Making a Breach: The Incorporation of Agent-Based Models into the Bank of England's Toolkit

Romain Plassard
Université Paris-Dauphine, Université PSL
Laboratoire d'Économie de Dauphine (UMR 8007).

ABMs in Central Banks

- The list includes:
  - The Bank of England.
  - The European Central Bank.
  - The Bank of Canada.
  - The Kansas City Fed.
  - The St Louis Fed.
- Questions:
  1. Under which conditions ABMs breached the walls of Central Banks?
  2. Are ABMs used to inform a wide range of policies?
  3. What are the forces underlying the deployment of ABMs in Central Banks?
- Answers based on the case of the Bank of England (BoE).

The case of the BoE

1. The conditions under which ABMs breached the walls of the BoE:
   - 1 ABM in 2008, but no follow-up for 8 years;
   - 3 ABMs were developed between 2016 and 2018;
   - 4 articles advocating for ABMs between 2016 and 2019.

   ⇨ The financial crisis of 2008 was not a sufficient condition for the adoption of ABMs+ What happened between 2008 and 2016?

2. A maximum of information on the use of ABMs.

Methodology of research

- The need to go beyond the analysis of the models' properties.
- Replace the use of ABMs in their political, institutional, intellectual, and material contexts.
- A large variety of sources (e.g., legal documents, political speeches, BoE's reports).
- Interviews with BoE's staff (e.g., Arthur Turrell and Karen Braun-Munzinger).

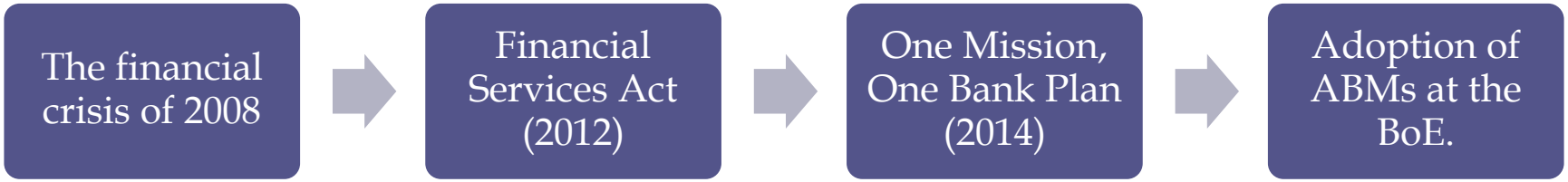
Results

1. Institutional reforms were central to the use of ABMs at the BoE;

2. ABMs are a marginal tool at the BoE;

3. The context is favorable to a broader use of ABMs at the BoE.

The adoption of ABMs at the BoE



The adoption of ABMs at the BoE

1. The failure of the UK regulatory system:
   - The "Turner Review" (2009).
   - Neglect of systemic risks.
   - A legal vacuum on macroprudential policy.

   ⇨ The Financial Services Act (2012).
2. The "One Bank, One Mission Plan" (2014):
   - Operationalization of the BoE's new mandate.
   - A new research agenda.
   - Creation of the Advanced Analytics division.
3. Supply and demand for ABMs
   - Turrell's hiring.
   - The need to have new tools to perform the BoE's missions.

The adoption of ABMs at the BoE

"One can easily have a (possibly triple-mandate) monetary policy, micro-prudential policies, macro-prudential policies lender-side (such as Countercyclical Capital Buffer) and borrower-side (such as affordability tests) in a single [agent-based] model. Therefore, central banks with broad responsibilities can naturally look at ABMs to study the interaction between all those policies" (Tanaka, Head of the Research Hub, e-mail of 16 July 2019).

A tool to inform the BoE's macroprudential policy

ABMs	Economists	Divisions	Directorates
Housing market	Marc Hinterschweiger	Financial Policy	Prudential Policy
	Katie Low	Macro-Financial Risks	Financial Stability Strategy and Risk
	Arzu Uluc	Macro-Financial Risks	Financial Stability Strategy and Risk
Corporate bond market	Karen Braun-Munzinger	Capital Markets	Financial Stability Strategy and Risk
	Zijun Liu	Capital Markets	Financial Stability Strategy and Risk
	Arthur Turrell	Advanced Analytics	Monetary Analysis
Foreign exchange market	Geir-Are Kårvik	Sterling Markets	Markets
	Joseph Noss	Capital Markets	Financial Stability Strategy and Risk
	Jack Worlidge	Capital Markets	Financial Stability Strategy and Risk
	Daniel Beale	Stress-Testing	Financial Stability Strategy and Risk

A marginal tool

- Focus on the financial cycle.
- The goal was to determine how to dampen fluctuations.
  - Small aspect of actual macroprudential policies (Thiemann, 2018).
- The ABMs could not be used to coordinate the BoE's monetary and macroprudential policies:
  - The real sector was not represented (Braun-Munzinger et al, 2016; Karvik et al, 2018);
  - Aggregate demand was not modeled (2016);
  - Contrast with DSGE models.

The fate of ABMs at the BoE

- Expansion of the existing models – e.g., the ABM of the housing market (Interview with Arzu Uluc).
- Can we expect a wider use of ABMs at the BoE?
- Constraints:
  1. To find computer programmers;
  2. Calibration;
  3. Resistances *vis-à-vis* agent-based modeling.

The fate of ABMs at the BoE

"The narrative is one of the key elements of the forecast, and one that the MPC considers absolutely crucial. ABMs are not able to provide a coherent well understood story, where the drivers and the mechanisms of the dynamics are clear. It is also not clear how to do policy analysis with ABMs. While I wouldn't argue that DSGE models are immune to the Lucas critique, they have a clear definition of deep, policy invariant, parameters. It's hard to argue (in my view) that the decision rules in ABMs are plausibly policy invariant" (Francesca Monti, e-mail of 23 July 2019).

A wider use of ABMs can be expected

- A lower resistance *vis-à-vis* agent-based modeling:
  - Criticisms of DSGE models at the BoE (e.g., Carney, 2015; Haldane, 2016);
  - DSGE modelers question their tool (e.g., Lindé et al, 2016).
- The BoE funded research to develop an ABM for stress-testing.
- Relaxation of constraints on programming and calibration:
  i. Increasing availability of micro-level data (Haldane, 2018).
  ii. Better storage capacities (Bholat, 2018);
  iii. Development of supercomputers (Turrell, 2017);
  iv. Increasing availability of computer programmers (ex: INET);
  v. Better software (Turrell, 2017);
  vi. A better capacity to forecast –e.g., Jakob Grazzini (2019).

Thank you!