

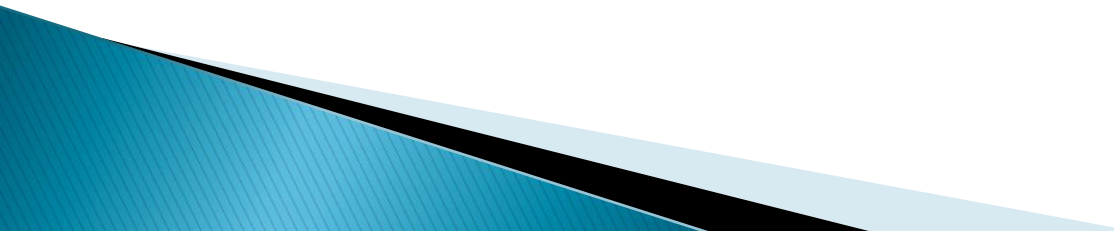
Measuring Financial Contagion Risks in the Caribbean:

The Caribbean Regional Financial Project (CRFP)

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*This presentation represents the personal views of Elie Canetti, and should not be construed to represent the views of the IMF's staff or Executive Board.

Outline

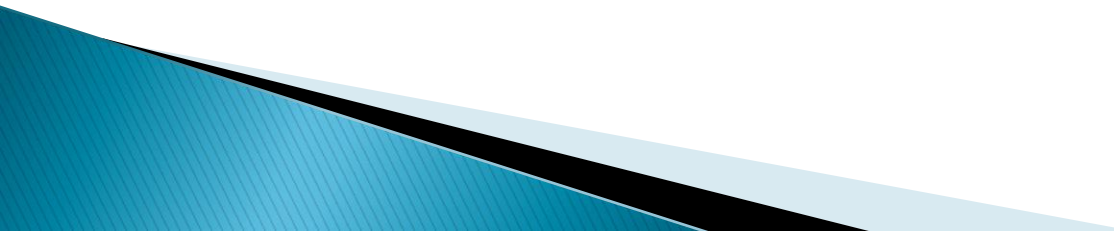
- ▶ CRFP Project Overview
 - ▶ Analytical Considerations
 - ▶ A Methodological Digression: Mapping Interconnectedness
 - ▶ Data Template
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The Caribbean Regional Financial Project (CRFP)

Project Overview: Work Program

- ▶ March 2013 – Initial Request
- ▶ May 2013 – Terms of Engagement
 - IMF/CARICOM Governors
 - CBTT To Coordinate
- ▶ Phase I – Analysis
 - July 2013 – Considerations
 - Oct. – Dec. 2013 – Draft Data Template
 - Data Collection
 - Produce Interconnectedness Maps
 - Network Simulations
- ▶ Phase II – Policy Phase (2015?)

Who Does What?

- ▶ CARICOM Governors – Steering Committee
 - ▶ RFSCC – Regional Coordinating Body
 - ▶ Central Bank of Trinidad and Tobago (CBTT)
 - Secretariat
 - Data Repository
 - ▶ IMF – Leads Analytical Work
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Phase I – Analytical Component

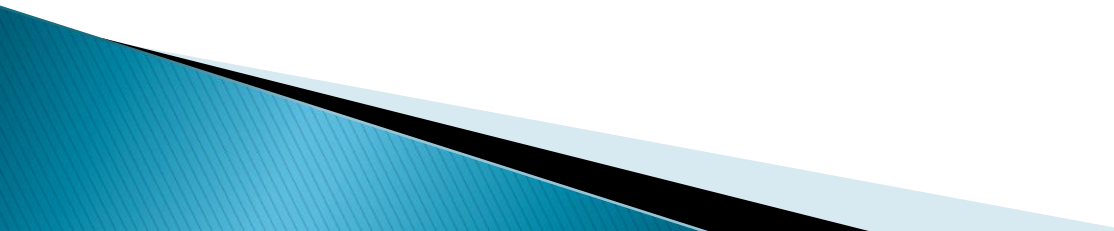
- ▶ **Descriptive Stocktaking***
 - Size of the Financial System
 - Financial Ownership Structure
 - Frameworks for:
 - Regulation
 - Supervision
 - Safety nets
 - Crisis management
- ▶ **Map Interconnections**
- ▶ **Stress Testing (Network Simulations)**

