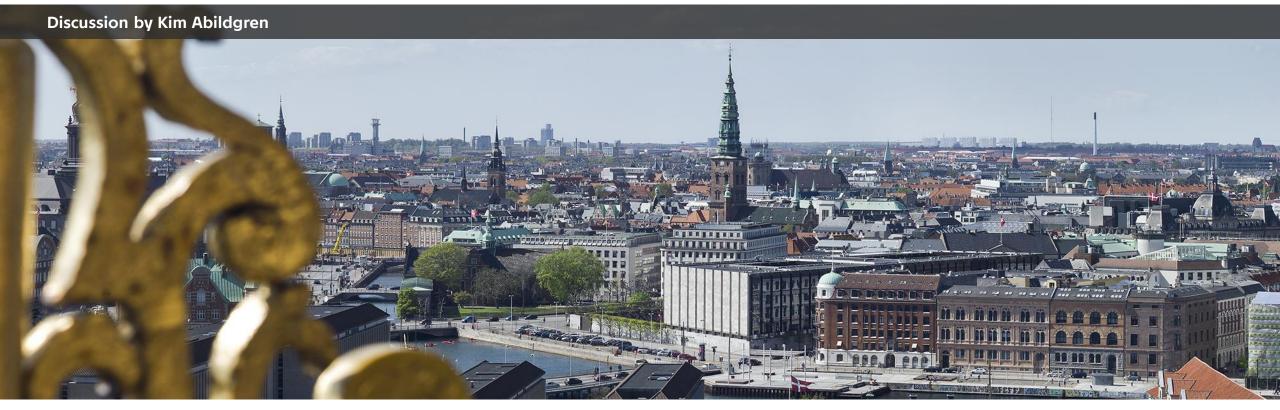
# DANMARKS NATIONALBANK

8th EBA Policy Research workshop, "The future of stress tests in the banking sector – approaches, governance and methodologies", Paris, 27-28 November 2019.

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





Views and conclusions expressed in the presentation are those of the presenter and do not necessarily represent those of Danmarks Nationalbank.

# 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 wellconducted 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 surpricing 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 nonlinearities into account)?
  - <u>Utilise more data</u> (more variables)?
- How important is dynamic balance sheet modelling comparred 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 af stress tests to assess the resilience of the banking system.
- I look forward to the **future research** mentioned in the conclusion involving <u>pre-crisis data</u> and evaluation of the ability of the deep leaning approach to <u>predict bank failures during the crisis</u>.

