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Applied Modeling Approaches to Systemic Tail Risk: Scenario Approaches

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Philipp Keller

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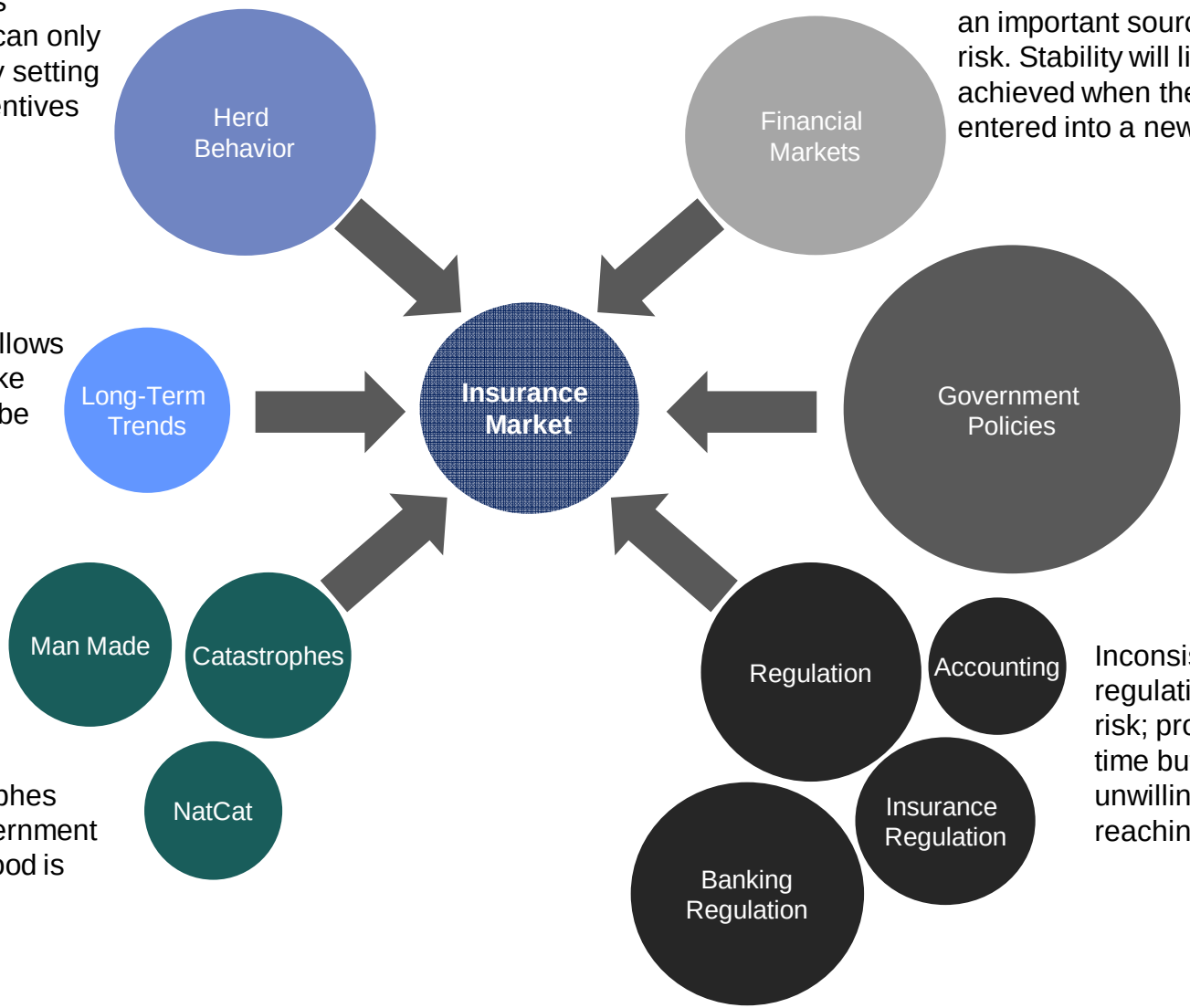
Risk Exposures: Comparative Importance

Human nature is immutable and can only be influenced by setting appropriate incentives



Financial markets continue to be an important source of systemic risk. Stability will likely only be achieved when the economy has entered into a new steady state

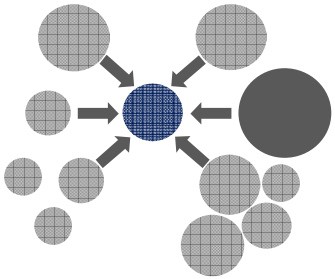
Long-term nature allows sufficient time to take actions; unlikely to be systemic

Large source of systemic risk to insurers given potential sovereign defaults and indebtedness

Extreme Catastrophes might require government actions but likelihood is low

Inconsistent and arbitrary regulation is source of systemic risk; problems will build up over time but lack of transparency and unwillingness to act might lead to reaching tipping points

Risk Exposures: Government Policies



It is likely that in the current situation, government policies are the main source of potential systemic risk, e.g.:

- Requirement or pressure for insurers to invest in the home market and in government bonds
- Restrictions on capital mobility
- Inflating debt away
- Government controlled entities with implicit and explicit government guarantees gaining market share by under-pricing
- Transferring social safety nets to private sector to reduce costs (e.g. pensions and health insurance)
- Protecting incumbents by erecting barriers, and implicit or explicit government guarantees
- Outright defaults

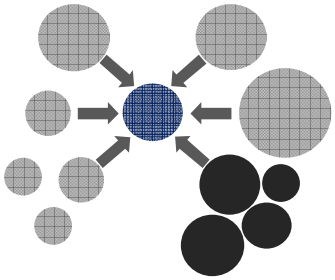
Supranational rules and supervision of government policies;

Adherence to free trade agreements

Clear identification of TBTF firms and special treatment

Use of global scenarios to achieve transparency

Risk Exposures: Regulation



Inconsistent regulation is a source of systemic risk, e.g.

- Allowing to take risk off-balance sheet
- Mixing market consistent valuation with hold-to-maturity approaches
- Supervision of groups and conglomerates
  - Dispersed and inconsistent regulation and supervision
  - Lack of clarity of the legal and regulatory situation in case of financial distress; risk of loss of capital mobility
- Regulation to support special interests, e.g. by underestimating risk or technical provisions
  - **Liquidity premium approach** to allow life insurers to continue to invest in illiquid financial instruments to achieve extra-yield
  - **Equity dampener** to allow insurers to invest heavily in equities
- Regulatory capital models allowing arbitrage opportunities

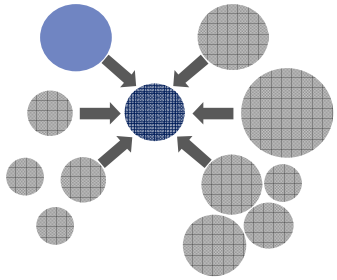
Firewalling non- or badly-regulated entities (in particular between insurers and banks)

Consistent capital requirements for financial institutions (banks and insurers, groups and conglomerates) → requires a substantial rethink of Basel II

Principles-based approaches and use of internal models

Use of global scenarios to achieve transparency and to take into account the shortcomings of (regulatory and internal) models

Risk Exposures: Herd Behavior



Herd behavior might be the most difficult source of systemic risks and is essentially insoluble

- Davos man, group think and confirmation bias
- Following investment fashions: In case of failure, blame is spread
- Picking up nickels in front of a steam roller:
- Short-term thinking

Better incentive systems: Rewarding not only profits but also absence of losses; risk-based compensations; reduction of absolute compensations

More focus on long-term situation

Use of global scenarios to achieve transparency and to make senior management and policy making aware and responsible for the potential consequences of their strategies

Systemic Risk Possibilities: Examples

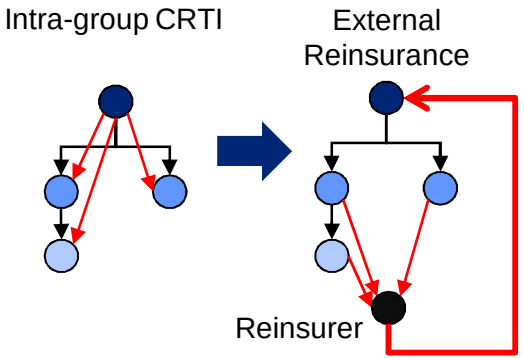
Pandemic


AKG Photo

Pandemic risk can be a material driver of risk-based capital requirements. Life insurers will increasingly cede extreme mortality risk to reinsurers. In case of a pandemic, possibly a number of reinsurers will be overexposed to mortality risk and default. In this situation, life insurer will both have to pay more claims than expected and in addition have increased capital requirements. Faster spread of a pandemic internationally is likely due to air travel.

Measures: Concentration risk management and global , consistent risk-based regulatory framework

Replacement of Intra-group Risk and Capital Transfer Instruments

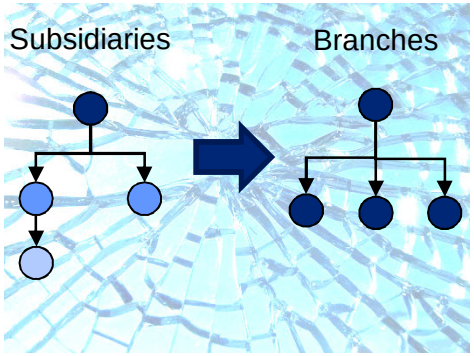


After AIG, ING and Fortis, supervisors will be more reluctant to reduce capital requirements of subsidiaries of groups due to intra-group capital and risk transfer instruments (CRTI). Groups will try to replace intra-group CRTI with external reinsurance. If a reinsurer defaults, the subsidiaries will have increased capital requirements, impacting different insurers and jurisdictions simultaneously.

