Fiscal Shocks, Government Bonds, and Credit Market Disruptions

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Overview of Bank-Sovereign Nexus

- A stylized fact in international finance is the coincidence of sovereign crises and banking crises.

- A causal relationship might run from banks to sovereigns, where public sector intervenes after a banking crisis, putting its own solvency at risk
  - Iceland and Ireland.

- A causal relationship might also run from sovereigns to banks, where sovereign distress impact bank performance and loan supply
  - Greece.
The sovereign debt crisis in Europe emphasizes the limits of fiscal independence in a monetary union.

In a monetary union, government debt is both domestic and external.

Should and how ECB can be involved in sovereign debt markets? How relevant are banks?
Possible Links from Sovereign to Banks

1. **Balance Sheet Channel**: Exposure to sovereign debt in normal times will create a balance sheet hit (deleveraging and low value collateral) given the decline in debt’s value during sovereign defaults. Buch, Koetter and Ohls (2013); Gennaioli, Martin, and Rossi (2014)

2. **Risk Taking Channel**: Banks accumulate sovereign bonds when they become risky in the anticipation of a default. Acharya and Steffen (2013)

3. **LOLR/Fiscal solvency Channel**: Fiscal distress will have an overall effect on the economy depending on the fiscal capacity of government (banks no different than pension funds; traded companies CDS also move with sovereign). Bofondi, Carpinelli and Sette (2013)

Banks may or may not be relevant depending on the channel: Key policy issue in terms of risk weighting sovereign debt holdings of banks.
Contribution

- **Much Studied:** Crisis transmission across borders via global banks.

- **Less Studied:** Transmission of sovereign risk to real-sector via banks.
Fiscal Shocks, Government Bonds, and Credit Market Disruptions: Bank Level Evidence from 1999 Turkish Earthquake, with Yusuf Soner Başkaya (CBRT)

- Identify the balance sheet channel as the key transmission mechanism for sovereign risk to real sector via banks

Corporate Debt Overhang with Firm, Bank, and Sovereign Linkages in Europe, with Luc Laeven (IMF)

- Explain the debt overhang in Europe (low investment) as a key outcome of the balance sheet channel where sovereign risk transmits to real sector via banks within and across borders
Key Challenge: Anticipation

Once crisis unfolds (default and recession is expected), it is not clear whether fiscally unsustainable sovereigns cause the demise of the banking sector or bad banks cause the public debt to become unsustainable.

- Banks can be induced to buy more government debt
- Take more risks in the expectation of a bail out/moral hazard or reach for yield
- Get rid of the bonds
- Anticipate low demand from private sector and switch to government bond market in advance
Use a natural disaster as a fiscal shock

The fiscal shock is such that it leads to an increase in sovereign risk without affecting the macroeconomy in general.

Using an exogenous fiscal shock delivers estimates for the effect of public debt on financial and real sector performance where these estimates are free from the endogenous—to the shock—portfolio choice of the banks.
Results from Baskaya and Kalemli-Ozcan

- For a median bank (gov bonds 18 percent of assets pre-earthquake), credit supply declines for 0.7 percentage points post-earthquake
  - 4 percent decline relative to pre-earthquake mean; (our estimates explain half of actual decline)
  - Comparison to Italy: During July-September 2011, when spreads increased 200 basis points, credit supply declined 1.3 percentage points for a bank with mean holdings.

- Net worth declines 1.5 percentage point post-earthquake; a 10 percent decrease relative to pre-earthquake mean

- Profits decline 0.8 percentage point post-earthquake; a 40 percent decrease relative to pre-earthquake mean
1999 Marmara Earthquakes: A Rare Disaster

- **August 17, 1999; November 12, 1999:** Two big earthquakes (7.6, 7.2) hit industrial heartland of Turkey: Kocaeli, Istanbul, Bursa, Sakarya, Yalova, Duzce, Bolu

- **Marmara region’s share in:**
  - Population: 25 percent
  - GNP: 35 percent
  - Industrial production: 50 percent
  - Credit: 50 percent
Does this rare disaster constitute a big fiscal shock?

