

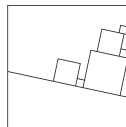
The Political Economy of Domestic and External Sovereign Debt

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Cluster of Excellence
The Politics of Inequality

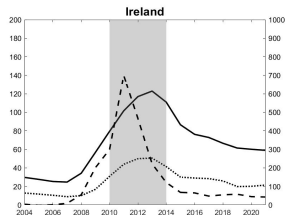
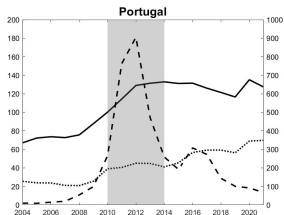
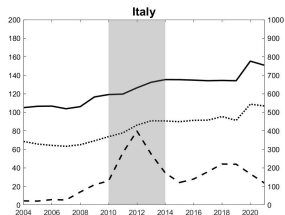
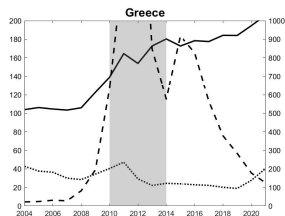
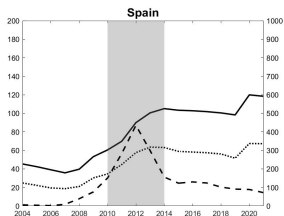
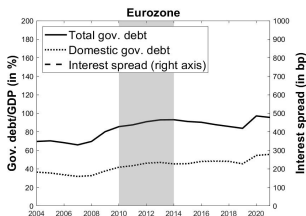


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Motivation

European Sovereign Debt Crisis



Source: ECB GFS, Eurostat, Arslanalp and Tsuda (2014)

Motivation

Distributional and Political Consequences of Debt Crises

- Debt crisis:
 - increasing debt service costs,
 - gov. cuts spending and raises taxation at expense of poor households.
- Political conflict between poor and wealthy households.



"Europe unites in austerity protests against cuts and job losses"
The Guardian (2012)

Research Questions

- 1 What are the political and distributional consequences of sovereign debt and default?
- 2 How are optimal fiscal policy choices affected by redistributive concerns, composition of sovereign debt, and political constraints?

This Paper

- Stochastic dynamic general equilibrium model with
 - income and wealth heterogeneity,
 - domestic and external sovereign debt,
 - endogenous default,
 - political constraint \Rightarrow fiscal policy needs approval.
- Application to Italian economy.
- Political and distributional consequences of debt and default.

Main Findings

In a debt crisis...

- increasing debt service cost (higher interest)
 - reduce redistributive transfers,
 - raise return on household savings.
- ⇒ wealth inequality increases
- political conflict:
 - wealthy households prefer repayment (benefit from higher interest),
 - poor households prefer default (suffer from austerity).
- ⇒ approval of fiscal plan decreases and raises likelihood of default

Related Literature

1 Fiscal policy and redistribution in models of public debt

Aiyagari and McGrattan (1998), Heathcote (2005), Azzimonti et al. (2014), Röhrs and Winter (2017), Ferriere (2015), Jeon and Kabukcuoglu (2018), Deng (2021), D'Erasmus and Mendoza (2016), **D'Erasmus and Mendoza (2021)**, Tran-Xuan (2022)

2 Political aspects in models of public debt

Cuadra and Sapriza (2008), Hatchondo et al. (2009), Guembel and Sussman (2009), Aguiar and Amador (2011), Dovis et al. (2016), Scholl (2017), Chatterjee and Eyigungor (2019), **Andreasen et al. (2019)**, Prein and Scholl (2021), Novelli (2021), Azzimonti and Mitra (2022)

The Model

- Builds on D'Erasmus and Mendoza (2021).
- Infinite-horizon small open endowment economy.

1. Households

- idiosyncratic income risk,
- savings in bonds,
- borrowing constraint.

3. Political Constraint

- fiscal plan requires majority,
- households evaluate fiscal plan,
- rejected fiscal plans \Rightarrow default.

2. Government

- stochastic gov. spending,
- income tax and transfers,
- non-state-contingent bonds,
- debt contracts not enforceable.

