Why Are Banks Not Recapitalized During Crises?

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THREE FACTS ABOUT THE EUROPEAN PERIPHERY
**FACT 1: RISK ↑, DEBT DOMESTIC OWNERSHIP ↑**

Sovereign Credit Risk and Share of Public Debt Domestically Held
FACT 2: CHANGING PORTFOLIO COMPOSITION
Credit to NonFin Institutions and Holdings of Government Bonds
FACT 3: UNDERCAPITALIZED BANKS
Undercapitalized Banks Before and During the Crisis

Compared to US:

- Non-credible stress tests
  (Acharya, Engle, Pierret (2014), Greenlaw, Kashyap, Shin, Schoenholtz (2012))
  - Inaccurate (reliance on risk-weights)
  - Few recapitalizations

- High leverage ratios
  - EU and US banks decreased from 2008 peak
Literature Review
Three Strand of Literature

1. Linkages between sovereign and financial sector

2. Transmission of sovereign shocks through banks

3. Capital regulation and banks portfolio choice.
The Model
This Paper
A Narrative Linking the Three Facts

1. Undercapitalized banks tilt their government bond portfolio towards domestic securities
   - Positive correlation with other sources of revenues
   - \( \Rightarrow \) gamble-for-resurrection
This Paper
A Narrative Linking the Three Facts

1. Undercapitalized banks tilt their government bond portfolio towards domestic securities
   - Positive correlation with other sources of revenues
   - $\Rightarrow$ gamble-for-resurrection

2. During sovereign crises, government bonds crowd-out private lending
   - Sovereign credit risk ↑, but govt yields ↓, debt capacity ↑
THIS PAPER
A Narrative Linking the Three Facts

1. Undercapitalized banks tilt their government bond portfolio towards domestic securities
   - Positive correlation with other sources of revenues
   - ⇒ gamble-for-resurrection

2. During sovereign crises, government bonds crowd-out private lending
   - Sovereign credit risk ↑, but govt yields ↓, debt capacity ↑

3. Governments face a trade-off when setting capital regulation
   - Well capitalized banks foster growth through lending
   - Undercapitalized banks optimally act as buyers-of-last-resort lowering yields
The Economy

Two Countries, Two Representative Banks, Two Governments

Spain

Italy

ES Firms

ES Bank

IT Bank

IT Firms
Bank Portfolio Problem (t=0)

Investment Opportunity Set: (i) NonFin Lending

Spain

Italy

ES Firms \( k \) Santander
Bank Portfolio Problem (t=0)
Investment Opportunity Set: (i) NonFin Lending (ii) Dom Govt Debt

ES Firms ← $k$ ← Santander

Spain

Italy

$\alpha(1-k)$

Motivation
Model
Discussion
Empirical Evidence
**Bank Portfolio Problem** (t=0)

Investment Opportunity Set: (i) NonFin Lending (ii) Dom Govt Debt (iii) For Govt Debt

\[ \alpha(1-k)(1-\alpha)(1-k) \]
Tax Collection and Debt Repayment (t=1)

Government and Bank Split the Revenues from Lending

\[ \text{ES Firms} \rightarrow k \rightarrow \text{Santander} \rightarrow (1 - \alpha)(1 - k) \rightarrow \text{Italy} \rightarrow \text{Spain} \rightarrow \alpha(1 - k) \rightarrow \text{ES Firms} \]

Tax collection

After-tax revenues
Spain Pays Back Bondholders

Tax Collection and Debt Repayment (t=1)

ES Firms → Santander

k

Tax collection

Spain

(1 - k)

a(1 - k)

Italy

(1 - a)(1 - k)

Santander

after-tax revenues

Spain

Motivation

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Empirical Evidence
TAX COLLECTION AND DEBT REPAYMENT (t=1)
Italy Pays Back Bondholders

\[
\text{ES Firms} \xrightarrow{k} \text{Santander} \xrightarrow{\alpha(1-k)} \text{Spain} \xrightarrow{(1-\alpha)(1-k)} \text{Italy}
\]

tax collection

after-tax revenues
**GOOD STATE (t=1)**

High Revenues and Tax Collection from NonFin Lending

\[ \alpha (1-k) \]

\[ (1-\alpha)(1-k) \]

High tax collection

High after-tax revenues
GOOD STATE (t=1)
Govt Repays Bondholders

ES Firms \[ \rightarrow k \] Santander

high tax collection

Spain \[ \alpha(1 - k) \]

Italy \[ (1 - \alpha)(1 - k) \]

high after-tax revenues
BAD STATE (t=1)
Low Revenues and Tax Collection from NonFin Lending

\[ \alpha(1-k)(1-k)(1-k) \]

low tax collection

low after-tax revenues
Bad State (t=1)
Govt Forced to Partially Default

**ES Firms**

\( k \)

low tax collection

\( \alpha(1-k) \)