- Total cost is 20 billion USD: 11-12 percent of GDP as of 2000.
- Ratio of damaged buildings (including key industrial/chemical factories) is 4 times higher than 1995 Kobe earthquake and 12 times higher than 1994 Northridge earthquake.
- Top ten in the U.S. Department of Commerce Significant Earthquakes database.
- Uncertainty: Two back to back earthquakes increases the expectation for more, which increases the uncertainty surrounding government’s ability to pay.
Figure 3a: Ratio of Total Government Securities Held By Banks to Total Bank Assets (Dashed Blue) versus the Average Ratio of Government Securities in Banks’ Total Assets (Line) - (Percent)
Figure 4: Credit to Non-Financial Sector as a Ratio to Banking Sectors' Assets (Percent)

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Figure 5a: Annual Compound Interest Rates on Auctions for 3-Month Coupons for Floating Rate T-Bills (Percent)

- Blue line: 3-Month Coupon Yield on Floating Rate T-Bills with Approximately 1050 Days to Maturity
- Red line: 3-Month Coupon Yield on Floating Rate T-Bills with Approximately 550 Days to Maturity

Earthquake occurred in August-99.
Figure 5: Share of Short Term Borrowing (<1 year maturity) in Total Government Borrowing
Figure 5c: Turkish Bond Spreads Over US Treasuries

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Bank Balance Sheet Data from CBRT

- Universe of banks in Turkey
- Universe of Government Debt Market
- Monthly balance sheets showing all government debt exposure and private credit provision, both with respect to domestic and foreign currency and the source of borrowing and lending (domestic vs. external).
- Confidential items such as securities portfolios
- Collected via compulsory reportings of banks to Central Bank of Turkey and Banking Regulation and Supervision Agency as of last business day of each month.
Simple Lending Model of Khawaja-Mian, 2008

- In period $t$, bank $i$ and a representative firm $j$ negotiate a loan of size $L_{ijt}$.
- Accounting identity: $D_{it} + B_{it} = L_{ijt}$. (D is deposit and B is costly external financing with marginal cost $\alpha_B$)
- Marginal return on loan is decreasing in size: $r_j - \alpha_L L_{ijt}$.
- The equilibrium amounts of $B_{it}$ and $L_{ijt}$ are determined by intersection of credit demand and supply.
- In $t + 1$, there are aggregate, bank and firm-specific shocks: $\lambda_t$, $\gamma_{it}$, $\delta_{jt}$, and hence deposits are $D_{it} + \lambda_t + \gamma_{it}$ and marginal return on loans is $r_j - \alpha_L L_{ijt} + \lambda_t + \delta_{jt}$.
- If we jointly solve FOC of MC=MR in both periods and accounting identity:

$$\Delta L_{ijt} = \frac{\alpha_B \lambda_t}{\alpha_L + \alpha_B} + \frac{\alpha_B \gamma_{it}}{\alpha_L + \alpha_B} + \frac{\delta_{jt}}{\alpha_L + \alpha_B} \tag{1}$$
Estimating Equation

\[ \Delta L_{ijt} = \frac{\alpha_B \lambda_t}{\alpha_L + \alpha_B} + \frac{\alpha_B \gamma_{it}}{\alpha_L + \alpha_B} + \frac{\delta_{jt}}{\alpha_L + \alpha_B} \] (2)

- The first term: common shock, can be captured by a time fixed effect.

- The second term is idiosyncratic to the bank, rewrite as \( \gamma_{it} = X_{it}.\Delta risk_{tc} \), \( X_{it} \) bank balance sheet health.

- The third term is firm specific demand effect, we proxy this effect by bank-quarter effects which will absorb slow moving bank-representative firm specific demand. (evidence based on loan officer survey and sticky bank-firm relationship literature; ex: Chodorow-Reich, 2013; Hale, 2012).
Figure 6: Credit Demand Changes Reported in CBRT Bank Loans Tendency Survey

- Fraction of Banks Reporting a Big Change in Demand for Commercial Loans
- Fraction of Banks Reporting a Big Change in Demand for Consumer Loans

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Differences-in-Differences

- We ask whether the higher level of exposure of a bank to government debt market has resulted in a net worth shock (worst performance) and lower credit supply, conditional on demand.

\[ y_{it} = \alpha_i + \lambda_t + \alpha_i \times \omega_{t+3} + \beta \text{Earthquake}_t \times \text{Government Debt Exposure}_{it-1} + \gamma \text{Gov Debt Exp}_{it-1} + \epsilon_{it-1} \]

- \( i \) is bank, \( t \) is month, \( \alpha_i \) is bank-fixed effects, \( \lambda_t \) is month fixed effects, \( \alpha_i \times \omega_{t+3} \) is bank*quarter fixed effects
- \( y_{it} \): Loan supply, banks’ profits, net worth
The earthquake is a binary variable equal to 1 between August 1999–November 1999.


