth for *i=L,H*:

$$c_0^i + q_0 b_1^i = y + b_0^i - \tau_0$$

Date-1 budget constraints **under repayment** for *i=L,H*:

$$c_1^i = y + b_1^i - \tau_1$$

Date-1 budget constraints **under default** for *i=L,H*:

$$c_1^i = (1 - \phi(g_1))y - \tau_1$$

Agents' Optimization Problem

Payoff function for i=*L,H* :

$$v^i(B_1,\gamma) = \max_{b_1^i}\left\{u(y+b_0^i-q_0b_1^i-\tau_0)+\right.$$

$$\left.\beta E_{g_1}\left[(1-d_1(B_1,g_1,\gamma))u(y+b_1^i-\tau_1^{d_1=0})+d_1(B_1,g_1,\gamma)u(y(1-\phi(g_1))-\tau_1^{d_1=1})\right]\right\}$$

$$\text{subject to } b_1^i \geq 0$$

Initial bond holdings given by initial wealth distribution and bond market clearing:

$$b_0^H = \frac{B_0-\gamma b_0^L}{1-\gamma} \geq b_0^L \geq 0$$

Government

Budget constraints

$$\tau_0 = g_0 + B_0 - q_0 B_1$$

$$\tau_1^{d_1=0} = g_1 + B_1 \qquad \tau_1^{d_1=1} = g_1$$

Default decision in 2nd period (as in 1-period model w. utilitarian SWF):

$$\max_{d \in \{0,1\}} \{W_1^{d=0}(B_1, g_1, \gamma), W_1^{d=1}(g_1, \gamma)\}$$

$$W_1^{d=0}(B_1, g_1, \gamma) = \gamma u(y - g_1 + b_1^L - B_1) + (1-\gamma) u(y - g_1 + b_1^H - B_1)$$

$$W_1^{d=1}(g_1, \gamma) = u(y(1 - \phi(g_1)) - g_1)$$

Debt issuance optimization problem in 1st period:

$$W_0(\gamma) = \max_{B_1} \left\{ \gamma v^L(B_1, \gamma) + (1-\gamma) v^H(B_1, \gamma) \right\}$$

Debt Issuance Decision in 1st Period

- Selling debt reduces dispersion at t=0 (*prog. red.*), but increases it at t=1 under repayment (*reg. red.*):

$$
\begin{aligned}
c_0^H - c_0^L &= \frac{1}{1-\gamma}\left[B_0 - q(B_1,\gamma)B_1\right] \\
c_1^{H,d=0} - c_1^{L,d=0} &= \frac{1}{1-\gamma}B_1 \\
c_1^{H,d=1} - c_1^{L,d=1} &= 0.
\end{aligned}
$$

- Gov. internalizes how default risk reduces the gain of issuing debt by lowering bond prices (debt Laffer curve).

- Debt market clearing induces a **demand composition effect** (as γ rises, each *H*-type has to buy more debt because there are fewer agents available to be bond holders)

$$b_1^L = B_1 - \epsilon \text{ and } b_1^H(\gamma) = B_1 + \tfrac{\gamma}{1-\gamma}\epsilon$$

Debt Issuance Optimality Condition

- **Without default**, some dispersion is optimal (liquidity benefit: debt helps relax L-types borrowing constraint)

$$u'(c_0^H) = u'(c_0^L) + \frac{\eta}{q(B_1,\gamma)\gamma}\left\{\gamma\mu^L\right\}$$

$$\eta \equiv q(B_1,\gamma)/\left(q'(B_1,\gamma)B_1\right) < 0$$

$$\mu^L \equiv q(B_1,\gamma)u'(c_0^L) - \beta E_{g_1}\left[(1-d^1)u'(c_1^L)\right] > 0.$$

- **With default risk**, more dispersion at t=0 repaying is traded off for zero at t=1 in default states

$$u'(c_0^H) = u'(c_0^L) + \frac{\eta}{q(B_1,\gamma)\gamma}\left\{\beta E_{g_1}\left[\Delta d \Delta W_1\right] + \gamma\mu^L\right\}$$

$$\Delta d \equiv d(B_1+\delta, g_1, \gamma) - d(B_1, g_1, \gamma) \geq 0, \quad \text{for } \delta > 0 \text{ small},$$

