



Contents lists available at ScienceDirect

## Journal of Financial Stability

journal homepage: [www.elsevier.com/locate/jfstabil](http://www.elsevier.com/locate/jfstabil)



# Macroprudential oversight, risk communication and visualization<sup>☆</sup>

Peter Sarlin<sup>\*</sup>

Center of Excellence SAFE at Goethe University Frankfurt and RiskLab Finland at Arcada University of Applied Sciences, and Hanken School of Economics, Helsinki, Germany

### ARTICLE INFO

#### Article history:

Received 4 November 2014  
Received in revised form 5 September 2015  
Accepted 21 December 2015  
Available online xxx

#### JEL classification:

G01  
G15  
F37  
F38  
F47

#### Keywords:

Macroprudential oversight  
Risk communication  
Visualization  
Analytical visualization  
Interactive visualization  
VisRisk

### ABSTRACT

This paper discusses the role of risk communication in macroprudential oversight and of visualization in risk communication. Beyond the increase in data availability and precision, the transition from firm-centric to system-wide supervision imposes vast data needs. Moreover, in addition to internal communication as in any organization, broad and effective external communication of timely information related to systemic risks is a key mandate of macroprudential supervisors. This further stresses the importance of simple representations of complex data. The present paper focuses on the background and theory of information visualization and visual analytics, as well as techniques within these fields, as potential means for risk communication. We define the task of visualization in risk communication, discuss the structure of macroprudential data, and review visualization techniques applied to systemic risk. We conclude that two essential, yet rare, features for supporting the analysis of big data and communication of risks are analytical visualizations and interactive interfaces. For visualizing the so-called macroprudential data cube, we provide the VisRisk platform with three modules: *plots*, *maps* and *networks*. While VisRisk is herein illustrated with five web-based interactive visualizations of systemic risk indicators and models, the platform enables and is open to the visualization of any data from the macroprudential data cube.

Crown Copyright © 2016 Published by Elsevier B.V. All rights reserved.

<sup>☆</sup> This research has been supported by a grant from the SWIFT Institute. The author wants to thank Mark Flood, Robert Hofmeister, John Kronberg, Victoria L. Lemieux, Alistair Milne, Samuel Rönnqvist, Mikael Sand, Peter Ware and members of the SWIFT Institute's Advisory Council for insightful comments and discussions. The VisRisk platform for interactive and analytical applications has been produced in co-operation with and is property of infolytika, and can be found here: <http://vis.risklab.fi/>. VisRisk is open to submissions of systemic risk data, indicators and models for visualization, which should be directed to the author of this paper. The paper has also benefited from feedback from conference and seminar participants at the Data Mining and Knowledge Management Laboratory, Åbo Akademi University on August 27, 2013 in Turku, Finland, the 11th Payment and Settlement System Simulation Seminar on 29–30 August, 2013 at the Bank of Finland, Helsinki, Universitat Pompeu Fabra on 18 September, 2013 in Barcelona, the Deutsche Bundesbank on 28 October, 2013 in Frankfurt am Main, the 7th International Conference on Computational Financial Econometrics on 14 December, 2013 at UCL and LSE in London, Arcada University of Applied Sciences on November 14, 2013 in Helsinki, Eindhoven University of Technology on January 7, 2014, the Future of Financial Standards conference by SWIFT Institute, SWIFT's Standards Forum and LSE on March 25, 2014 in London, the Center of Excellence SAFE, Goethe University on 7 May, 2014 in Frankfurt, the Systemic Risk Center at LSE on May 16, 2014 in London, the ECB Financial Stability seminar on 25 June, 2014 in Frankfurt, the 34th International Symposium on Forecasting on June 29, 2014 in Rotterdam, and at the EBA Seminar on good practices in IT supervision on October 14, 2014 in Zagreb.

<sup>\*</sup> Correspondence to: Hanken School of Economics, Arkadiagatan 22, 00100 Helsinki, Finland. Tel.: +358 405727670.

