Macro stress testing at the BOJ incorporating macro-financial linkages

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Objective: BOJ's macro stress testing

BOJ's macro stress testing aims to:

1. **identify potential macro-financial risks** that Japan's financial institutions face;

2. **evaluate the resilience** of Japan's financial system/ FIs against those risks;

    and

3. **facilitate enhanced communication** with relevant groups of people inside and outside the Bank;
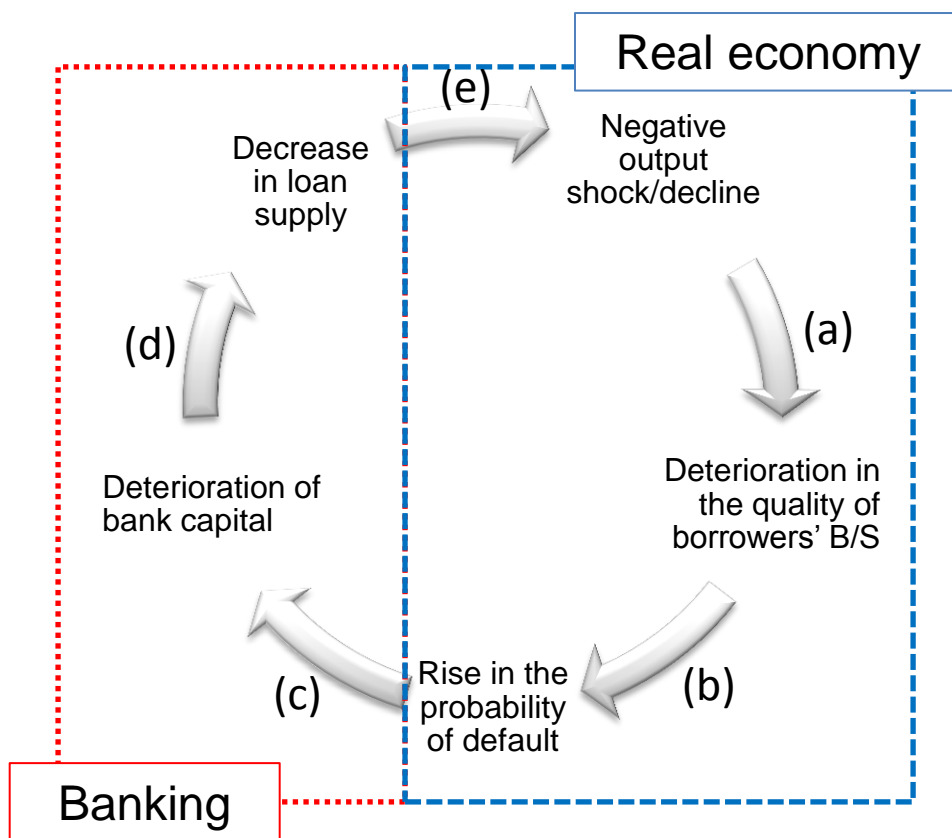
    in order to secure the stability of Japan's financial system.

Main features of the exercise

- Core: top-down, running a BOJ's Financial Macroeconometric Model (FMM).

- FMM incorporates:
  - **feedback loops between real economy and financial (banking) sector;**
  - **dynamic behaviour of individual banks** against macro-financial shocks (covering 370 banks, almost 90% of bank assets);
  - Not only the aggregate but also bank-by-bank impact is estimated.

- Transparent: system of equations is published.
  - Kitamura et al. (2014) "Macro Stress Testing at the Bank of Japan"
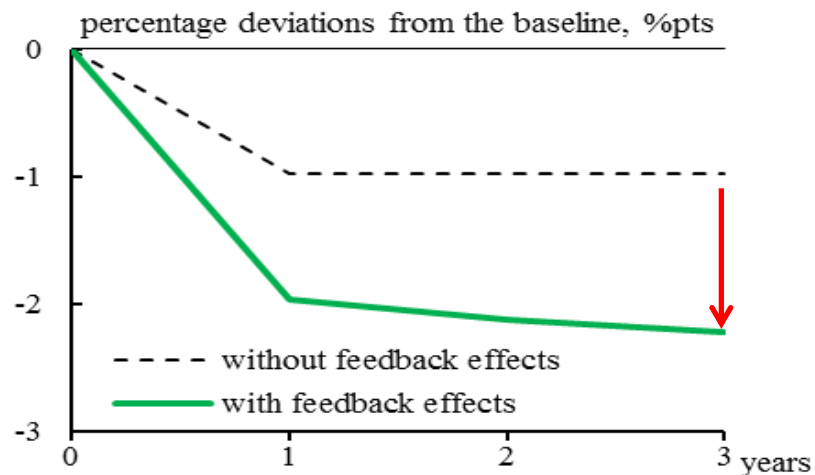
- Still developing: continuously updated.

