

The Aggregate-Demand Doom Loop: Precautionary Motives and the Welfare Costs of Sovereign Risk

Francisco Roldán
IMF

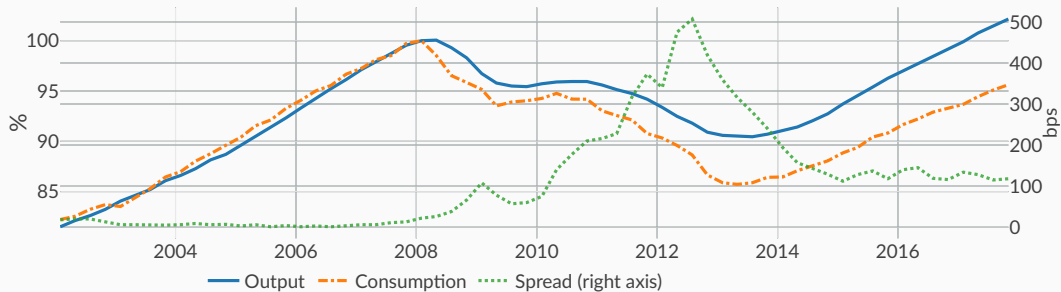
August 2020

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

Spain in the Eurozone Crisis

- Sovereign risk associated with **deep** recessions

Output and Consumption for Spain



► Detrended data

► Trade balance

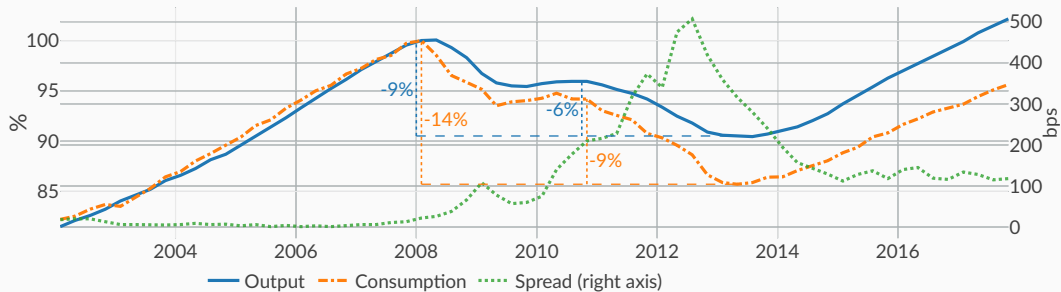
► Low demand?

► Nondurable consumption

Spain in the Eurozone Crisis

- Sovereign risk associated with **deep** recessions

Output and Consumption for Spain



► Detrended data

► Trade balance

► Low demand?

► Nondurable consumption

Sovereign Risk

- Spain: large contractions in **output** and **consumption**
... $|\Delta C| > |\Delta Y|$
- Pattern consistent across EU countries
 - Spreads associated with contractions in output, consumption, and APCs

This paper

- Aggregate-demand **doom loop** rationalizes big recessions in response to sovereign risk
- Key: sovereign default risk boosts **precautionary motives**
- New light on consumption response to sovereign risk
 - Spanish households' wealth $\sim 100\%$ of GDP pre-crisis. No consumption smoothing?

► More

Sovereign Risk

- Spain: large contractions in **output** and **consumption**
... $|\Delta C| > |\Delta Y|$
- Pattern consistent across EU countries
 - Spreads associated with contractions in output, consumption, and APCs

This paper

- Aggregate-demand **doom loop** rationalizes big recessions in response to sovereign risk
- Key: sovereign default risk boosts **precautionary motives**
- New light on consumption response to sovereign risk
 - Spanish households' wealth $\sim 100\%$ of GDP pre-crisis. No consumption smoothing?

