

Macroeconomic models for monetary policy:

State of play and way forward

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Model development needs – themes and priorities at the Bank of Canada

Yang Zhang

MODEL DEVELOPMENT DIVISION
CANADIAN ECONOMIC ANALYSIS DEPARTMENT
BANK OF CANADA



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Long-standing tradition of using models to inform policy

RDX, RDX₂, RDXF

- Research Department Experimental (Forecasting) model
- Keynesian theory and demand side focus
- After 1973 oil shock, added supply side

- Bottom-up approach with considerable detail

QPM

- Quarterly Projection Model
- Forward-looking expectations
- Endogenous policy
- Stock-flow dynamics

- Inflation targeting
- Fiscal adjustment

ToTEM, LENS

- Terms-of-Trade Economic Model (DSGE)
- Large Empirical and Semi-structural Model

- Terms-of-trade shocks
- Extended monetary policy
- High household debt

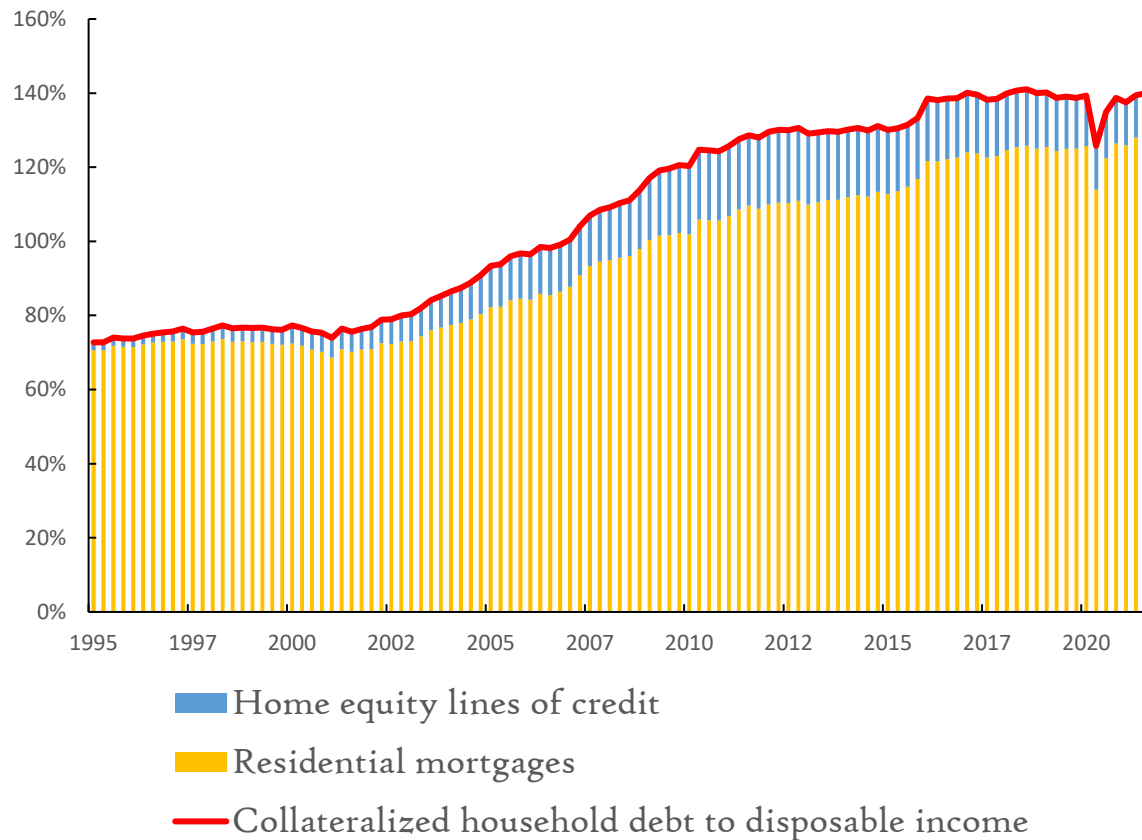


Key Post-pandemic Modelling Challenges

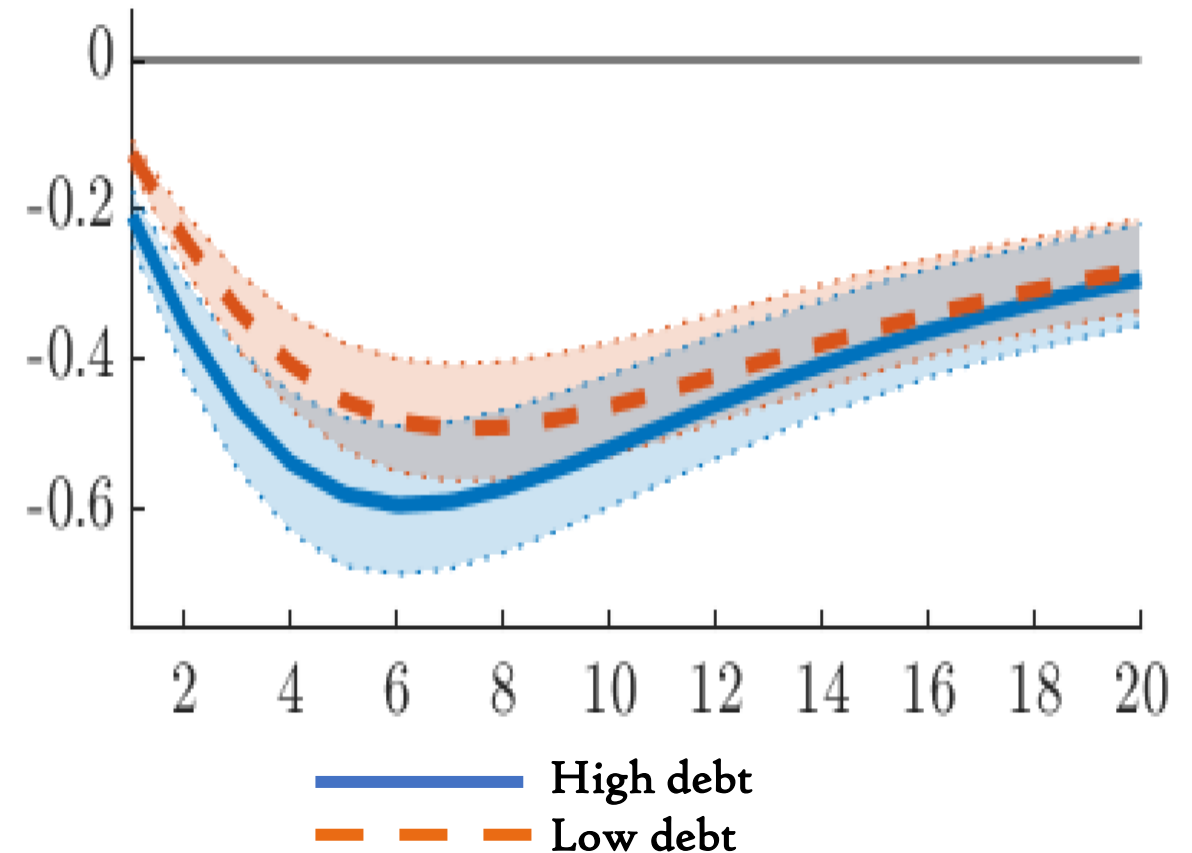
1. **Household heterogeneity** matters for monetary policy transmission
 - Household income and wealth distribution
 - Extensive margin (e.g. home-buying decision)
 - Uninsurable income risk and precautionary savings
2. Modelling **realistic expectation formation** in a **low neutral rate** setting
 - Need to incorporate learned insight from lab and survey evidence
 - Greater need to capture non-linearities (ELB and Value-at-Risk)
3. Think **“Network”**
 - Supply chain channel
 - Global trade and geopolitical uncertainty
 - Commodity prices channel
4. Long-run **trends** and **climate change**

High debt amplifies impact of monetary policy

Ratios of household debt to disposable income
(seasonally-adjusted)



Consumption



Left: Statistics of Canada. **Right:** ToTEM simulated impulse responses to a 100bps monetary policy shock under low-debt or high-debt calibration. See: [Corrigan et al. \(2021\)](#).

Theme 1: Household Heterogeneity

Changes in household income/wealth distributions are key in monetary policy transmission

- **What we have:**

- Borrowing constraint: DSGE model with borrowers and savers
- Income constraint: High MPC households *vs* Low MPC households