E-mail address: [peter@risklab.fi](mailto:peter@risklab.fi)

<http://dx.doi.org/10.1016/j.jfs.2015.12.005>

1572-3089/Crown Copyright © 2016 Published by Elsevier B.V. All rights reserved.

*"In the absence of clear guidance from existing analytical frameworks, policy-makers had to place particular reliance on our experience. Judgement and experience inevitably played a key role. [...] But relying on judgement inevitably involves risks. We need macroeconomic and financial models to discipline and structure our judgemental analysis. How should such models evolve?"*

– Jean-Claude Trichet, President of the ECB, Frankfurt am Main, 18/11/2010

### 1. Introduction

Macroprudential oversight refers to surveillance and supervision of the financial system as a whole. As can be exemplified by recently founded supervisory bodies with the mandate of safeguarding financial stability, a system-wide perspective to financial supervision is currently being accepted and implemented as a common objective of governmental authorities and supervisors. To this end, the European Systemic Risk Board (ESRB) in Europe, the Financial Policy Committee (FPC) in the UK, and the Financial Stability Oversight Council (FSOC) in the US were founded in the aftermath of the financial instabilities of 2007–2008. Beyond the increase in availability and precision of data, the transition from firm-centric to system-wide supervision imposes obvious data needs when

analyzing a large number of entities and their constituents as a whole (see e.g. Flood and Mendelowitz, 2013). As central tasks ought to be timely and accurate measurement of systemic risks, big data and analytical models and tools become a necessity (see Section 3.1 for a definition of big data in this context). While analytics might aid in automated modeling, one approach to dealing with vast amounts of data and modeling problems is to improve end users' understanding of them in order to tap into their expertise. As above noted by Mr. Trichet, we need means supporting disciplined and structured judgmental analysis based on policymakers' experience and domain intelligence – and not only models but also means to understand their output and underlying data. Further, the mandates of macroprudential supervisors have to date been stressing (or even limited to) communication, issuing warnings and giving recommendations, which boils down to an emphasis on broad and effective communication of timely information related to systemic risks. This paper discusses the role of visualization in macroprudential oversight at large, especially for the purpose of risk communication.

Financial systems, described by the three pillars of financial intermediaries, markets and infrastructures, have been shown to be recurrently unstable due to limitations related to market imperfections (de Bandt and Hartmann, 2002; Carletti, 2008). Underlying systemic risk, while having no unanimous definition, has commonly been distinguished into three categories (de Bandt et al., 2009; ECB, 2009): (i) build-up of widespread imbalances, (ii) exogenous aggregate shocks, and (iii) spillover and contagion. With the aim of mitigating system-wide risks, macroprudential oversight is commonly comprised into a process, where key tasks include (i) risk identification, (ii) risk assessment, and (iii) policy assessment, implementation and follow-up. As a soft policy intervention, risk communication concerns the overall task of spreading broadly and effectively timely information related to systemic risks, as well as other vulnerabilities concerning the financial system and its macro-financial environment. Policymakers have been developing a broad tool box of analytical models with three types of models following the above listed three forms of systemic risk (e.g., ECB (2010)): (i) early warning of the build-up of widespread vulnerabilities and imbalances, (ii) stress-testing the resilience of the financial system to a wide variety of exogenous aggregate shocks, and (iii) modeling contagion and spillover to assess how resilient the financial system is to cross-sectional transmission of financial instability. While the first approach aids in risk identification and the second and third provide in risk assessment, risk communication relates to all of the above approaches.

Despite macroprudential bodies having only recently been mandated with macroprudential oversight, central bank communication is far from a new task. As reviewed by Blinder et al. (2008), over the past 20 years central banks have started placing a larger weight on communication and overall become more transparent. That said, the role of communication related to financial stability and overall macroprudential tasks is more recent (e.g., Cihák et al., 2012; Born et al., 2014). Accordingly, this points out a mismatch between the current objectives and needs and the available tools: while a key task is the communication of risks, the toolbox of analytical models lacks a focus on approaches that support human understanding.