► More

This paper

- Extend a quantitative model of sovereign debt
 - Prominent role for households' income-fluctuations problem
 - Consumption vs savings, **precautionary motives**
 - **Exposures** to sovereign risk
 - Endogenous wealth distribution that interacts with gov't default choice
 - **Bewley** setup + portfolio choice
 - Nominal rigidities
 - Externality: households cut consumption **more** than planner
- **Potential** defaults create
 - Aggregate income losses ← TFP costs of default
 - Redistributive effects ← Domestic debt holdings
 - ... Those who benefit from redistribution: high MPCs from current income, low from future income
- Default risk **interacts** with precautionary behavior

This paper

- Extend a quantitative model of sovereign debt
 - Prominent role for households' income-fluctuations problem
 - Consumption vs savings, **precautionary motives**
 - **Exposures** to sovereign risk
 - Endogenous wealth distribution that interacts with gov't default choice
 - **Bewley** setup + portfolio choice
 - Nominal rigidities
 - Externality: households cut consumption **more** than planner
- **Potential** defaults create
 - Aggregate income losses ← TFP costs of default
 - Redistributive effects ← Domestic debt holdings
 - ... Those who benefit from redistribution: high MPCs from current income, low from future income
- Default risk **interacts** with precautionary behavior

This paper

- Extend a quantitative model of sovereign debt
 - Prominent role for households' income-fluctuations problem
 - Consumption vs savings, **precautionary motives**
 - **Exposures** to sovereign risk
 - Endogenous wealth distribution that interacts with gov't default choice
 - **Bewley** setup + portfolio choice
 - Nominal rigidities
 - Externality: households cut consumption **more** than planner
- **Potential** defaults create
 - Aggregate income losses ← TFP costs of default
 - Redistributive effects ← Domestic debt holdings

... Those who benefit from redistribution: high MPCs from current income, low from future income
- Default risk **interacts** with precautionary behavior

How is sovereign risk costly?

Feedback loop between spreads and output

$\uparrow \text{Spreads} \implies \downarrow \text{Demand} \implies \downarrow \text{Output} \implies \uparrow \text{Spreads}$

Main Findings

- **Feedback** explain significant portion of the crisis
 - 30% of output contraction
 - 40% of agg. consumption contraction
- Large welfare effects
 - Volatility of output **tripled** with sovereign risk
 - Volatility of agg. consumption increases by an order of magnitude
 - Eliminating sovereign risk worth on average 1.76% of permanent consumption
 - As much as 6.8% at height of **crisis**
- Distributional effects
 - Value of removing default risk **ranges** from 10.2% to 5.6% of consumption

- **Sovereign risk affecting the supply side through finance**

Arellano, Bai and Mihalache (2020), Bocola (2016), Arellano, Bai and Bocola (2017), Arellano, Bai and Mihalache (2018), Balke (2017)

- **Domestic debt and default incentives**

Gennaioli, Martin and Rossi (2014), Mengus (2014), Mallucci (2015), Pérez (2018), Sosa-Padilla (2018), D'Erasmus and Mendoza (2016), Ferriere (2016), Deng (2020) ...

- **Sovereign risk and fiscal austerity**

Cuadra, Sánchez, and Sapriza (2010), Romei (2015), Bianchi, Ottonello and Presno (2016), Anzoategui (2020), Philippon and Roldán (2018)

- **Shocks affecting aggregate demand through redistribution**

Auclert (2017), Eggertsson and Krugman (2012), Korinek and Simsek (2016), ...

- Description of Model
- Results and simulations
- Crises
- Concluding remarks

Description of Model

General Description

- Small open economy with
 - Sovereign default risk
 - Uninsurable idiosyncratic risk + incomplete markets
 - Nominal rigidities
- Actors
 - Government
 - Issues long-term debt, purchases goods, decides **repayment**
 - Domestic households
 - Choose consumption, savings, and **portfolio choice** btw gov't bond + risk-free asset
 - Differ in ex-post wealth + idiosyncratic income shock
 - Firms
 - Produce goods with labor subject to **wage rigidities**
 - Foreigners
 - Lend to gov't + private agents, **price** all assets

At each t , the government

- Chooses **repayment** $h_t \in \{1, 1 - \bar{h}\}$
- Follows fiscal rules for new **issuances** $B'(S_t)$ and spending $G(S_t)$
 - Can depend on full state: $(B_t, \lambda_t, \xi_t, \zeta_t, z_t)$ ► Fiscal rules
- Must satisfy its budget constraint

$$\underbrace{q_t^g}_{\text{debt price}} \underbrace{(B'_t - (1 - \rho)B_t)}_{\text{new debt issued}} + \underbrace{T_t}_{\text{lump-sum}} + \underbrace{\tau w_t L_t}_{\text{payroll tax}} = \underbrace{G_t}_{\text{spending}} + \underbrace{\kappa B_t}_{\text{coupon}}$$