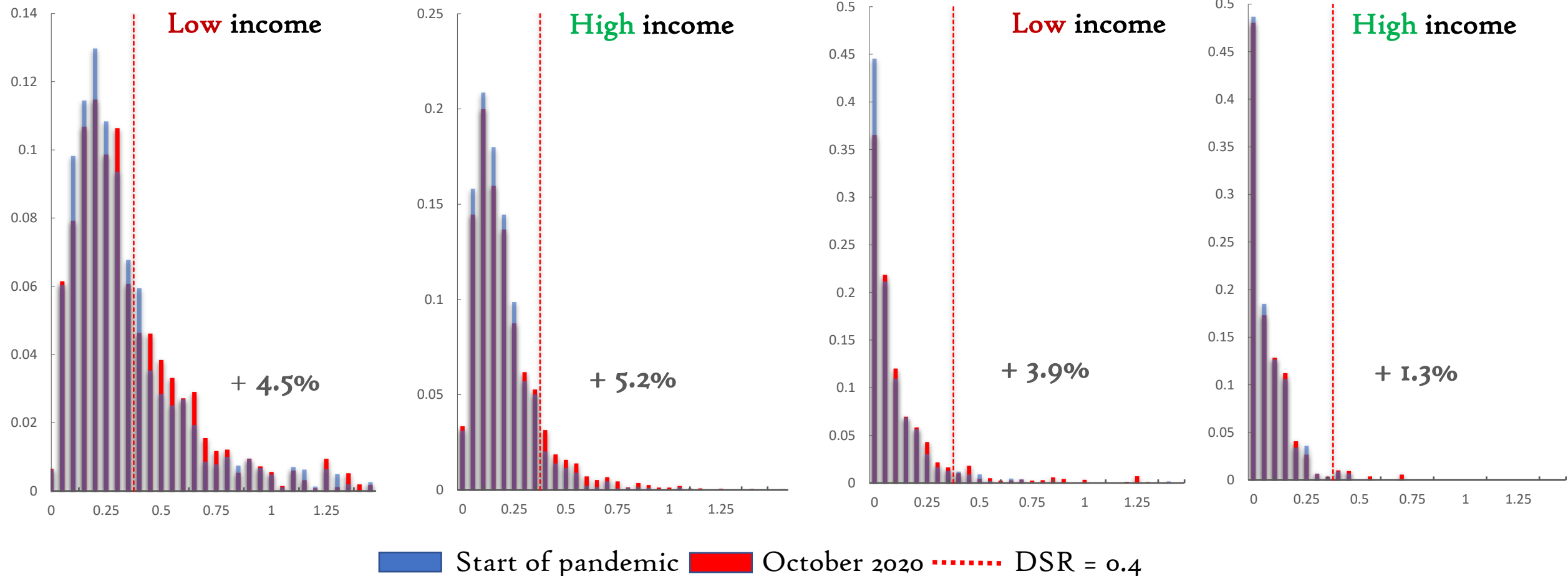
- **Needed:**

- Evidence that extensive margins matters for business cycles
 - Buying (first time or not) vs. renting
- **Distributional implication**: countercyclical income/unemployment risk and **precautionary savings effect** in policy models
- Interaction between monetary policy and **financial vulnerabilities**

Home-ownership and income both mattered for financial vulnerability

Homeowners with mortgages

Renters



Theme 2: Modelling realistic expectations

- **What we have:**

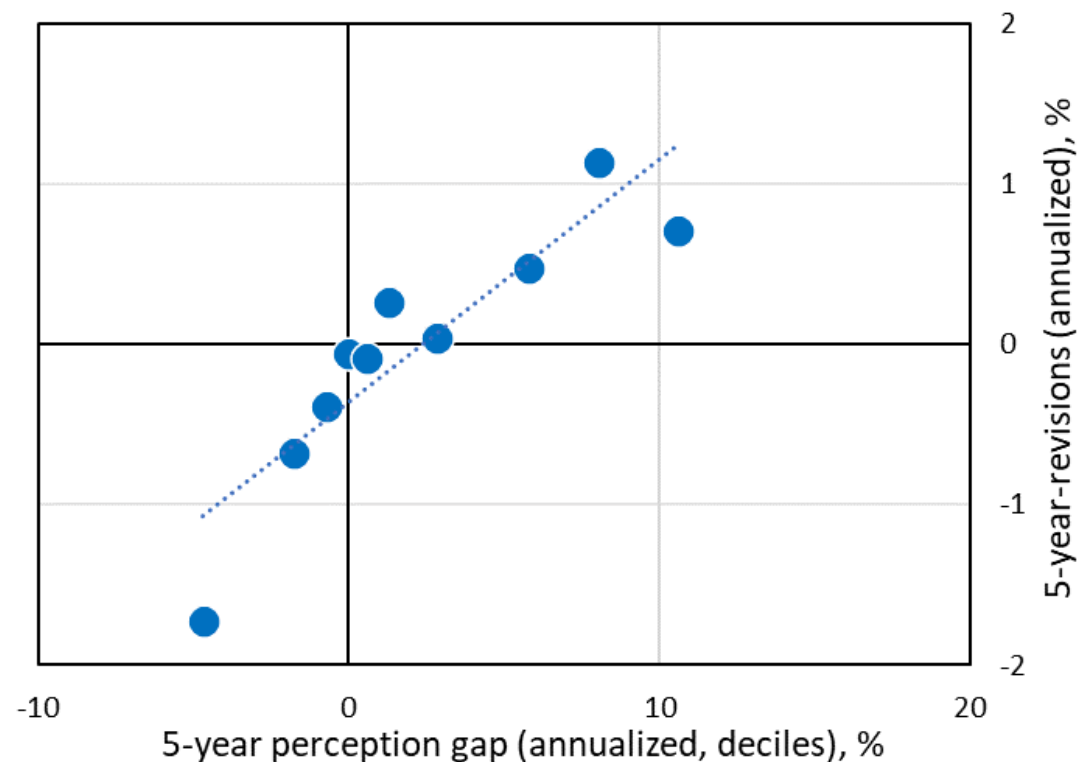
- Rational expectations (with some rule-of-thumb in ToTEM)
- VAR-based expectation (LENS)
- NK model with bounded rationality ([Gabaix, 2020](#))