* See “Financial Integration in the Nordic–Baltic Region: Challenges for Financial Policies”, IMF, 2007 and “Financial Interconnectedness and Financial Sector Reforms in the Caribbean, IMF WP/13/175

Handoff Analysis After Phase I

- ▶ Ongoing Work by Regional Central Banks
 - Data Collection
 - Identify and Fill Data Gaps
 - Interconnectedness analysis and simulations
 - Enrich Analysis

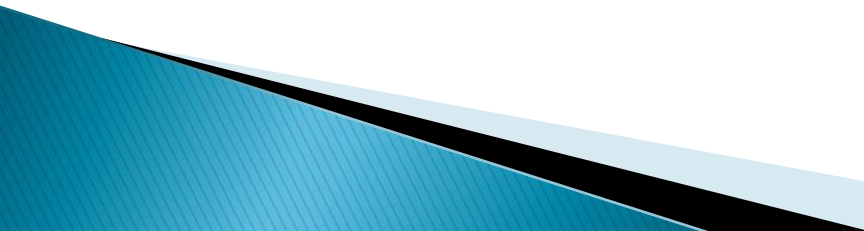
Phase II – Policy Component

- ▶ Regional Supervision
 - ▶ Regional Legal Framework
 - ▶ Crisis Prevention and Management
 - Information Sharing
 - Policy Instruments
 - Financial Safety Nets
 - Cross–Border Resolution Regimes
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II. Analytical Considerations

Potential Goals of Interconnected Analysis.

To identify:

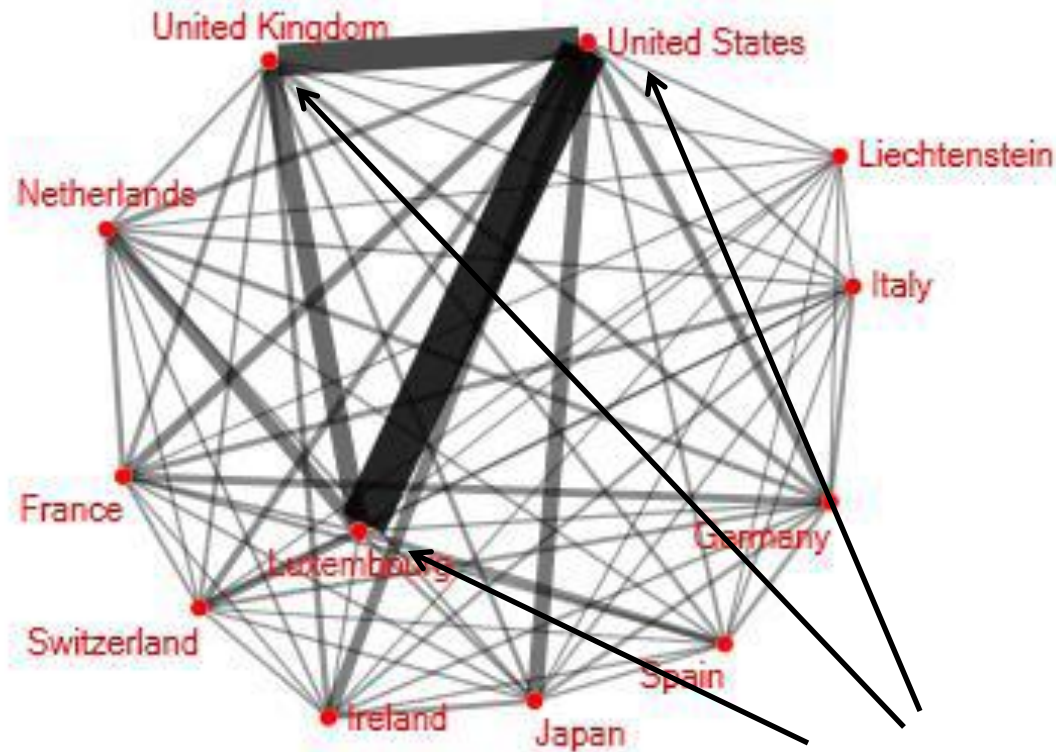
- ▶ Systemically important financial institutions (SIFIs)
 - ▶ Clusters of financial institutions
 - ▶ Common exposures (countries, sectors, instruments)
 - ▶ Common funding sources
 - ▶ Currency or Maturity Mismatches
 - ▶ Common Business Models
 - ▶ Systemically Important Financial Infrastructure Institutions
 - ▶ Institutions with few substitutes
- 