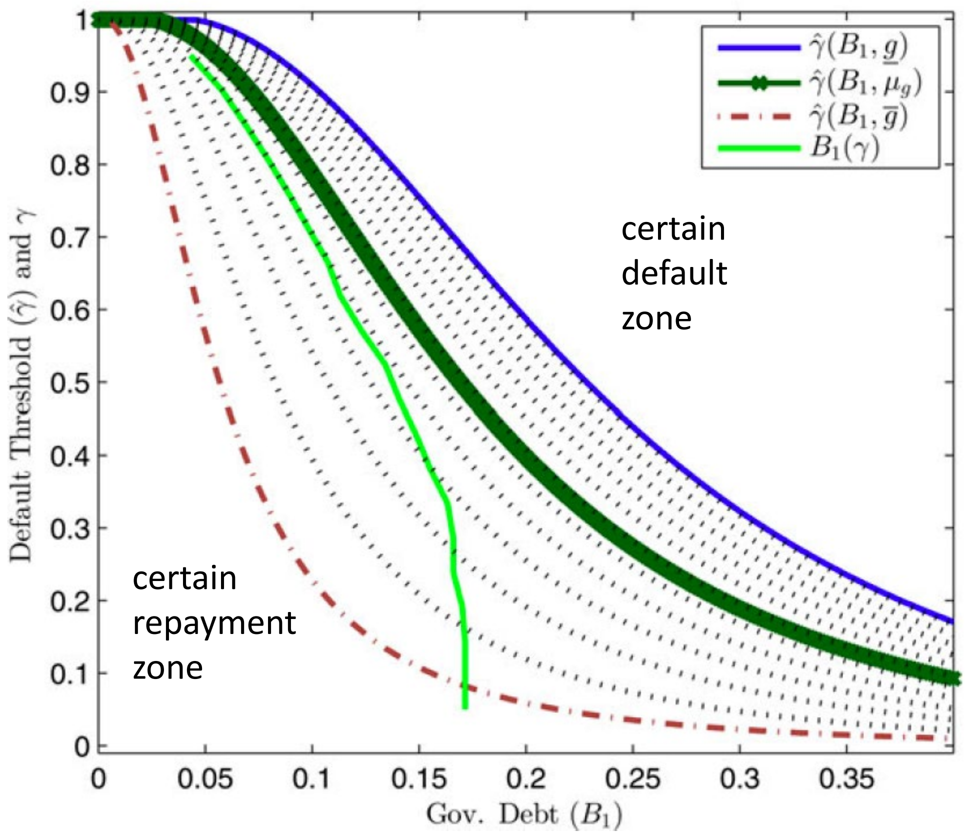
$$\Delta W_1 \equiv W_1^{d=1}(g_1,\gamma) - W_1^{d=0}(B_1, g_1, \gamma) \geq 0,$$

Calibration to European Data

Parameter		Value
Discount factor	β	0.96
Risk aversion	σ	1.00
Average income	y	0.79
Low household wealth	b_0^L	0.00
Average government consumption	μ_g	0.18
Autocorrel. G	ρ_g	0.88
Std. dev. error	σ_e	0.017
Initial government debt	B_0	0.35
Output cost default	φ_0	0.004

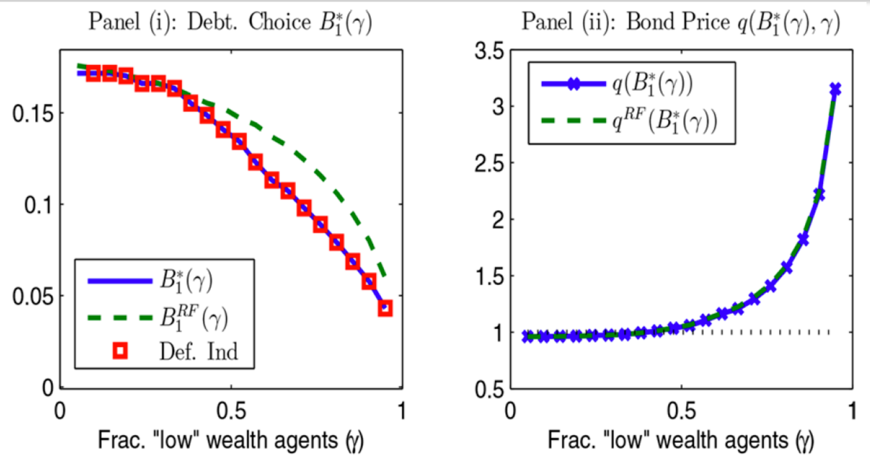
Notes: Government expenditures, income, and debt values are derived using data from France, Germany, Greece, Ireland, Italy, Spain, and Portugal.