4. Foreign Creditors

- risk-neutral,
 - borrow/lend at risk-free rate.
- \Rightarrow no discrimination between domestic and foreign creditors.

Environment

1. Households

- Continuum (measure one) of **households** with identical preferences:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t u(c_t).$$

- If gov. repays debt:

$$c_t + q_t b_{t+1} = y_t(1 - \tau) + b_t + T_t,$$
$$b_{t+1} \geq 0.$$

- If gov. defaults:

$$c_t = y_t(1 - \tau) + T_t - \underbrace{\phi(G_t)}_{\text{default cost}}.$$

Environment

2. Government

- **Government** maximizes weighted expected discounted lifetime utility.
- Gov.'s political preferences: welfare weights $\omega(b_t, y_t)$.
- If gov. repays debt:

$$T_t = \tau Y - G_t - B_t + q_t B_{t+1},$$
$$B_{t+1} \geq 0.$$

- If gov. defaults:

$$T_t = \tau Y - G_t.$$

Environment

3. Political Constraint

- Gov.'s **political constraint** (Andreasen et al., [2019](#))
⇒ fiscal plan needs majority of votes.
- Individual approval $p_t \in \{0, 1\}$:

$$p_t = \begin{cases} 1 & \text{if discounted expected lifetime} \\ & \text{utility of repayment} > \text{default} \\ 0 & \text{else} \end{cases}$$

- Aggregate approval $P_t \in (0, 1)$ using distribution $\Lambda_t(b_t, y_t)$.
- Fiscal plan accepted if approval exceeds vote threshold: $P_t > P^s$.

Environment

4. Foreign Creditors

- Risk-neutral **foreign creditors**:
 - perfect competition,
 - borrow/lend at risk-free rate r ,
 - perfect information about economy.
- Bond price \Rightarrow zero expected profit condition

$$q_t = \frac{1 - \delta_t}{1 + r}$$

Model Timing

- 1 At the beginning of each period, shocks are realized.
- 2 Individual states, aggregate states and distribution are observed.
- 3 Gov. proposes fiscal plan and individual voting takes place.
- 4 Either fiscal plan is implemented or sovereign default takes place.
- 5 Given gov.'s policies, households make consumption-savings choices.

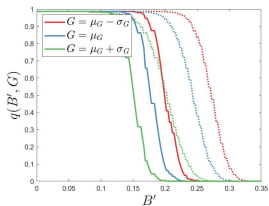
Calibration

- Utility: $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$.
- Default cost function: $\phi(G) = \phi_1(\bar{G} - G)^{0.5}$.
- AR(1) processes for income and gov. spending shock.
- Political preferences: $\omega(b, y) = \pi^*(y) \frac{1}{\bar{\omega}} e^{-\frac{b}{\bar{\omega}}}$.

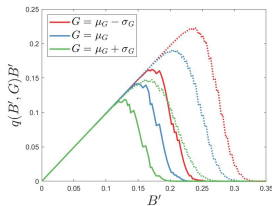
Parameter			Target
<u>External</u>			
Risk-free rate	r	0.013	German bond yields
Risk aversion	σ	2	Standard value
Idiosyncratic income	ρ_y	0.85	Autocorrelation income
	μ_y	1.0	Average income
	σ_v	0.274	Standard deviation income
Gov. spending	ρ_G	0.82	Autocorrelation gov. spending
	μ_G	0.189	Average gov. spending
	σ_ϵ	0.024	Standard deviation gov. spending
Voting threshold	P^S	0.5	Simple majority
<u>Internal</u>			
Time preference	β	0.795	Average domestic debt ratio
Default cost	ϕ_1	0.733	Average bond spreads vs. Germany
Income tax	τ	0.28	Tax revenues as share of GDP
Pareto weight	$\bar{\omega}$	0.062	Total debt as share of GDP