→ T_t summarizes a default / austerity tradeoff

- Given govt's policies, aggregates, and evolution of the state

$$v(\omega, \epsilon, \mathbf{S})^{\frac{\psi-1}{\psi}} = \max_{c, a', b'} (1 - \beta) c^{\frac{\psi-1}{\psi}} + \beta \mathbb{E} \left[\left(v(\underbrace{a' + R_{\mathbf{S}, \mathbf{S}'} b'}_{=\omega'}, \epsilon', \mathbf{S}') \right)^{1-\gamma} \middle| \omega, \epsilon, \mathbf{S} \right]^{\frac{\psi-1}{\psi(1-\gamma)}}$$

$$\text{subject to } p_c(\mathbf{S})c + q^h(\mathbf{S})a' + q^g(\mathbf{S})b' = \omega + \ell(\mathbf{S})\epsilon - T(\mathbf{S})$$

$$\ell(\mathbf{S}) = w(\mathbf{S})L(\mathbf{S})(1 - \tau) + \Pi(\mathbf{S})$$

$$R_{\mathbf{S}, \mathbf{S}'} = \mathbb{1}_{(\zeta'=1)}\kappa + (1 - \rho) (1 - \hbar \mathbb{1}_{(\zeta=1)(\zeta' \neq 1)}) q^g(\mathbf{S}')$$

$$a' \geq \bar{a}; \quad b' \geq 0$$

$$\mathbf{S}' = \Psi(\mathbf{S}, \xi', z', h')$$

$$\text{Exog LoMs for } (\epsilon, \xi, z); \text{ prob of } h' \text{ given } (\mathbf{S}, \xi', z')$$

Households in a crisis

$$\pi \uparrow \implies \mathbb{E}[w'L'] = \pi \mathbb{E}[w'L' | \zeta' \neq 1] + (1 - \pi) \mathbb{E}[w'L' | \zeta' = 1] \downarrow$$

$$q^g \downarrow \implies \text{ex-post capital losses : } \omega \downarrow \text{ for all}$$

$$\text{cov}(R_{S,S'}, sdf' \mid S) \downarrow$$

Private Economy

Given a government policy $h(S, \xi', z')$, $B'(S)$, $T(S, q^g)$, in a comp eq'm

- Risk-neutral foreigners

$$q^g(S) = \underbrace{\frac{1}{1+r^*}}_{q^h(S)} \mathbb{E} \left[\underbrace{\mathbb{1}_{(\zeta'=1)}(1-\xi')\kappa}_{\text{coupon}} + \underbrace{(1-\rho)}_{\text{depreciation}} \underbrace{(1-\hbar \mathbb{1}_{(\zeta=1 \cap \zeta' \neq 1)})}_{\text{potential haircut}} \underbrace{q^g(S')}_{\text{resale price}} \mid S \right]$$

- Firms
 - Traded and nontraded goods, CES aggregator, wage rigidities

$$Y_{Nt} = L_{Nt}^{\alpha_N} (1 - \Delta \mathbb{1}_{(\zeta \neq 1)})$$

$$Y_{Tt} = z_t L_{Tt}^{\alpha_T} (1 - \Delta \mathbb{1}_{(\zeta \neq 1)})$$

$$w_t \geq \bar{w}$$

- Households
 - Approximation: $\lambda_t = \log \mathcal{N}(\mu_t, \Sigma_t)$. So $S = (B, \mu, \sigma, \xi, \zeta, z)$

Private Economy

Given a government policy $h(S, \xi', z')$, $B'(S)$, $T(S, q^g)$, in a comp eq'm

- Risk-neutral foreigners

$$q^g(S) = \underbrace{\frac{1}{1+r^*}}_{q^h(S)} \mathbb{E} \left[\underbrace{\mathbb{1}_{(\zeta'=1)}(1-\xi')\kappa}_{\text{coupon}} + \underbrace{(1-\rho)}_{\text{depreciation}} \underbrace{(1-\hbar \mathbb{1}_{(\zeta=1 \cap \zeta' \neq 1)})}_{\text{potential haircut}} \underbrace{q^g(S')}_{\text{resale price}} \mid S \right]$$