Default thresholds and debt decision rule

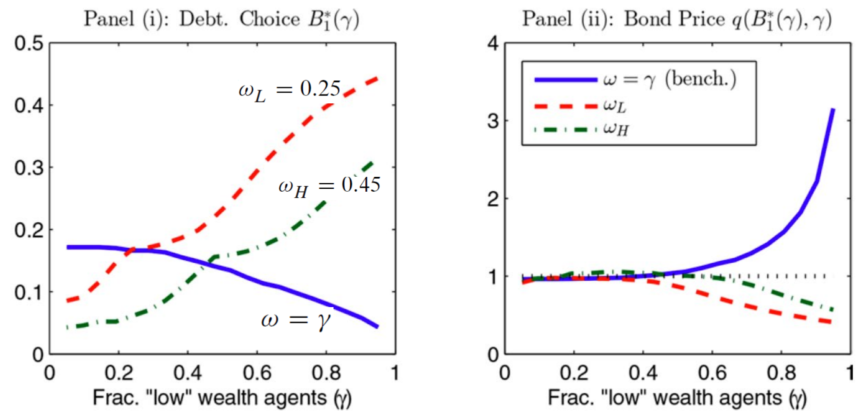


Equilibria as Fraction of Non-debt-holders Rises

Utilitarian government

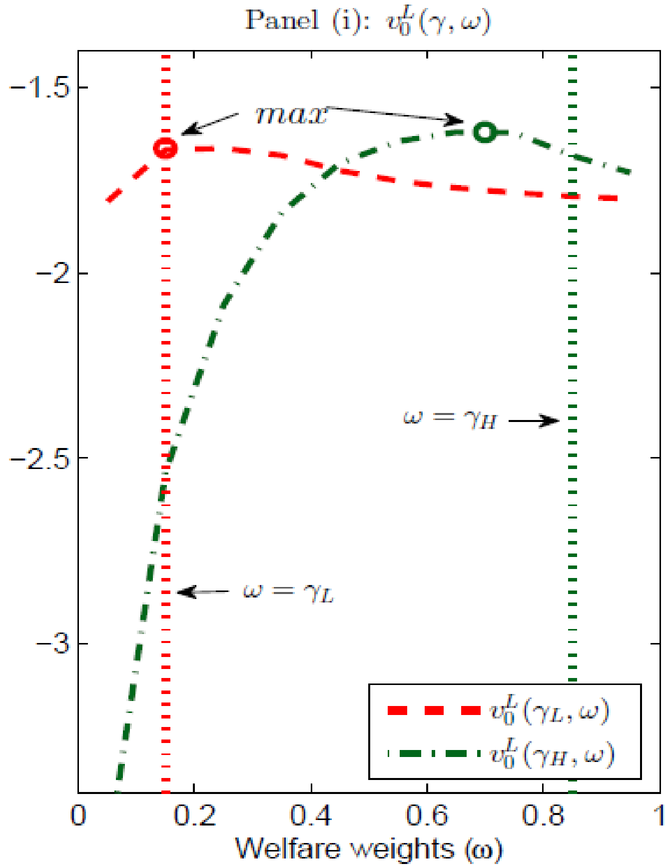


Biased Government



Non-bond-holders may prefer bias!

(if ownership is sufficiently concentrated)



Measuring the social value of debt

- Assume a given initial outstanding debt *B*
- Compare economy without default v. one that starts with a once-and-for-all default (no def. *risk*, no dist. incentives)
- Individual default gains/costs (Lucas-style comp. variation):

$$\alpha(b, y, B, g) = \left[\frac{V^{d=1}(y, g)}{V^{c}(b, y, B, g)}\right]^{\frac{1}{1-\sigma}} - 1$$

- Social value of public debt:

$$\bar{\alpha}(B, g) = \int \alpha(b, y, B, g) d\omega(b, y)$$

  – Two options for weights: calibrated or average of endogenous distribution of debt and income (utilitarian)

Social value of debt is large

Using calibrated welfare weights (w. creditor bias)

B/GDP	B^d/GDP	$\bar{\alpha}(B,\mu_g)\%$	$\bar{\alpha}(B,\underline{g})$	$\bar{\alpha}(B,\bar{g})$	hh's $\alpha(b,y,B,\mu_g)>0$
5.0	4.25	-1.87	-4.66	-1.13	0.9
10.0	4.25	-0.90	-3.76	-0.12	29.1
15.0	4.25	0.04	-2.88	0.89	66.0
20.0	4.25	1.00	-1.99	1.90	83.9

Using average wealth distribution

B/GDP	B^d/GDP	$\bar{\alpha}(B,\mu_g)\%$	$\bar{\alpha}(B,\underline{g})$	$\bar{\alpha}(B,\bar{g})$	hh's $\alpha(b,y,B,\mu_g)>0$
5.0	4.25	-1.75	-4.56	-1.00	0.0
10.0	4.25	-0.95	-3.81	-0.15	9.2
15.0	4.25	0.00	-2.93	0.85	75.8
20.0	4.25	1.07	-1.92	1.99	86.9

4. Quantitative Analysis of Complete Model

Model calibration

- Calibration to Eurozone (also a case with only Spain)
- Most parameters set to data estimates
- Maturity adjustment: Macaulay duration rate of a consol proxied by mean duration *D*, so $B=B^{obs}/D=0.48/6.35=7.45\%$
- Three parameters set by SMM:
  a) Default cost targets mean debt ratio $\phi(g) = \phi_1 \max\{0, (\mu_g - g)^{1/2}\}$
  b) Discount factor targets mean *domestic* debt ratio
  c) Creditor bias targets mean spread (v. Germany)

			Moments (%)	Data	Model
Discount Factor	β	0.871	Avg. Ratio Domestic Debt	55.53	55.47
Welfare Weights	$\bar{\omega}$	0.065	Avg. Spread Eurozone	0.92	1.22
Default Cost	ϕ_1	0.793	Avg. Debt to GDP (maturity adjusted)	7.45	7.87

