Macroprudential oversight, risk communication and visualizations: The case of mapping techniques

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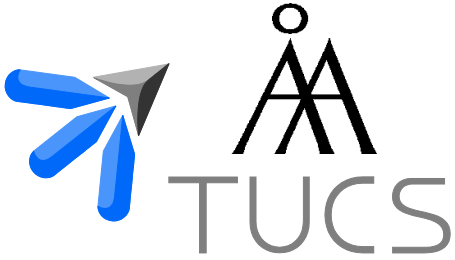
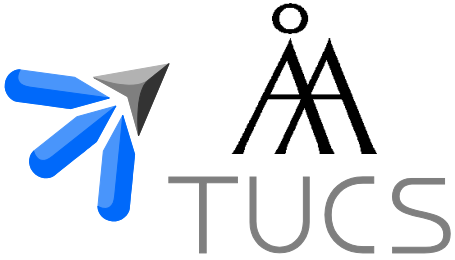


Motivation

- Macroprudential oversight
  - Surveillance and supervision of the financial system as a whole
  - Surveillance tools: risk identification & assessment
  - Mandate: issue warnings and recommendations & to follow-up
  - Surveillance tools: no explicit focus on risk communication
- Risk communication: disseminate info internally and externally
- Is there potential in visualization methods?
  - Tap into policymakers' domain intelligence and experience
  - Intuitive representations for the general public

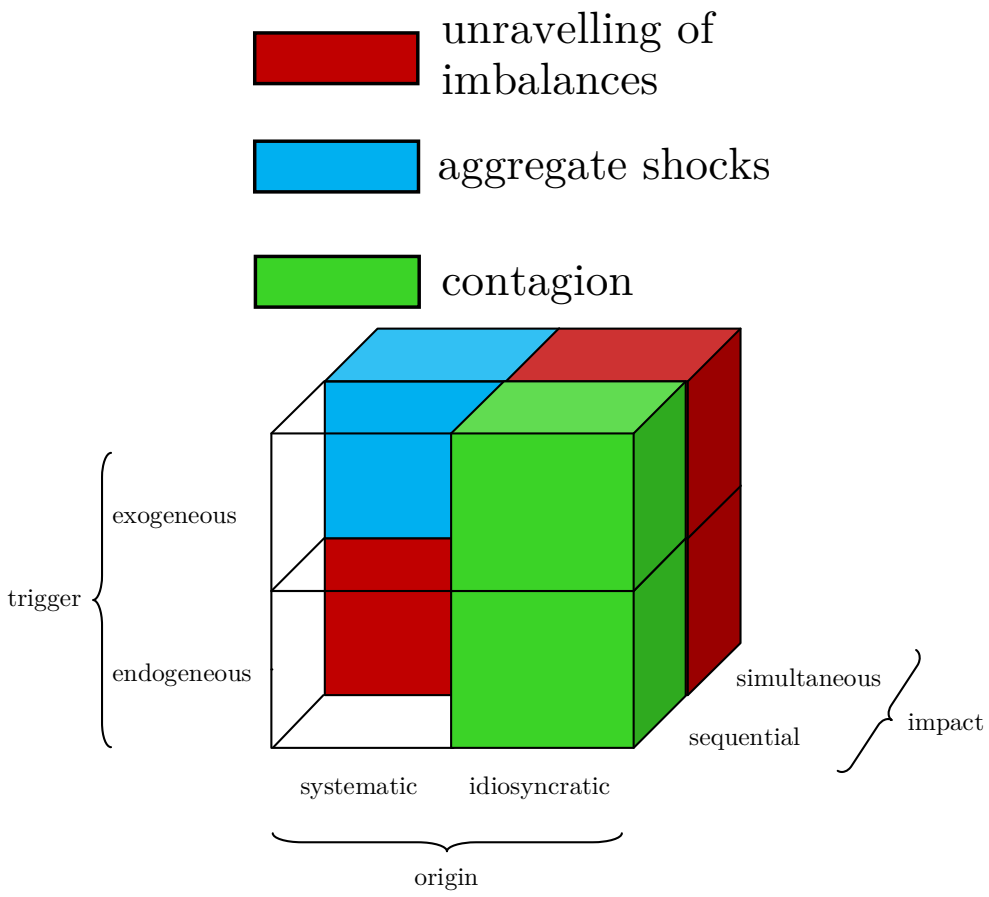


This talk

1. Macroprudential oversight and risk communication
2. Information visualization and visual analytics
3. Visualizations in macroprudential oversight
4. The case of mapping techniques