- Firms
 - Traded and nontraded goods, CES aggregator, wage rigidities

$$Y_{Nt} = L_{Nt}^{\alpha_N} (1 - \Delta \mathbb{1}_{(\zeta \neq 1)})$$

$$Y_{Tt} = z_t L_{Tt}^{\alpha_T} (1 - \Delta \mathbb{1}_{(\zeta \neq 1)})$$

$$w_t \geq \bar{w}$$

- Households
 - Approximation: $\lambda_t = \log \mathcal{N}(\mu_t, \Sigma_t)$. So $S = (B, \mu, \sigma, \xi, \zeta, z)$

Given a government policy $h(S, \xi', z')$, $B'(S)$, $T(S, q^g)$, in a **comp eq'm**

- Risk-neutral foreigners

$$q^g(S) = \underbrace{\frac{1}{1+r^*}}_{q^h(S)} \mathbb{E} \left[\underbrace{\mathbb{1}_{(\zeta'=1)}(1-\xi')\kappa}_{\text{coupon}} + \underbrace{(1-\rho)}_{\text{depreciation}} \underbrace{(1-\hbar \mathbb{1}_{(\zeta=1 \cap \zeta' \neq 1)})}_{\text{potential haircut}} \underbrace{q^g(S')}_{\text{resale price}} \mid S \right]$$

- Firms
 - Traded and nontraded goods, CES aggregator, wage rigidities

$$Y_{Nt} = L_{Nt}^{\alpha_N} (1 - \Delta \mathbb{1}_{(\zeta \neq 1)}) \quad Y_{Tt} = z_t L_{Tt}^{\alpha_T} (1 - \Delta \mathbb{1}_{(\zeta \neq 1)}) \quad w_t \geq \bar{w}$$

- Households
 - **Approximation:** $\lambda_t = \log \mathcal{N}(\mu_t, \Sigma_t)$. So $S = (B, \mu, \sigma, \xi, \zeta, z)$

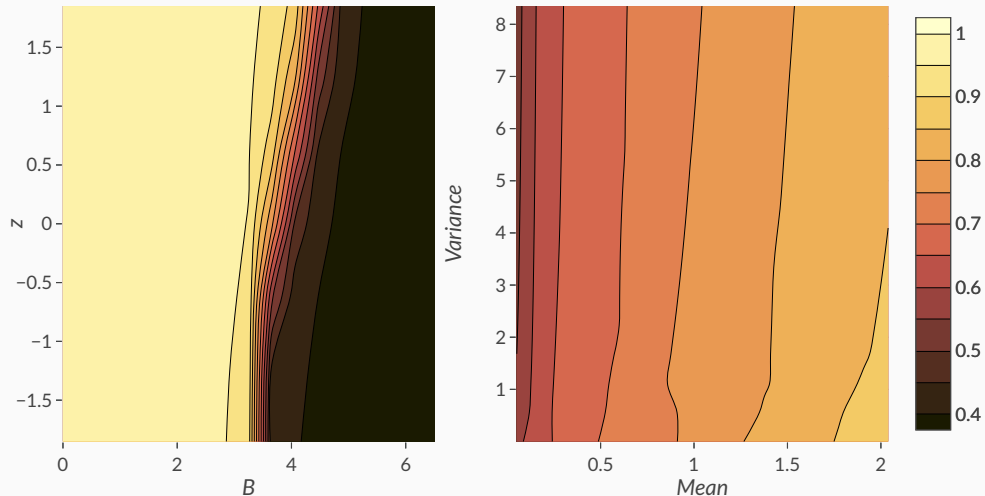
Results and simulations

Calibration

- Simulate model solution for 50000 years
- Agents believe $\lambda_t = \log \mathcal{N}(\mu_t, \sigma_t)$
- Keep track of actual distribution