Quantitative findings

1. Model matches two key R&R historical facts:
   a) Infrequent defaults: 1.2% in model v. 1.1% in data
   b) Defaults w. low external debt (44% of total debt on average)
2. Debt sold at risk-free price 75% of the time, but amount of debt sharply reduced by inability to commit
3. Pre-default dynamics typical of debt crises: Debt & spreads rise sharply, suddenly before defaults (debt 38% above average, spreads at 953 basis points)
4. In line with key cyclical moments (negative corrs. of spreads with disp. income and gov. expenditures)
5. Large, time-varying dispersion in private default gains

Quantitative findings contn'd

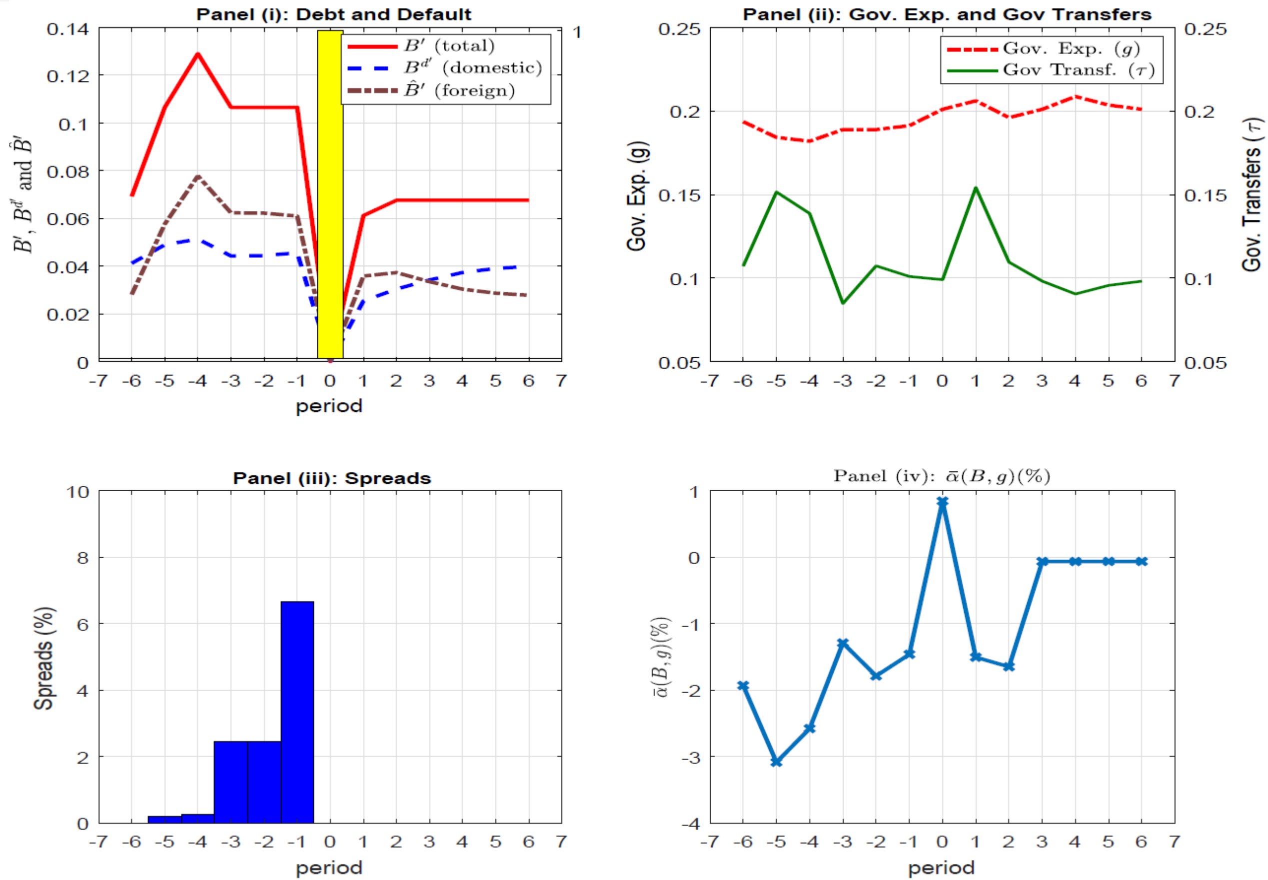
6. When default incentives are low, debt is used for tax-smoothing, but as they rise, gov. generates fewer resources by borrowing, so debt falls when *g* rises

7. Optimal debt moves across three zones:
   A. Low enough *B* and/or *g*, debt is sold at risk-free price and is in upward-sloping region of Laffer curve
   B. High enough *B* and/or *g* such that debt still sells at risk-free price but at the max. of the Laffer curve.
   C. Region of *B* and/or *g* in which debt carries risk premium but can be at the max. of Laffer curve or less (gov. desires more resources than what debt at risk-free price yields, but not always the most it can generate at a positive spread)
   – Debt is in region c) less frequently, so it sells at the risk-free price more often but option to default always restricts debt.