The Stand-By Agreement: between January 2000–November 2000

The Turkish crisis: between February 2001–December 2001
Figure 8a: Average Equity to Assets Ratio With respect to Government Debt Exposure (Percent)

The Banks with Above Median Exposure to Government Debt

The Banks with Below Median Exposure to Government Debt

Asian Crises

Russian Crises

Earthquake Period

Stand-By Begins

February 1997

June 1997

September 1997

December 1997

March 1998

June 1998

September 1998

December 1998

March 1999

June 1999

September 1999

December 1999

March 2000

June 2000

September 2000

December 2000

March 2001

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Figure 8b: Average Profits to Assets Ratio With respect to Government Debt Exposure (Percent)

The Banks with Above Median Exposure to Government Debt
The Banks with Below Median Exposure to Government Debt

Asian Crises
Russian Crises
Earthquake Period
Stand-By Begins

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Figure 8c: Average Credits to Assets Ratio with Respect to Government Debt Exposure

- **Asian Crises**
- **Russian Crises**
- **Earthquake Period**
- **Stand-By Begins**

- **Banks with Below Median Exposure to Gov. Debt**
- **Banks with Above Median Exposure to Gov. Debt**

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Fiscal Shocks, Government Bonds, and Credit Market Disruptions
## Table: Government Debt Exposure and Credit Provision: Loan/Assets

<table>
<thead>
<tr>
<th>Sample</th>
<th>No state</th>
<th>No state</th>
<th>No state</th>
<th>No state</th>
<th>No state</th>
<th>Drop foreign</th>
<th>Survivors</th>
</tr>
</thead>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
</tr>
<tr>
<td>Gov. Bonds/Assets</td>
<td>-0.0387** (0.0162)</td>
<td>-0.0397** (0.0163)</td>
<td>-0.0373** (0.0174)</td>
<td>-0.0472** (0.0205)</td>
<td>-0.0420** (0.0173)</td>
<td>-0.0470** (0.0234)</td>
<td>-0.0645*** (0.0214)</td>
</tr>
</tbody>
</table>
| *Earthquake & 
Gov. Bonds/Assets | -0.200*** (0.0143) | -0.199*** (0.0143) | -0.201*** (0.0145) | -0.188*** (0.0194) | -0.112*** (0.0277) | -0.127*** (0.0418) | -0.115*** (0.0197) |
| *Asia & 
Gov. Bonds/Assets | -0.0283 (0.0450) | -0.0249 (0.0458) | -0.0350 (0.0467) | 0.0309 (0.0445) | 0.151 (0.0700) | 0.0650 (0.0564) |
| *Russia & 
Gov. Bonds/Assets | -0.0265 (0.0265) | 0.0301 (0.0283) | 0.0194 (0.0225) | 0.0427* (0.0225) | 0.0323 (0.0261) | 0.0351 (0.0202) |
| *Stand-by & 
Gov. Bonds/Assets | -0.0611** (0.0211) | 0.0812*** (0.0269) | 0.0949** (0.0602) | 0.101*** (0.0195) |
| *Crisis & 
Gov. Bonds/Assets | -0.0367 (0.0238) | 0.0704*** (0.0267) | 0.0704*** (0.0359) |
| Bank fix effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Month fix effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Demand control | No | No | No | No | No | Yes | Yes |
### Table: Channel: Net Worth/Assets and Profits/Assets