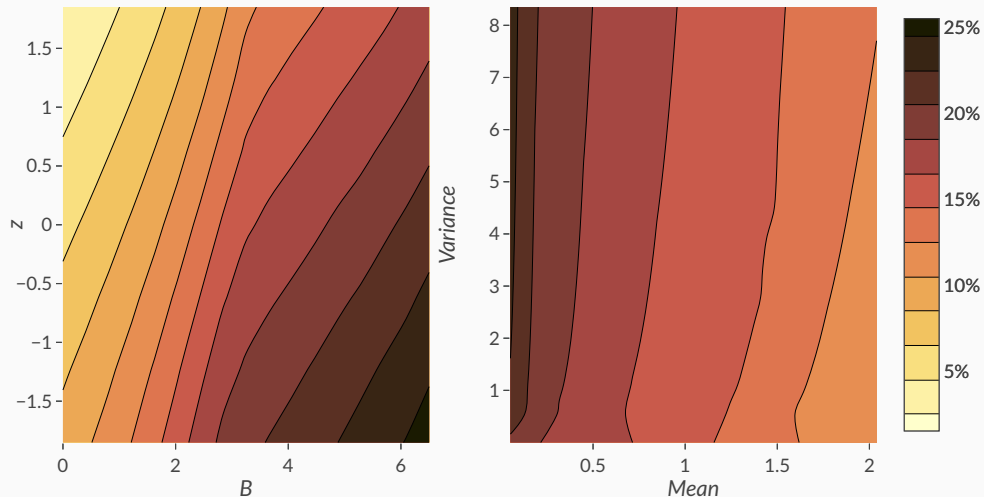
Target	Model	Data
AR(1) coef $\log(Y_t)$	0.976	0.966
Std coef $\log(Y_t)$	0.0168	0.0129
AR(1) coef $\log(C_t)$	0.977	0.962
Std coef $\log(C_t)$	0.0141	0.0166
AR(1) coef spread	0.983	0.967
Std coef spread	0.0161	0.103
Avg Debt-to-GDP	31.6%	64.6%
Std Debt-to-GDP	12.8%	23.5%
Avg unemployment	7.01%	15.9%
Std unemployment	5.84%	6.09%
Median dom holdings	39.2%	56.5%
Avg wealth-to-GDP	63.8%	94.5%
Avg wealth Gini	57.2%	57.5%

Price of Debt



Unemployment

Unemployment

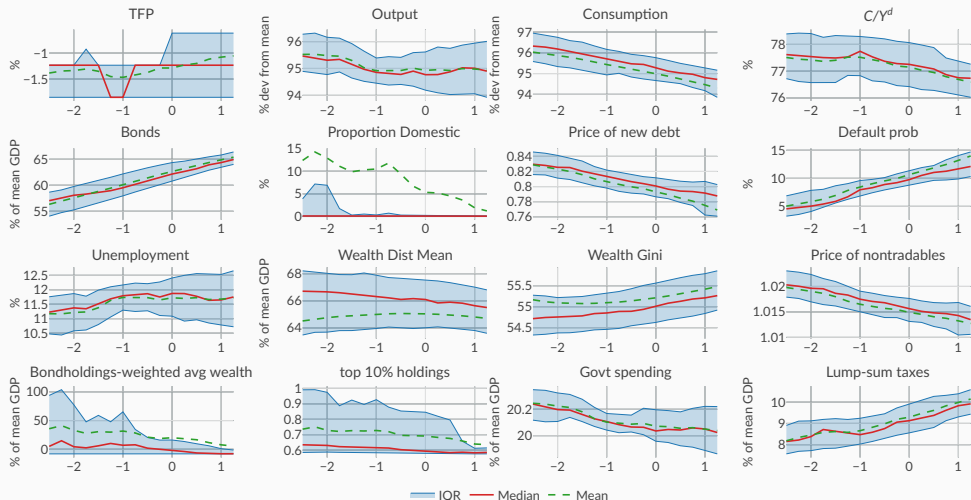


Crises

In simulated data

- Record all episodes of
 - default probability $\geq 6\%$ (match output 5% below 'trend')
 - but no default
 - for 11 quarters (2010 – September 2012)
- Plot distribution of endogenous variables

Crises



Decomposition

- Decompose output contraction between
 - Shocks + wage rigidity
 - Aggregate demand + default risk
- Compare against a **no-default** benchmark
 - Simulate the no-default economy with the **same shocks**
 - Extract the same time periods

Key

Conditioning on high spreads only \implies economies **only** differ in expectations