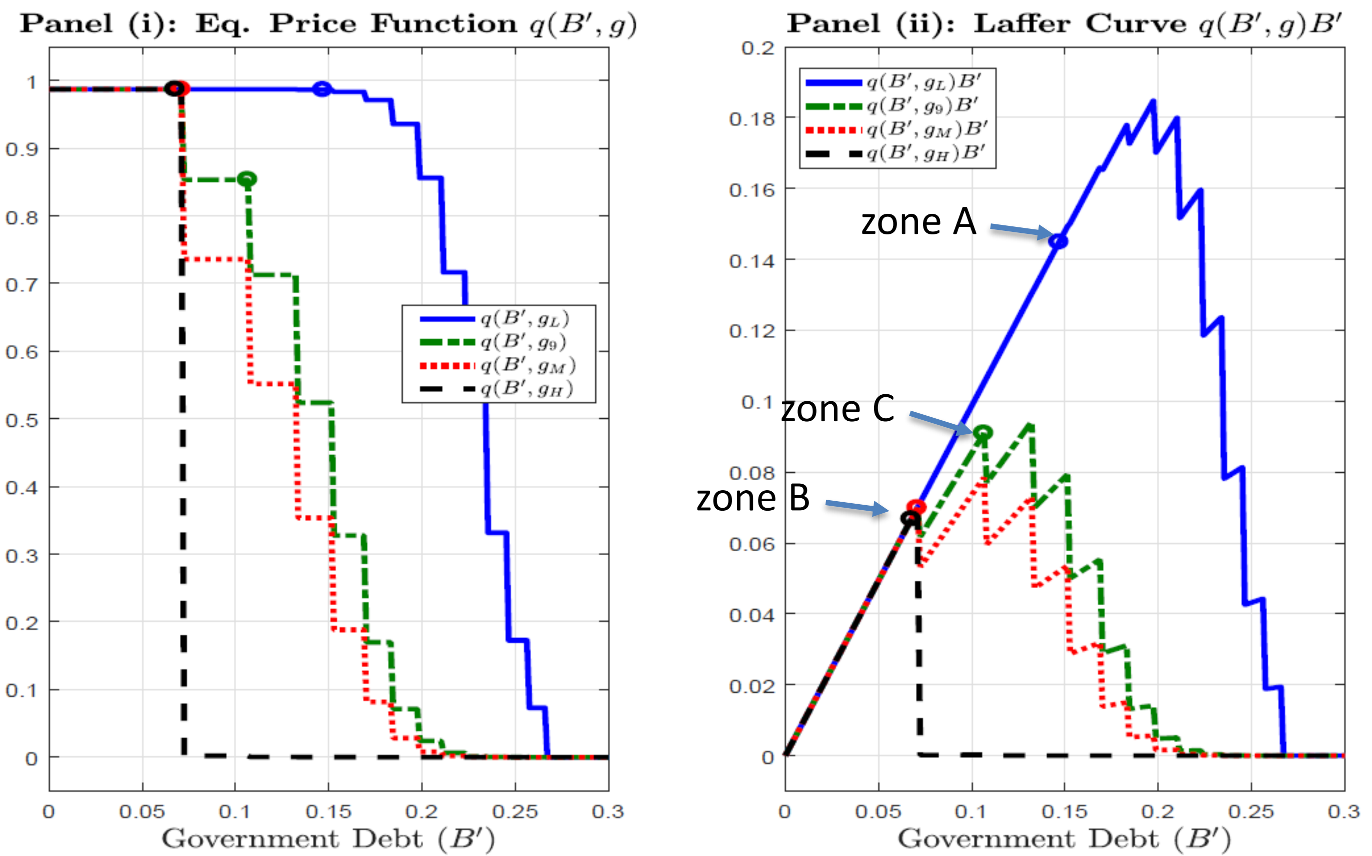
Long-run and pre-crisis moments

	Data		Model	
Moment (%)	Avg.	Crisis Peak	Average	Prior Default
Gov. Debt B	7.45*	10.94	7.87	10.82
Domestic Debt B^d	4.14	5.92	4.37	4.87
Foreign Debt $\widehat{B}$	3.31	5.02	3.50	5.95
Ratio B^d/B	55.53*	54.15	55.47	44.97
Tax Revenues $\tau^y Y$	30.01*	29.20	30.01	30.01
Gov. Expenditure g	19.98*	21.34	19.99	19.15
Transfers τ	8.15	16.78	9.90	10.35
Spread (%)	0.92*	3.34	1.22	9.53