(1 - \( \alpha \))(1 - \( k \))

low after-tax revenues

Spain

Santander

Italy
Foreign Government Debt
Payoff Depends on the Foreign State of The World

Mathematical Model:

\[ \text{Payoff} = \alpha (1 - k) (1 - \alpha) (1 - k) \]

After-tax revenues

Tax collection

ES Firms \rightarrow k \rightarrow Santander

Spain \rightarrow \alpha (1 - k) \rightarrow Italy

Italy \rightarrow (1 - \alpha) (1 - k) \rightarrow Spain

Santander \rightarrow k \rightarrow ES Firms
**Agents’ Problem**

Banks’ Problem

\[ \max_{k, \alpha} \left( \left[ (1 - \tau) \mathbb{E}(\epsilon) f(k) + \alpha \mathbb{E}(\lambda)(1 - k) + (1 - \alpha) R^* \mathbb{E}^*(\lambda^*)(1 - k) - L \right]^+ \right) \]

- Private lending technology
- Domestic government bonds
- Foreign government bonds
- Initial private debt \( L \in (0, 1) \)
AGENTS’ PROBLEM

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AGENTS’ PROBLEM

Government Problem

- Maximises spending
  - Zero initial debt
  - Taxes revenues from lending technology
  - Issues one-year bonds at $t = 0$
- Must fund a non-discretionary level of expenditure $g > 0$
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- \( t=0 \): Investors willing to buy govt debt iff

\[
\underbrace{DR}_{\text{payment due}} \leq \underbrace{\mathbb{E}(\epsilon)\tau f(k) - g}_{\text{Expect. tax coll.}}
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- Debt Capacity: $D = (\mathbb{E}(\epsilon) \tau f(k) - g)R^{-1}$
**Agents’ Problem**

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- Debt Capacity: $D = (\mathbb{E}(\epsilon) \tau f(k) - g) R^{-1}$
- $t=1$: Govt default policy
  - Good state: $DR < \epsilon_H \tau f(k) - g \implies \lambda_H = 1$
  - Bad state: $DR \geq \epsilon_L \tau f(k) - g \implies \lambda_L < 1$
CAPITALIZATION AND DOMESTIC BONDS
Govt Bond Portfolio Choice: Well Capitalized Banks

Domestic Bonds

\[ \theta \]
\[ 1 - \theta \]
\[ R \]
\[ \lambda R \]
CAPITALIZATION AND DOMESTIC BONDS

Govt Bond Portfolio Choice: Well Capitalized Banks

Domestic Bonds

\[ \theta \]

\[ 1 - \theta \]

\[ \lambda R \]

\[ R \]

Foreign Bonds

\[ \theta \]

\[ 1 - \theta \]

\[ \lambda R \]

\[ \theta \]

\[ \mathbb{E}^*(\lambda^*)R^* \]
Capitalization and Domestic Bonds
Govt Bond Portfolio Choice: Well Capitalized Banks

Domestic Bonds

\[ \theta \]

\[ 1 - \theta \]

\[ \lambda R \]

Foreign Bonds

\[ \theta \]

\[ 1 - \theta \]

\[ \mathbb{E}^*(\lambda^*)R^* \]

Risk-neutral banks: invest abroad iff

\[ R\mathbb{E}(\lambda) \leq R^*\mathbb{E}^*(\lambda^*) \]
Capitalization and Domestic Bonds

Govt Bond Portfolio Choice: Undercapitalized Banks

Domestic Bonds

Foreign Bonds

θ

R

Ε*(λ*)R*

θ

1 − θ

0

1 − θ

0

Risk-neutral banks: invest abroad iff

\[ R \leq R^*E^*(\lambda^*) \]
Benchmark Case
Well Capitalized Banks

- Countries are identical
- Both financial sectors are well capitalized:
  - Perfect risk-sharing
  - Continuum of eqm with $\alpha^i = \alpha$, $k^i = k$, $R^i = R$
Benchmark Case
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- Countries are identical
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**Equilibrium Home Bias and Crowding-Out**

**IT Banks undercapitalized, ES Banks well capitalized**

▶ **Fact 1:** home bias in the govt bond portfolio
  ▶ Italian banks buy more Italian bonds
  ▶ Italian government bond yields ↓
  ▶ Spanish banks tilt their holdings towards domestic bonds

⇒ IT undercapitalized banks cause home bias in ES

▶ **Fact 2:** reduced *supply* of private lending
  ▶ If \( \lambda_L < \frac{e_L}{e_H} \)  ⇒  \( k \downarrow \)  \( D \uparrow \)  \( R \downarrow \)
Banks' Capitalization
Banks' Capitalization
Let $\Pi$ be banks’ profits

Govt recapitalizes banks iff

$$D_{UU} - D_{WW} \leq (1 - \theta)\tau(\epsilon_H - \epsilon_L)(f(k_{WW}) - f(k_{UU}))$$

lower debt issuace \quad increased tax coll.
Let $\Pi$ be banks' profits

- Govt recapitalizes banks iff
  $$D_{UU} - D_{WW} \leq (1 - \theta)\tau(\epsilon_H - \epsilon_L)(f(k_{WW}) - f(k_{UU}))$$
  lower debt issuance increased tax coll.