<table>
<thead>
<tr>
<th>Sample</th>
<th>All Profit (1)</th>
<th>No state Profit (2)</th>
<th>All Net Worth (3)</th>
<th>No state Net Worth (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LHS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gov. Bonds/Assets *Earthquake</td>
<td>-0.0452*** (0.0167)</td>
<td>-0.0796** (0.0363)</td>
<td>-0.0445** (0.0173)</td>
<td>-0.0760** (0.0368)</td>
</tr>
<tr>
<td>Gov. Bonds/Assets *Asia</td>
<td>0.0439*** (0.0133)</td>
<td>-0.0365 (0.0251)</td>
<td>0.0354** (0.0144)</td>
<td>-0.0494 (0.0360)</td>
</tr>
<tr>
<td>Gov. Bonds/Assets *Russia</td>
<td>-0.0216 (0.0271)</td>
<td>-0.0795 (0.0459)</td>
<td>-0.0196 (0.0272)</td>
<td>-0.0698 (0.0468)</td>
</tr>
<tr>
<td>Gov. Bonds/Assets *Stand-by</td>
<td>-0.124*** (0.0274)</td>
<td>-0.242*** (0.0599)</td>
<td>-0.115*** (0.0281)</td>
<td>-0.235*** (0.0606)</td>
</tr>
<tr>
<td>Gov. Bonds/Assets *Crisis</td>
<td>-0.219*** (0.0291)</td>
<td>0.148** (0.0678)</td>
<td>-0.228*** (0.0302)</td>
<td>0.177** (0.0740)</td>
</tr>
</tbody>
</table>

Bank fix effects: Yes
Month fix effects: Yes

Other bank controls: Demand, interbank exposure, cash, central bank balance.
What about investment? Results from Kalemli-Ozcan and Laeven

- This balance sheet channel of sovereign risk transmission from sovereigns to banks via holdings cause a reduction in credit supply and reinforces debt overhang in Europe when sovereign spreads rise.

- Debt overhang as in Myers (1977): reduced incentive for highly levered borrowers (firms) to make investments because some value of such investments accrues to existing debt (rather than equity).
Conclusion

- A big negative impact of public debt on banks’ performance during a period of heightened default risk, where an UNANTICIPATED exogenous fiscal shock is used to identify such an effect.

- Highlight the channel from sovereign debt to low credit supply via weakened banks in an emerging market.

- Normative implication: If bonds are held as part of normal business, risk weighting government bonds during crises might induce procyclicality without breaking the sovereign-bank nexus.

- Follow up work: Shows the effect of the same channel on investment in Europe when the shock is anticipated.

- Due to weakened banks ala balance sheet channel via their sovereigns, the lending channel cannot operate and private sector investment can be sluggish even in a low interest rate environment—as in Europe.
Robustness

- More on channel (valuation item goes down more for high exposure banks)
- Placebo earthquake
- Foreign banks who are not active in lending market (their balance sheet got hit but no effect on their lending)
Credit Over GDP By Regions (Percent)

- Mediterranean
- Aegean
- South Eastern
- North East
- Marmara
- Central East

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Figure 7: Bank Entry and Exit

- Number of Non-SDIF Banks (By End of Year)
- Number of SDIF Banks (By End of Year)

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Figure A.1: Ratio of Banks in Corresponding Categories Holding Government Securities
Figure A.2: Share of Government Securities in Banks’ Assets by Bank Categories

- State banks
- Private domestic savings banks
- Foreign investment banks
- Domestic investment banks

Key Events:
- Asian Crises
- Russian Crises
- Earthq. Period
- 2001 Crises
- Stand-by Period

Periods:
- 2001
- Crises
- Stand-by Period

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Kalemli-Ozcan and Laeven: Debt Overhang with Firm-Bank-Sovereign Linkages

Dependent Variable is \( \frac{(K_t - K_{t-1})}{K_{t-1}} \)

