Financial stability analytics

Mark D. Flood
Department of Finance
University of Maryland

Center for Latin American Monetary Studies (CEMLA)
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Financial Stability

Financial stability as a public good
- Liquidity as an emergent phenomenon
- Risk management fallacy of composition
- Deadweight costs of bankruptcy

Crises and lessons learned – Flood (2014)
- Panic of 1907 → Federal Reserve
- Great Depression → FDIC
- Great Depression → SEC
- Great Depression → Bank of Canada
- Global Financial Crisis → FSOC
- Global Financial Crisis → OFR
- Global Financial Crisis → FCA (U.K.)

Plus ça change …
- This Time is Different – Reinhart and Rogoff (2009)
What is systemic risk?

• Two general approaches to a definition

• Focus on the real economy
  • Systemic risk is a threat to financial stability “so widespread that it impairs the functioning of a financial system to the point where economic growth and welfare suffer materially”
    • European Central Bank (2010, p.138)

• Focus on the financial sector
  • Systemic risk is “the potential for widespread financial externalities—whether from corrections in asset valuations, asset fire sales, or other forms of contagion—to amplify financial shocks and in extreme cases disrupt financial intermediation”
    • Adrian, Covitz and Liang (2015)
What is systemic risk?

• **Mechanisms** of systemic risk
  • Global imbalances
    • Caballero and Krishnamurthy (2009)
  • Correlated exposures
    • Acharya, Pedersen, Philippon, and Richardson (2017)
  • Spillovers to the real economy
    • Group of Ten (2001)
  • Information disruptions
    • Mishkin (2007)
  • Feedback behavior
    • Kapadia, Drehmann, Elliott, and Sterne (2009)
  • Asset bubbles
    • Brunnermeier, Rother and Schnabel (2019)
  • Contagion
    • Martínez-Jaramillo, Pérez Pérez, Avila Embriz, and López Gallo Dey (2010)
  • Negative externalities
    • Financial Stability Board (2009)
Diversity of the problem

• Sources
  • Securitization / shadow banking (2007-09 Financial Crisis)
  • Sovereign debt (1997 Asian crisis)
  • Equity market bubble (1999 tech bubble)

• Crisis mechanisms
  • Credit surprise (1998 Russian bond default, LTCM)
  • Market risk (1973 oil price shock)
  • Operational event (2010 flash crash)
  • Clearing crisis (1974 Herstatt crisis)

• Policy responses
  • More capital (Basel III – Common Equity Tier 1)
  • Liquidity reserves (Basel III – NSFR, HQLA)
  • Greater disclosure (CCAR/DFAST stress-test data)
  • Rapid resolution (Qualified Financial Contracts, living wills)
All models are wrong, but some are useful...

Classifying the literature – Four taxonomies – Bisias, et al. (2012)

- **Supervisory scope**
  - Microprudential
    - Securities & commodities
    - Banking & housing
    - Insurance & pensions
    - General applications
  - Macroprudential

- **Research method**
  - Probability-distribution measures
  - Contingent claims and default measures
  - Illiquidity
  - Network analysis
  - Macroeconomic measures

- **Data requirements**
  - Macroeconomic measures
  - Granular foundations and network measures
  - Forward-looking risk measures
  - Stress-test measures
  - Cross-sectional measures
  - Illiquidity and insolvency

- **Event / decision time horizon**
  - Ex-ante
    - Early warning
    - Counterfactual simulation & stress testing
  - Contemporaneous
    - Fragility
    - Crisis monitoring
  - Ex-post
    - Forensic
    - Orderly resolution
Policy implications

Statistical challenges

• Very noisy signal environment
  • “Are Home Prices the Next Bubble?” – McCarthy and Peach (2004)
    “… market fundamentals are strong enough to explain the recent path of
    home prices and that no bubble exists”
    +2.0 to +2.8% annually
Policy implications

Statistical challenges

• Endogenous policy response to systemic developments
  • “Greenspan Put” (asymmetric liquidity provision in response to stress)
  • Counterfactuals are not measurable

• And endogenous systemic response to policy developments:
  • “Any observed statistical regularity will tend to collapse once pressure is placed upon it for control purposes” – Goodhart’s Law (1975)
  • “Any change in policy will systematically alter the structure of econometric models” – Lucas Critique (1976)

• “Maginot” problem:
  • No single measure is sufficient

• Nonstationarity in the statistical regime
  • Crisis correlations
    • Flight to quality forces $\rho \approx 1.0$
  • Volatility paradox
    • Low market volatility masks risk accumulation
  • Revealed loss surprises
    • Ex ante, crisis is a low probability event