1. Macroprudential oversight

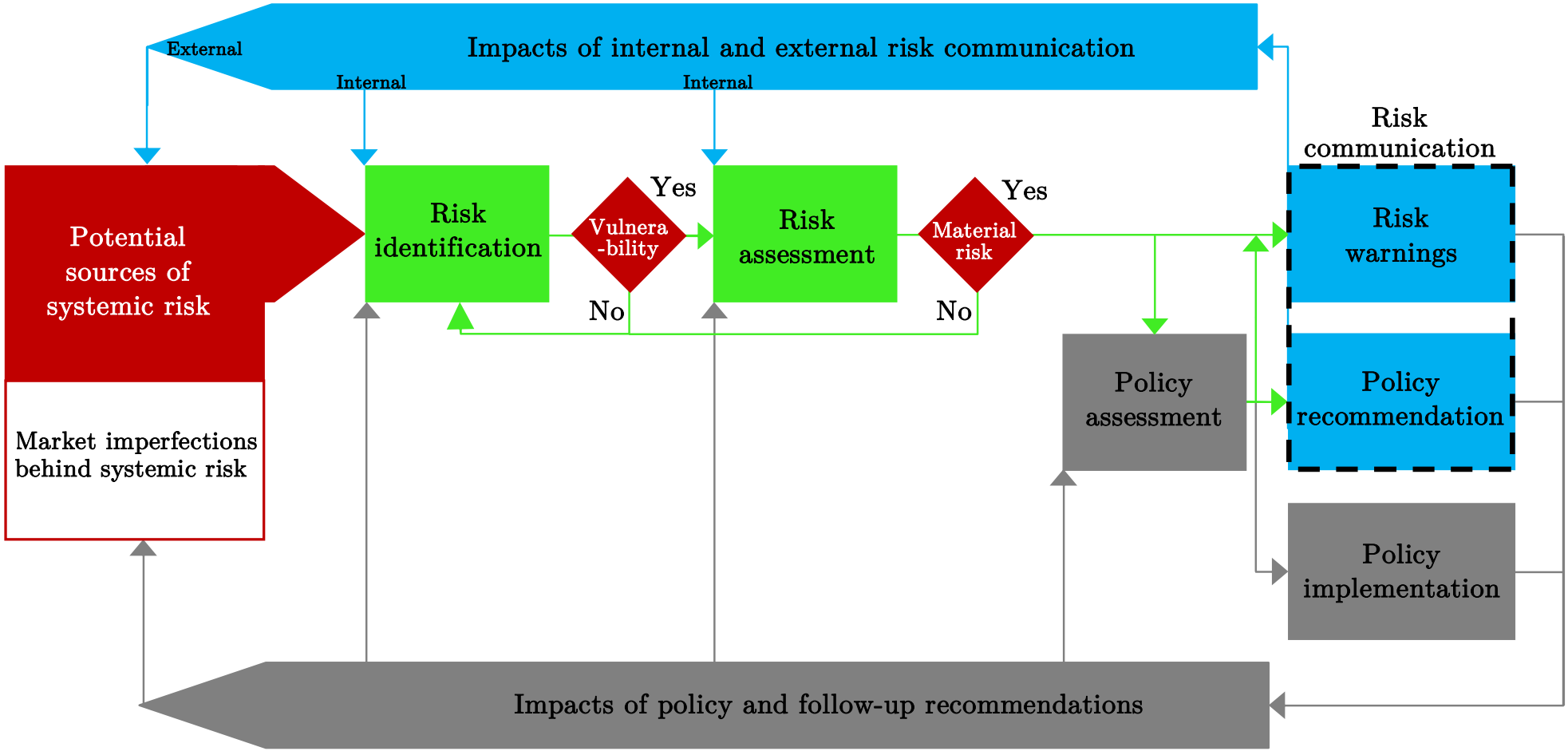
- Three types of systemic risks (adapted from ECB 2010):

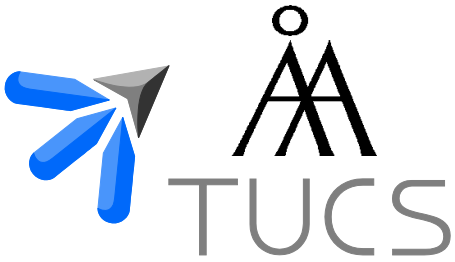


- Three types of tools for surveillance
  - early-warning models
  - macro stress-testing models
  - contagion and spillover models

1. Macroprudential oversight

- Macroprudential oversight process (adapted from ECB 2010)



