Financial Risk and Network Theory
Seminar 23 September 2014

Financial Catastrophe Risk Modelling

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Dr Fabio Caccioli
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Cambridge Centre for Risk Studies
Cambridge Centre for Risk Studies Background

Understanding Catastrophic Failure in Complex Systems

- **Proceedings:**

- **Focus of the Centre for Risk Studies** has been an enabler of projects and interchanges on complexity science and emergent behaviour.

- **Analysis of tightly-coupled systems, non-linear feedback loops, and failure analysis.**

- **Risk Centre conference:** *Managing the Risk of Catastrophic Failure in Complex Systems*

- Prompted a research programme into the effects of shocks on business networks: ‘*A Shock to the System*’

- Applying catastrophe risk modelling techniques to network analysis.

- Has a focus on macroeconomics and financial impacts for practitioners.
Exogenous Shocks to the Economic & Financial System

Taxonomy of Threats

Cyber Catastrophe Stress Test Scenario

Pandemic Stress Test Scenario

Geopolitical Conflict Stress Test Scenario

Social Unrest Stress Test Scenario

Reports available for download from: CambridgeRiskFramework.com
Network Models and Connectivity

International Trading Networks

Travel Flows of People and Goods

Business Relationships between Companies

Communications and Social Media
Uses of Stress Test Scenarios by Practitioners

- Monthly reporting of potential losses against standard scenario
  - Monitoring progress of asset portfolio management towards resilience
- Risk capital allocation across different departments of operations
- Comparison of different drivers of vulnerability in portfolio or operations
- Counterparty risk and credit control management
- Business limit setting and allocation of underwriting loss potential

**Stress tests**
- Need to be sufficiently severe to challenge managers assumptions of the status quo
- Need to be plausible, coherent, and accessible
- Have to reference the decisions made by managers
Financial Stress Test Scenarios

Asset Bubble Shock

Global Property Bubble Collapse
Sudden collapse of property prices in China followed by many other emerging and developed markets triggers a cascading crisis throughout the global financial system

Sovereign Default Shock

Eurozone Meltdown
Unexpected default of Italy is followed by a number of other European countries, leading to multiple cession from the Union and causing an extensive financial crisis for investors

High-Inflation Trend

Food and Energy Price Spiral
A series of world events puts pressure on energy prices and food prices in a price increasing spiral, which becomes structural and takes many years to unwind

De-Americanization of Financial System

Dollar Dethroned
US dollar loses its dominance as the default trading currency as it becomes supplanted by the Chinese Renminbi, leading to rapid unwinding of US Treasury positions and economic chaos
Bubble Babble

Bank of England governor warns of a bubble as UK house prices rise 10.5%
Mark Carney told MPs that high levels of mortgage debt can lead to overstretched buyers cutting back on other purchases.

Australia central bank warns about housing prices

Australia's central bank has issued a stark warning about the housing market, saying prices are becoming irrational and the risks are significant. The Reserve Bank of Australia (RBA) made the comments in its quarterly statement on monetary policy, which was released on Tuesday.

Canada in ‘significant’ housing bubble

Canada’s housing market is in a “major bubble,” according to a new report from the National Bank of Canada. The report, released on Tuesday, says that the country’s housing market is overvalued by 10-20% and at risk of a “severe correction.”

The Nordic Housing Bubble

The Nordic Housing Bubble or Scandinavian Housing Bubble has been in the news recently, with several countries experiencing significant price increases. This phenomenon is characterized by high house prices relative to income and affordability.

The Norwegian Housing Bubble

The Norwegian Housing Bubble is another example of a housing market gone wrong. Experts have warned that the country is facing a potential housing crisis, with prices far exceeding what most people can afford.

The Economic Times

Increase in real estate prices giving rise to property bubble

The Economic Times of India has reported that the real estate market is witnessing a significant increase in prices, which is leading to a property bubble. The report cites data from various sources indicating that prices have risen by over 20% in recent months.

Shiller Warns of Housing Bubble Surge After 225% Surge: Brazil Credit

Robert Shiller, who predicted the collapse of the U.S. housing market, is warning that a bubble is emerging in Brazil at a time when a sluggish economy and persistent inflation are eroding investor confidence.

