Sovereign Risk and Economic Activity: The Role of Firm Entry and Exit

Gaston Chaumont
University of Rochester

Violeta Gutkowski
St. Louis Fed

Givi Melkadze
Georgia State University

Ia Vardishvili
Auburn University

January 6, 2022

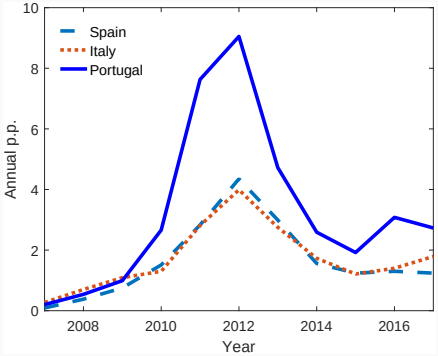
ASSA 2022

Motivation

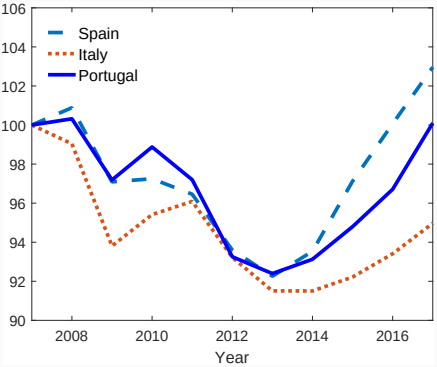
European Sovereign Debt Crisis

- Increased sovereign default risk
- Significant and persistent decline in economic activity

Sovereign spreads

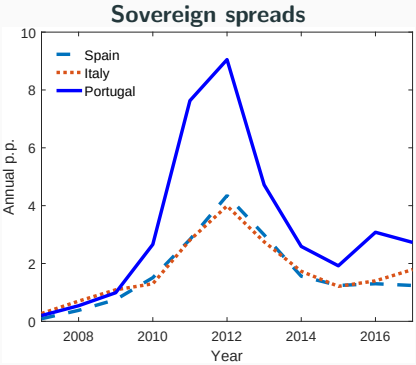


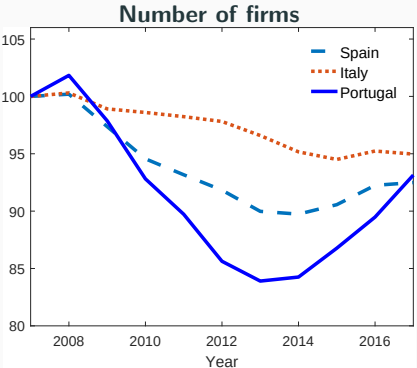
GDP



Motivation

- Firm dynamics literature: extensive margin matters for business cycles (Clementi&Palazzo (2016), Gourio et al. (2016), Sedláček&Stark (2017), Sedláček (2020), among others)
- Potentially a relevant margin during sovereign debt crises:





Source: Business Demography Database, Population of active enterprises, period 2007-2017, Eurostat.

This paper

Research Questions:

- What is the output and employment costs of a sovereign debt crisis?
- How large is the contribution of firms' entry and exit?

Our approach:

- We develop a heterogeneous firm dynamics model with endogenous entry and exit, sovereign default risk and financial frictions
- The calibrated model can reproduce firms' life-cycle dynamics and salient features of the sovereign-bank-firm relationships in Portugal
- We use the model to quantify how much of the output costs of soveregn debt crises is due to changes in firms' entry and exit decisions

Our findings

Empirical regularities:

- The higher sovereign risk during the European deb crisis (2010-2012) is associated with a decline in firm entry and a rise in exit
- Those sectors that rely more heavily on external finance were affected more during the debt crisis, consistent with the bank lending channel
- Cohorts of firms exposed to high sovereign default risk consists of fewer firms and employ persistently fewer workers over the life cycle
- The cumulative drop in employment across exposed cohorts is significant and has a long-lasting negative effect on the dynamics of the economic aggregates

Quantitative model:

- Endogenous fall in entry amplifies the fall in employment at impact
- Endogenous fall in entry significantly increases the persistence of recessions

Firms entry and exit during the European debt crisis

Default risk, entry and exit in Europe

$$log(Y_{s,j,t}) = \beta_0 + \beta_1 spread_{j,t} + \alpha_s + \gamma_j + \phi_{s,j} + \eta_t + \psi_{s,t} + X_{s,j,t} + \varepsilon_{s,j,t},$$