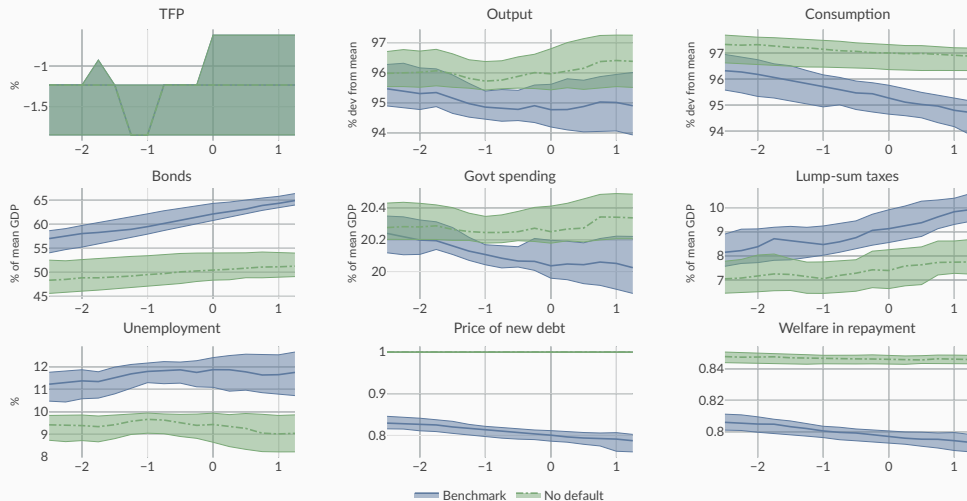
Decomposition

- Decompose output contraction between
 - Shocks + wage rigidity
 - Aggregate demand + default risk
- Compare against a **no-default** benchmark
 - Simulate the no-default economy with the **same shocks**
 - Extract the same time periods

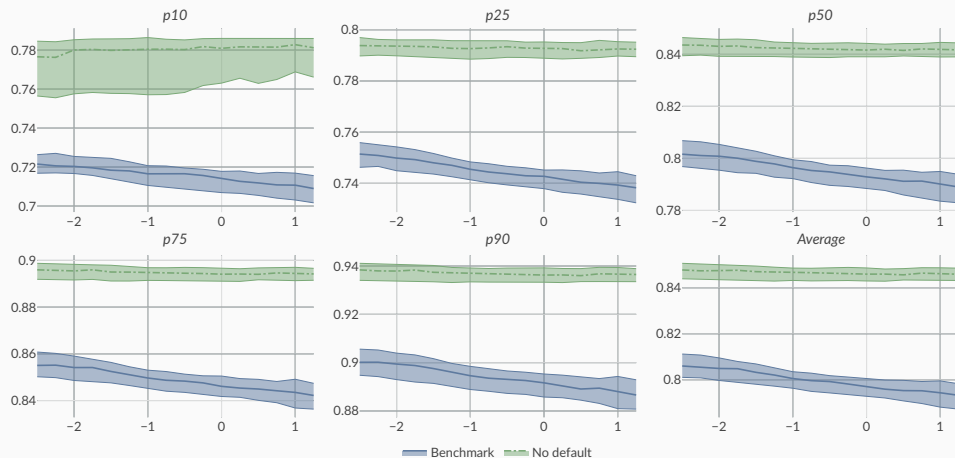
Key

Conditioning on high spreads only \implies economies **only** differ in expectations

No default benchmark



Costs of sovereign risk across the wealth distribution



Models

Moment	Benchmark	$\Delta = 0$	No dom. holdings	No default
AR(1) coef $\log(Y_t)$	0.976	0.973	0.976	0.979
Std coef $\log(Y_t)$	0.0168	0.00665	0.0171	0.00561
AR(1) coef $\log(C_t)$	0.976	0.983	0.979	0.998
Std coef $\log(C_t)$	0.0141	0.00404	0.0135	0.00107
AR(1) coef spread	0.983	0.965	0.977	1
Std coef spread	0.0161	0.0521	0.0199	0
Avg Debt-to-GDP	31.6%	38%	32.7%	31.7%
Std Debt-to-GDP	12.8%	9.15%	13.2%	11.8%
Avg unemployment	7.01%	6.59%	7.32%	5.63%
Std unemployment	5.83%	2.42%	6.06%	2.29%
Median dom holdings	38.5%	0.723%	0%	184%
Avg wealth-to-GDP	63.8%	56.3%	64.6%	56.4%
Avg wealth Gini	57.2%	60.5%	56.7%	60.5%
Default frequency	1.11%	2.94%	1.27%	0%
Welfare in repayment	0.854	0.853	0.84	0.869

