The Thorny Arithmetic of Financial Contagion

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Will the failure of a financial institution trigger the subsequent failure of others?

- Perhaps one of the **most important question for a financial supervisor** when faced with an institution in distress.

- **Example:** Bailout of AIG in September 2008: "…*failure under the conditions prevailing would have posed unacceptable risks for the global financial system and for our economy*"

  Ben Bernanke, Testimony before the Committee on Financial Services, American International Group. U.S. house of representatives, Washington D.C., March 24, 2009

Two Reasons Why Supervisors Should be interested in Contagion Analysis

- Knowing whether a failure of a particular institution could trigger the failure of others is important for **crisis management**

- Knowing whether an institution's failure would have a large knock on effect on the banking system is also important for **crisis prevention**. These institutions could be subject to more rigorous supervision or tighter capital regulation
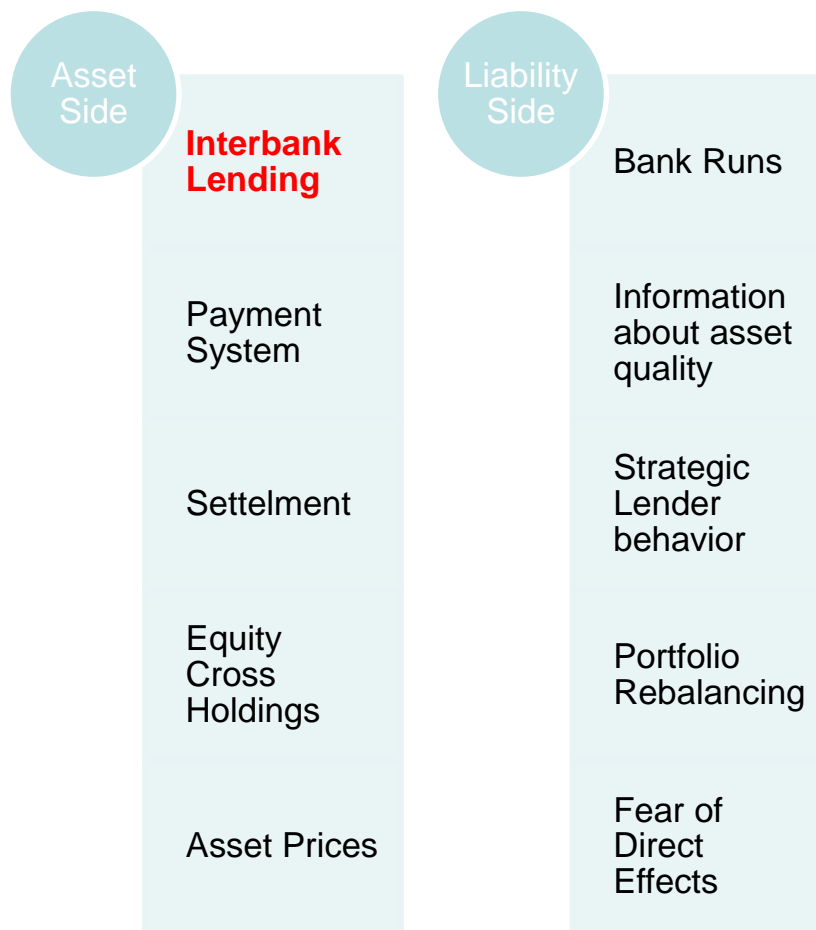
Research on Contagion

- The interest in research about contagion has gained momentum by the recent financial crisis but within the central banking community there has been a continuous interest in this subject since the Asian Crisis 1998.

- There is relatively **little empirical work**, because a collapse of institutions is relatively rarely observed.