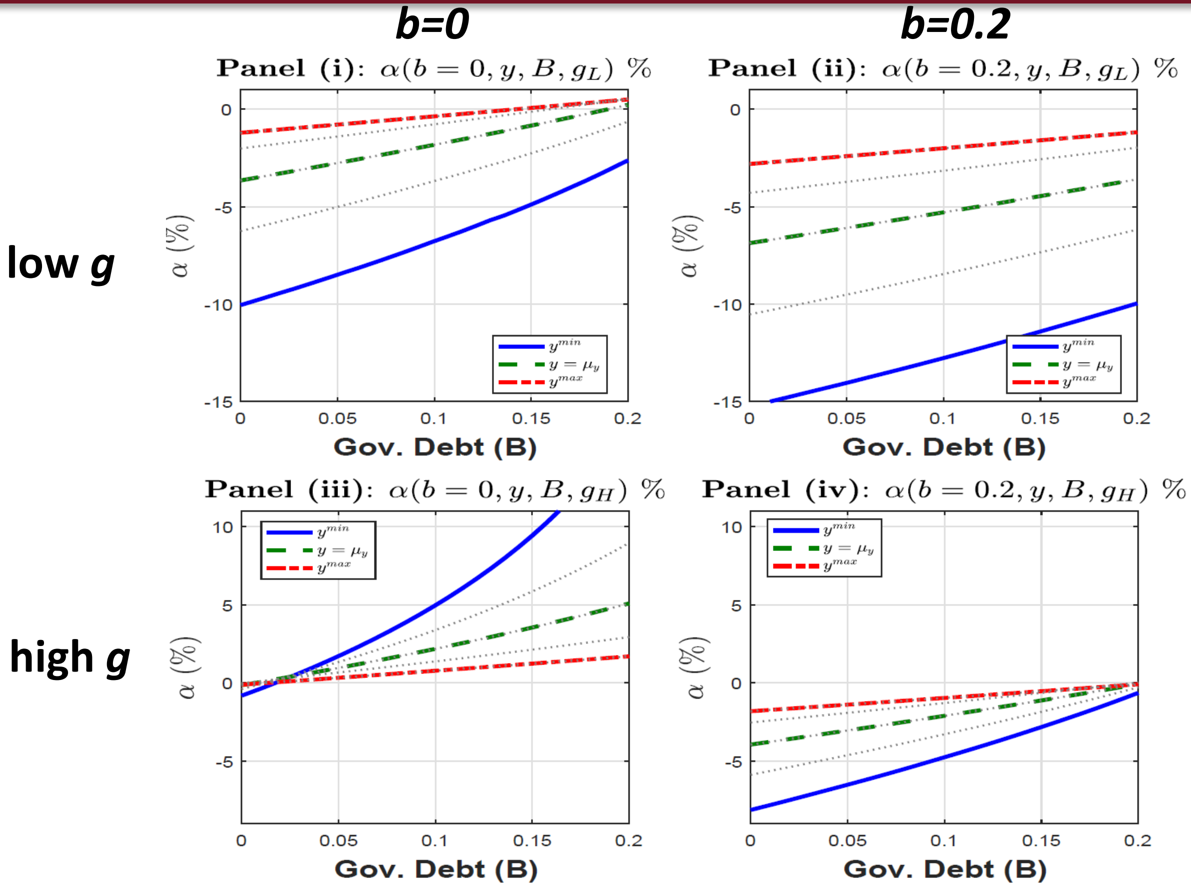
Default event dynamics



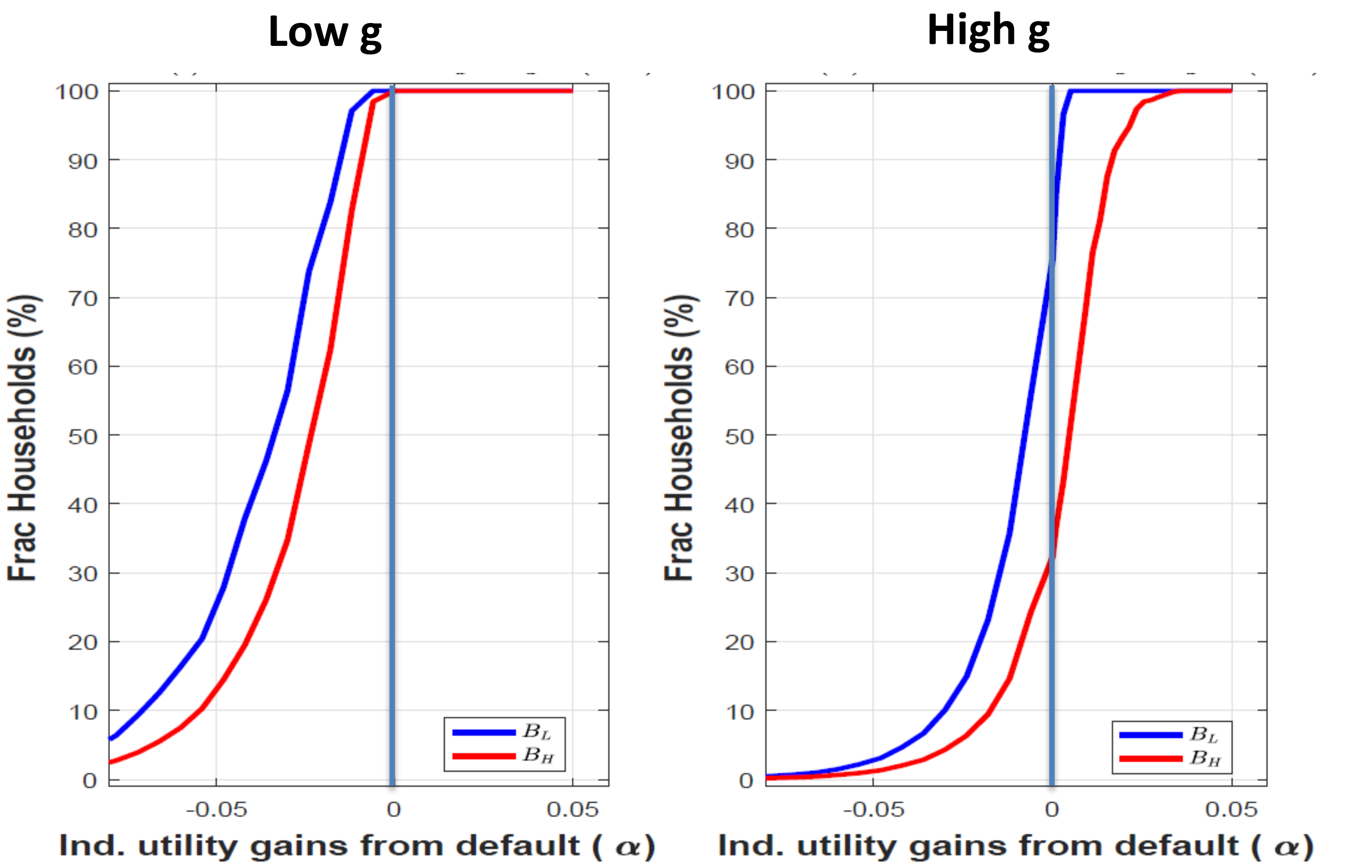
Pricing function & Laffer curve



Dispersion in gains from default



Evolution of social default gains



5. Robustness Analysis & Conclusions

Robustness Analysis

1. Welfare weights
2. Risk aversion and subjective discount factor
3. Idiosyncratic income variability
4. Exogenous default costs
5. Income tax rates
6. Exogenous and endogenous partial default

Relevance of welfare weights

- Weighing non-bond holders more:
  1. *Riske-free utilitarian*: Use long-run average of (b, y) distribution without default risk $\omega(b, y) = \bar{\Gamma}^{rf}(b, y)$
  2. *Quasi-Rawlsian weighting*: Modify weighting function to assign weight z to agents with zero bond holdings

$$\omega(b, y) = \sum_{y_i \leq y} \pi^*(y_i) \left(1 - e^{-\frac{(b+z)}{\bar{\omega}}}\right)$$

- Model sustains debt with positive risk premia in both experiments (for lower $\bar{\omega}$ and/or $z > 0$)
- Default incentives are stronger, so default freq./spreads increase and sustainable debt ratios fall

Results with different welfare weights