Concluding remarks

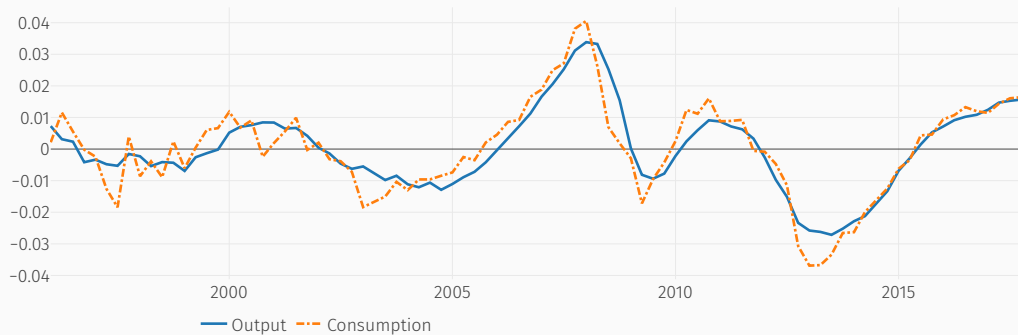
Concluding remarks

- Interested in **interaction** between
 1. Sovereign default risk
 2. Precautionary behavior
 - + implications for **amplification** of shocks
- Channel helps explain severity of recessions in debt crises
 - Default risk exacerbates **volatility** of consumption and output
 - Large welfare costs of sovereign risk
 - about **1.76%** of permanent consumption in unconditional average
 - as much as **6.8%** during crises
 - Wide variation across wealth **distribution**
- Key
 - Savings against aggregate + redistributive effects **if** default
 - Timing flips MPC / transfer argument

Spain in the Eurozone Crisis

[◀ Back](#)

Filtered Spanish output and consumption

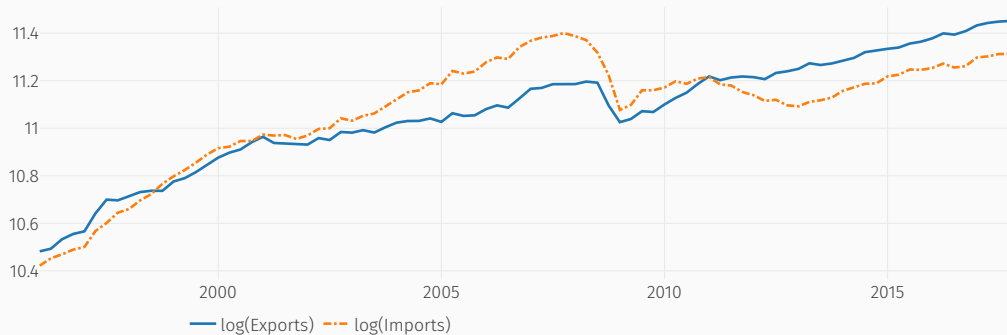


Spain in the 2000s

Spain in the Eurozone Crisis

[◀ Back](#)

Trade balance for Spain

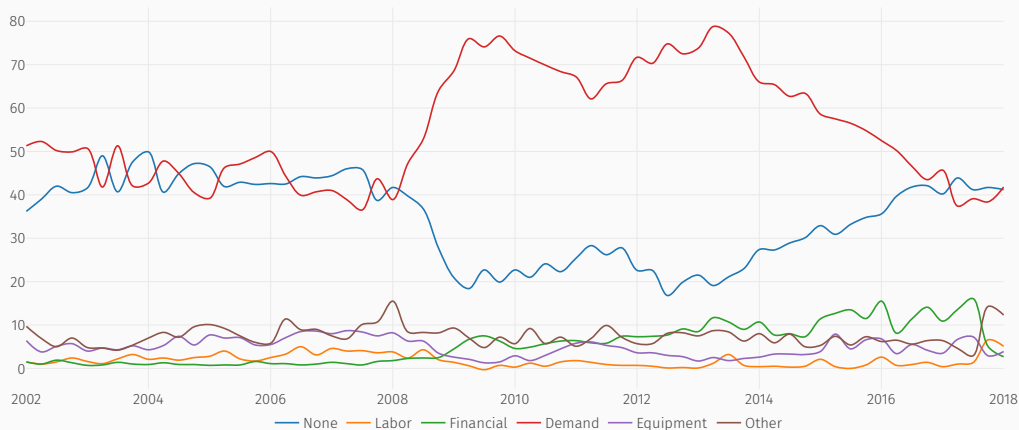


Spain in the 2000s

Low demand?