Measures: Concentration risk management and a global, consistent risk-based regulatory framework; consistent group and conglomerate regulation and supervision

Systemic Risk Possibilities: Examples

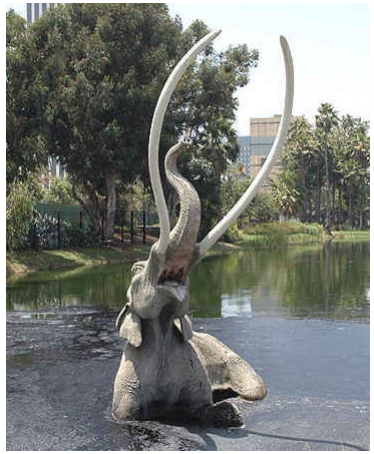
Change to Branch Structures



The increased difficulty to down-stream group diversification to subsidiaries gives incentives to groups to change into a branch structure (replacing subsidiaries with branches). In case of financial stress, the groups will have fewer management options - and in particular no option to default on subsidiaries – and become insolvent as a whole. Some groups will locate parents of branches in jurisdictions with supervisory authorities they perceive as weak. System as a whole will become more unstable and brittle.

Measures: Give incentives to keep subsidiaries by accepting down-streaming of group-level diversification by having clear rules on legal and regulatory situation in case of financial stress

Illiquidity Premium



The illiquidity premium approach envisaged in Solvency II gives an incentive to insurers to invest in illiquid financial instruments. In case of a market downturn and financial stress, assets can not be sold or only by incurring losses.

Measures: Use a truly market consistent valuation standard. Concentration risk requirements for illiquid financial instruments

Systemic Risk Possibilities: Examples

Regulatory Arbitrage

Basle II

Solvency II

Standard formulae like Solvency II and especially Basel I and II are easily arbitraged against. They consist of a large number of rules and products and investment can be structured so that the standard formulae underestimate the risks. Arbitrage can be done both within the regulatory frameworks and well as across sectors.

Measures: Rely on principles-based approaches and firms' own internal models.
Build-up supervisory framework for reviewing company's models
Use stress tests to assess risks independently of regulatory and internal models
Put fire-walls in place between differently regulated and supervised entities if necessary

Why Stress Tests

Inappropriate risk cultures

- Inability to imagine extreme events
- Group think and pressure to conform
- Compliance culture rather than a willingness to deal with real risks
- Short-term thinking

Models

- Models calibrated often to historical data and experience only
- Often not being used for effective decision making
- Sometimes merely fig leaves to present to rating agencies, supervisors and BoD
- Senior managers often do not know the limits of the models

Regulation and Supervision

- Simple models and rules that can easily be arbitraged against
- Models that do not keep up with changing risk landscape
- Rules-based approaches
- Often calibrated to a market average

Stress testing and scenario approaches are powerful tools to make managers, supervisors and policy makers aware of potential risks

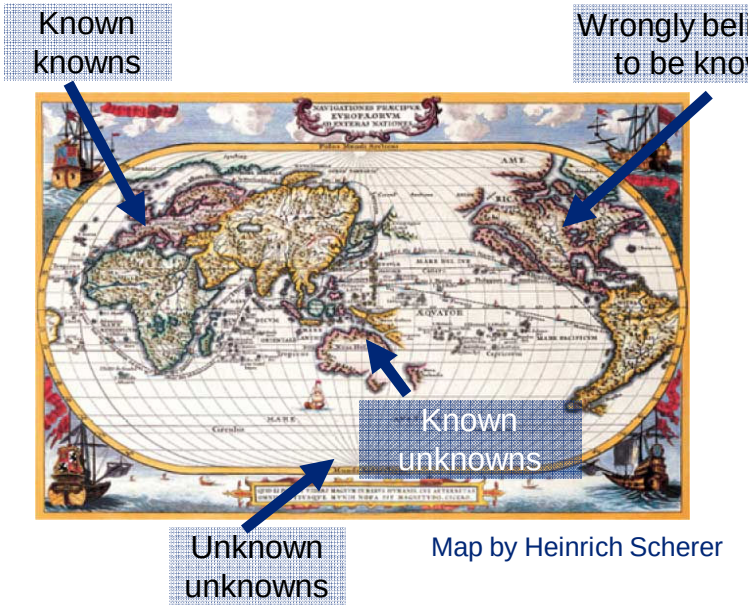
Stress tests / scenarios expose managers and policy makers to inconvenient facts and can act therefore as checks against overly optimistic assumptions and group-think

Epistemology

"There are known knowns. These are things that we know. There are known unknowns. That is to say, there are things that we know we don't know. But there are also unknown unknowns. There are things that we don't know we don't know."