Understanding the Mechanisms

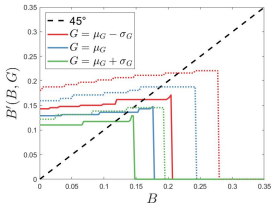
(a) Bond Price



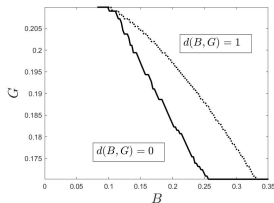
(b) Debt Laffer Curve



(c) Borrowing Policy

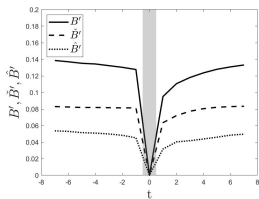


(d) Default Set

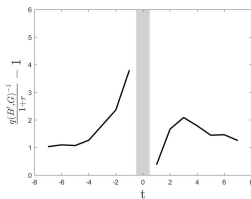


Default Event

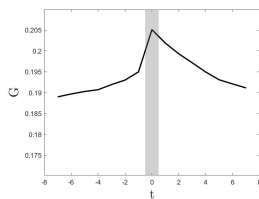
(a) Debt



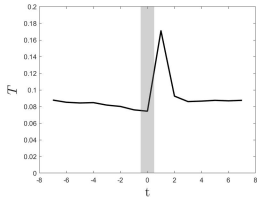
(b) Interest spread



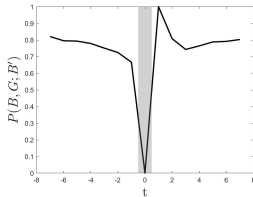
(c) Gov. spending



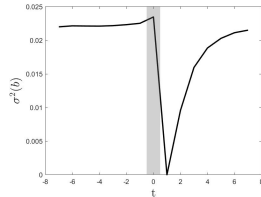
(d) Transfers



(e) Approval



(f) Inequality



Conclusions

This Paper

- Quantitative model of debt and default with heterogeneous households:
 - idiosyncratic income risk,
 - savings in non-state contingent gov. bonds,
 - gov.'s fiscal plans require support of majority.

Results

- Debt crises \Rightarrow political conflict:
 - debt service costs \uparrow , transfers \downarrow ,
 - conflict between wealthy and poor households,
 - approval fiscal policy \downarrow , likelihood of default \uparrow .

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Recursive Equilibrium

Private Sector

- Household value functions given B' and $d \in \{0, 1\}$:

$$V(b, y, B, G; B') = (1 - d)V^{d=0}(b, y, B, G; B') + dV^{d=1}(y, G)$$

$$V^{d=0}(b, y, B, G; B') = \max_{\{c, b'\}} u(c) + \beta \mathbb{E}[V(b', y', B', G'; B'') | y, G]$$

s.t.

$$c + q(B', G)b' = y(1 - \tau) + b + T$$

$$V^{d=1}(y, G) = u(c) + \beta \mathbb{E}[V(0, y', 0, G'; B'') | y, G]$$

s.t.

$$c = y(1 - \tau) + T - \phi(G)$$

- Solution: $c(b, y, B, G; B')$ and $b'(b, y, B, G; B')$

Recursive Equilibrium

Political Process

- Household supports gov.'s fiscal plan if expected discounted lifetime utility of repayment $>$ default:

$$p(b, y, B, G; B') = \begin{cases} 1 & \text{if } V^{d=0}(b, y, B, G; B') > V^{d=1}(y, G) \\ 0 & \text{else} \end{cases}$$

- Aggregate vote share supporting fiscal plan using distribution $\Lambda(b, y)$:

$$P(B, G; B') = \int_{\mathbb{Y} \times \mathbb{B}} p(b, y, B, G; B') d\Lambda(b, y)$$

Recursive Equilibrium

Public Sector

- Gov. chooses between repayment and default:

$$\max_{d \in \{0,1\}} \{W^{d=0}(B, G; B'), W^{d=1}(G)\}.$$

- Gov. imposes welfare weights $\omega(b, y)$ in social welfare function W :

$$W^{d=0}(B, G; B') = \sum_{y \in \mathbb{Y}} \int_{\mathbb{B}} V^{d=0}(b, y, B, G; B') \omega(b, y) db,$$
$$W^{d=1}(G) = \sum_{y \in \mathbb{Y}} V^{d=1}(y, G) \pi^*(y)$$