<table>
<thead>
<tr>
<th>Weak Bank :</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bond holdings</td>
<td>Bond holdings</td>
<td>Bond holdings</td>
</tr>
<tr>
<td>Loans/Assets</td>
<td>(-0.227***)</td>
<td>(-0.442***)</td>
<td>(-0.346***)</td>
</tr>
<tr>
<td></td>
<td>((-16.45))</td>
<td>((-17.47))</td>
<td>((-20.50))</td>
</tr>
<tr>
<td>Weak Bank</td>
<td>(-0.736***)</td>
<td>(-0.396***)</td>
<td>1.02***</td>
</tr>
<tr>
<td>*Loans/Assets</td>
<td>(5.06)</td>
<td>(12.83)</td>
<td>(5.51)</td>
</tr>
<tr>
<td>Weak Sovereign</td>
<td>0.576***</td>
<td>0.452***</td>
<td>0.770***</td>
</tr>
<tr>
<td>*Loans/Assets</td>
<td>(10.65)</td>
<td>(16.64)</td>
<td>(17.19)</td>
</tr>
<tr>
<td>Weak Bank*Weak Sov.</td>
<td>(-3.50***)</td>
<td>3.40***</td>
<td>(-5.43***)</td>
</tr>
<tr>
<td>*Loans/Assets</td>
<td>((-6.65))</td>
<td>(6.44)</td>
<td>((-11.64))</td>
</tr>
</tbody>
</table>

Firm fixed effects: Yes
Bank fixed effects: Yes
Year fixed effects: No
Country-sector-year fixed effects: Yes
Controls: Yes

Controls: Cash flow (+), Sales growth (+), Size (−), Weak Bank*Weak Sovereign (+).
How big are previous shocks?

- **Asian Crisis, June 1997:** First shock to Turkish banks that borrow internationally
  - A large decline in exports and GDP (-8% GDP decline)
  - A massive capital outflow of 7.2 billion USD (one third of the FX Reserves of CBRT)
  - A discrete jump on nominal interest rates on T-bills (from 77% to 137% within 1.5 months)
- **Russian Crisis, August 1998:** Second shock
  - Even before the earthquake, it became very hard for Turkish government to borrow
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Even before the earthquake, it became very hard for Turkish government to borrow
Earthquake Shock

- **Earthquake, August 1999:**
  - A significant blow to public finances
  - Further decline in GDP of -3 percent
  - Need for a Stand-By program became inevitable; started in January 2000 without banking reform

- A substantial liquidity crises in November 2000 followed by abolishment of the exchange rate peg and Stand-By in February 2001 and a full-blown banking crisis.
Earthquake Shock

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  - A significant blow to public finances
  - Further decline in GDP of -3 percent
  - Need for a Stand-By program became inevitable; started in January 2000 without banking reform

- A substantial liquidity crises in November 2000 followed by abolishment of the exchange rate peg and Stand-By in February 2001 and a full-blown banking crisis.
### Table: Domestic Debt, External Debt, Credit Growth (%): 1995–2009

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Domestic Public Debt/GDP</td>
<td>14</td>
<td>20</td>
<td>43</td>
<td>35</td>
</tr>
<tr>
<td>External Public Debt/GDP</td>
<td>24</td>
<td>24</td>
<td>36</td>
<td>17</td>
</tr>
<tr>
<td>External Private Debt/GDP</td>
<td>11</td>
<td>19</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Domestic/Total Public Debt</td>
<td>42</td>
<td>50</td>
<td>61</td>
<td>71</td>
</tr>
<tr>
<td>Private Credit/GDP</td>
<td>26</td>
<td>20</td>
<td>11</td>
<td>22</td>
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<tr>
<td>Bank Assets/GDP</td>
<td>42</td>
<td>70</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Private Credit/Bank Assets</td>
<td>40</td>
<td>30</td>
<td>20</td>
<td>37</td>
</tr>
<tr>
<td>Government Bonds/Bank Assets</td>
<td>36</td>
<td>36</td>
<td>76</td>
<td>60</td>
</tr>
</tbody>
</table>
36 Month Stand-By Program announced on December 9, 1999 aiming at reducing inflation and restoring fiscal balances.

Entailed a planned crawling peg regime for Jan. 2000-June 2001 in line with inflation targets, and a crawling band regime with a widening band for July 2001 to Dec. 2002 as a gradual exit to floating exchange rate regime.

Central Bank commitment to no sterilization, whereby changes in the net foreign assets of its balance sheet would be the main source of changes in the monetary base.

Explicit austerity measures on government expenditures and explicit primary balance as performance criteria.

Resulted in a liquidity crises in November 2000, outflow of 6 billion USD as well as take-over of the control of a number of banks by Saving Deposit Insurance Fund.

The grant of extra 7.5 billion USD by IMF as part of Supplementary Reserve Facility and a technical revision on the monetary policy side of the program in late December 2000.