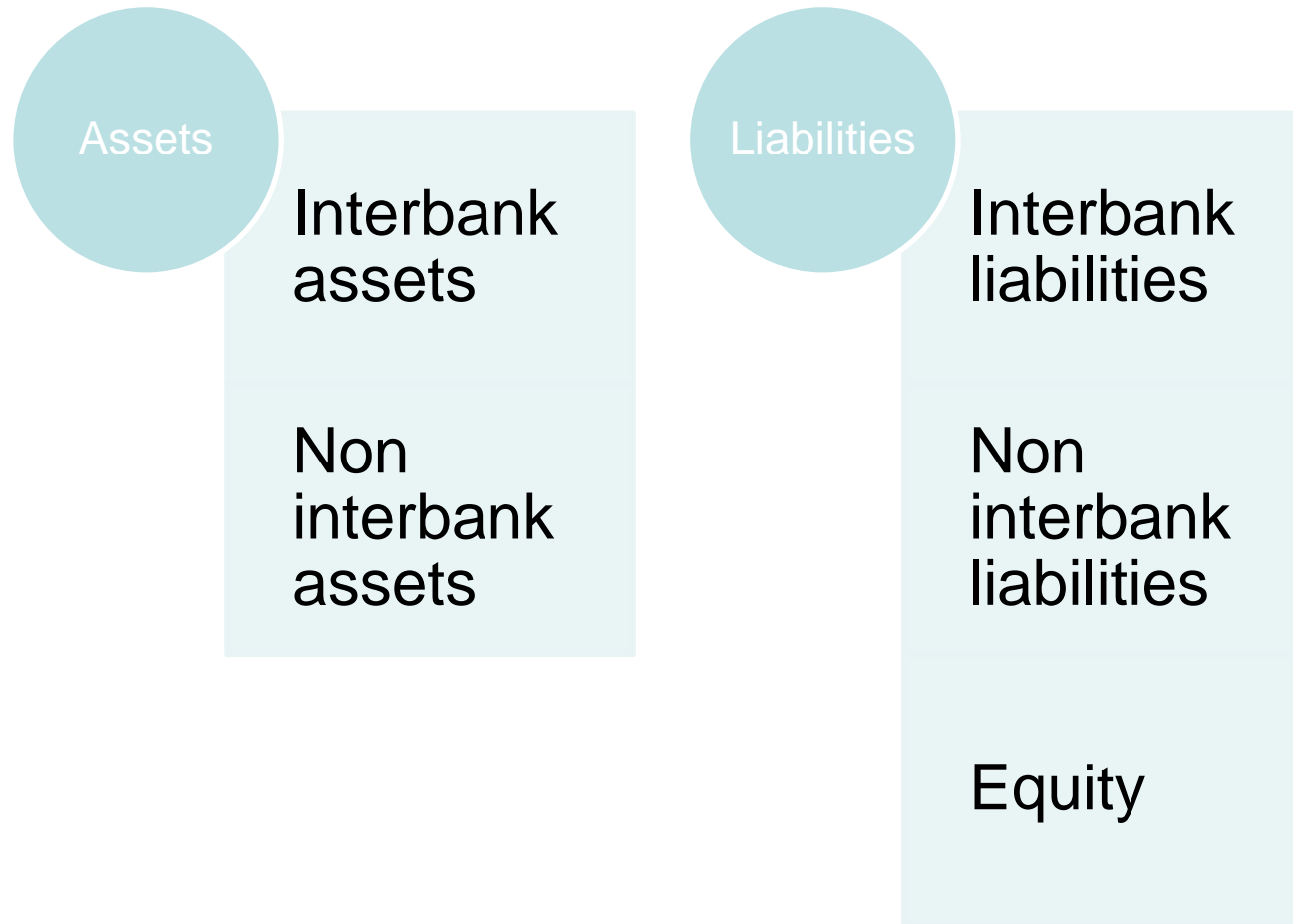- Most studies of contagion therefore relied on **simulations**.

