Our Question

• Sharp increases in international sovereign debt spreads coincide with increases in domestic private debt spreads

• What causes these debt crises?
Our Answer

- Optimal loan contracts provide incentives via socially costly liquidation.

- Suppose marginal social cost of liquidation is increasing in aggregate liquidation.

- Then, optimal loan contracts may have a second, inferior, equilibrium.

- In this equilibrium: there are self-fulfilling defaults.
Implications

1. **Sovereign and domestic defaults happen together**
   
   • Entrepreneurs coordinate on defaulting based on a non-fundamental shock

   • Self-fulfilling domestic default crisis leads to a fall in government taxes and sovereign default

2. **Sovereign and domestic rates move together**

   • An increase in the probability of the non-fundamental shock leads to an increase in domestic and sovereign default risk
Why Do We Need This Model?

- Defaults due to changes in fundamentals left unexplained why:
  - sovereign defaults happen in both recessions and booms
    (Tomz and Wright)
  - sovereign debt crises are very correlated across emerging countries

- Common explanation of sovereign debt crises: sunspot-driven coordination failure among foreign lenders
  - Cole and T. Kehoe, among others
• But it has problems:
  
  – Why do foreign lenders only fail to coordinate for certain countries?
  
  – Why is there a link between sovereign defaults and domestic defaults?

• Our new model addresses both of these failings
Evidence

Fact 1: Sovereign default risk and private default risk move together

Private default risk: dollar lending rate - US Tbill

Sovereign default risk: EMBI+ yield - US Tbill
### Correlations of Sovereign and Private Default Risk

<table>
<thead>
<tr>
<th>Country</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>0.81</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.38</td>
</tr>
<tr>
<td>Chile</td>
<td>0.45</td>
</tr>
<tr>
<td>Colombia</td>
<td>0.08</td>
</tr>
<tr>
<td>Ecuador</td>
<td>0.37</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.29</td>
</tr>
<tr>
<td>Korea</td>
<td>0.54</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.18</td>
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<tr>
<td>Mexico</td>
<td>0.85</td>
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<tr>
<td>Nigeria</td>
<td>0.47</td>
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<tr>
<td>Panama</td>
<td>0.44</td>
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<tr>
<td>Peru</td>
<td>0.69</td>
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<tr>
<td>Philippines</td>
<td>-0.40</td>
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<tr>
<td>Poland</td>
<td>-0.48</td>
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<tr>
<td>Russia</td>
<td>0.47</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.54</td>
</tr>
<tr>
<td>Ukraine</td>
<td>0.41</td>
</tr>
<tr>
<td>Venezuela</td>
<td>0.33</td>
</tr>
</tbody>
</table>
Fact 2: Private default events occur together with sovereign defaults

Use Standard & Poors dates for sovereign defaults

Use Caprio and Klingbiel (2003) banking crises dates which are characterized by widespread private defaults

<table>
<thead>
<tr>
<th>Sovereign Defaults and Internal Debt Crises from 1980-2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only Sovereign</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Emerging markets</td>
</tr>
<tr>
<td>Middle income countries</td>
</tr>
</tbody>
</table>
Fact 3: Causal channel

- Private default crises frequently occur without sovereign defaults.
- Converse is *not* true.
- Natural conclusion: private defaults cause sovereign defaults.
- Timing also supports this conclusion.
Case Study: Indonesia (1998)

- Indonesia banking system looked good in June 1997
  - less than 10% of loans were non-performing

- Thai baht falls in summer 1997

- Little connection between Thailand and Indonesia.
• Nonetheless: Big problems in Indonesian banks

• 50 insolvent banks by October 1997

• These banks had large numbers of insolvent loans
  
  – by July 1998: nearly 50% of loans non-performing

• Big pressure on Indonesian government to bail out banks

• By January 1998: provided banks with "liquidity" = 7% GDP

• Government defaulted in August 1998
Lessons:

• Non-fundamental shock leads to ...

• Domestic default crisis leads to ...

• Sovereign default
Model

- 2 period small open economy with 1 domestic lender, 2 entrepreneurs and a government

- Entrepreneurs have an investment technology that converts 1 unit of investment goods in pd. 1 into:
  
  - 1 unit of capital and $R_n$ units of consumption in period 2

- $R_n$ is private information to entrepreneur $n$

- Domestic lender has 2 units of investment goods in pd 1. and an outside option of $2R$ units of pd. 2 goods
Liquidation

- After production in period 2, the lender can liquidate $L$ capital

- Entrepreneur gets $B_E(1 - L)$ units of consumption, where $B_E > 1$
  
  - entrepreneur-specific benefits of owning capital

- Lender gets $\delta L$ units of consumption, where $0 \leq \delta \leq 1$

- Liquidation is an *inefficient* way to repay lender
Sovereign Lending

- In period 1, government borrows $G$ units for public goods

- Foreign lenders are risk-neutral, with deep pockets

- In period 2, government levies lump-sum taxes $\tau$ on domestic lenders

- Uses taxes to repay $R^{FOR}$ to the foreign lenders
Increasing marginal cost of liquidating capital