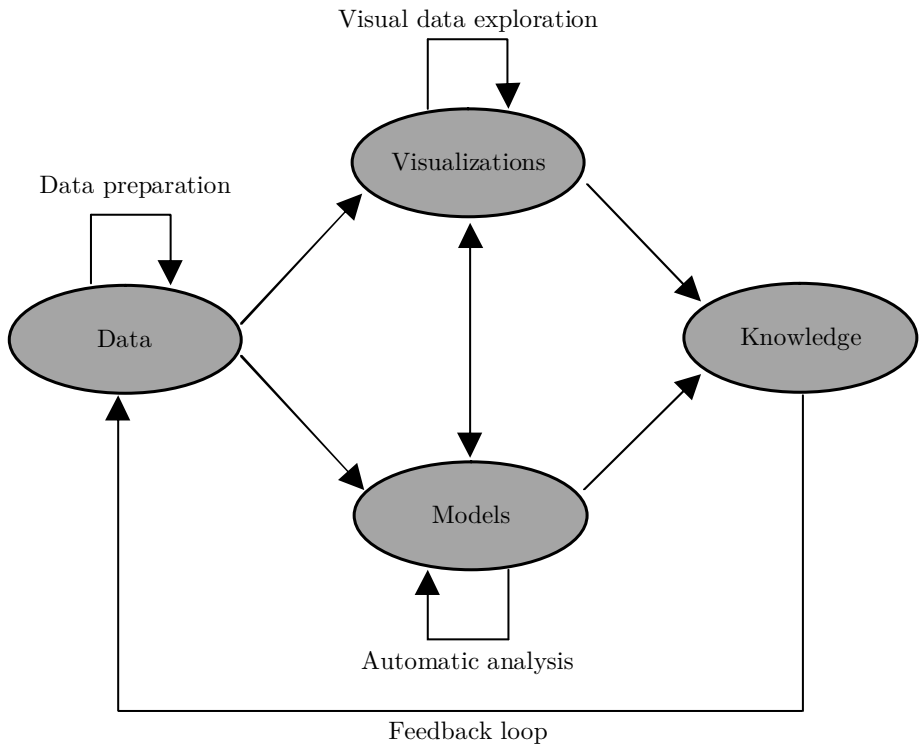


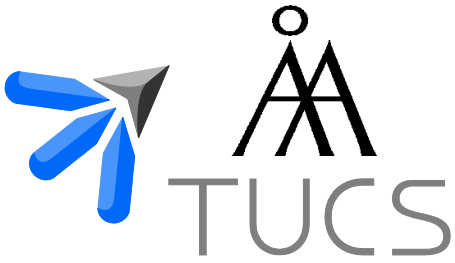
2. Visualization

- Information Visualization
  - Human perception & cognition (Ware 2004, Card et al. 1999)
  - Data graphics design (Bertin 1983, Tufte 1983)
  - Visualization & interaction methods (Zhang et al. 2012, Keim and Kriegel 1996)
- Visual information seeking mantra (Shneiderman 1996): "*Overview first, zoom and filter, then details-on-demand*".
  - have a high-level *overview* of the entire collection
  - to *zoom* in on a portion of items that are of particular interest
  - to *filter* out or to eliminate uninteresting and unwanted items
  - to select an item/group of items for further *details-on-demand*

2. Visualization