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Agenda

- **Contagion Modeling: OeNB Systemic Risk Monitor**

- **What do we learn from this model?**

- **What were the findings of other contagion models?**
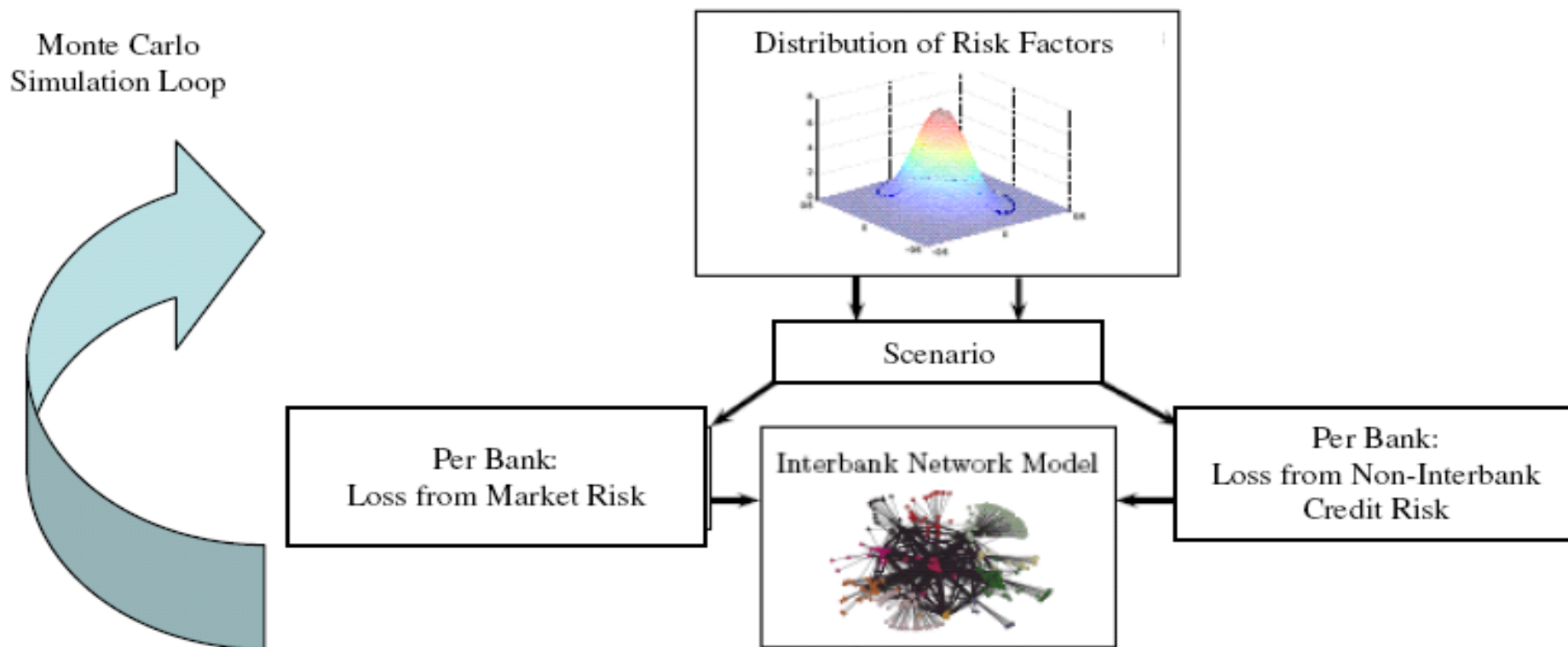
- **Way forward**