Analytical Constructs

- ▶ **Centrality Analysis**
 - Find “central” nodes in a financial network (most interconnections)
- ▶ **Cluster Analysis**
 - Identify subgroups of interconnected nodes within a system
- ▶ **Systemic Importance**
 - Assume failure of each institution and measure the systemic losses

Interconnectedness Map

Example: Cross-Border Funds



Principal Nodes (Most Interconnections) - Note Luxembourg's Importance as a Conduit

Source: "Understanding Financial Interconnectedness", IMF, 10/4/10

III. A Methodological Digression

- ▶ It is intended to analyze interconnectedness through the Network Approach of Espinosa and Sole*
- ▶ See also IMF Global Financial Stability Report, April 2009, “Assessing the Systemic Implications of Financial Linkages”
- ▶ As an aside:
 - April 2009 GFSR used four techniques to assess systemic linkages:
 - Network approach
 - Co-Risk Model
 - Distress Dependence Matrix
 - Default Intensity Model
 - Co-Risk and Distress Dependence rely heavily on market data (typically CDS). They help assess market views of interconnectedness, but not enough data to use for Caribbean.
 - Default Intensity requires a large sample of bank default data.

Espinosa and Sole Model: Network Simulations

Pre-Shock
Balance Sheet

$\sum_j x_{ji}$	k_i
	d_i
a_i	b_i
	$\sum_j x_{ij}$

Before the Shock

Assets = Bilateral Claims on Other Banks 1 to j plus other assets (a)

Capital = Each bank i has capita k_i

Liabilities = Deposits, Bonds and interbank borrowings.

Post-Shock Balance Sheet

λx_{hi}	λx_{hi}
$\sum_j x_{ji}$	k_i
	d_i
a_i	b_i
	$\sum_j x_{ij}$

After the Shock

Assume one bank defaults. Each bank exposed to it loses λ (the loss-given-default rate) times its exposure to that bank. This reduces assets and, by assumption, capital by that amount.

Algorithm

- ▶ **First Round**
 - Which banks become insolvent (capital wiped out) from initial shock?
- ▶ **Second Round**
 - Which banks become insolvent from the first round shock
- ▶ **End the Loop**
 - Keep doing rounds until no more banks become insolvent

Post-Shock Balance Sheet

$\sum_j x_{ji}$	$\delta \rho x_{ih}$
	k_i
a_i	d_i
	b_i
$(1 + \delta) \rho x_{ih}$	$\sum_j x_{ij}$
	ρx_{ih}

Liquidity Extension: Credit+Funding Shock

Bank h defaults, bank i can only replace $(1 - \rho)$ of its funding. So interbank lending falls by ρ times its funding from that bank. It is assumed it then has to liquidate that amount of assets, but must sell them at a discount, δ . Thus, its asset losses are greater than its loss of liquidity, and this hits capital.

Outputs

- ▶ Assume every institution in system defaults.
For each:
 - Obtain total number of other institutions that fail
 - Obtain total loss of capital (even without domino effects)
 - These can be used as measures of the institution's systemic importance
- ▶ Other Extensions
 - Can do at the level of systems
 - Can take into account risk transfers if data available

Data Requirements

▶ Required

- Matrix of Gross Inter-Institution exposures
- Capital by Institution

▶ Highly Desired

- Sectoral Exposures by Institution
 - Allows one to simulate which institutions will default in response to a specific credit risk
 - Simulate how that credit shock propagates through system
- Composition of assets and liabilities
 - Allows one to simulate a shock to a specific instrument (e.g. bonds, a deposit run, etc.)

Example: Contagion Path Triggered by Failure of Italian Banks

Figure 7: Contagion Path Triggered by the Italian Failure under the Credit Shock Scenario



Panel 1 (trigger failure)
Affected Countries: Italy.



Panel 2 (1st contagion round)
Affected Countries: Italy, France.