Donald Rumsfeld

1. **things that are known:** e.g. high frequency - low impact risk
2. **things that are known to be unknown:** e.g. the impact of the next financial market bubble, natural catastrophes, terror events, …
3. **things that are believed to be known but are actually unknown:** e.g. operational risks, financial market risks
4. **things that are preferred to stay unknown:** company dependent; often risks that would force a change in the business model or government policies
5. **things that are unknown to be unknown:** unknown by definition



Map by Heinrich Scherer

In practice, often the main focus of risk management and supervision is on **1** and **2**.
However, in many cases, companies become financially distressed by **3**, **4** and **5.**
Most dangerous are actually situations **3** and **4**:

3 leads to over-confidence and a belief that risks are controlled

4 is the sign of an inappropriate risk culture and likely the cause of most financial problems

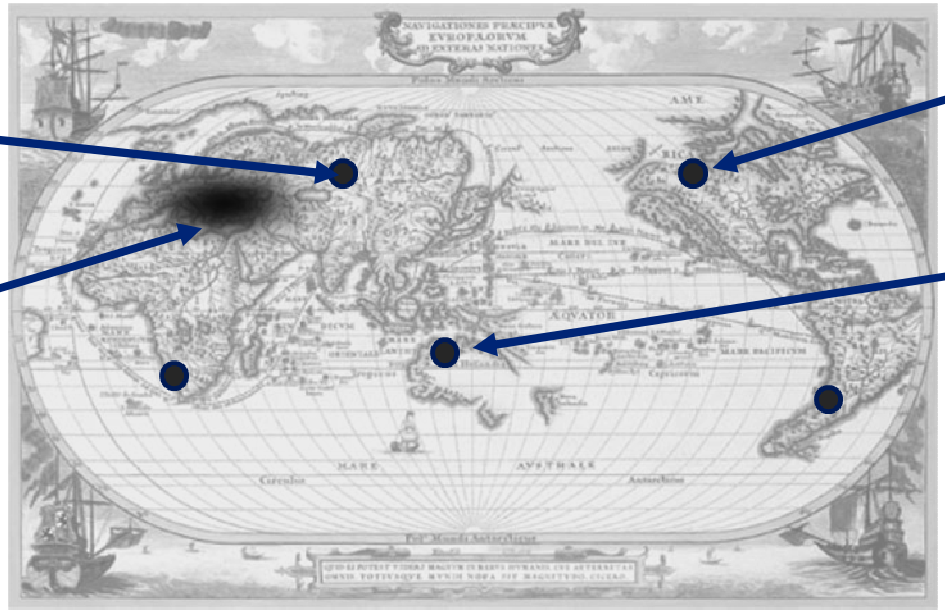
Scenarios

Scenarios allow to extend the domain of applicability of internal models

They should be formulated if possible without relying purely on analytical models to reduce model risk

Scenario as a sense check for the performance of an internal model

Internal Model



Scenario that allows to check whether models that are believed to be appropriate adequately capture reality

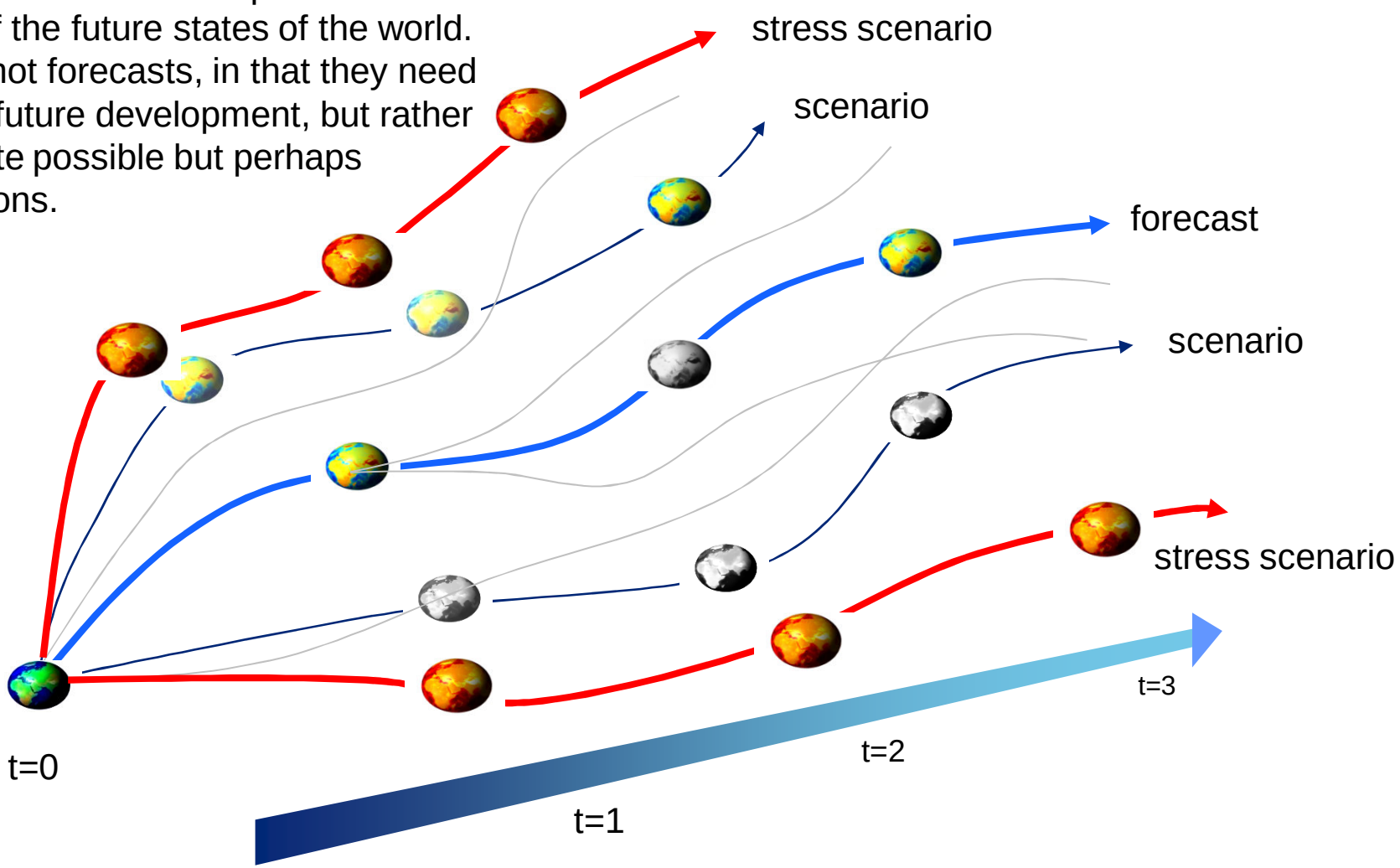
Scenario that illuminate situations that are outside the zone of applicability of internal models