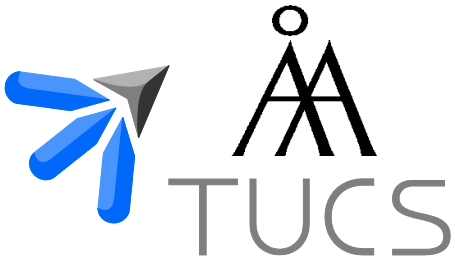
- Visual analytics (Thomas and Cook 2005): "*the science of analytical reasoning facilitated by interactive visual interfaces*".
- Visual analytics mantra (Keim et al. 2006): "*Analyze first, show the important, zoom, filter and analyze further, details on demand*".





3. Visualizations in macroprudential oversight

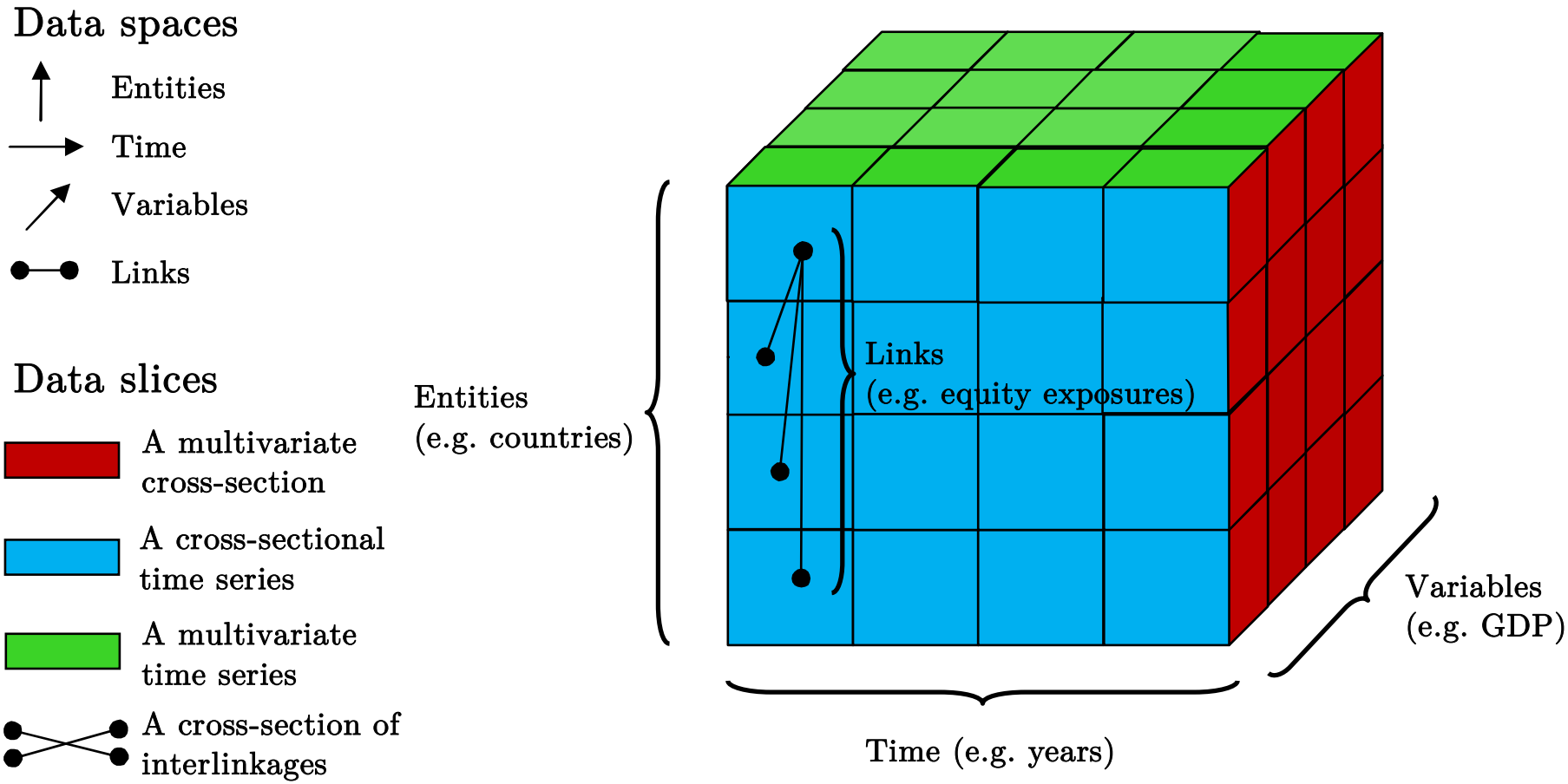
- Within the framework for macroprudential oversight, visualizations are used for two purposes:
  1. Internal communication: Decision support for analysts and policymakers overall
     - Visual Analytics, but also IV
  2. External communication: Means for disseminating information to the public
     - Information Visualization, but also VA