Macro-financial feedback mechanism in FMM

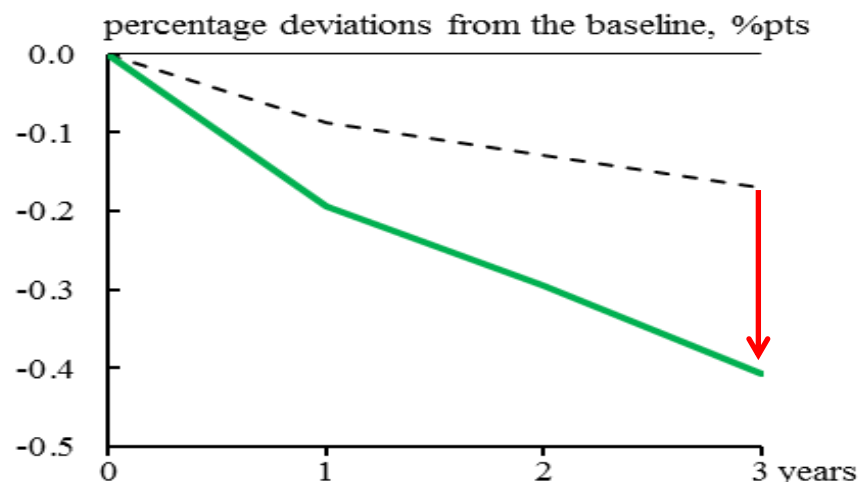## Feedback Loops between real economy and financial (banking) sector

Real economy

(e)

Decrease in loan supply

Negative output shock/decline

(d)

(a)

Deterioration of bank capital

Deterioration in the quality of borrowers' B/S

(c)

Rise in the probability of default

(b)

Banking

"Macro model meets bank panel data."

"A large-scale Structural VAR model."