Scenarios are no simple means to make up for the shortcomings of models: To formulate a scenario is equally complex as developing an appropriate internal model

Scenarios are only effective if they depict **internally consistent and sufficiently extreme events**

Stress Tests

Stress Tests / Scenarios can be seen as thought experiments about the possible development of the future states of the world. Scenarios are not forecasts, in that they need not predict the future development, but rather should illuminate possible but perhaps extreme situations.



Thinking in Scenarios

"*It is hard for us, without being flippant, to even see a scenario within any kind of realm of reason that would see us losing one dollar in any of those transactions.",* Joseph J. Cassano, a former A.I.G. executive, August 2007

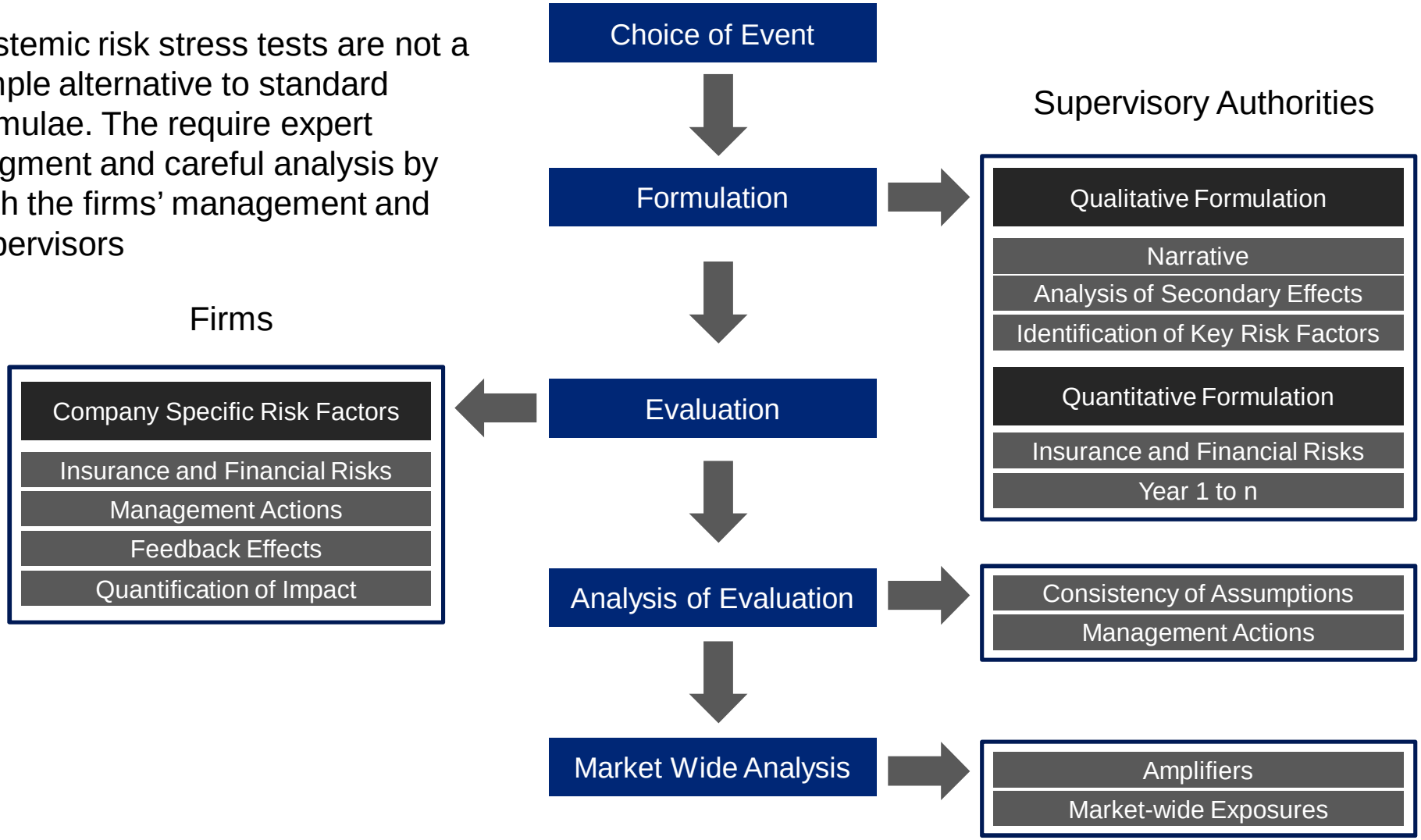
"Almost no one expected what was coming. It's not fair to blame us for not predicting the unthinkable.", Daniel H. Mudd, former chief executive, Fannie Mae

