Applying the Data and Tools: Development of Macroprudential Policy for Financial Stability

Mila Getmansky Sherman
Associate Professor
Isenberg School of Management, UMass Amherst

Financial Stability Analysis: Using the Tools, Finding the Data Conference
May 31, 2013
Washington, DC
Based on the recent work

1. **Econometric Measures of Connectedness and Systemic Risk in the Finance and Insurance Sectors**

2. **On a New Approach for Analyzing and Managing Macrofinancial Risks**

3. **Sovereign, Bank, and Insurance Credit Spreads: Connectedness and System Networks**

Objectives

• Analyzing and managing **sovereign risk**, the **risks of financial institutions**, and the interactions among sovereigns and financial institutions are important for financial stability

• Concentrate on **credit**

• **CDS** values do not fully account for default risk, as they only reflect the default after the first loss. **Underestimated** due to values of guarantees.

• Important to account for implicit and explicit **guarantees**

• We propose **Expected Loss Ratios** (based on CCA) and **network measures** to analyze financial system interactions and **systemic risk**
### Table 1: Credit-related Assets and Liabilities of the U.S. Government, 2010
(billions of dollars)

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct loans</td>
<td>Treasury debt held by public</td>
</tr>
<tr>
<td>828</td>
<td>9,060</td>
</tr>
<tr>
<td>Guaranteed loans</td>
<td>Off-balance-sheet guaranteed loan financing</td>
</tr>
<tr>
<td>1,867</td>
<td>1,867</td>
</tr>
<tr>
<td>Mortgages guaranteed or held by Fannie Mae and Freddie Mac</td>
<td>Fannie and Freddie debt</td>
</tr>
<tr>
<td>5,321</td>
<td>1,453</td>
</tr>
<tr>
<td></td>
<td>Fannie and Freddie MBSs</td>
</tr>
<tr>
<td></td>
<td>3,868</td>
</tr>
<tr>
<td>Other federally-backed credit (FDIC, FHLBs, FCS, PBGC, Federal Reserve loans and SIVs)</td>
<td>Off-balance-sheet financing of other federally-backed credit</td>
</tr>
<tr>
<td>10,140</td>
<td>10,140</td>
</tr>
<tr>
<td></td>
<td>Taxpayer/stakeholder equity</td>
</tr>
<tr>
<td></td>
<td>-8,232</td>
</tr>
</tbody>
</table>

Source: Author’s tabulations based on Treasury Financial Statements, FDIC and Federal Reserve Releases, OMB Analytical Perspectives, and FHFA 2010 Annual Report to Congress. From *Credit Policy as Fiscal Policy*, Deborah Lucas, MIT, November 15, 2011, p. 29
Feedback Loops of Risk from Explicit and Implicit Guarantees

An adverse feedback loop ties sovereigns stresses to banking sector challenges

DOMESTIC

SOVEREIGN

A. Mark-to-market fall in value of govt bonds held by local banks

B. Increase in bank funding costs

C. Erosion in potential for official support

FOREIGN

SOVEREIGN

D. Mark-to-market fall in value of govt bonds held by foreign banks

E. Similar sovereigns come under pressure

F. Contagion channels (A, B, & C as above)

BANKS

G. Rise in counter-party credit risk

H. Withdrawal of funding for risky banks

I. Increase in contingent liabilities of govt.

Source: IMF GFSR 2010, October  Dale Gray
Measuring Connectivity and Influence on Credit Ratings Between Sovereigns and Financial Institutions

- Expected Loss Ratio = Guarantee/Riskfree Debt
  \[ = \frac{PUT}{B} \exp[-rT] \]
  \[ = \text{ELR} \]
- Fair Value CDS Spread = \(-\log (1 - \text{ELR})/T\)
- \(\text{ELR}_k(t) = a_{jk} + b_{jk} \text{ELR}_j(t-1) + \varepsilon_t\)
- \(\text{ELR}_j(t) = a_{kj} + b_{jk} \text{ELR}_k(t-1) + \zeta_t\)
- If \(b_{jk}\) is significantly > 0, then j influences k
- If \(b_{kj}\) is significantly > 0, then k influences j
- If both are significantly > 0, then there is feedback, mutual influence, between j and k.
Data

• Sample: Jan 01-Mar12
• Monthly frequency
• Entities:
  – 17 Sovereigns
  – 63 Banks
  – 39 Insurance Companies
• Moody’s KMV CreditEdge:
  – Expected Loss Ratio (ELR)

Network Measures

• **Degrees**
  - Indegree (IN): number of incoming connections
  - Outdegree (FROM): number of outgoing connections
  - Totdegree: Indegree + Outdegree

• **Connectivity**
  - Number of node connected: Number of nodes reachable following the directed path
  - Average Shortest Path: The average number of steps required to reach the connected nodes

• **Centrality**
  - Eigenvector Centrality (EC): The more the node is connected to central nodes (nodes with high EC) the more is central (higher EC)

P-Value=0.01

P-Value=0.01
Connectedness to Greece: August 2008

Connectedness to Italy and US: March 2012

Blue Insurance
Black Sovereign
Red Bank

Blue Insurance
Black Sovereign
Red Bank

Sovereign, Bank, and Insurance Credit Spreads: Connectedness and System Networks.
Network Measures: FROM and TO Sovereign

17 X 102 = 1734 potential connections FROM (TO)

Sovereign, Bank, and Insurance Credit Spreads: Connectedness and System Networks.
Network Measures: FROM Sovereign

From Sovereign

CDS
KMV
Network Measures:
TO Sovereign
Network Measures: FROM and TO Sovereign

Sovereign, Bank, and Insurance Credit Spreads: Connectedness and System Networks.
Greece, Ireland, Italy, Portugal and Spain: GIIPS

FROM GIIPS minus TO GIIPS

Conclusion

• The system of banks, insurance companies, and sovereigns in our sample is highly dynamically connected
• Important to use the right data to measure interconnectedness
• Sovereigns are interconnected with other sovereigns
• Network measures allow for early warnings and assessment of the system complexity
Functional Description of Being a Lender or Guarantor of Debt When There is Risk of Default

RISKY DEBT + GUARANTEE OF DEBT = RISK-FREE DEBT

RISKY DEBT = RISK-FREE DEBT - GUARANTEE OF DEBT

\[ A = D + E \]

IN DEFAULT, THE HOLDER OF THE GUARANTEE RECEIVES PROMISED VALUE OF THE DEBT MINUS VALUE OF ASSETS RECOVERED FROM DEFAULTING ENTITY = MAX [0, B – A]

VALUE OF GUARANTEE = PUT OPTION ON THE ASSETS OF BORROWER

CREDIT DEFAULT SWAPS ARE GUARANTEES OF DEBT AND THEREFORE ARE PUT OPTIONS ON THE ASSETS OF THE BORROWER
Non-linear Macro Risk Buildup

Copyright © 2012 by Robert C. Merton
General Measures of Credit Connectedness and Influence among Institutions: Linear Granger Causality Tests

\[ X_t = \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{m} b_j Y_{t-j} + \epsilon_t \]

\[ Y_t = \sum_{j=1}^{m} c_j X_{t-j} + \sum_{j=1}^{m} d_j Y_{t-j} + \eta_t \]

- \( Y \Rightarrow_G X \) if \( \{b_j\} \) is different from 0
- \( X \Rightarrow_G Y \) if \( \{c_j\} \) is different from 0
- If both \( \{b_j\} \) and \( \{c_j\} \) are different from 0, feedback relation
- Test is robust to autocorrelation and heteroschedasticity