

On a New Approach for Analyzing and Managing Macrofinancial Risks

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The Issues

- Macrofinancial (Systemic) risk is a big issue for both governments and large asset pools.
- The Financial Crisis of 2008-2009 and the ongoing European Debt Crisis were centered around credit risk.
- The propagation of credit risk among financial institutions and sovereigns is related to the degree of "connectedness" among them
- Tools for measuring connectedness and its dynamic changes are presented using network theory and econometric techniques
- This is new research still in progress but the basic approach and the findings appear to be well-founded



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

Corporation		
Operating Assets, A	Debt (face value B), D	
	Common Stock, E	

$\mathsf{A}=\mathsf{D}+\mathsf{E}$

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 essentially put options on the assets of the defaulting borrower



Non-Linear Macro Risk Buildup





Destructive Feedback Loops: Guarantors Writing Guarantees of their Own Guarantors

- Guarantor writes a guarantee in which its assets will not be adequate to meet its obligations precisely in those states of the world in which it will be called on to pay.
- Government region X's debt is held by financial institutions whose liabilities are guaranteed by Government X (applies to Eurozone Debt Crisis)
- Federal Deposit Insurance Corp. debt held by FDIC-insured banks
- The Pension Benefit Guarantee Corp. investing in the equities of the companies whose pensions it guarantees
- A corporation writing a CDS contract on its own debt
- Funding a corporate pension fund with the plan sponsor's own stock
- A company writing put options on its own stock



Feedback Loops of Risk from Explicit and Implicit Guarantees





Measuring Connectivity and Influence on Credit Ratings Between Sovereigns and Financial Institutions

Expected Loss Ratio = Guarantee/Riskfree Debt

= PUT/B exp[-rt]

= ELR

- Fair Value CDS Spread = -log (1 ELR)/ T
- ELRk (t) = ajk + bjk ELRj(t-1) + Et

 $ELRj(t) = akj + bkj ELRk(t-1) + \zeta t$

- If bjk is significantly > 0, then j influences k
- If bkj is significantly > 0, then k influences j
- If both are significantly > 0, then there is feedback, mutual influence, between j and k.



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



Data

- Sample: January 2001–March 2012
- Monthly frequency
- Entities:
 - 17 Sovereigns
 - 63 Banks
 - 39 Insurance Companies
- Moody's KMV CreditEdge:
 - Expected Loss (EL)



Connectedness July 2004–June 2007: Sovereigns, Banks, and Insurance Companies





Connectedness April 2009–March 2012: Sovereigns, Banks, and Insurance Companies





Connectedness to Greece: August 2008





Connectedness to Spain: December 2011





Connectedness to Italy and US: March 2012





Connectedness to Italy: March 2012





Network Measures: From and To Sovereign





Network Measures: From and To Sovereign





Unified Macrofinance Framework Targets

Inflation, GDP, financial system credit risk, sovereign credit risk







Traditional Flow and Accounting Framework

No risk-adjusted balance sheets (asset volatility = 0) No credit risk or guarantees; No risk exposures







Government: Economic-Risk Balance Sheet

Assets	
	\$ Bn
Present Value of Incomes from:	
TAXES	1130.7
Income	573.6
Assets	83.7
Customs	1.1
Excise & GST	220.4
	80.9
Others-Tax	171.0
FEES	84.8
Sales of Goods	4.9
Rental	26.4
All other Fees	53.5
SEIGNORAGE	TBD
Balances of:	
INVESTMENTS	688.0
Pension Fund	160.0
Wealth Fund	528.0
CASH	112.3
INFRASTRUCTURE	TBD
Government-owned Enterprises	TBD
CURRENCY RESERVES	204.0
	254.0
REAL ESTATE	TBD
OTHER ASSETS	6.0
TOTAL	2225.7

Liabilities	
	\$ Bn
Present Value of Non Discretionary Expense SOCIAL DEVELOPMENT	es on: 653.0
SECURITY & EXTERNAL RELATIONS	600.6
ECONOMIC DEVELOPMENT	193.4
GOVERNMENT ADMINISTRATION	70.7
Balances of: MONETARY BASE	TBD
GOVERNMENT DEBT OUTSTANDING Foreign Currency Local Currency	TBD
PENSION LIABILITIES	TBD
Contingent Claims (Implicit Guarantees) GUARANTEES TO BANKS AND NON-BANKS GUARANTEES ON RETIREMENT INCOME GUARANTEES ON SOCIAL WELFARE	TBD TBD TBD
<i>General Balance</i> (Economic Assets in excess of Economic Liabi	708.1
TOTAL	2225.7

Note: Economic Balance Sheet integrates central bank



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