Stress tests will play a much more important role in regulation and in risk management:

- They are a very useful tool to gain additional insight into potential future situations with which the company might be faced
- They are explanatory, they actually tell senior management and supervisors in which situations a firm might fail and how
- Their output is much more than a single risk number and can be used to analyze the firm's risk exposure in a given event in detail
- They allow to cover risks which can not be adequately quantified in standard actuarial and financial models
- They can be used to gain insight into highly uncertain events where probabilities cannot be reliably assigned
- They allow the analysis of market-wide risks

Systemic Risk Stress Tests

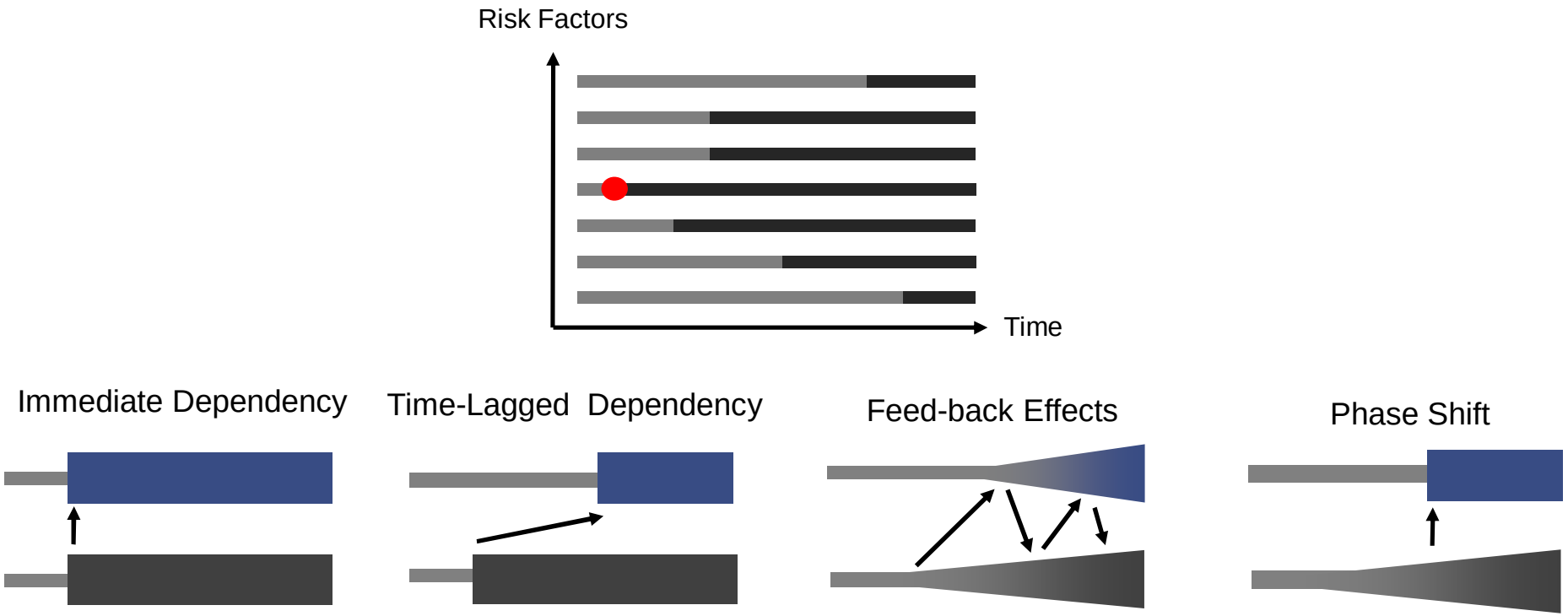
Systemic risk stress tests are not a simple alternative to standard formulae. The require expert judgment and careful analysis by both the firms' management and supervisors



Scenarios and Dependencies

Disruptive events are often not a short, sharp shocks but drawn out over months and years (e.g. Pandemic 1918/19, Global Deflation 1929+, Credit Crisis 2007+)