Table 1: Sovereign Risk, Entry and Exit

	Dependent Variable					
	(a) **Entry**			(b) **Exit**		
	(1)	(2)	(3)	(1)	(2)	(3)
Sovereign spread	-0.018***	-0.025***	-0.025***	0.025***	0.025***	0.023***
	(0.005)	(0.006)	(0.006)	(0.005)	(0.006)	(0.005)
Country FE	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓
Country×Industry FE	✓	✓	✓	✓	✓	✓
Year FE	–	✓	✓	–	✓	✓
Industry×Year FE	–	–	✓	–	–	✓
Controls	–	✓	✓	–	✓	✓
Observations	5,436	5,107	5,107	4,549	4,306	4,259
R^2	0.9761	0.979	0.9843	0.9761	0.9811	0.9844

External finance dependence, entry and exit

$$log(Y_{s,j,t}) = \beta_0 + \beta_1 \text{spread}_{j,t} + \beta_2 \text{spread}_{j,t} \times \text{high-EFD}_s + \beta_3 \text{spread}_{j,t} \times \text{high-EFD}_s \times \text{periphery}_j + \alpha_s + \gamma_j + \phi_{s,j} + \eta_t + \eta_{j,t} + \psi_{s,t} + \theta_{j,t} + X_{s,j,t} + \varepsilon_{s,j,t},$$

Table 2: External Finance Dependence, Entry, and Exit

	Dependent Variable					
	(a) **Entry**		(b) **Exit**		(c) **Net Entry**	
Sovereign spread	-0.017***		0.023***		-0.027***	
	(0.006)		(0.005)		(0.008)	
Sovereign spread×high-EFD	0.016	0.009	-0.008	-0.003	0.026	0.022
	(0.018)	(0.020)	(0.012)	(0.013)	(0.018)	(0.021)
Sovereign spread×high-EFD×periphery	-0.047***	-0.034*	0.002	-0.004	-0.042**	-0.038*
	(0.016)	(0.020)	(0.011)	(0.013)	(0.018)	(0.021)
Country FE	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓
Country×Industry FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Industry×Year FE	✓	✓	✓	✓	✓	✓
Country×Year FE	–	✓	–	✓	–	✓
Controls	✓	✓	✓	✓	✓	✓
Observations	5107	5436	4259	4306	4339	4386
R^2	0.984	0.986	0.986	0.992	0.567	0.696

The credit channel, entry and exit

$$Y_{s,j,t} = \beta_0 + \beta_1 \text{sovcrisis}_t \times \text{high-EFD}_s \times \text{periphery}_j + \alpha_s + \gamma_j + \phi_{s,j} + \eta_t + \eta_{j,t} + \psi_{s,t} + \theta_{j,t} + \varepsilon_{s,j,t},$$

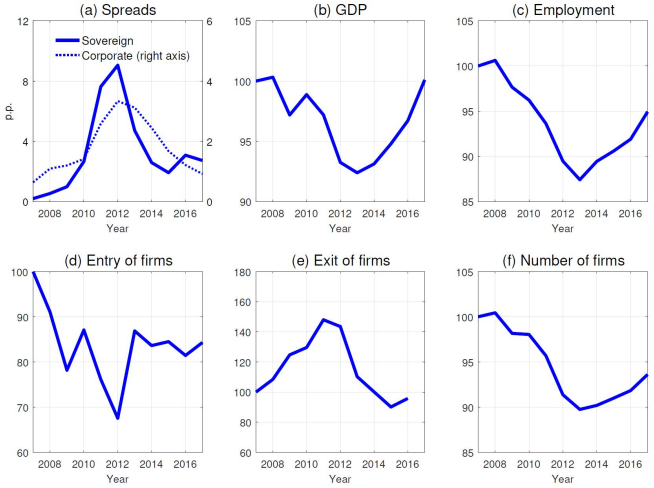
Table 3: Sovereign crisis, credit channel, and entry and Exit

	Panel A Dependent Variable			Panel B Dependent Variable		
	Entry	Exit	Net Entry	Entry	Exit	Net Entry
Crisis×high-EFD×periphery	-0.077*	0.021	-0.116**			
	(0.044)	(0.035)	(0.055)			
Crisis×high-EFD×periphery×spread				-0.020***	0.004	-0.023**
				(0.008)	(0.007)	(0.011)
Country FE	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓
Country×Industry FE	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓
Industry×Year FE	✓	✓	✓	✓	✓	✓
Country×Year FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Observations	5,902	4,680	4,848	5,902	4,680	4,848
R^2	0.987	0.992	0.678	0.987	0.992	0.678

Firms entry and exit in Portugal

Higher sovereign spreads, lower entry and higher exit rates

Figure 1: Interest rate spreads, GDP, employment and firm dynamics in Portugal



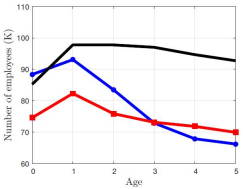
Even more so in sectors with higher external finance dependence