The term visualization has a wide meaning and relates to a number of interdisciplinary topics, in particular information visualization and visual analytics. The rationale behind the use of visual representations and their usefulness relates to traits of the human visual system (see, e.g., Ware (2004)). Card et al. (1999) assert visualization as a type of cognitive support or amplification, which leads to a focus on strengths and weaknesses of human perception. This highlights the importance of principles for designing visuals that meet the demands of the human visual system. Although the

computer age has brought visuals, and even the design of them, to the desks of ordinary people, including policymakers, the most influential literature on data graphics design still today dates back to work by Tufte (1983) and Bertin (1983). Rather than an exact theory, Tufte and Bertin provide a set of principles and rules of thumb to follow. Techniques supporting visualization can be divided into two types: graphical representations of data and means for interaction. While the former can be summarized in various categories of visualization techniques, such as per output and data, the latter refer to how the user can interact with or manipulate the displayed data, such as zooming or panning, which often has its basis in one or more graphical displays for enabling more flexibility to explore data. This invokes two questions: 1. (2. how) would tapping into visualization support risk communication in macroprudential oversight?

Risk communication comprises two tasks. Internal communication concerns spreading information about systemic risks within but at various levels of the organization, such as among divisions, groups or analysts, whereas external communication refers to the task of disseminating information about systemic risks to the general public. In this paper, we mainly focus on the background and theory of information visualization and visual analytics, as well as techniques provided within these disciplines, as potential means for risk communication. The topic of visualization is in this paper discussed from three viewpoints. First, based upon the needs for internal and external risk communication, we define the task of visualization in macroprudential oversight. Second, we present the so-called macroprudential data cube, by discussing the type of available data for identifying and assessing systemic risk, including their structure and its potential implications for analysis and visualization. Third, we review the current state of the art in visualization techniques applied to the analysis of systemic risk. This provides an overview of which tasks should be supported by visualization and the underlying data to be visualized. Eventually, the discussion boils down to two essential, but to date rare, features for supporting the analysis of big financial data and the communication of risks: analytical visualizations and interactive interfaces.

For visualizing the macroprudential data cube through analytical and interactive visualization, we utilize the VisRisk platform with three modules: *plots*, *maps* and *networks*.<sup>1</sup> *Plots* focuses on interactive interfaces for representing large amounts of data, but does not make use of analytical techniques for reducing complexity. While *maps* provides analytical means for representing the three standard dimensions of a data cube in simple formats, *networks* aims at visualization of the fourth data cube dimension of interlinkages. As VisRisk enables and is open to the visualization of any data from a macroprudential data cube, we aim at providing a basis with which systemic risk indicators and models can be widely communicated. It is herein illustrated with five web-based interactive visualizations of systemic risk indicators and models, of which three make use of analytical visualizations. First, we make use of analytical techniques for data and dimension reduction to explore high-dimensional systemic risk indicators and time-varying networks of linkages. Second, this paper adds interactivity to not only dashboards of standard risk indicators and early-warning models, but also to the analytical applications. The ultimate aim of VisRisk, and this paper at large, is to provide a basis for the use of visualization techniques, especially those including analytical and interactive features, in macroprudential oversight in general and risk communication in particular.

<sup>1</sup> The VisRisk platform for interactive and analytical applications can be found here: <http://vis.risklab.fi/>. VisRisk has been produced in co-operation with and is property of infolytika. In addition to the author of this paper, VisRisk has benefited from contributions by John Kronberg, Samuel Rönqvist and Mikael Sand.

Download English Version:

<https://daneshyari.com/en/article/5106568>

Download Persian Version:

<https://daneshyari.com/article/5106568>

[Daneshyari.com](https://daneshyari.com)