Nominal GDP

percentage deviations from the baseline, %pts

- - - without feedback effects
— with feedback effects

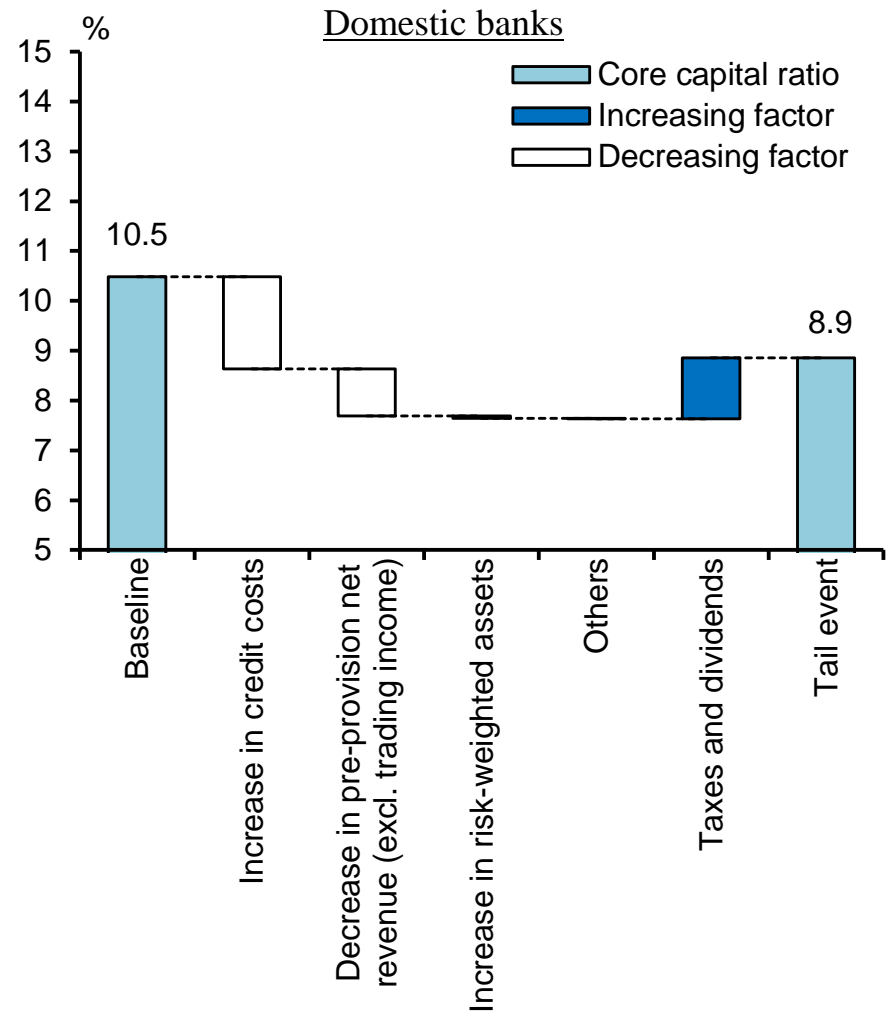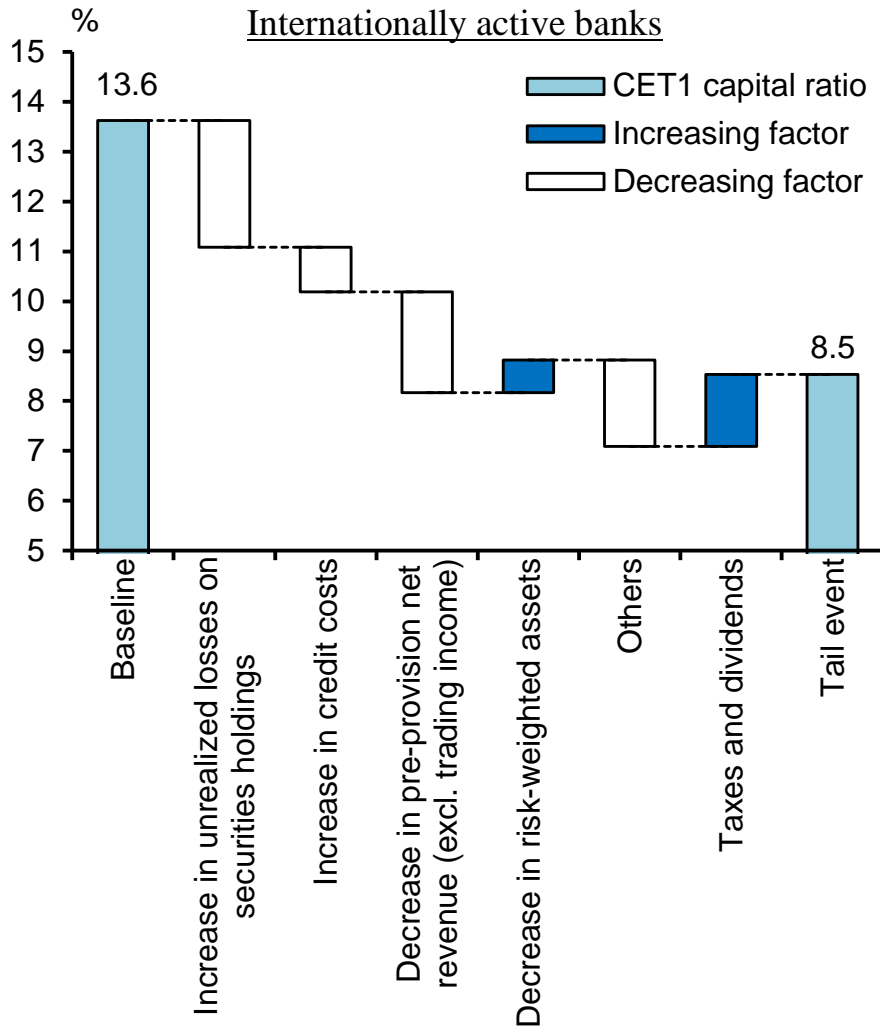### Bank Capital (CET1) ratio

percentage deviations from the baseline, %pts

(Source) Kitamura *et al* [2014], BOJWP

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Aggregate impact: Tail event scenario (FSR Apr 2018)

Decompositions of the CET1 capital ratio and the core capital ratio

Internationally active banks

- CET1 capital ratio
- Increasing factor
- Decreasing factor

13.6 — Baseline
8.5 — Tail event

Categories: Baseline, Increase in unrealized losses on securities holdings, Increase in credit costs, Decrease in pre-provision net revenue (excl. trading income), Decrease in risk-weighted assets, Others, Taxes and dividends, Tail event

Domestic banks

- Core capital ratio
- Increasing factor
- Decreasing factor

10.5 — Baseline
8.9 — Tail event

Categories: Baseline, Increase in credit costs, Decrease in pre-provision net revenue (excl. trading income), Increase in risk-weighted assets, Others, Taxes and dividends, Tail event

Facilitate enhanced communication

- Published in Financial System Report (FSR) semiannually:
  - potential macro-financial risks that Japan's financial institutions face;
  - resilience of the Japan's financial system against those risks.