- Recapitalizations always efficient as $\mathbb{E}(\Pi_{WW}) \geq \theta \Pi_{UU}$
RELAXING ASSUMPTIONS
#1 Allowing Foreign Private Lending

- Banks can invest
  - in government bonds \((\alpha \text{ domestically})\)
  - in private lending technology \((\mu \text{ domestically})\)
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- Banks can invest
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- Sovereigns default when
  - the home country is in the bad state and \(\mu\) is high
  - the foreign country is in the bad state and \(\mu\) is low
#1 Allowing Foreign Private Lending

- Banks can invest
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  $\rightarrow$ incentive to gamble-for-resurrection disappears
#1 Allowing Foreign Private Lending

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  - the home country is in the bad state and \(\mu\) is high
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  \(\rightarrow\) incentive to gamble-for-resurrection disappears

- Data: domestic banks accounted in Sep14, for \(> 60\%\) of total lending to the non-fin private sector in the Euro periphery (BIS)
## Banks' Exposure to Sovereigns

<table>
<thead>
<tr>
<th>Bank Country</th>
<th>GIIPS Bank Name</th>
<th>Exposure to</th>
<th>EAD (€ m)</th>
<th>EAD/E</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR</td>
<td>EFG Eurobank Ergasias</td>
<td>GR</td>
<td>53,005</td>
<td>47.0</td>
</tr>
<tr>
<td>GR</td>
<td>Alpha Bank</td>
<td>GR</td>
<td>46,171</td>
<td>18.1</td>
</tr>
<tr>
<td>IT</td>
<td>Banca Monte Paschi Siena</td>
<td>IT</td>
<td>205,347</td>
<td>15.6</td>
</tr>
<tr>
<td>ES</td>
<td>Banco Popular Espanol</td>
<td>ES</td>
<td>120,981</td>
<td>11.2</td>
</tr>
<tr>
<td>IT</td>
<td>Banco Popolare</td>
<td>IT</td>
<td>122,583</td>
<td>10.0</td>
</tr>
<tr>
<td>ES</td>
<td>Caixa</td>
<td>ES</td>
<td>259,731</td>
<td>8.7</td>
</tr>
<tr>
<td>IE</td>
<td>Irish Life and Permanent</td>
<td>IE</td>
<td>36,487</td>
<td>8.0</td>
</tr>
<tr>
<td>ES</td>
<td>BBVA</td>
<td>ES</td>
<td>378,707</td>
<td>7.3</td>
</tr>
<tr>
<td>IT</td>
<td>Intesa Sanpaolo</td>
<td>IT</td>
<td>418,126</td>
<td>6.8</td>
</tr>
<tr>
<td>IT</td>
<td>Unicredit</td>
<td>IT</td>
<td>382,176</td>
<td>5.4</td>
</tr>
<tr>
<td>IE</td>
<td>Bank of Ireland</td>
<td>IE</td>
<td>68,883</td>
<td>5.2</td>
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<tr>
<td>GR</td>
<td>EFG Eurobank Ergasias</td>
<td>PL</td>
<td>5,707</td>
<td>5.1</td>
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<tr>
<td>IE</td>
<td>Bank of Ireland</td>
<td>GB</td>
<td>64,743</td>
<td>4.9</td>
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<tr>
<td>IE</td>
<td>Allied Irish Banks</td>
<td>IE</td>
<td>85,923</td>
<td>4.6</td>
</tr>
<tr>
<td>GR</td>
<td>EFG Eurobank Ergasias</td>
<td>RO</td>
<td>4,552</td>
<td>4.0</td>
</tr>
<tr>
<td>ES</td>
<td>Banco Santander</td>
<td>ES</td>
<td>355,523</td>
<td>3.3</td>
</tr>
<tr>
<td>GR</td>
<td>EFG Eurobank Ergasias</td>
<td>BG</td>
<td>3,607</td>
<td>3.2</td>
</tr>
<tr>
<td>ES</td>
<td>Banco Santander</td>
<td>GB</td>
<td>292,735</td>
<td>2.7</td>
</tr>
<tr>
<td>GR</td>
<td>EFG Eurobank Ergasias</td>
<td>DE</td>
<td>2,801</td>
<td>2.5</td>
</tr>
<tr>
<td>IT</td>
<td>Unicredit</td>
<td>DE</td>
<td>151,948</td>
<td>2.1</td>
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<tr>
<td>GR</td>
<td>Alpha Bank</td>
<td>CY</td>
<td>4,848</td>
<td>1.9</td>
</tr>
<tr>
<td>IE</td>
<td>Irish Life and Permanent</td>
<td>GB</td>
<td>8,466</td>
<td>1.9</td>
</tr>
<tr>
<td>IE</td>
<td>Allied Irish Banks</td>
<td>GB</td>
<td>32,117</td>
<td>1.7</td>
</tr>
<tr>
<td>GR</td>
<td>Alpha Bank</td>
<td>RO</td>
<td>4,261</td>
<td>1.7</td>
</tr>
<tr>
<td>GR</td>
<td>Alpha Bank</td>
<td>GB</td>
<td>3,059</td>
<td>1.2</td>
</tr>
<tr>
<td>IT</td>
<td>Unicredit</td>
<td>AT</td>
<td>74,355</td>
<td>1.0</td>
</tr>
</tbody>
</table>
#2 Correlated Shocks