3. Visualizations in macroprudential oversight

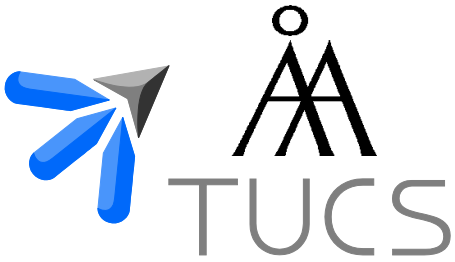
- Visual means to support three surveillance tasks:
  - early warning of build-ups of widespread imbalances
  - stress-testing resilience to exogenous aggregate shocks
  - modeling contagion to test resilience to cross-sectional shocks
- Systemic risk along two dimensions (Borio 2009):
  - Time: risk builds-up in tranquil times and abruptly unravels in times of crisis
  - Cross-sectional: risk at a given point in time can be transmitted through various channels

3. Visualizations in macroprudential oversight



4. The case of mapping techniques

1. A map to visualize country-specific risks (external)
   - Build-up of imbalances over time OR across countries
2. A map to visualize how risks evolve in the system (internal)
   - Build-up of imbalances over time AND across countries

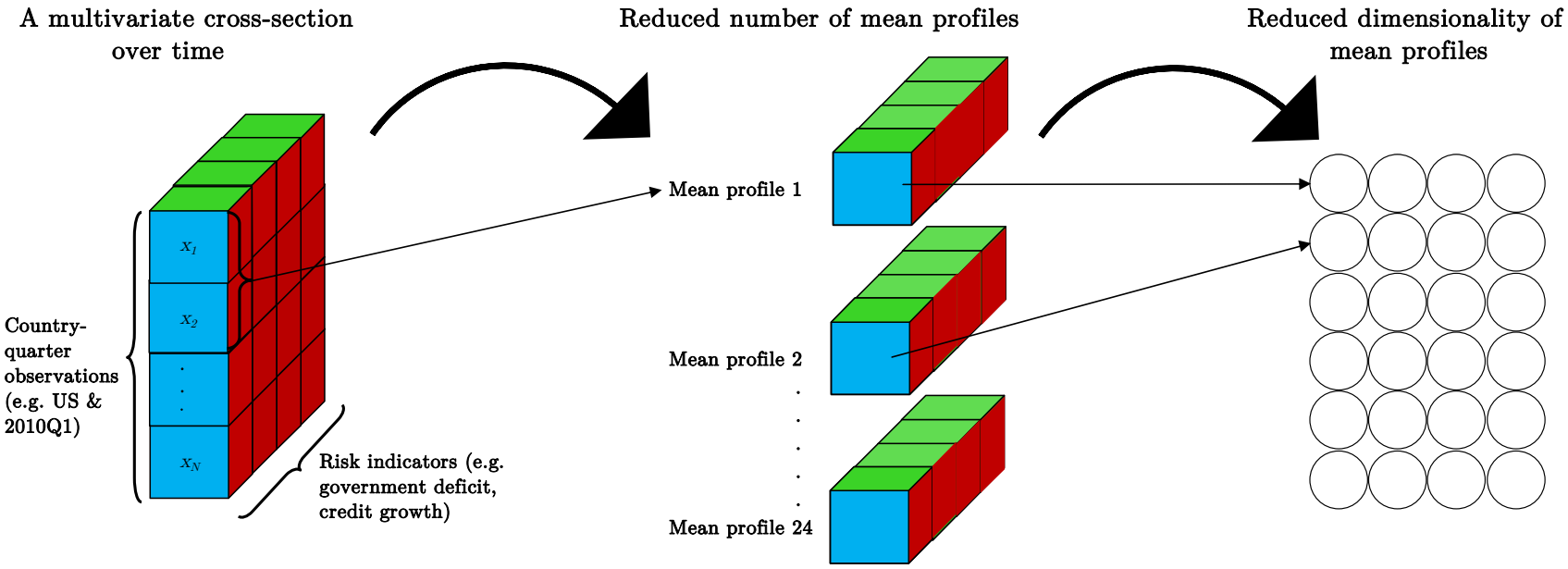


4. The case of mapping techniques

- Also called dimension reduction, projection, manifold learning, embedding, etc. (see Lee and Verleysen 2007)
- Facilitate the visualization of high-dimensional data
  - represent data in two dimensions such that similar high-dimensional data are nearby and dissimilar distant
- Examples of mapping techniques
  - Principal Component Analysis
  - Force-directed graphs
  - Multidimensional scaling
  - Self-Organizing Maps

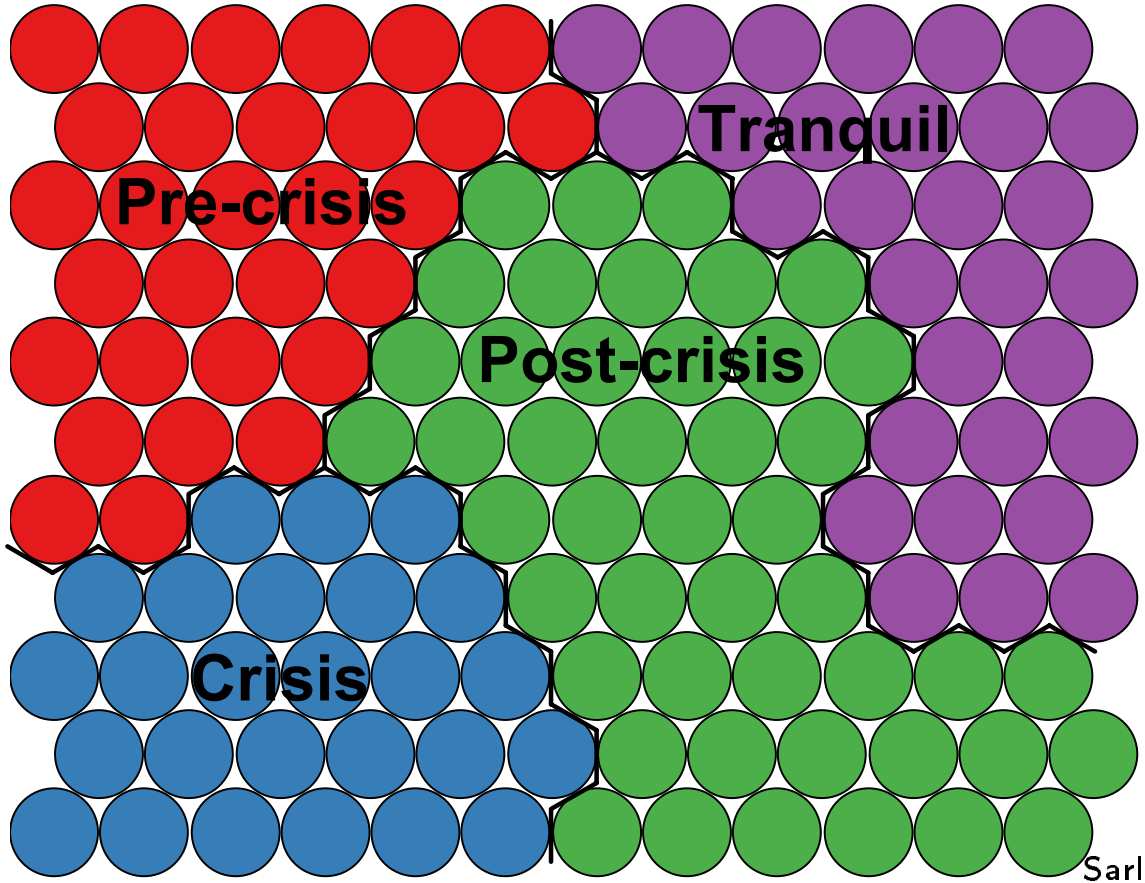
4.1 Self-Organizing Financial Stability Map

- Self-Organizing Map
  - Reduce large amounts of high-D data to fewer mean profiles
  - Provide a low-D representation of the high-D mean profiles