Channels of Contagion

Asset Side

Interbank Lending

Payment System

Settlement

Equity Cross Holdings

Asset Prices

Liability Side

Bank Runs

Information about asset quality

Strategic Lender behavior

Portfolio Rebalancing

Fear of Direct Effects

A stylized bank balance sheet

Assets

Interbank assets

Non interbank assets

Liabilities

Interbank liabilities

Non interbank liabilities

Equity

The Main Building Blocks of SRM

Summary of the Credit Risk Model

Bank A   Bank B   Bank C

1. Draw macro-scenario
   from multivariate risk
   factor change distribution
   (common economic shock)

2. Calculate obligor pds

$$p^i_{t,s} = f(p^i_{rating}, X_{t,s}; \hat{\beta}_s) + \varepsilon_{t,s}$$

3. Compute loan loss
   distributions

4. Draw independent
   loan losses for each bank
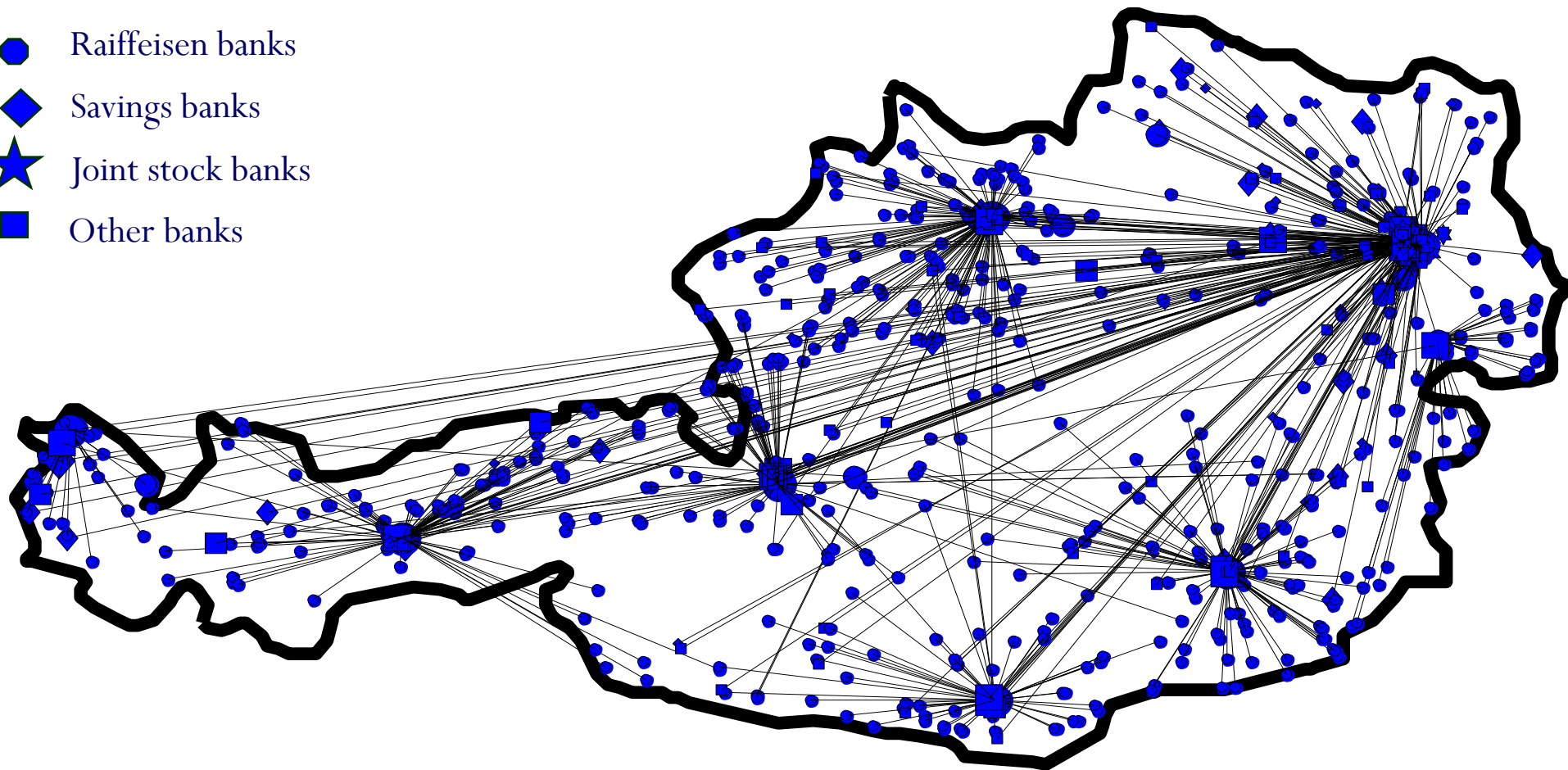   (idiosyncratic shock)

Scenario generating loop

The Network Model

- **The network model of the banking sector is defined as follows**
  - Nodes are characterized by banks and their net values of assets and liabilities not connected to the Interbank market
  - Edges are formed by financial claims between banks (debt and equity)

- **The network model combines for each bank in each scenario**
  - the net value of assets and liabilities not connected to the interbank market,
  - credit- and market-risk losses (or gains) and
  - gains and losses from interbank holdings