Moment (%)	Baseline $\bar{\omega} = 0.065$ $z = 0$	(A) $\bar{\omega} = 0.065$ $z = 0.025$	(B) $\bar{\omega} = 0.055$ $z = 0$	(C) $\bar{\omega} = 0.055$ $z = 0.025$	(D) $\omega(b, y)$ $= \bar{\Gamma}^{rf}(b,$
Long Run Avg.					
Gov. Debt B	7.87	5.71	6.61	4.93	3.76
Dom. Debt B^d	4.37	4.21	4.27	4.14	3.23
Foreign Debt $\hat{B}$	3.50	1.50	2.35	0.79	0.53
Default Frequency	1.21	2.26	2.10	3.52	4.39
Spreads	1.22	2.32	2.15	3.65	4.592
Transf τ	9.90	9.93	9.92	9.95	10.01
Frac. Hh's $b = 0$	65.58	67.42	67.69	67.33	69.64
$\bar{\alpha}(B, g)$	-0.814	-0.781	-0.862	-0.766	-0.768
Avg. Prior Default					
Gov. Debt B	10.82	7.99	9.26	6.97	5.43
Dom. Debt B^d	4.87	4.79	4.95	4.76	4.28
Foreign Debt $\hat{B}$	5.95	3.20	4.32	2.21	1.15
Spreads	9.53	12.67	12.30	19.78	16.16
Def. Th. $\hat{b}(\mu_y)$	0.095	0.068	0.081	0.060	0.049
%. Favor Repay (1-$\omega(\hat{b}(\mu_y), \mu_y)$)	22.44	21.92	21.59	20.48	4.91
% Favor Repay (1-$\bar{\gamma}(\hat{b}(\mu_y), \mu_y)$)	4.48	5.19	4.97	5.51	5.53
Cumulative Welfare Weights					
$\Omega(b = 0)$	0.00	32.06	0.00	36.59	65.64
$\Omega(b = 0.0004)$	1.00	32.29	0.51	36.84	65.65
$\Omega(b = 0.0447)$	50.00	67.09	57.48	73.01	85.83
$\Omega(b = 0.3025)$	99.00	99.41	99.63	99.77	93.82