Recursive Equilibrium

Public Sector

- Gov.'s fiscal plan given political constraint and private sector policies:

$$\max_{B'} W^{d=0}(B, G; B')$$

s.t.

$$T = \tau Y + q(B', G)B' - B - G,$$

$$B' \geq 0,$$

$$P(B, G; B') \geq P^s,$$

$$c(b, y, B, G; B') \text{ and } b'(y, B, G; B').$$

- Any fiscal plan satisfies $P(B, G; B') \leq P^s \Rightarrow$ default.
- Solution: $d(B, G)$ and $B'(B, G)$.

Recursive Equilibrium

Foreign Creditors

- Bond price satisfies zero expected profit condition:

$$q(B', G) = \frac{1 - \delta(B', G)}{1 + r}.$$

- Gov.'s default probability:

$$\delta(B', G) = \sum_{G' \in \mathbb{G}} d(B', G') \psi(G'|G).$$

Definition: Recursive Equilibrium

Given initial distribution $\Lambda_0(b, y)$, default decision $d(B, G)$, debt policy $B'(B, G)$, transfers T , a recursive equilibrium is a set of value functions $V^{d=0}(b, y, B, G; B')$, $V^{d=1}(y, g)$ and $V(b, y, B, G; B')$, households' decision rules $b'(y, b, B, G; B')$ and $c(y, b, B, G; B')$, bond price $q(B', G)$, default probability $\delta(B', g)$ and transition function of distribution $\Lambda'(b, y) = H(\Lambda(b, y))$ such that:

- 1 value functions and decision rules solve the households' problem,
- 2 international creditors' zero expected profit condition holds,
- 3 distribution transition function is given by $H(\Lambda(b, y))$,
- 4 gov. budget constraints of repayment and default hold,
- 5 bond market clearing holds: $\hat{B}' + \check{B}' = B'$,
- 6 aggregate resource constraints are satisfied:
 - repayment: $C + G = Y - \hat{B} + q(B', G)\hat{B}$,
 - default: $C + G = Y - \phi(G)$.

Solution Method

Algorithm

- Aggregate approval P depends on distribution $\Lambda(b, y)$.
- Forecasting rule $F(T, q, \alpha)$ to predict P .

Algorithm

- 1 Initial guess for α .
- 2 Value function iteration \Rightarrow solve private and public sector.
- 3 Simulate model \Rightarrow distribution, voting and approval.
- 4 Simulated time series \Rightarrow estimate α .
- 5 Update $\alpha \Rightarrow$ step 2.
- 6 Iterate $\Rightarrow \alpha$ converges.

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Solution Method

Forecasting Rule

- Fractional response model (Papke and Wooldridge, 1996):

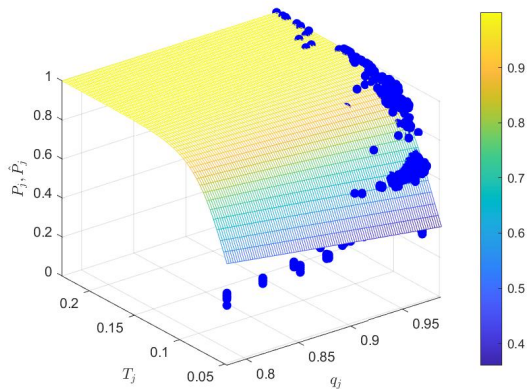
$$P_j = \underbrace{f(x_j' \alpha)}_F + \epsilon_j, \quad j = 1, \dots, n$$

- Dependent variable P_j
 - Cumulative distribution function $0 \leq f(x_j' \alpha) \leq 1$
 - Independent variables $x_j = (T_j, q_j)$
 - Vector of regression coefficients α
 - Error term ϵ_j
- Maximize log-likelihood using logistic function $f(z) = \frac{\exp(z)}{1 + \exp(z)}$:

$$\mathbb{L}(\alpha) = \sum_j^n P_j \log(f(x_j' \alpha)) + (1 - P_j) \log(1 - f(x_j' \alpha))$$

