Foundations of System-Wide Stress Testing

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Introduction

**Stress tests:**

- Evaluate resilience against financial shocks
- Key post-crisis regulatory innovation
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- Evaluate resilience against financial shocks
- Key post-crisis regulatory innovation

- Initial shock
- Endogenous shock amplification

“Need a robust and [easily] implementable framework”
A “robust and implementable framework” for system-wide stress tests

• Existing frameworks and models fail to meet the challenge:

**Framework shortcomings**
- ✗ Highly tailored to *specific* settings
- ✗ Not flexible to new implementations
- ✗ ‘Reinventing the wheel’

**Modelling issues**
- ✗ Multiple, simultaneously operating *amplification mechanisms*
- ✗ *Heterogeneity* in institutions, contracts, (regulatory) constraints, behaviours...
Objectives & Contributions

**Framework for system-wide financial stability analysis**

- A generic method to model:
  - Interacting *contagion* mechanisms
  - Banks and non-banks
  - Multiple interacting *constraints*
- A *flexible, modular, scalable* framework

**EU implementation of a system-wide stress test and policy experiments**

- System-wide analysis and *calibration*
- Centrality of “*usable capital*”
Generic System-Wide Stress Testing

- **Python**-based **system-wide simulation engine**
  - Simulation engine also available in **C++**
  - Open-source **library** available online
- Flexible ‘ontology’ (‘**building blocks**’)

![Diagram showing financial institutions, contracts, behavior, constraints, and information in relation to stress simulation and simulation timeline.]
Implementation: EU Financial System

Initial adverse shock
- European Banking Authority 2018 Stress Test Scenario
- Used as a microprudential benchmark

Five building blocks
- Financial institutions: banks (42), hedge funds, asset managers
- Contracts: tradable assets, interbank contracts, repo, other
- Markets: price formation via price impact function
- Constraints: risk-weighted capital ratio, leverage ratio, liquidity coverage ratio, margin call, repayment obligations
- Behaviours: contractual and regulatory obligations
### Implementation: Institutions and Interconnections

#### Bank

<table>
<thead>
<tr>
<th>Hedge Fund</th>
<th>Asset Manager</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cash</strong></td>
<td><strong>Cash</strong></td>
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<tr>
<td><strong>External Assets</strong></td>
<td></td>
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<tr>
<td><strong>Interbank Loans</strong></td>
<td><strong>LT Funding</strong></td>
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<tr>
<td><strong>Reverse Repo</strong></td>
<td><strong>Interbank Deposits</strong></td>
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<tr>
<td>** Tradable Assets**</td>
<td><strong>Repo</strong></td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td><strong>Other</strong></td>
</tr>
<tr>
<td><strong>Equity</strong></td>
<td><strong>Equity</strong></td>
</tr>
</tbody>
</table>

**Hedge Fund**
- Cash
- Tradable Assets
- Repo
- Equity

**Asset Manager**
- Cash
- Tradable Assets
- Shares
Policy experiment 1: From Micro to Macro: A Macroprudential Overlay to the EBA 2018 Stress Test

- Key finding: The financial system may be stable or unstable given a microprudential stress test outcome, depending on its shock-amplifying tendency. Therefore, microprudential stress tests are poor predictors of stability and system-wide stress test are necessary.
Policy Experiment 2: ‘Usability’ of Buffers and Contagion

- Key finding: Systemic risk decreases in an increasing ‘usability’ of regulatory capital buffers.
Policy Experiment 3: Calibration of Buffers with System-Wide Stress Tests

Key finding: The size of regulatory buffers needed to confine systemic risk may be underestimated if calibrated with microprudential stress tests, which do not capture system-wide amplifications, rather than with system-wide stress tests.
Policy Implications and Discussion

1. System-wide stress tests are necessary complements to microprudential stress tests to assess systemic risk – and further research in this area continues to be critical.

2. The usability of capital is key to systemic resilience.

3. The calibration of capital buffers should explicitly take into account system-wide dynamics.
Key finding: Contagion mechanisms may mutually amplify systemic risk. The degree of amplification is heterogeneous in the market liquidity and differs among contagion mechanisms.
Thank you for your attention.

Any questions?