Results with different preference parameters and income process

		β		σ		σ_u		
Moment (%)	Baseline	0.853	0.888	0.75	1.25	$0^{\dagger}$	0.28	0.34
Long Run Avg.								
Gov. Debt B	7.87	7.90	8.03	7.79	7.90	2.82	7.86	7.88
Dom. Debt B^d	4.37	2.45	7.53	1.05	10.07	0.00	2.85	5.92
Foreign Debt $\hat{B}$	3.50	5.46	0.50	6.74	-2.16	2.82	5.01	1.96
Def. Freq.	1.21	1.23	1.19	1.26	1.19	8.92	1.21	1.18
Spreads	1.22	1.24	1.21	1.278	1.202	9.793	1.224	1.199
Transf τ	9.896	9.895	9.897	9.896	9.896	10.35	9.896	9.896
Frac. Hh's $b = 0$	65.58	82.99	60.07	88.75	55.67	99.99	81.30	63.28
$\bar{\alpha}(B, g)$	-0.814	-0.946	-0.698	-0.771	-0.877	-0.666	-0.803	-0.827
Avg. Prior Default								
Gov. Debt B	10.82	10.84	10.74	10.24	10.78	3.73	10.80	10.82
Dom. Debt B^d	4.87	2.78	8.52	1.17	10.60	0.00	3.22	6.74
Foreign Debt $\hat{B}$	5.95	8.06	2.22	9.08	0.17	3.73	7.57	4.08
Spreads	9.530	9.495	9.631	9.299	9.563	14.76	9.562	9.530

Baseline model parameters are $\beta = 0.871$, $\sigma = 1$ and $\sigma_u = 0.31$

Results with different tax rates & default costs

$$\phi(g) = \phi_1 \max\{0, (\hat{g} - g)^{\psi}\}$$

		τ^y		ϕ_1		ψ		$\hat{g}$	
Moment (%)	Baseline	0.29	0.48	0.59	0.99	0.40	0.60	0.188	0.209
Long Run Avg.									
Gov. Debt B	7.87	7.85	7.87	7.36	8.23	8.26	7.19	6.80	13.52
Dom. Debt B^d	4.37	7.41	2.33	4.22	5.48	4.41	4.24	4.22	4.44
Foreign Debt $\hat{B}$	3.50	0.45	5.54	3.14	2.75	3.85	2.96	2.58	9.09
Def. Freq.	1.21	1.21	1.18	0.42	4.10	1.30	0.31	0.06	2.64
Spreads	1.220	1.223	1.189	0.42	4.28	1.32	0.31	0.06	2.71
Transf τ	9.896	2.40	17.41	9.898	10.91	9.89	9.90	9.90	9.74
Frac. Hh's $b = 0$	65.58	59.94	83.08	66.85	73.63	65.35	66.34	65.68	66.79
$\bar{\alpha}(B, g)$	-0.814	-0.897	-0.766	-0.636	-3.880	-1.046	-0.541	-0.213	-1.963
Avg. Prior Default									
Gov. Debt B	10.82	10.78	10.82	9.40	9.97	12.02	9.03	11.03	18.62
Dom. Debt B^d	4.87	8.31	2.66	4.56	5.85	5.08	4.54	5.37	4.46
Foreign Debt $\hat{B}$	5.95	2.47	8.16	4.85	4.12	6.94	4.49	5.65	14.15
Spreads	9.530	9.560	9.524	4.207	10.33	10.42	2.98	8.46	11.34

Baseline parameters are $\tau^y = 0.386$, $\phi_1 = 0.793$, $\psi = 1/2$ and $\hat{g} = 0.199$.

Results with partial default

		(A)	(B)	(C)	(D)
	Baseline	Fixed Default Rate			Endogenous
Moment (%)	$\varphi = 1.0$	$\varphi = 0.90$	$\varphi = 0.80$	$\varphi = 0.50$	Default Rate
Long Run Avg.					
Gov. Debt B	7.87	7.96	8.21	12.62	7.87
Dom. Debt B^d	4.37	4.28	4.30	4.68	4.37
Foreign Debt $\hat{B}$	3.50	3.68	3.91	7.93	3.50
Def. Freq.	1.21	1.10	1.05	1.87	1.21
Spreads	1.220	1.111	1.058	1.902	1.220
Transf τ	9.896	9.910	9.921	10.199	9.896
Frac. Hh's $b = 0$	65.58	67.17	66.43	59.00	65.58
$\bar{\alpha}(B, g)$	-0.814	-0.849	-0.870	-1.112	-0.814
Avg. Prior Default					
Gov. Debt B	10.82	10.94	11.60	20.57	10.82
Dom. Debt B^d	4.87	4.85	4.92	6.12	4.87
Foreign Debt $\hat{B}$	5.95	6.09	6.67	14.45	5.95
Spreads	9.530	8.415	8.098	9.802	9.530
Recovery Rate $(1 - \varphi)$	0.00	10.00	20.00	50.00	0.00

Conclusions

- Heterogeneous-agents model with defaultable public debt (feedback mechanism links debt, spreads & dist. of debt holdings)
- Default is optimal when distributional incentives are stronger than social value of debt
  - Redistribution alone cannot sustain debt
  - Large social value (liquidity, self-insurance risk-sharing)
- Calibrated to Eurozone, model yields low freq. of domestic defaults and debt sold at risk free price most of the time (but lack of commitment limits debt)
- Large, time-varying dispersion in private default gains
- Realistic debt crisis dynamics
- Tax smoothing only with weak default incentives