- **Through "clearing" the interbank market**
  - Calculation of final values for each bank under the assumption that all interbank claims (debt and equity) have to be met immediately
  - If this value is below zero the bank is technically insolvent
  - The default of bank could imply the default of another bank (contagious default)

- **The network model is the main innovation of SRM**
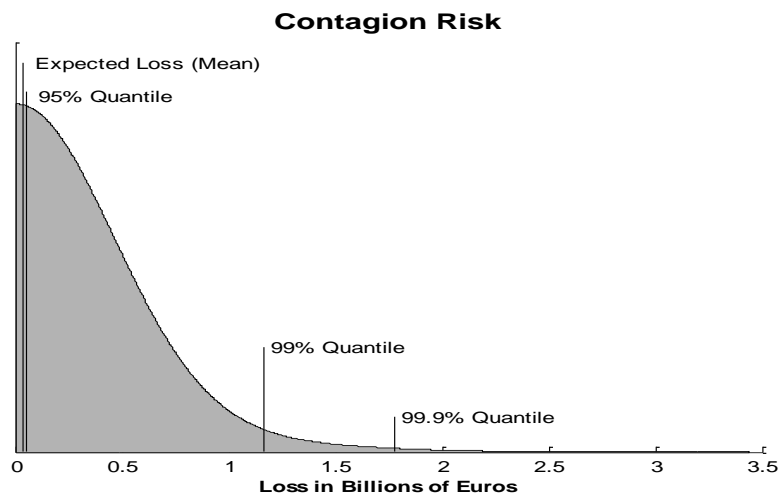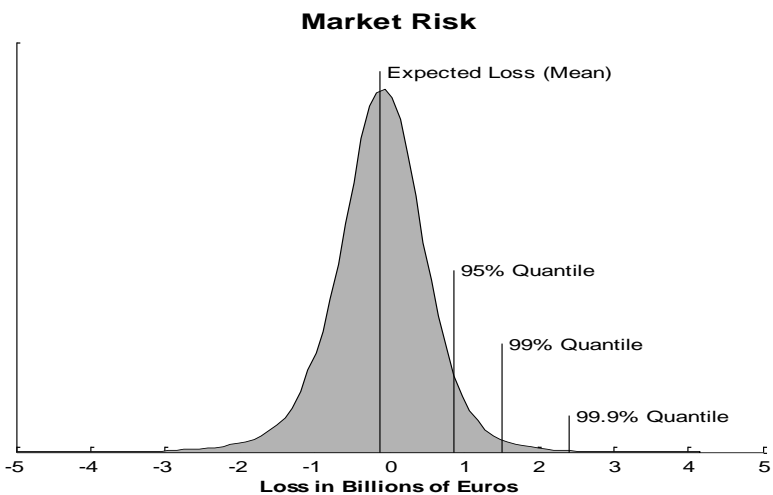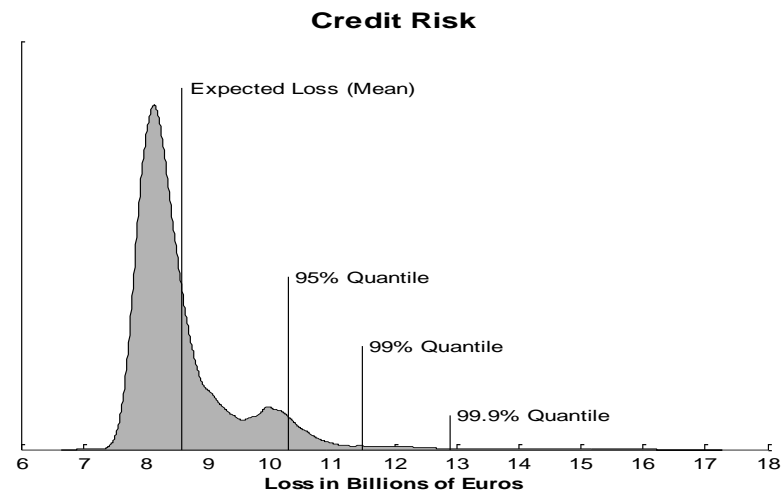 - makes it a model for systemic risk in the banking sector
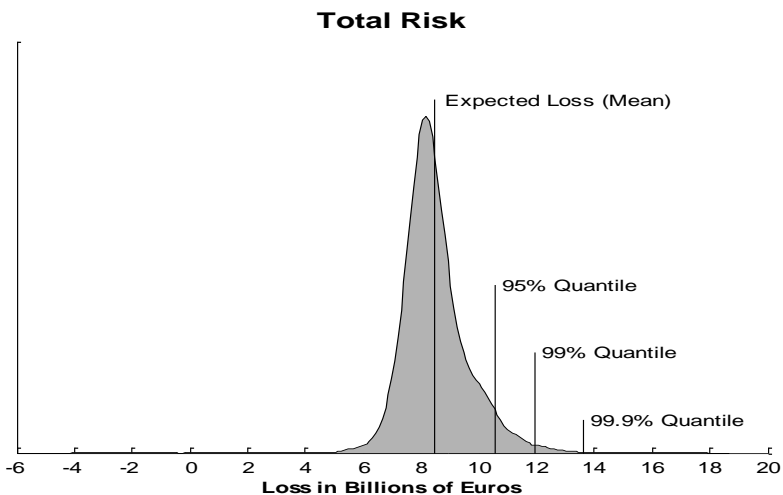
The Network of the Austrian Interbank Market

