

Anastasios Petropoulos, Vasilis Siakoulis, Nikolaos Vlachogiannakis, Evaggelos Stavroulakis, "Deep-Stress: A deep learning approach for dynamic balance sheet stress testing"

Discussion by Kim Abildgren



Brief recap of the paper

- **Background:**
 - Recent financial crises revealed a need for improved stress tests.
- **General research question:**
 - Can big data and machine learning techniques add value in stress testing frameworks?
- **Approach:**
 - Simulating dynamic balance sheets for US banks using deep learning algorithms based on public bank-level data 2008-2015.
- **Key findings:**
 - Significantly lower prediction error of the Capital Adequacy Ratio under the deep learning approach compared to other stress testing approaches.

Overall assessment

- Addresses a topic of **high relevance** for the main topic of the workshop.
 - Should be of great interest for regulators, central banks and other actors involved in stress testing of the banking system.
- The paper is **well written** and presents the results of a **well-conducted** empirical study.
- The paper **adds to the literature** by illustrating how big data and machine learning techniques might be used in relation to stress tests.

Comments - 1

- **“Observations regarding failed banks are excluded from the analysis since stress testing is performed on healthy financial entities.”** (page 6)
 - Might seem somewhat surprising to many readers.
 - Contagion channels (interbank exposures vis-a-vis failed banks and fire sales of assets by failing banks) can be important during financial stress.
 - Furthermore, non-linearities might have been most important for the failed banks.
 - **Why is the information contained in observations for failed banks not of importance for estimating a good model?** Please elaborate for the benefit of the reader.



Comments - 2

- **The out-of-sample period 2014-2015 is located after the financial crisis** (cf. page 13).
- It would - as acknowledged by the authors in the concluding section - strengthen the paper if it was explored how well the deep learning approach performs relative to other approaches if it was fitted on pre-crisis data and used to forecast Capital Adequacy Ratios in 2008-2009.
- If the necessary data are not available for the US, it could be an interesting exercise to do the experiment on data from other countries.

Comments - 3

- **Why is the Deep Learning approach superior to the other approached studied?**
 - Better estimation technique (for instance better at taking non-linearities into account)?
 - Utilise more data (more variables)?
- **How important is dynamic balance sheet modelling compared to constant balance sheets for a given estimation method? Can we quantify this issues?**

Summing up

- **Great paper!**
- **Innovative use** of data and machine learning techniques.
- **Very timely:** Address the opportunities of using big datasets within the areas of stress tests to assess the resilience of the banking system.
- I look forward to the **future research** mentioned in the conclusion involving pre-crisis data and evaluation of the ability of the deep learning approach to predict bank failures during the crisis.