Table 4: Sovereign Risk, Entry and Exit

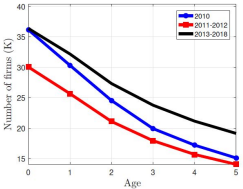
	Dependent Variable			
	Panel A. **Entry**		Panel B. **Exit**	
	(1)	(2)	(1)	(2)
Sovereign spread	-.022***		.073***	
	(.008)		(.008)	
Sovereign spread × high-EFD		-.029***		-0.002
		(.006)		(.007)
Controls	✓	–	✓	–
Sector FE	✓	✓	✓	✓
Time FE	–	✓	–	✓
N	658	611	611	611
R^2	0.988	0.979	0.988	0.985

Cohorts exposed to high spreads have less firms and employ less workers

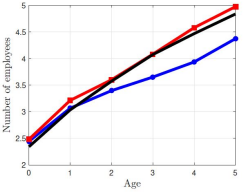
Figure 2: Cohorts' Post-Entry Dynamics



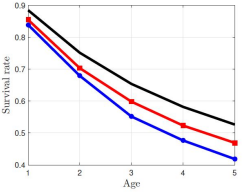
(a) Cohort-level employment



(b) Number of firms



(c) Average size

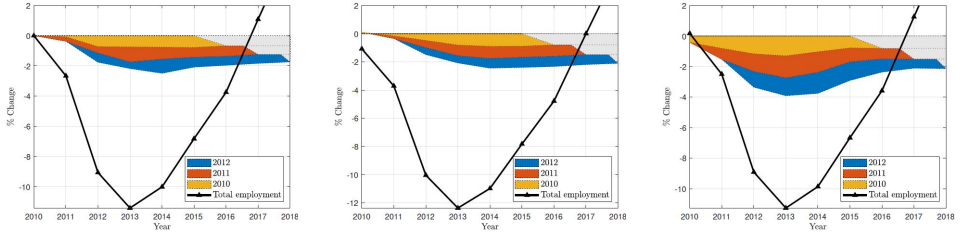


(d) Survival

High spreads have large and long-lasting effects on employment

- Cohorts exposed to the high spreads accounted for 16% of jobs lost by 2013, and their persistent contribution explains 33% of jobs lost by 2016.

Figure 3: The Changes in the Total Employment Accounted by Cohorts Born over 2010-2012.



(a) Relative to 2010 (b) Relative to 2013 (c) Relative to 2005

The Model

Set Up

Follows Arellano, Bai, Bocola (2021). We incorporate endogenous entry and exit.

- **Households**
  - Choose consumption and labor supply.
- **Firms**
  - Incumbents
    - Choose production and exit
    - **Borrow** money to finance **working capital**
  - Entrants
    - Make entry decisions
    - **Borrow** money to finance **entry cost and initial working capital**
- **Government**
  - Default risk is governed by an exogenous process
- **Banks**
  - Price government bonds according to a standard no-arbitrage condition
  - Supply loans to firms passing-through default risk to corporate loans interest rates

Sovereign Default Risk

Sovereign default risk evolves exogenously as in Bocola (2016)

In every period the economy is hit by a shock $\varepsilon_{d,t}$ drawn from a standard logistic distribution.

$$D_{t+1} = \begin{cases} 1 & \text{if } \varepsilon_{d,t+1} - d_t \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

where d_t is an AR(1) process

$$d_{t+1} = (1 - \rho_d)\overline{d} + \rho_d d_t + \sigma_d \varepsilon_{d,t+1}, \qquad \varepsilon_{d,t+1} \sim \mathcal{N}(0, 1)$$

The probability of default

$$\pi^d \equiv \text{Prob}(D_{t+1} = 1) = \frac{e^{d_t}}{1 + e^{d_t}}$$

Sovereign Bond Pricing and Bank Lending Rates

Sovereign bond's price is determined by a standard no-arbitrage condition

$$q_t = \mathbb{E}_t \left[\beta (1 - D_{t+1})(\vartheta + q_{t+1}(1 - \vartheta)) \right]$$

Bank lending rate is a (reduced form) function of of sovereign bond rates:

$$R_t = \chi_1 R_{g,t}^{\chi_2} \tag{1}$$

where χ_1 and χ_2 are parameters capturing the pass-through of sovereign bond's rates to the interest rate of corporate loans

$$R_{g,t} = 1 + \frac{\vartheta}{q_t} - \vartheta$$

Lending Rate $\Leftrightarrow$ Entry and Exit

Higher lending rates $\Rightarrow$ **higher exit**: Need to finance working capital

Incumbent firms problem

$$V^I(z,k;s) = \max_{l,i,k'} (1-\tau) z_t (k_t^{\alpha} l_t^{1-\alpha})^{\theta} - (1-\phi)\left[wl + i + g(k,k')\right] - \phi R(s) b$$
$$+ \int_{c_f} \max\left\{ V_x(k),\ \beta(1-\gamma)\mathbb{E}\left[V^I(z',k';s')|z,s\right] - c_f \right\} dF_{c_f}(c_f)$$

$$k' = (1-\delta)k + i$$

and the working capital constraint

$$b = \phi\left[wl + i + g(k,k')\right]$$

The Higher R, the higher the cost of investment and labor, the lower capital, the lower continuation value, the higher exit probability.