Since January 2008, home prices in Sao Paulo have soared 181 percent and jumped 226 percent in Rio de Janeiro, according to the Fipe Zap index. That's as much as twice the increase in rent prices, signaling that the housing market has become overheated, according to Shiller, a Yale University professor who helped create the S&P/Case-Shiller Index (SPC50) of U.S. home prices, which has dropped 13.7 percent since 2007.

The warning comes as Brazil's economy heads for its weakest two-year expansion in more than a decade and the central bank raises interest rates by the most in the world to contain inflation. Mortgage lenders such as Caixa Economica Federal will have to pass on rising borrowing costs to consumers already struggling with record debt by hesitating to refinance, according to the Institute for Applied Research.
China Property Bubble

- China housing prices have sustained an **average annual growth rate of 17%** for past decade
  - Data based on 35 major Chinese cities, Aug 2014
- In same period, average growth of real GDP has been 10%
  - Impressive but far below housing price escalation
- Great housing boom has generated a large number of empty (‘ghost’) apartments across major cities in China
  - Large majority are sold but unoccupied properties held for appreciation rather than owner usage or rental income generation
  - Indicator of **strong speculative demand**, rather than excess supply
- In 2013 the national urban housing vacancy rate in China reached **22.4%**
  - Far more than developed countries
  - Homeowner vacancy rate in U.S. was only about 3% during the peak of the U.S. housing bubble in 2006
Inflated Housing Markets

Property Market Bubble Risk

Tier 1: China & Emerging Markets
China, Hong Kong, India, Brazil, Philippines, Indonesia, Turkey

Tier 2: Commonwealth
Canada, Australia, New Zealand

Tier 3: Nordics
Norway, Finland, Sweden

Tier 4: UK
United Kingdom

Tier 5: Europeans
France, Belgium, Netherlands

Tier 6: Other Europe
Spain, Portugal, Italy, Greece, Ireland, Austria, Denmark

Tier 7: US
United States

Tier 8: Prudent Europe
Germany, Switzerland

Tier 9 Industrial Asia
Japan and South Korea

Tier 10 RoW
Other markets

House Price-to-Income Ratio
% deviation from long term average

Most Unaffordable

House Price to Rental Ratio
% deviation from long term average

Source: IMF Global Housing Watch
Global Property Bubble Stress Test Scenario

- In this exercise we consider the geographical extent and the severity of the property price correction that would cause a significant contagion event through the financial system
- We use network analytics to define a plausible, severe hypothetical event for use as a stress test
- We are developing this as a stress test for use by practitioners managing investment portfolios
- This requires a model of the global financial system that can propagate property price corrections as a contagion process
Developing a Model of Global Financial System

- Integrating multiple sources of data on banks, lending patterns, cross-holdings, and assets
- Currently includes 18,516 banks
  - Important to include all jurisdictions and markets as one global financial system
- This example focuses on cross-holdings and mortgage lending
- Future potential to link it to database of corporate enterprises

Data Sources include:

- Bureau van Dijk
- Bankscope
- The Banker Database
- Bloomberg
- Euromoney
- Quandl
- Google Finance
18,516 banks
- Total market value of $214 Trillion
- Total equity value of $17.4 Trillion

Mortgage assets total $18.1 Trillion
- Mortgage lending exceeds the equity value of banks

3,520 banks have direct exposure to mortgage lending

3,628 banks have cross-holdings in banks with mortgage exposures

All banks have exposure to assets that would devalue in the event of a property price correction
## Mortgage Exposure of GSIBs