4.1 Self-Organizing Financial Stability Map

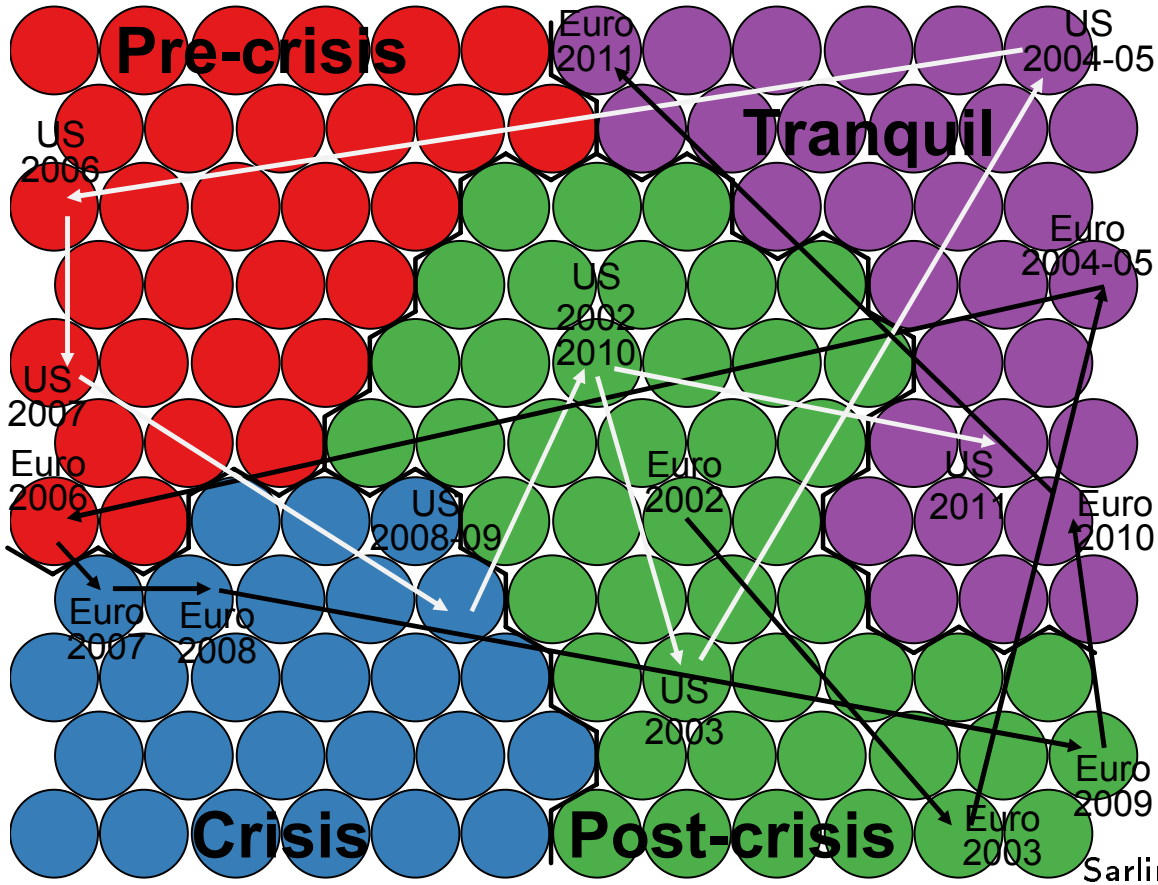
- The Self-Organizing Financial Stability Map based upon 14 macro-financial indicators for 28 economies from 1990–2005



Sarlin and Peltonen (2013)

4.1 Self-Organizing Financial Stability Map

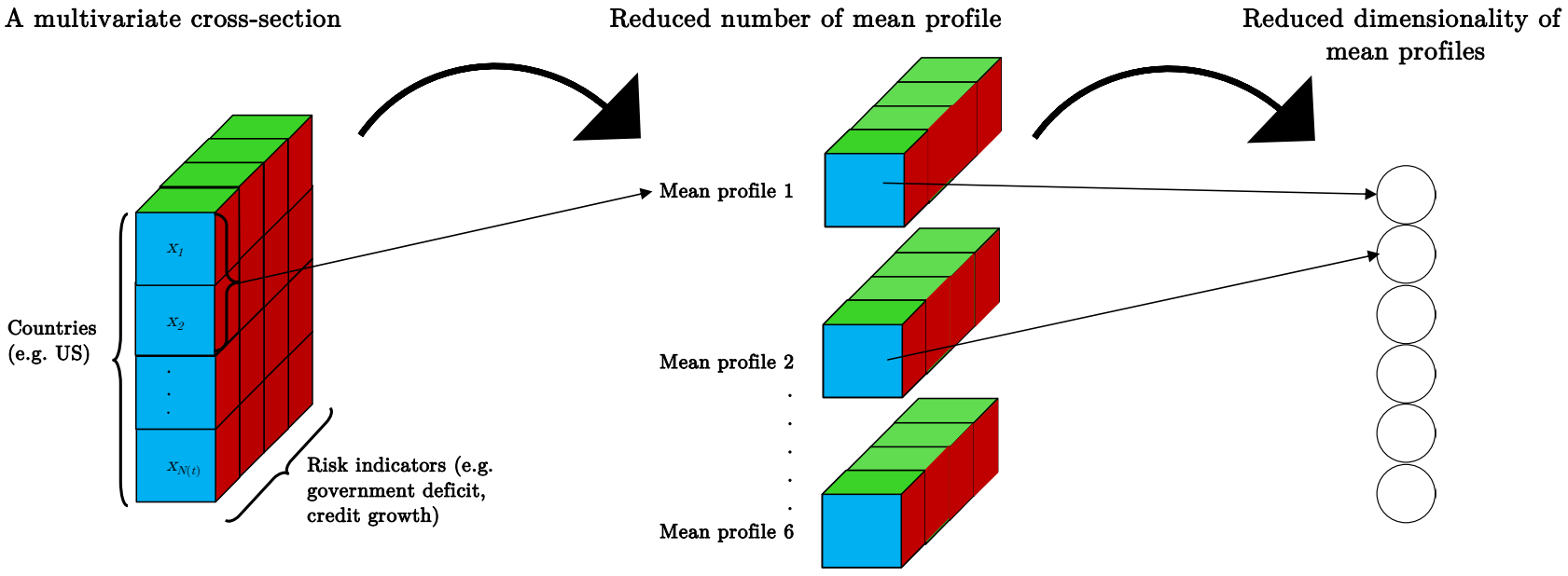
- Evolution of macro-financial conditions (14 indicators) for the United States and the euro area (2002–11, first quarter)