Volatility Paradox
S&P 500 Index 90-day Realized Volatility

Image: OFR
The big (data) picture

Rise of shadow banking
- Traditional intermediation (banking) drops in half 1950–2018
  - Introduction of option pricing in the 1970s
  - Introduction of collateralized mortgage obligations (CMOs) in the 1980s

Bank-centric blind spots
- Banks are only half the story
- Shadow banking is the rest

Accounting blind spots
- Historical view
- Monovalent metrics

Contract (network) focus
- Interactions and contagion
- Risk diversity

Data scalability
- Rise of fintech

Trends in credit intermediation, 1952–2017
Big data and financial stability monitoring

Big data is a *scalability problem*

• Fundamentally issues of implementation
  “You can’t solve exponential problems with linear solutions”
  – Prof. Banny Banerjee

• Problem contains seeds of its own solution
  Fight computation with computation

The Four Vs of big-data scalability challenges

• **Volume** – sentiment analysis
• **Velocity** – high-frequency trading
• **Variety** – legal entity identifier
• **Veracity** – raw quote/transaction feeds
Big data and financial stability monitoring

Five Tasks – Flood, Jagadish and Raschid (2016)

1. System Instrumentation and Data Acquisition
2. Data Cleaning and Data Quality
3. Data Integration and Representation
4. Data Modeling and Analysis
5. Data Sharing and Transparency
Resolution enhancement in four dimensions

- **Coverage** – where are our blind spots?
  - Example: G20 Data Gaps Initiative, [FSB-IMF (2015)]

- **Frequency** – temporal resolution requirements and limits
  - Example: High frequency trading time stamps, [Lombardi (2015)]

- **Granularity** – aggregation level (over database rows)
  - Example: Bucketing portfolio risk exposures, [Flood & Monin (2016)]

- **Detail** – measured and derived attributes (database columns)
  - Example: Fat regression problem ($P >> N$), [Donoho & Stodden (2006)]
Information acquisition granularity – Example

Risk-measurement bucketing

- Form PF records risk exposures for private funds (e.g., hedge funds)
- Risk statistics for various sub-portfolios

Is the bucketing too coarse?

Measure a vector of risk attributes:

\[ R = [ R_{PF} \mid R^{+} ] \]

- \( R = \) everything you want to know
- \( R_{PF} = \) captured on Form PF
- \( R^{+} = \) everything else (unmeasured)

Fully granular transparency can reveal a very different risk picture

Image: Flood and Monin (2016)
Data cleaning/quality – Example

Mortgage foreclosure scandal

• Post-crisis explosion of foreclosures

![Mortgage Foreclosures, Delinquencies and Charge-offs](image-url)

Overwhelmed financial processes in history

• Civil War Greenbacks, 1863
• Paperwork Crisis of 1968
• CDS backlog of 2005

Images: Toles, Washington Post; Flood, Mendelowitz and Nichols (2013)
Data Integration – Example

The global legal entity identifier (LEI) minimizes confusion:
• Centralizes basic public facts
• Standardizes the representation

OFR and NIST funded a set of public challenges:
• Financial Entity Identification and Information Integration (FEIII)
Traditional risk measurement

Firm accounting statements

Highly standardized
- FASB
- GAAP
- Basel capital rules

Backward looking
- Historical/fair value
- Monovalent

Market transaction data

Pre-trade transparency
- Quotes and spreads
- Limit orders

Post-trade transparency
- Transaction prices
- Volumes
The *Four Ls* of systemic risk – *Billio, et al. (2012)*

- Leverage
- Losses
- Linkages
- Liquidity
Leverage Cycle

Minsky (1977) moments

- Marginal buyer is the most optimistic buyer
- Speculators’ access to leverage drives price cycles

Image: Fostel and Geanakoplos (2014)
Linkage complexity in bank holding companies (BHCs)

BHCs have complex internal structure

• Focus on ownership/control hierarchies

• Graph quotienting exposes dependencies as cycles

We have the data

• FR Y-10 reports
• FFIEC / NIC

Fundamental Rule of Data Collection

Endogenous Myopia

- Firms’ visibility into their networks
  - Distance \(\leq 1\) contractual link
  - Position information is closely held
- Implies a role for public supervision

State-dependent data requirements

- Supervisory needs increase under
  - Crisis monitoring
  - Failure resolution
  - Forensic investigation

System-wide Data Collection

Requires Data Standards
Reading Suggestions


Thanks!