<table>
<thead>
<tr>
<th>FSB Bucket</th>
<th>Financial Institution</th>
<th>Total Market Value (US$ Bn)</th>
<th>Mortgage (US$ Bn)</th>
<th>Mortgage Book as % of Total Value</th>
<th>Equity (US$ Bn)</th>
<th>Mortgage/Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>JP Morgan Chase</td>
<td>3,280</td>
<td>189</td>
<td>6%</td>
<td>275</td>
<td>69%</td>
</tr>
<tr>
<td>4</td>
<td>HSBC</td>
<td>2,488</td>
<td>181</td>
<td>7%</td>
<td>220</td>
<td>82%</td>
</tr>
<tr>
<td>3</td>
<td>Barclays</td>
<td>2,095</td>
<td>210</td>
<td>10%</td>
<td>119</td>
<td>176%</td>
</tr>
<tr>
<td>3</td>
<td>Citigroup</td>
<td>1,949</td>
<td>144</td>
<td>7%</td>
<td>208</td>
<td>69%</td>
</tr>
<tr>
<td>3</td>
<td>Deutsche Bank</td>
<td>2,833</td>
<td>128</td>
<td>5%</td>
<td>128</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>BNP Paribas</td>
<td>2,875</td>
<td>106</td>
<td>4%</td>
<td>167</td>
<td>64%</td>
</tr>
<tr>
<td>2</td>
<td>UBS</td>
<td>1,321</td>
<td>180</td>
<td>14%</td>
<td>83</td>
<td>218%</td>
</tr>
<tr>
<td>2</td>
<td>Mitsubishi UFJ FG</td>
<td>2,591</td>
<td>168</td>
<td>6%</td>
<td>253</td>
<td>67%</td>
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<tr>
<td>2</td>
<td>Credit Suisse</td>
<td>1,663</td>
<td>134</td>
<td>8%</td>
<td>134</td>
<td>100%</td>
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<tr>
<td>2</td>
<td>Bank of America</td>
<td>2,375</td>
<td>19</td>
<td>1%</td>
<td>381</td>
<td>5%</td>
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<tr>
<td>2</td>
<td>Goldman Sachs</td>
<td>1,700</td>
<td>14</td>
<td>1%</td>
<td>105</td>
<td>14%</td>
</tr>
<tr>
<td>2</td>
<td>Morgan Stanley</td>
<td>205</td>
<td>5</td>
<td>2%</td>
<td>24</td>
<td>19%</td>
</tr>
<tr>
<td>2</td>
<td>Royal Bank of Scotland</td>
<td>2,047</td>
<td>0.4</td>
<td>0%</td>
<td>233</td>
<td>0%</td>
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<tr>
<td>2</td>
<td>Group Crédit Agricole</td>
<td>2,353</td>
<td>0</td>
<td>0%</td>
<td>110</td>
<td>0%</td>
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<tr>
<td>1</td>
<td>Groupe BPCE</td>
<td>1,549</td>
<td>376</td>
<td>24%</td>
<td>75</td>
<td>499%</td>
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<tr>
<td>1</td>
<td>Bank of China</td>
<td>2,306</td>
<td>230</td>
<td>10%</td>
<td>167</td>
<td>137%</td>
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<tr>
<td>1</td>
<td>Santander</td>
<td>1,009</td>
<td>121</td>
<td>12%</td>
<td>80</td>
<td>151%</td>
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<tr>
<td>1</td>
<td>Société Générale</td>
<td>1,886</td>
<td>105</td>
<td>6%</td>
<td>82</td>
<td>129%</td>
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<tr>
<td>1</td>
<td>Nordea</td>
<td>956</td>
<td>102</td>
<td>11%</td>
<td>59</td>
<td>174%</td>
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<tr>
<td>1</td>
<td>State Street</td>
<td>1,861</td>
<td>98</td>
<td>5%</td>
<td>175</td>
<td>56%</td>
</tr>
<tr>
<td>1</td>
<td>ING Bank</td>
<td>947</td>
<td>73</td>
<td>8%</td>
<td>116</td>
<td>63%</td>
</tr>
<tr>
<td>1</td>
<td>Sumitomo Mitsui FG</td>
<td>698</td>
<td>58</td>
<td>8%</td>
<td>78</td>
<td>74%</td>
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<tr>
<td>1</td>
<td>Bank of New York Mellon</td>
<td>1,135</td>
<td>50</td>
<td>4%</td>
<td>104</td>
<td>48%</td>
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<tr>
<td>1</td>
<td>Unicredit Group</td>
<td>867</td>
<td>50</td>
<td>6%</td>
<td>86</td>
<td>58%</td>
</tr>
<tr>
<td>1</td>
<td>BBVA</td>
<td>631</td>
<td>14</td>
<td>2%</td>
<td>65</td>
<td>22%</td>
</tr>
<tr>
<td>1</td>
<td>Mizuho FG</td>
<td>1,583</td>
<td>6</td>
<td>0%</td>
<td>118</td>
<td>5%</td>
</tr>
<tr>
<td>1</td>
<td>ICBC</td>
<td>3,041</td>
<td>5</td>
<td>0%</td>
<td>210</td>
<td>2%</td>
</tr>
<tr>
<td>1</td>
<td>Standard Chartered</td>
<td>471</td>
<td>3</td>
<td>1%</td>
<td>37</td>
<td>9%</td>
</tr>
<tr>
<td>1</td>
<td>Wells Fargo</td>
<td>1,403</td>
<td>2</td>
<td>0%</td>
<td>139</td>
<td>1%</td>
</tr>
</tbody>
</table>