Lending Rate $\Leftrightarrow$ Entry and Exit

Higher lending rates $\Rightarrow$ **lower entry**: Need to borrow to finance entry cost and working capital

The value function after entry decision is made reads

$$\tilde{V}^E(p,s) = \max_{i^e} \left\{ -(1-\phi)(i^e + g^e(i,k_0)) - Rb_i^e + \beta \mathbb{E}[V'(z',k',s')|p,s] \right\}$$

subject to

$$k'^e = k_0 + i^e$$

$$b_i^e = \phi \left[i^e + g^e(i,k_0) \right]$$

The value of waiting to enter is

$$V^w(p,s) = \beta \int_{s'} V^E(p,s') dF(s'|s)$$

Lending Rate $\Leftrightarrow$ Entry and Exit

A potential entrant with signal p makes entry decision according to the following rule,

$$V^E(p,s) = \max\left\{V^w(p,s), \quad \tilde{V}^E(p,s) - (1-\phi)c_e - Rb^e_{c_e}\right\}$$

with

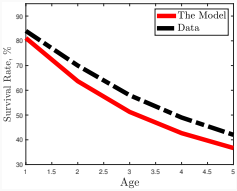
$$b^e_{c_e} = \phi c_e$$

The higher R, the higher the cost of entry, the lower the entry.

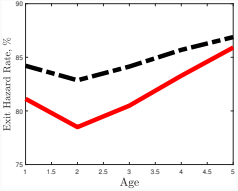
Quantitative Analysis

Calibration: Cohort life cycle

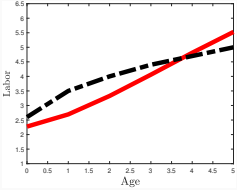
Figure 1: Cohorts Average Life Cycle Characteristics



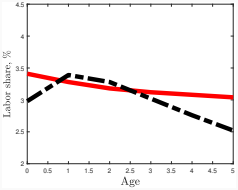
(a) Average survival rate



(b) Exit rate by age



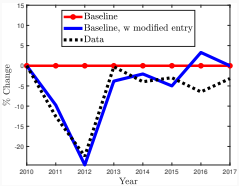
(c) Average Size



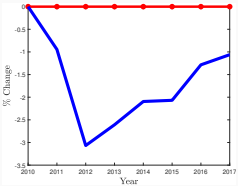
(d) Share

What is the role of entry on employment dynamics?

Figure 2: The role of the observed dynamics of entry over 2011-2018.



(a) Number of entrants

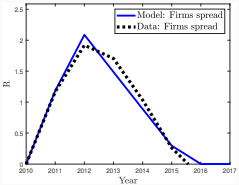


(b) Number of firms

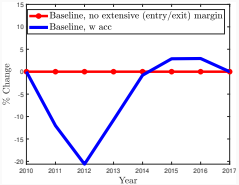
(c) Employment

The response of the economy to an increase in bank lending rates

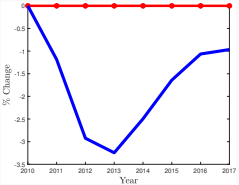
Figure 3: Impulse response to a shock process that matches the dynamics of the firm spread to the one observed in Portugal over the period 2010-2017.



(a) Interest rate

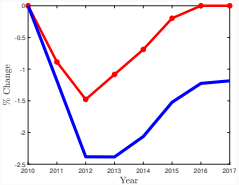


(b) Number of entrants



(c) Number of firms

(d) Investment



(e) Employment

(f) Output

Concluding Remarks

Conclusions

This paper:

- We study how firm dynamics shape the economic costs of a debt crisis

Empirical regularities:

- During the European debt crisis there was less entry and more exit
- Sectors with higher EFD were affected more, consistent with the bank lending channel
- Cohorts affected by the crisis are smaller and employ persistently less workers
- The cumulative drop in employment has a long-lasting negative effect on employment and output

Quantitative Analysis:

- Endogenous fall in entry amplifies the fall in employment at impact
- Endogenous fall in entry significantly increases the persistence of recessions

Sovereign Risk and Economic Activity: The Role of Firm Entry and Exit

Gaston Chaumont
University of Rochester

Violeta Gutkowski
St. Louis Fed

Givi Melkadze
Georgia State University

Ia Vardishvili
Auburn University

January 6, 2022

ASSA 2022