- Used as inputs which facilitate discussions with relevant groups of people including:
  - **JFSA**, especially in the context of macropru collaboration;
  - **Firms (Banks)**;
  - **BOJ onsite/ off-site bank examination teams**;
  - **BOJ monetary policy makers**: the macro assessment of financial system stability is also regarded as an important input in assessing risks in economic and price developments from a medium- to long-term perspective;
  - **Other CBs & Regulators, academic economists** to get their insight.

Macroprudential Collaboration with JFSA

- BOJ and JFSA have held meetings of the **Council for Cooperation on Financial Stability (CCFS)** biannually since June 2014
  - to exchange views on the current situation of financial system and markets, with a view to the cooperation regarding macro-prudential policy.

- The CCFS is also to discuss any change in the level of the **countercyclical capital buffer (CCyB)** before the final decision is made by the JFSA.

Overview of CCFS

Objective	Participants	Frequency
To exchange views on the current situation of financial system and markets	Senior officials, including the JFSA Commissioner and the BOJ Deputy Governor	Meeting is held biannually and accordingly when deemed necessary

Communication with BOJ examination teams & firms

- Collaborate with **BOJ on-site/ off-site bank examination teams**, leveraging their relationship skills.
  - Enhance the utilization of stress testing via closer dialogue with firms.

- Start up a joint research program with a large firm.
  - analyse the firm's rich, obligor-level panel dataset to mutually improve credit risk modeling.
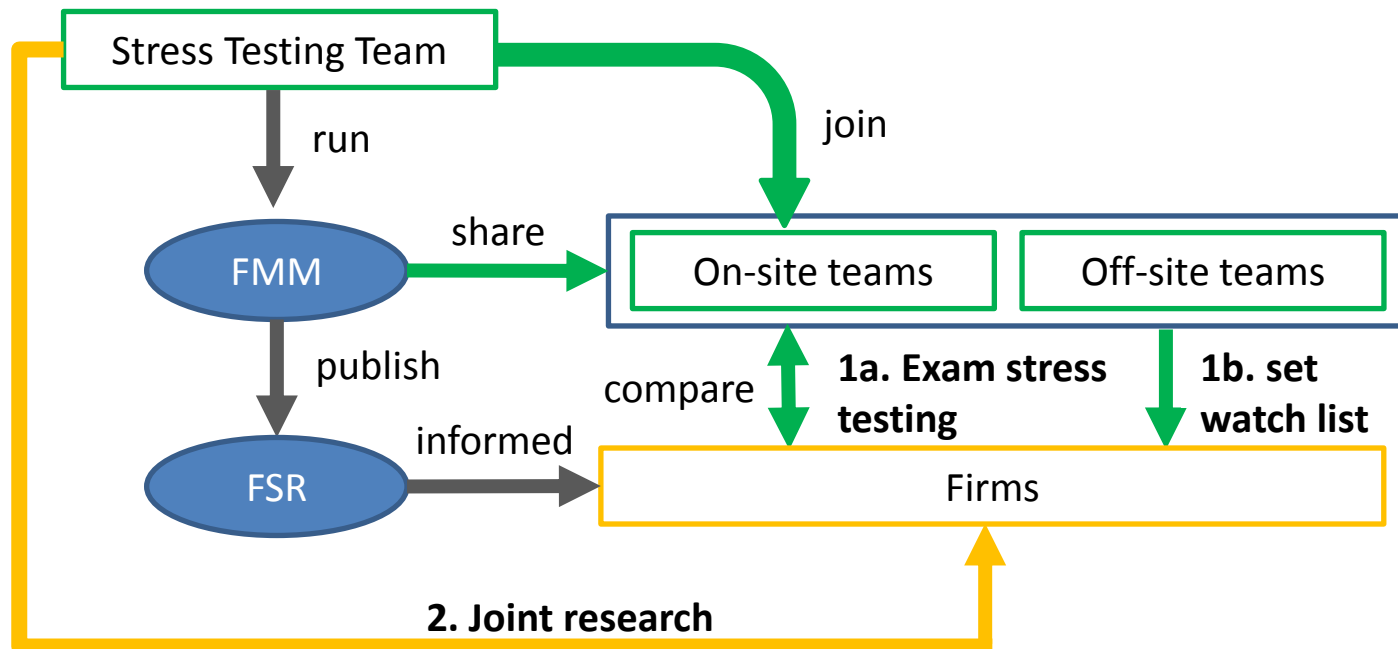
# Joint research program – motivation

Firms (Banks)

- Aim to enhance their use of stress testing exercises.
  - Firms increasingly use their stress tests for setting their risk appetite.
  - They want to model the impact of various kinds of shocks on their capital and liquidity, not only at firm level but also at sub-portfolio level.