Legend:
- ● Raiffeisen banks
- ◆ Savings banks
- ★ Joint stock banks
- ■ Other banks

Note: The figure shows for each bank its largest loan exposure to other banks. The size of the marker reflects the size of the bank (small, medium, large and the largest five)

System-wide Loss Distributions (Baseline Simulation)

Total Risk

Expected Loss (Mean)

95% Quantile

99% Quantile

99.9% Quantile

Loss in Billions of Euros

Credit Risk

Expected Loss (Mean)

95% Quantile

99% Quantile

99.9% Quantile

Loss in Billions of Euros

Market Risk

Expected Loss (Mean)

95% Quantile

99% Quantile

99.9% Quantile

Loss in Billions of Euros

Contagion Risk

Expected Loss (Mean)

95% Quantile

99% Quantile

99.9% Quantile

Loss in Billions of Euros

Note: Baseline Simulation without stress; based on end 2007 data

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- **Way Forward**

Two main general insights

- **Contagion is likely to be rare** but if it occurs it can affect large parts of the banking system

- **Contagion becomes wide spread only after doomsday scenarios**. About 30 % of total assets of the banking system have to become impaired

- The fact that the **model ignores endogenous reactions of prices and portfolio decisions** seems to be at the root of these findings.

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Results from other studies

- By now approximately 15 studies of interbank contagion have been published.

- In contrast to the model discussed here these studies consider idiosyncratic bank failures and their consequences.

- These studies also find that contagion is likely to be rare but if it occurs large parts of the banking system can be affected: 15-20 %.

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Future Developments

- The contagion models presented have been developed before the financial crisis.

- They did not predict the crisis and they did not play a significant role in shaping the policy discussion during this period.

- Does this mean they were useless and will remain to be useless in the future?

Why are the models useful ?

- In contrast to reporting systems and supervisory data collection practices in the past these models help to **take into view the system as a whole** and how individual bank data are connected in a bigger picture.

- While in the Lehman bankruptcy no institutions failed because of direct exposures to Lehman the uncertainty about the exposures of others to Lehman led to a gridlock of the financial system, a model like presented here could have helped to **substantially reduce this uncertainty**.

- They can support supervisors to **think in counterfactual scenarios and to assess alternatives**.

Outlook

- Clearly models like this have **much to do to improve** their usefulness.

- The complexity of modern financial systems as well as their global nature will make it unlikely that **supervision in the future** can proceed with received wisdom and traditional tools without embarking on the use of more abstract modelling.

- Two investments into supervisory tools that are very likely to provide a high return:

  - **Sharing data internationally and with researchers**

  - **Modelling systemic risk**

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