Solution Method

Model Fit



$$RMSE = \sqrt{\frac{\sum_j^n (\hat{P}_j - P_j)^2}{n}}$$

$$= 0.078$$

$$AME = \frac{\sum_j^n |\hat{P}_j - P_j|}{n}$$

$$= 0.06$$

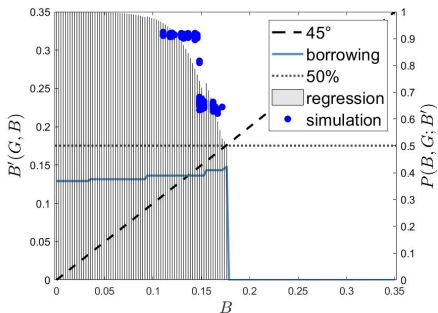
Data

Table: Data

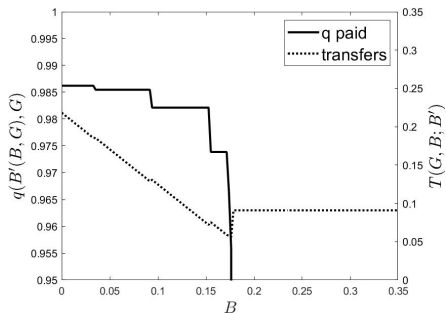
Description	Period	Source
Gov. debt (consolidated) (% of GDP)	1995 - 2015	ECB GFS
Gov. debt held by residents (% of GDP)	1995 - 2015	ECB GFS
Average residual maturity of gross gov. debt	1995 - 2015	Bank of Italy
General gov. final consumption expenditure (% of GDP)	1995 - 2015	WDI
Gov. transfers (% of GDP)	1995 - 2015	D'Erasmus and Mendoza (2021)
Gov. tax revenue (% of GDP)	1995 - 2015	D'Erasmus and Mendoza (2021)
EMU convergence criterion bond yields (Italy and Germany)	2002 - 2015	Eurostat
Real household net disposable income	1995 - 2015	OECD.stat
External balance on goods and services (% of GDP)	1995 - 2015	WDI

Aggregate Approval of Fiscal Plans

(a) Approval and Borrowing Policy



(b) Bond Price Paid and Transfers



Long-Run Statistics

Description	Variable	Counterfactual	Benchmark	Data
Total debt	B	17.89	13.68	13.72
Domestic debt	\check{B}	8.28	8.17	8.58
External debt	\hat{B}	9.62	5.51	5.15
Domestic debt ratio	\check{B}/B	46.25	59.75	62.5
Government spending	G	18.9	18.9	18.9
Transfers	T	8.85	8.86	4.96
Interest spread	$\frac{q(B', G)^{-1}}{1+r} - 1$	1.62	1.13	1.21
Default rate	$\frac{I_{d=1}}{10.000}$	1.80	1.06	-
Gini domestic debt	$Gini(b)$	73.68	73.91	99.0*
Gini income	$Gini(y)$	31.66	31.66	34.4
Fraction at borrowing constraint	$\frac{I_{b=0}}{10.000}$	48.57	51.07	-

Business Cycle Statistics

Description	Variable	Benchmark	Data
Standard deviation			
Disposable income	$\sigma(DY)$	1.07	1.07
Consumption	$\sigma(C)/\sigma(DY)$	0.87	0.98
Trade balance	$\sigma(TB)/\sigma(DY)$	0.33	0.55
Interest spread	$\sigma(IS)/\sigma(DY)$	1.96	0.47
Total debt	$\sigma(B)/\sigma(DY)$	1.76	2.73
Domestic debt	$\sigma(\check{B})/\sigma(DY)$	0.56	2.54
Correlation /w disposable income			
Consumption	$\rho(C, DY)$	0.92	0.67
Trade balance	$\rho(TB, DY)$	-0.69	-0.50
Interest spread	$\rho(IS, DY)$	-0.39	-0.60

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