50,119 2,772 6%

All Banks in Financial System: 219,000 18,000 8%

G-SIBs as % of Total FS: 23% 15%
Analysis of Asset Structure of a GSIB

HSBC Holdings plc

Higher-order subsidiaries

Direct Subsidiaries

Shareholders

Owned by other Financial institutions
32 direct shareholders, inc:
JP Morgan Chase Bank, NA . 4.7%
BlackRock, Inc. 5.8%

$2,488 Bn
Value of bank held outside the financial system
‘Market Value’

$3,394 Bn
Consolidated Value

Scale

Non-mortgage assets
Mortgage assets
Embodied non-mortgage assets
Embodied mortgage assets
Embodied non-mortgage assets (not controlled)
Embodied mortgage assets (not controlled)

Higher-order subsidiaries

HSBC Bank plc
UK

inc: HSBC France

HSBC Ltd
Hong Kong

inc: Hang Seng Bank (62%)
Bank of Communications (19%)

HSBC North America
(Majority Owned)

Other controlled:
9 banks, throughout world

Non-Controlled
141 direct holdings
inc: CoBiz Financial Inc., (4.1%)
LIC Housing Finance Ltd. (3.6%)

$1,000 Billion

$1,000 Billion

$2,488 Bn
Value of bank held outside the financial system
‘Market Value’

$3,394 Bn
Consolidated Value

Scale

Non-mortgage assets
Mortgage assets
Embodied non-mortgage assets
Embodied mortgage assets
Embodied non-mortgage assets (not controlled)
Embodied mortgage assets (not controlled)
What mechanisms cause financial contagion?

- Interbank lending (Counterparty Failure Risk)
- Commonly-held asset devaluation (Fire-Sales)
- Ownership equity devaluation (Cross-Holding)
- Repo borrowing calls (Rollover Risk)

Interaction between these mechanisms is more important than a single mechanism on its own.

In this presentation we represent two:

- Cross-Holding Loss (dynamically)
- Commonly-Held Asset Fire-Sales (non-dynamically)
Banks cross-share holdings are a significant contagion mechanism

- We use the contagion model recently proposed by Elliott, Golub and Jackson (AER, forthcoming).
- Bank cross-holdings can also be used as a proxy for interbank relationships (see Battiston et al. SR 2012)

The “value” of a bank depends on the value of other banks it is connected to

If a banks’ “value” falls below a given threshold the bank become distressed and discontinuously loses further value (as determined by a specified failure cost)

A distressed bank causes direct losses to other banks it is connected to
How This Scenario Might Play Out

- Fed begins tapering as US economic growth accelerates and jobless rates drop below 6%
- Credit sensitive instruments sell off:
  - Corporate bonds, junk bonds, Munis, Real Estate, Utilities
- The most inflated property markets in emerging economies are hit first
  - China begins the property bubble deflation with a rapid pricing collapse
- Other inflated property markets follow suit, with different degrees of correction
  - Global housing bubble
- Contagion flows through the financial system
  - Significant loss of value to the entire system
- Lengthy recession ensues
  - Global economy returns to another cycle of negative growth
Correlation of Investment Assets with Real Estate