Sarlin and Peltonen (2013)

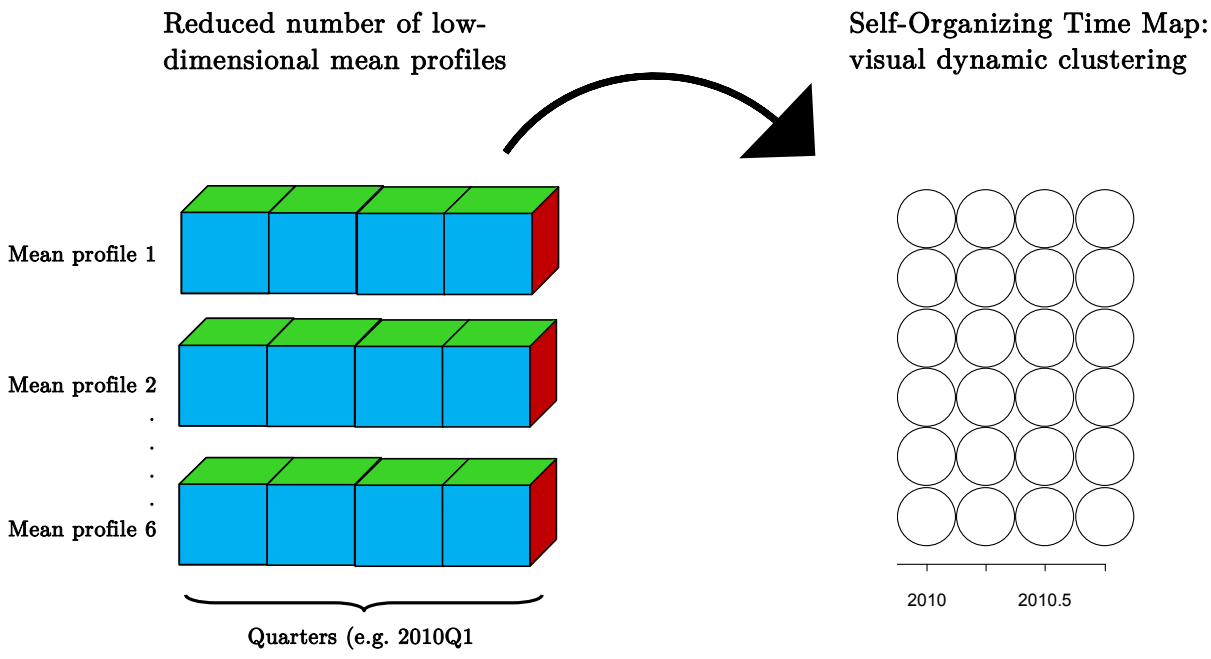
4.2 Self-Organizing Time Map

- Self-Organizing Time Map
  - Focus on individual cross-sections



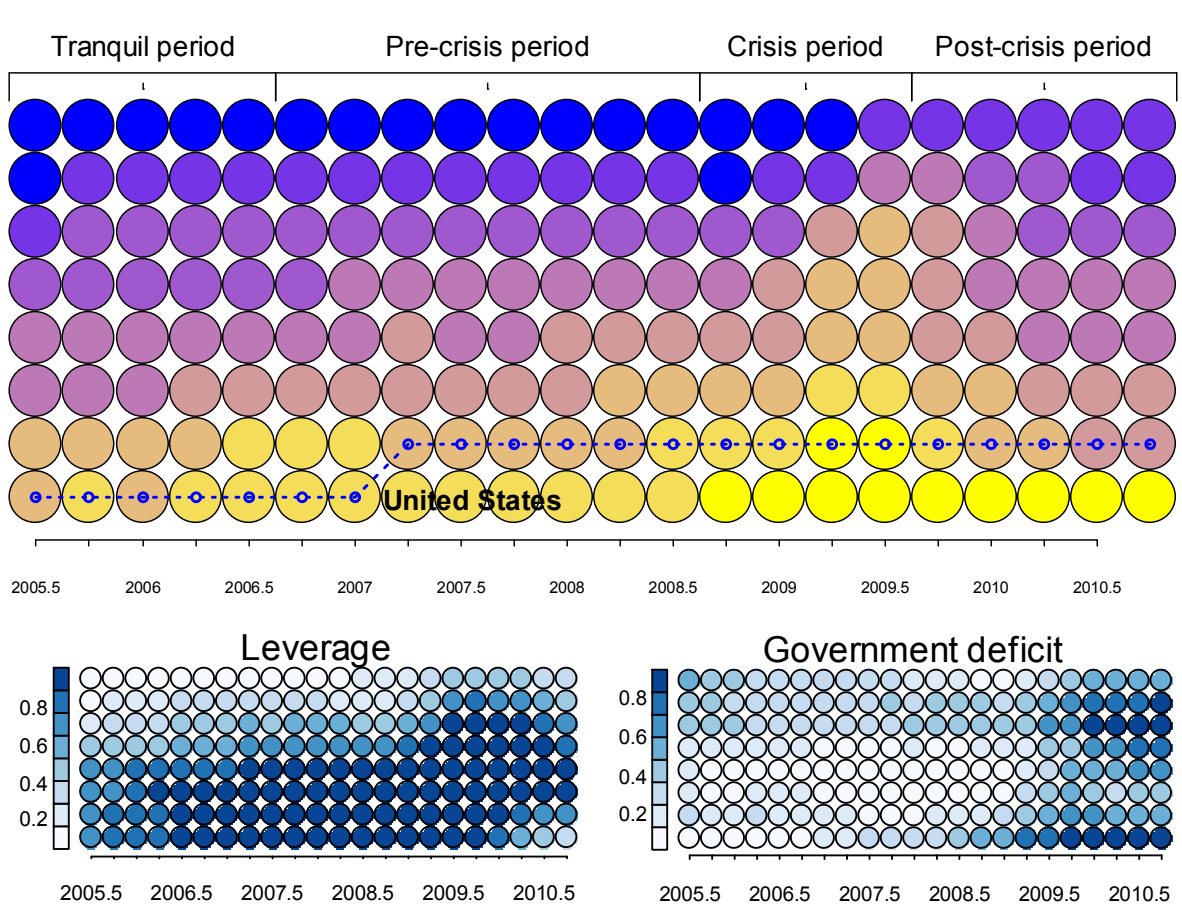
4.2 Self-Organizing Time Map

- Self-Organizing Time Map
  - One more step: Illustrate how mean profiles change over time

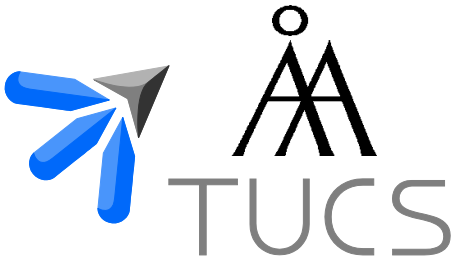


4.2 Self-Organizing Time Map

- Evolution of macro-financial conditions (14 indicators) in the cross-section (2005Q2–2010Q2, 28 economies)

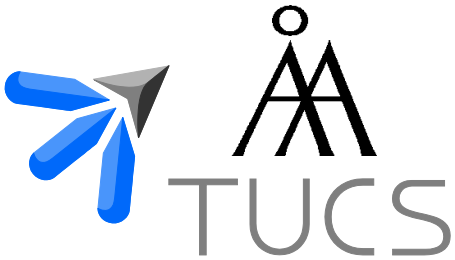


Sarlin (2013)



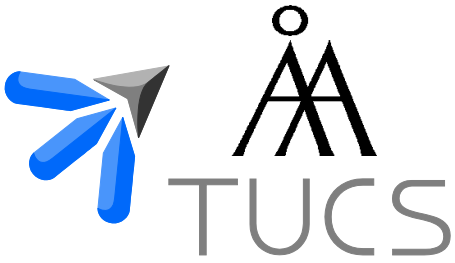
Conclusions

- A key task in macroprudential oversight is communication
- Why not integrate visual means into surveillance tools?
- Visualizations provide means for
  - Risk communication: disseminate info internally and externally
  - Tap into policymakers' domain intelligence and experience
- The future of visual representations
  - Network data are seldom static, so how do they evolve?
  - Can we better look into emergence in agent-based models?
  - How do we illustrate the process of shock absorption in risk assessment tools?
  - How interactive are visuals in macropru?



Thanks for your attention!

Comments? Questions? Discussion?



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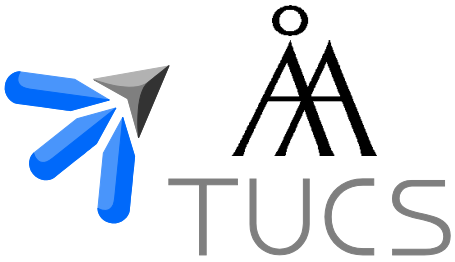

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