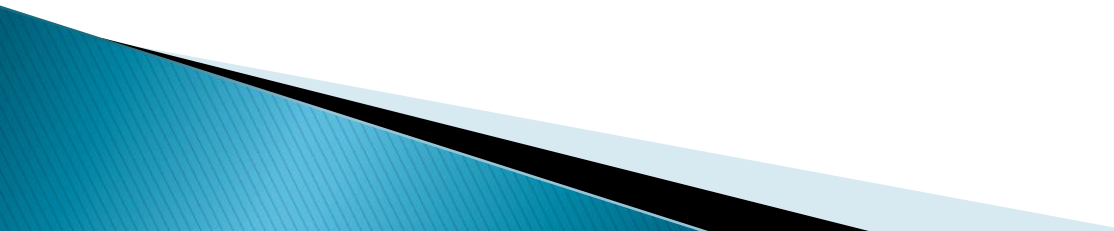
Panel 3 (2nd contagion round)
Affected Countries: Italy, France,
Belgium, Germany, Switzerland.



Panel 4 (final round)
Affected Countries: Italy, France, Belgium,
Germany, Switzerland, Austria, Sweden,
Netherlands.

Source: Authors

IV. Data Considerations: Perimeter of Coverage

- ▶ Type of Institution
 - Banks
 - Insurers
 - Credit Unions
 - Securities Firms
 - ▶ Size of Institution
 - ▶ Size of Counterparties
- 

Data Considerations: Level of Aggregation

- ▶ Level of Aggregation
 - Institution-to-Institution
 - Institution-to-Aggregate
 - Aggregate-to-Aggregate
- ▶ Note, Thacker et. al. mapped interconnectedness using:
 - Public Information on banks (Bankscope)
 - Information on assets and ownership
 - No interconnectedness data
 - BIS aggregate data on banking systems
 - Bilateral connections of BIS reporting banks in 25 reporting countries to Caribbean destinations
 - A-A data
 - Misses direct links of Caribbean destinations to each other
 - Misses non-banks
 - CPIS – only 2 Caribbean jurisdictions (Bahamas and Barbados) report

*"Financial Interconnectedness and Financial Sector Reforms in the Caribbean", IMF WP/13/175

Data Considerations: Crossings

- ▶ Crossings
 - Country
 - Sector
 - Instrument
 - Currency
 - Maturity
- ▶ More Crossings Imply
 - Richer “What-If” Experiments...
 - ... but Exponential Increase in Data Requirements

A 5-way crossing with x categories in each would require x^5 separate data entries per institution

Data Considerations: Risk Concept


- ▶ Immediate Risk Basis
 - Data Easier to Collect
 - But May Give Misleading Understanding of Economic Risks
- ▶ Final Risk Basis
 - Nets out Collateral
 - Nets out “Risk Transfers”
 - Guarantees
 - Hedges (Financial, not Garden)
 - Extremely Difficult to Measure
 - Degree of Risk Transfer May Be Contingent on Circumstances

Data Considerations

Confidentiality Issues

- ▶ Do Legal Frameworks Vary Across Jurisdictions?
- ▶ Can Supervisors Share Individual Institution Data?
 - With IMF
 - Yes, Given IMF's Confidentiality Framework (data may need to be coded)
- ▶ Can Supervisors Share Counterparty Information
 - With Other Supervisors?
 - With IMF?
- ▶ Use of Coding Systems
 - Can an Independent Party Assign Codes
 - Could IMF Do Analysis Without Data Retention?

CRFP – An Interim Way Forward

- ▶ Use Aggregated Data on Sector by Nationality
 - ▶ Units of Analysis (by Country):
 - Banking Systems
 - Sovereigns
 - Insurers (hopefully)
 - Credit Unions?
 - Others?
 - ▶ It is critical to have a commonly shared definition (i.e. list of specific institutions) of each sector
 - Otherwise, interconnectedness map will be inaccurate – nodes have to be uniformly defined
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Ultimate Objective

- ▶ Institution-to-Institution Data Will Remain Critical
 - Sectoral Aggregates Mask Critical Information
 - Financial Crises Begin as Crises of Institutions
 - Network Simulations Misleading with Aggregates
 - Require Huge Shocks for a Sector to Become Collectively Insolvent
- ▶ Continue to Work on Legal Frameworks for Information Sharing