Minimum Spanning Tree correlation
Stress Test
Real Estate (IYR) Down 3.5 SDs

Source: HeavyTails™
Finding the Contagion Point for Property Bubble

Top 6 Tiers of Property Markets

<table>
<thead>
<tr>
<th>Property Value Reduction Shock</th>
<th>5%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>35%</th>
<th>40%</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Value Reduction</td>
<td>0%</td>
<td>1%</td>
<td>5%</td>
<td>7%</td>
<td>7.5%</td>
<td>8%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Lost Value to Total Financial System

- **Direct Shock:** 0.2% 0.8% 2.9% 4.1% 4.5% 4.9% 6.1%
- **Total Loss with Contagion (Same markets + International):** 0.2% 0.8% 4.3% 9.0% 12.2% 15.5% 29.0%
- **Contagion amplifier:** 0.0 0.0 0.5 1.2 1.7 2.2 3.8

- **Number of Failed Banks:** 0 0 150 243 291 342 1,059
- **Banks that failed from Mortgage-shock:** 0 0 159 239 284 324 1,027
- **Banks that failed through contagion:** 0 0 0 6 7 18 32
- **Failed GSIBs:** 0 0 0 2 4 6 14

Lost Value to Total Financial System

Tier 1-6 Countries (Most exposed 24 markets)
Geographical Spread and Severity

10% Mortgage Shock + 1% NMA
20% Mortgage Shock + 5% NMA
30% Mortgage Shock + 7% NMA
40% Mortgage Shock + 8% NMA
50% Mortgage Shock + 10% NMA

Property Market Bubble Risk
Tier 1: China & Emerging Markets
China, Hong Kong, India, Brazil, Philippines, Indonesia, Turkey
Tier 2: Commonwealth
Canada, Australia, New Zealand
Tier 3: Nordics
Norway, Finland, Sweden
Tier 4: UK
United Kingdom
Tier 5: Europeans
France, Belgium, Netherlands
Tier 6: Other Europe
Spain, Portugal, Italy, Greece, Ireland
Tier 7: US
United States
Tier 8: Prudent Europe
Germany, Switzerland
Tier 9: Industrial Asia
Japan and South Korea
Tier 10: RoW
Other markets

Tier 1: China & Emerging Markets
Tier 2: Commonwealth
Tier 3: Nordics
Tier 4: UK
Tier 5: Europeans
Tier 6: Other Europe
Tier 7: US
Tier 8: Prudent Europe
Tier 9: Industrial Asia
Tier 10: RoW
Other markets
## Global Property Bubble Stress Test Scenario (S1)

### Property Market Bubble Risk

<table>
<thead>
<tr>
<th>Tier 1: China &amp; Emerging Markets</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>China, Hong Kong, India, Brazil, Philippines, Indonesia, Turkey</td>
<td>40%</td>
<td>8.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 2: Commonwealth</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada, Australia, New Zealand</td>
<td>40%</td>
<td>8.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 3: Nordics</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norway, Finland, Sweden</td>
<td>40%</td>
<td>8.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 4: UK</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>35%</td>
<td>7.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 5: Europeans</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>France, Belgium, Netherlands</td>
<td>35%</td>
<td>7.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 6: Other Europe</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain, Portugal, Italy, Greece, Ireland, Austria, Denmark</td>
<td>30%</td>
<td>7.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 7: US</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>10%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 8: Prudent Europe</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany, Switzerland</td>
<td>10%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 9 Industrial Asia</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan and South Korea</td>
<td>10%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tier 10 RoW</th>
<th>Property Correction Shock</th>
<th>Shock to Non-Mortgage Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other markets</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Lost Value to Total Financial System

- **Tier 1: China & Emerging Markets**
  - Lost Value: 40%
  - Shock to Total Financial System: 8.0%

- **Tier 2: Commonwealth**
  - Lost Value: 40%
  - Shock to Total Financial System: 8.0%

- **Tier 3: Nordics**
  - Lost Value: 40%
  - Shock to Total Financial System: 8.0%

- **Tier 4: UK**
  - Lost Value: 35%
  - Shock to Total Financial System: 7.5%

- **Tier 5: Europeans**
  - Lost Value: 35%
  - Shock to Total Financial System: 7.5%