BOJ

- Searches a platform of next generation models.
  - BOJ is especially keen to evaluate costs and benefits of using more granular data, *e.g.* obligor-level credit information.
  - Obligor-level credit information may be too noisy for the purpose of forecasting stress losses against macro-financial shocks at firm and/or macro level.
  - That said, having some level of data granularity must be helpful in improving the stress-loss forecasting.
  - Different purpose may require different data granularity.

Search for optimal data granularity

Elasticity of probability of default to the output gap by industry

Elasticity of PD to the output gap
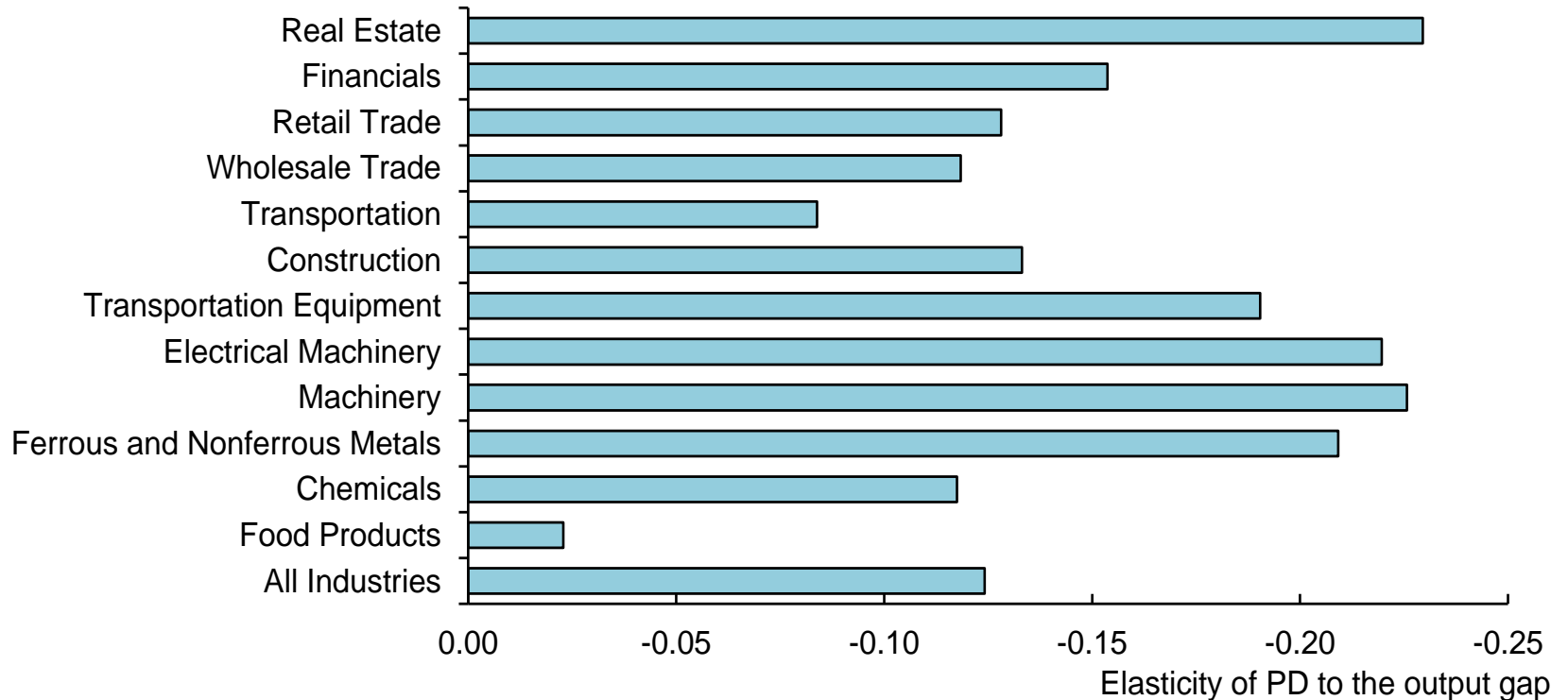
(Source) BOJ-FSR Annex[2016], October 2016 Ch.B3-2

Thank you!