[◀ Back](#)

Factors Limiting Production



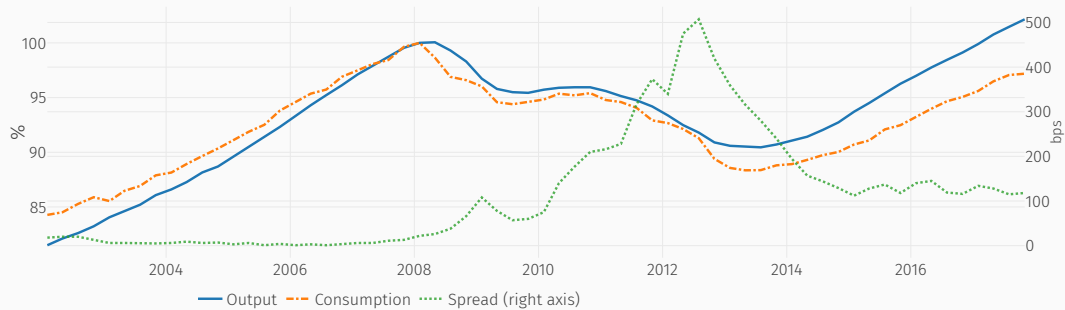
Spanish firms' self-reported limits to production

Source: Eurostat

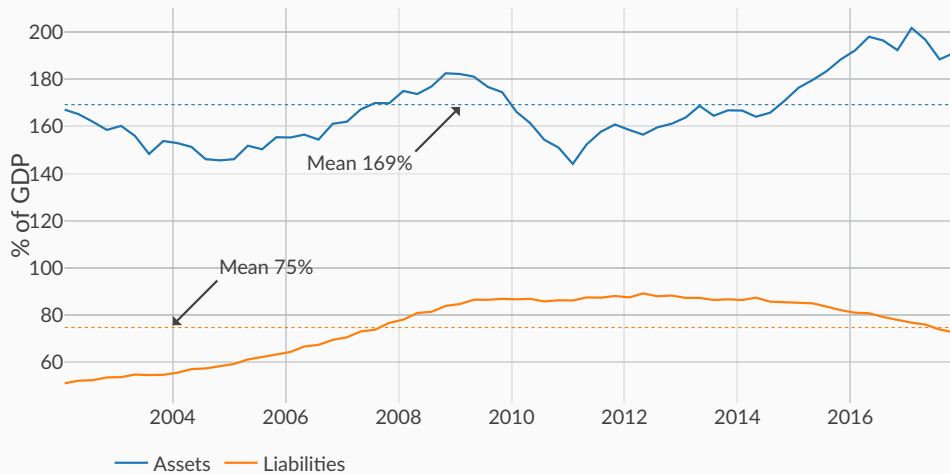
Nondurable Consumption

[◀ Back](#)

Output and Consumption for Spain



Net Worth of Spanish households

[◀ Back](#)

	G_t/Y_t		$(B'_t - (1 - \rho)B_t) / Y_t$	
	(1)	(2)	(3)	(4)
Unemployment _t	0.031 (0.039)	0.073*** (0.015)	0.334** (0.158)	0.346*** (0.059)
Unemployment _t ²	0.002 (0.001)		0.0001 (0.006)	
B_t/Y_t	0.010* (0.005)	−0.017*** (0.002)	−0.010 (0.020)	0.009 (0.007)
$(B_t/Y_t)^2$	−0.0002*** (0.00004)		0.0001 (0.0001)	
Net Exports _t	0.009 (0.019)	0.007 (0.012)	0.046 (0.075)	0.019 (0.046)
Net Exports _t ²	−0.0001 (0.001)		−0.001 (0.003)	
Mean FE	20.675	21.085	1.079	0.571
Country + Time FE	✓	✓	✓	✓
Observations	968	968	957	957
Adj. R ²	0.904	0.901	0.697	0.698

Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Fiscal Rules (cont'd)

[◀ Back](#)