- Let $\rho$ be the correlation coefficient between the two country-specific shocks
  - I keep marginal probabilities unchanged
- WW case: unchanged, i.e. invest domestically iff $R \geq R^*$
- U bank: if $\rho = 1$, risk-shifting incentive disappears
#3 One Safe Country, One Risky Country

Germany Safe, Italy Risky

- DE government always have enough tax collection to repay bondholders
- Benchmark WW case
  \[ R^D < R^I \implies D^D > D^I \]
- IT banks undercapitalized
  - Home Bias
#4 High Recovery Value $\lambda$

Two Equilibria in the UW case

- No Crowding-Out
  - Private Lending chosen to risk-shift
  - $\uparrow$ tax collection
  - IT attracts foreign investors with high $R$

Diagram:

- Italy
  - Bank$^I$
- Spain
  - Bank$^S$
- Italy
  - Bank$^I$
- Spain
  - Bank$^S$
Supporting Empirical Evidence
## Summary Statistics

**EBA Average Exposures (tn EUR)**

<table>
<thead>
<tr>
<th></th>
<th>Mar10</th>
<th>Dec10</th>
<th>Sep11</th>
<th>Dec11</th>
<th>Jun12</th>
<th>Dec12</th>
<th>Jun13</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peripheral Banks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.39</td>
<td>0.42</td>
<td>0.42</td>
<td>0.40</td>
<td>0.46</td>
<td>0.50</td>
<td>0.57</td>
</tr>
<tr>
<td>Domestic</td>
<td>0.29</td>
<td>0.34</td>
<td>0.33</td>
<td>0.32</td>
<td>0.37</td>
<td>0.40</td>
<td>0.45</td>
</tr>
<tr>
<td>GIIPS</td>
<td>0.32</td>
<td>0.36</td>
<td>0.35</td>
<td>0.33</td>
<td>0.39</td>
<td>0.41</td>
<td>0.47</td>
</tr>
<tr>
<td>Core</td>
<td>0.04</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.04</td>
<td>0.06</td>
<td>0.06</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1.03</td>
<td>0.99</td>
<td>0.94</td>
<td>0.87</td>
<td>0.92</td>
<td>0.96</td>
<td>0.97</td>
</tr>
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<td>0.49</td>
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<td>0.48</td>
<td>0.52</td>
<td>0.55</td>
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<td>0.11</td>
<td>0.12</td>
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<td>0.65</td>
<td>0.70</td>
<td>0.70</td>
<td>0.65</td>
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<td>0.75</td>
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### SUMMARY STATISTICS

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**NOTE:** The table above provides the summary statistics for EBA average exposures in trillions of euros (tn EUR) for different periods and categories.
**Motivation**

**Model**

**Discussion**

**Empirical Evidence**

**Undercapitalized Banks Buy More Dom. Govt Bonds**

Domestic Govt Bonds / Total Assets

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**Domestic Government Bonds and Leverage**

- **Low Leverage**
- **High Leverage**

**Domestic Government Bonds and International Credit Exposure**

- **Diversified**
- **Undiversified**
Alternative Channels

- Voluntary entanglement
  - Higher chance of government bailout
- Moral suasion
  - As long as what we observe is an equilibrium outcome
- Regulatory arbitrage
  - Lower holdings of peripheral non-domestic bonds
- Eligible collateral at ECB
  - Lower holdings of peripheral non-domestic bonds
CONCLUSION

- Presented three stylized facts about European peripheral banks during the crisis
- Developed a tractable GE model that can rationalize these facts and yield additional empirical implications
- Presented empirical evidence supporting the proposed channel