- **Tier 6: Other Europe**
  - Lost Value: 30%
  - Shock to Total Financial System: 7.0%

- **Tier 7: US**
  - Lost Value: 10%
  - Shock to Total Financial System: 1.0%

- **Tier 8: Prudent Europe**
  - Lost Value: 10%
  - Shock to Total Financial System: 1.0%

- **Tier 9 Industrial Asia**
  - Lost Value: 10%
  - Shock to Total Financial System: 1.0%

- **Tier 10 RoW**
  - Lost Value: 0%
  - Shock to Total Financial System: 0%
Global Property Bubble Stress Test Scenario
Global Property Bubble Stress Test Scenario

1 Tier 1 Markets – China and emerging markets – suffer property correction
Global Property Bubble Stress Test Scenario

2 Property correction wave spreads to Tier 2 markets: Commonwealth countries

Tier 1: China & Emerging Markets
China, Hong Kong, India, Brazil, Philippines, Indonesia, Turkey

Tier 2: Commonwealth
Canada, Australia, New Zealand
Global Property Bubble Stress Test Scenario

3 Tier 3 markets affected - Nordics

Tier 1: China & Emerging Markets
China, Hong Kong, India, Brazil, Philippines, Indonesia, Turkey

Tier 2: Commonwealth
Canada, Australia, New Zealand

Tier 3: Nordics
Norway, Finland, Sweden

Tier 4: UK
United Kingdom

Tier 5: Europeans
France, Belgium, Netherlands

Tier 6: Other Europe
Spain, Portugal, Italy, Greece, Ireland, Austria, Denmark

Tier 7: US
United States

Tier 8: Prudent Europe
Germany, Switzerland

Tier 9 Industrial Asia
Japan and South Korea

Tier 10 RoW
Other markets
Global Property Bubble Stress Test Scenario

4 Property price slump affects UK – Tier 4 market
Global Property Bubble Stress Test Scenario

5 Property market corrections begin in Tier 5 – France, Belgium, Netherlands
Global Property Bubble Stress Test Scenario

6 Property market collapse reaches other Europeans – Tier 6
Global Property Bubble Stress Test Scenario

7 Milder property pricing correction in US
Global Property Bubble Stress Test Scenario

8 Tier 8 countries affected

Tier 1: China & Emerging Markets
China, Hong Kong, India, Brazil, Philippines, Indonesia, Turkey

Tier 2: Commonwealth
Canada, Australia, New Zealand

Tier 3: Nordics
Norway, Finland, Sweden

Tier 4: UK
United Kingdom

Tier 5: Europeans
France, Belgium, Netherlands

Tier 6: Other Europe
Spain, Portugal, Italy, Greece, Ireland, Austria, Denmark

Tier 7: US
United States

Tier 8: Prudent Europe
Germany, Switzerland

Tier 10: RoW
Other markets
9 Finally reaches least exposed markets – Tier 9
Global Property Bubble Stress Test Scenario

10 Global wave of property market collapse is complete
Key Metrics of Consequences of Scenario

- Our fictional ‘Global Property Crash of 2015’ wipes out 5-15% of the value of the financial system
  - It is highly systemic, and has strong contagion characteristics
- Four GSIBs fail
- It is geographically diverse and has implications for all major markets
- This $10-32 Trillion value loss could potentially be significantly larger than the value loss to the system suffered in the 2008-9 Great Financial Crisis
  - We estimate the lost Global GDP 2007-12 at $18 Trillion ($20 Trillion at today’s values)
  - The GFC caused a lengthy period of reduced economic activity
- Performance of individual financial institutions is highly heterogeneous
  - Internal risk management processes can dramatically change the outcome for specific financial entities
Conclusions: A Research Agenda

- Practitioners are learning from the pioneers of network theory in finance
- Looking for practical applications and real-world calibrations to guide ‘what-if’ estimates
- Less interested in prediction or best estimate forecasts…
- …more interested in uncertainty characterization and considering worst cases and extreme limits
- The Centre for Risk Studies is looking to play a role in developing network theory for application in business decision support
- **Empowering practitioners to manage their own risk will reduce systemic risk better than regulation**