- Stark: Total capital liquidation is bounded from above by $\xi$

$$L_1 + L_2 \leq \xi$$

And

$$1 < \xi < 2$$

- The upper bound on $\xi$ is the key to our analysis

- Motivated by evidence from Indonesia in 97-98.
Equilibrium

- Two states for returns: $R_n = R^H$ with prob. $(1 - p)$; $R_n = R^0 = 0$ with prob. $p$

- Government sets taxes $(\tau_2, \tau_1, \tau_0)$ to maximize sum of domestic agents' utilities

- $\tau_s$ is tax payment if $s$ entrepreneurs announce high returns

- After government chooses $\tau$, lender chooses loan contract:

  \[(F_{ij}, L_{ij}) \quad i, j \in \{0, H\}\]

  An entrepreneur pays $F_{ij}$ and liquidates $L_{ij}$ if his announced return is $R_i$ and other entrepreneur announced $R_j$
• The lender can only choose contracts that satisfy an incentive constraint:

\[
\sum_{j=\{H,0\}} \Pr(R_n = R^j) u_E(B_E(1 - L_{Hj}) + R^H - F_{Hj})
\geq \sum_{j=\{H,0\}} \Pr(R_n = R^j) u_E(B_E(1 - L_{0j}) + R^H - F_{0j})
\]

• The incentive compatible contract for entrepreneur \(i\) is constructed assuming entrepreneur \(j\) tells the truth
• The equilibrium contract maximizes the entrepreneur’s objective subject to:
  
  – feasibility constraint
  
  – incentive constraint
  
  – individual rationality constraint for domestic lender
  
  – zero-profit constraint for foreign lender
Equilibrium sovereign default

- Typically, in an equilibrium contract:
  \[\tau_2 > \tau_1 > \tau_0\]

- \(\tau_2\) denotes the face value of sovereign debt and \(\tau_0\) sovereign default

- \(\tau_0\) may well be negative (if \(G\) is relatively small)

- Foreign lenders may be bailing out sovereign who in turn bail out domestic lenders
Coordinated Default Crises

- In the equilibrium contract, successful entrepreneurs do not lie

- Contract is constructed so that the entrepreneur does not lie when the other entrepreneur is telling the truth

- BUT: there may be another equilibrium in which both entrepreneurs lie

- Suppose

  \[ u_E(B_E + R^H - B_EL_0) > u_E(B_E + R^H - F_{H0}) \]

- Here, successful entrepreneur \( i \) should default if entrepreneur \( j \) is known to default: coordinated default crisis
When do we get coordinated default crises?

- **Case 1:** If $\xi$ is sufficiently high, there are no crises.

- **Case 2:** If $\xi$ is sufficiently low:

  \[
  \frac{\xi}{2} < \frac{R + R^{FORG}/2}{(1 - p)B_E + \delta p}
  \]

  the possibility of coordinated default crises exists.

- Intuition: If $\xi$ is small, cost of liquidation is small if other entrepreneur defaults.
In Case 2, the eq’m contract features:

\[
\tau_2 = 2F_H - 2R \\
\tau_1 = (F_H + \delta L_{0H}) - 2R \\
\tau_0 = \delta \xi - 2R
\]

\(\tau_0 < \min\{\tau_2, \tau_1\}\); if \(\xi\) is not too large, \(\tau_2 > \tau_1\)

**Result 1:** Sovereign default takes place during domestic default crisis
Crises and Correlations

- Rational agents will put positive probability on crises

- Suppose:

\[ \xi/2 < \frac{R + R_{FORG}/2}{(1 - p)B_E + \delta p} \]

- And with probability \( \varepsilon \), entrepreneurs coordinate on defaulting

- Then equilibrium contract adjusts in response to this possibility
• If default probability $\varepsilon$ rises: face values $F_H$ and $\tau_2$ both go up.

• Necessary to compensate lenders for increased default probability.

• Result 2: Sovereign and domestic debt returns move together (as $\varepsilon$ varies)
Conclusions

- We document that in the data
  - Sovereign and private default risk co-move
  - Sovereign and private defaults occur together
  - Main impulse seems to be non-fundamental.

- We build a model which replicates these facts

- Everything follows from one assumption: the marginal cost of liquidation is steeply increasing
• There is a debate about the appropriate way to stop sovereign default crises
  – IMF as bankruptcy court?
  – stopping government bailouts of banks?

• In our model, the one way to improve welfare is to increase $\xi$

• Useful reforms should involve improving domestic financial institutions to deal with potential large scale defaults