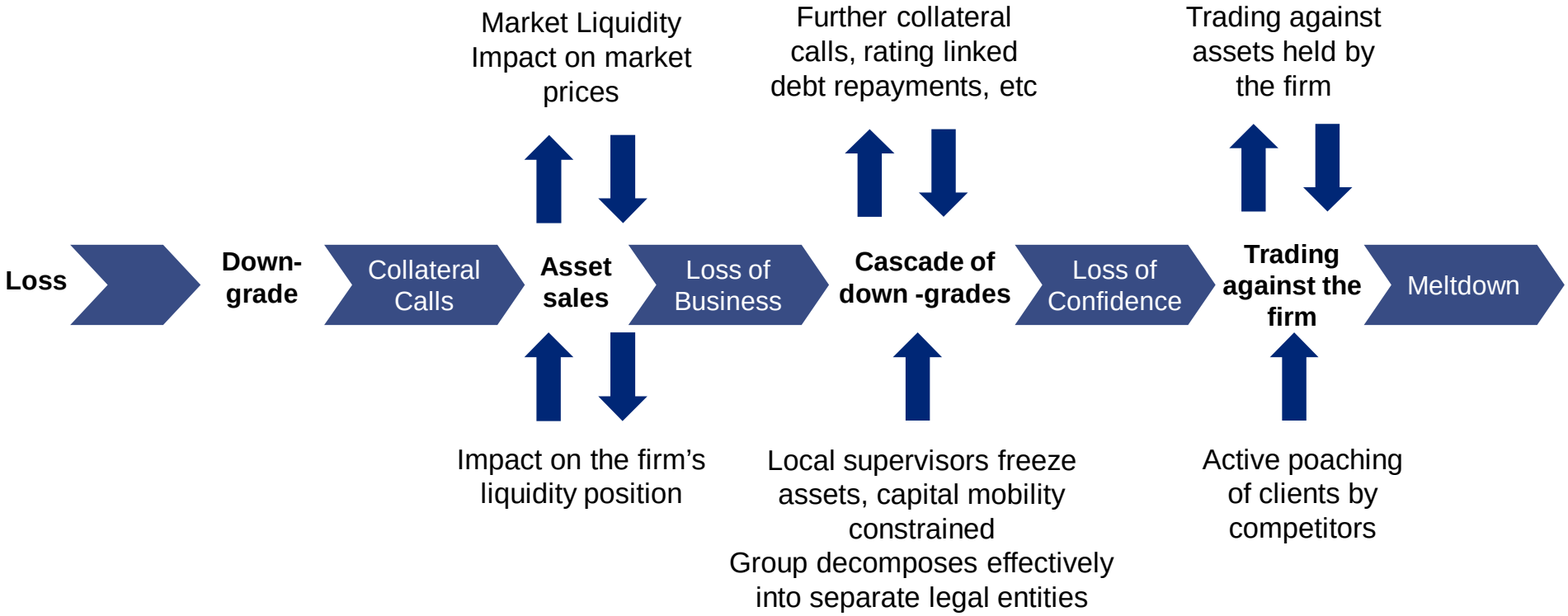
Normally disconnected risk factors become connected over time through intermediate linkages



Correlations, copulas and other standard mathematics tools are not necessarily the appropriate way to model such dependencies → explanatory approaches are more useful for defining stress tests

Evaluation of Stress Tests – Secondary Effects

Stress tests are only useful if the evaluation is realistic. Overly simplistic approaches can lead to an underestimation of the true impact → Stress tests require in-depth supervisory review

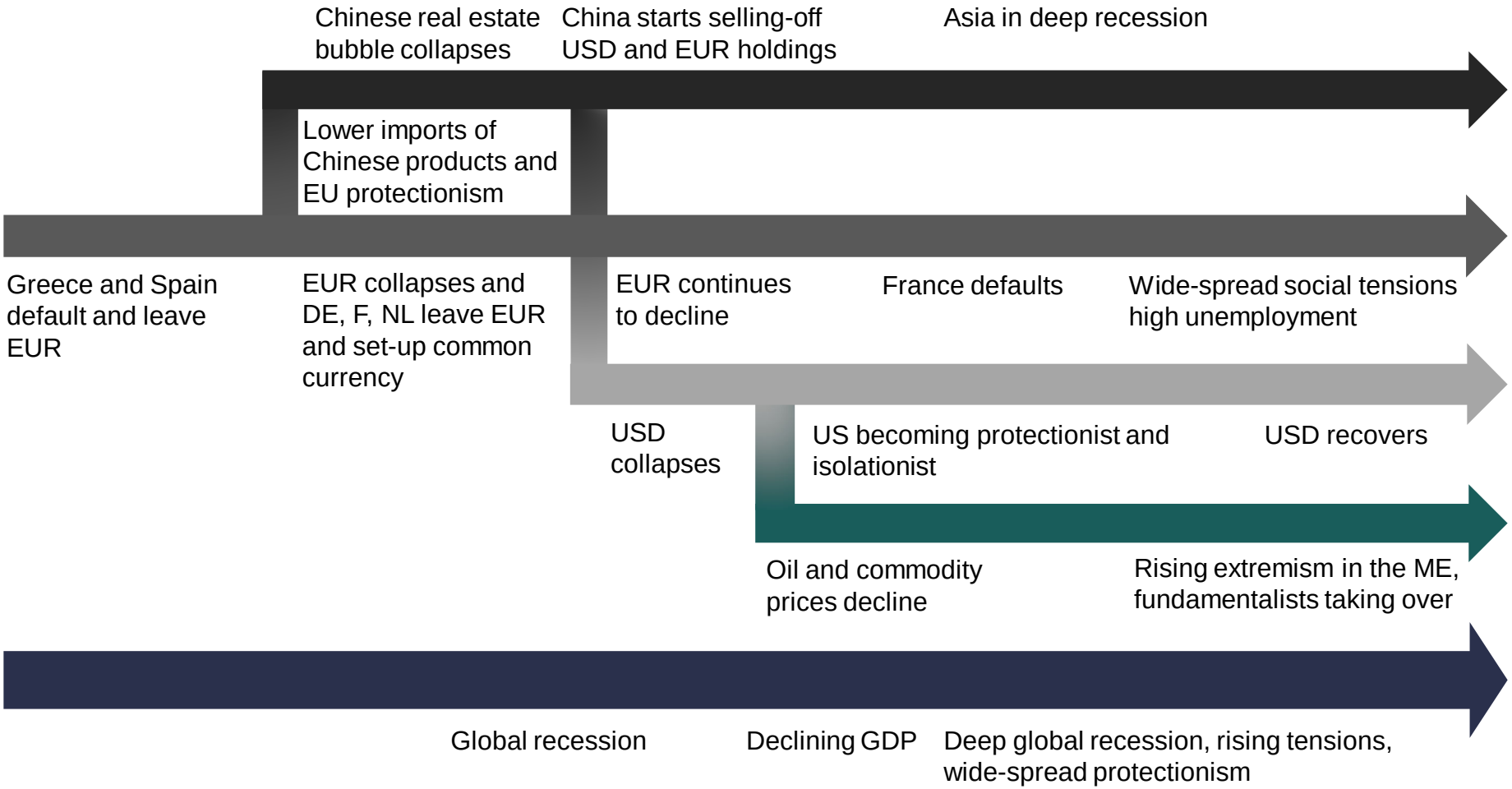


In many cases, even complex standard models can not capture adequately the situation of a firm in case of stress.

The impact of a stress test can depend sensitively on the firm's assets and liabilities, its collateral requirements, its capital mobility in case of stress, its credit lines in place etc. Appropriately evaluated stress tests can achieve insight in a firm's situation in case of stress

Stress Tests: Example

Formulating scenarios can expose risk managers to ridicule or even stronger reactions. This is especially true if the scenario describes a hypothetical situation that is unpleasant and against preconceived opinions



Stress Tests: Conclusions

For insurers, it is key that systemic risk stress tests:

- are **consistent descriptions of hypothetical but possible states of the world:** Not simple stresses of single risk factors but taking into account all relevant risk factors that are impacted by the event. Stress tests should be formulated by inter-disciplinary teams that can cover the entire spectrum of risk factors that can be affected.
- are **sufficiently adverse** to illuminate potential exposures to risk: Insufficiently adverse stress tests are counterproductive while too improbable ones are not believable. Formulating sufficiently adverse stress tests can be politically challenging as they can force the decision makers to face inconvenient truths and to take unpleasant decisions.
- describe the possible **evolution of the state of the world given an initial event,** not just a stress at a fixed point of time.
- are **evaluated based on an economic, market consistent valuation standard**, taking into account all relevant risks that can impact the firms' balance sheet, including off-balance sheet vehicles etc.
- are conducted by a group supervisor which has a **comprehensive view on a group or conglomerate**
- are conducted not as a mechanical compliance exercise, **but are carefully analyzed and discussed** with the firm's modelers and risk managers to gain insight into assumptions taken and to assess the firm's risk culture

Stress Tests: Conclusions

- Insurers **not engaged in non-insurance financial business** are unlikely to cause systemic risk as defined by the FSB/IMF/BIS/IAIS
- Insurers that are engaged heavily in financial business (AIG) or conglomerates (ING, Fortis) can obviously be the source of systemic risk due to their activities

- There are situations imaginable that would cause a financial stress to a number of insurers simultaneously and might require state intervention, These situations differ from the sudden collapse of the payment system or lending activity that are potentially caused by banks

- Risks in the insurance industry differ from those of the banking industry. They can be handled by strengthening insurance supervision by:
  - The use of **globally defined stress tests** to assess risks and deal with the limitations of (regulatory and internal) models
  - Implementing a **consistent and comprehensive group and conglomerate regulatory and supervisory framework**
  - Having **not only a consolidated view** of groups and conglomerates but taking into account the **situation of the legal entities in case of stress**
  - The requirement to **take all material risk into account**
  - A **consistent economic valuation standard** to achieve comparability
  - **Putting firewalls in place** between insurers' core entities and non- or badly-regulated entities

Contact

Philipp Keller
Insurance Risk Management
Deloitte AG

Tel: +41 44 421 6290
Mobile: +41 79 874 2575
Email: phkeller@deloitte.ch