- **Needed:**

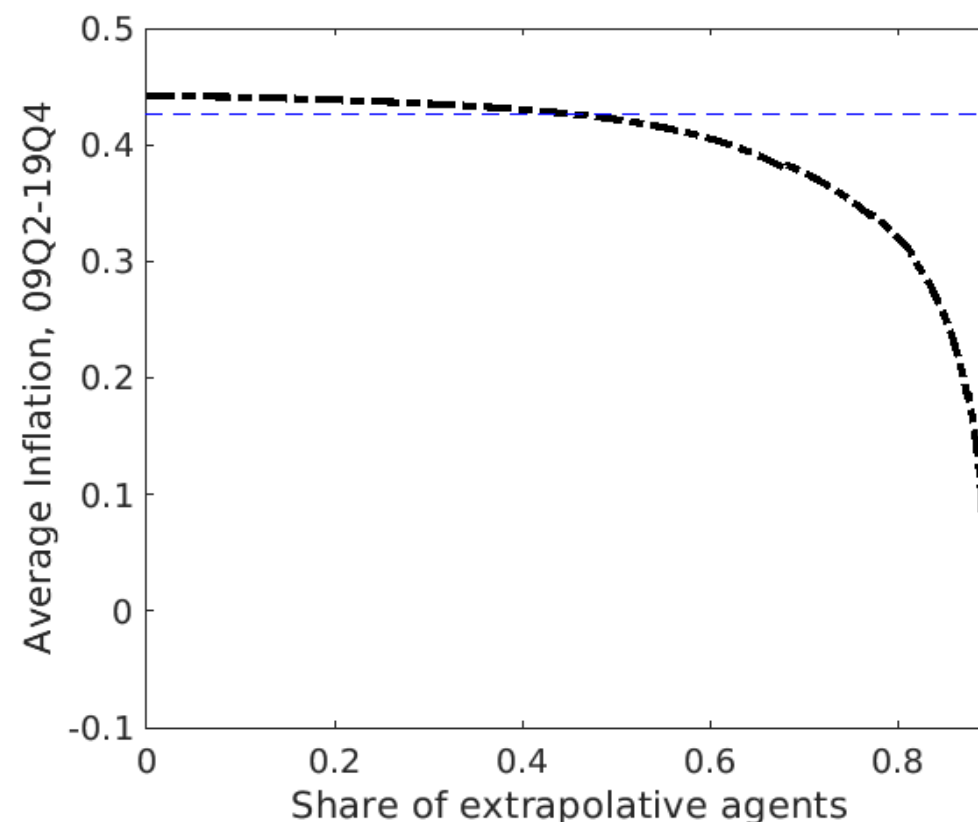
- **Lab experiments:** Simple heuristics and adaptive rules usually provide a better characterization of subjects' behavior.
- **Estimated Macro Models:**
 - State-dependent extrapolative expectations - [Granziera and Kozicki \(2015\)](#)
 - Micro-founded bounded rationality - [Woodford and Xie \(2020\)](#)
 - Adaptive learning - [Ozden \(2021\)](#), [Hommes et al \(2019\)](#)
- **Better match survey expectations**

Extrapolative expectations in survey and simulations

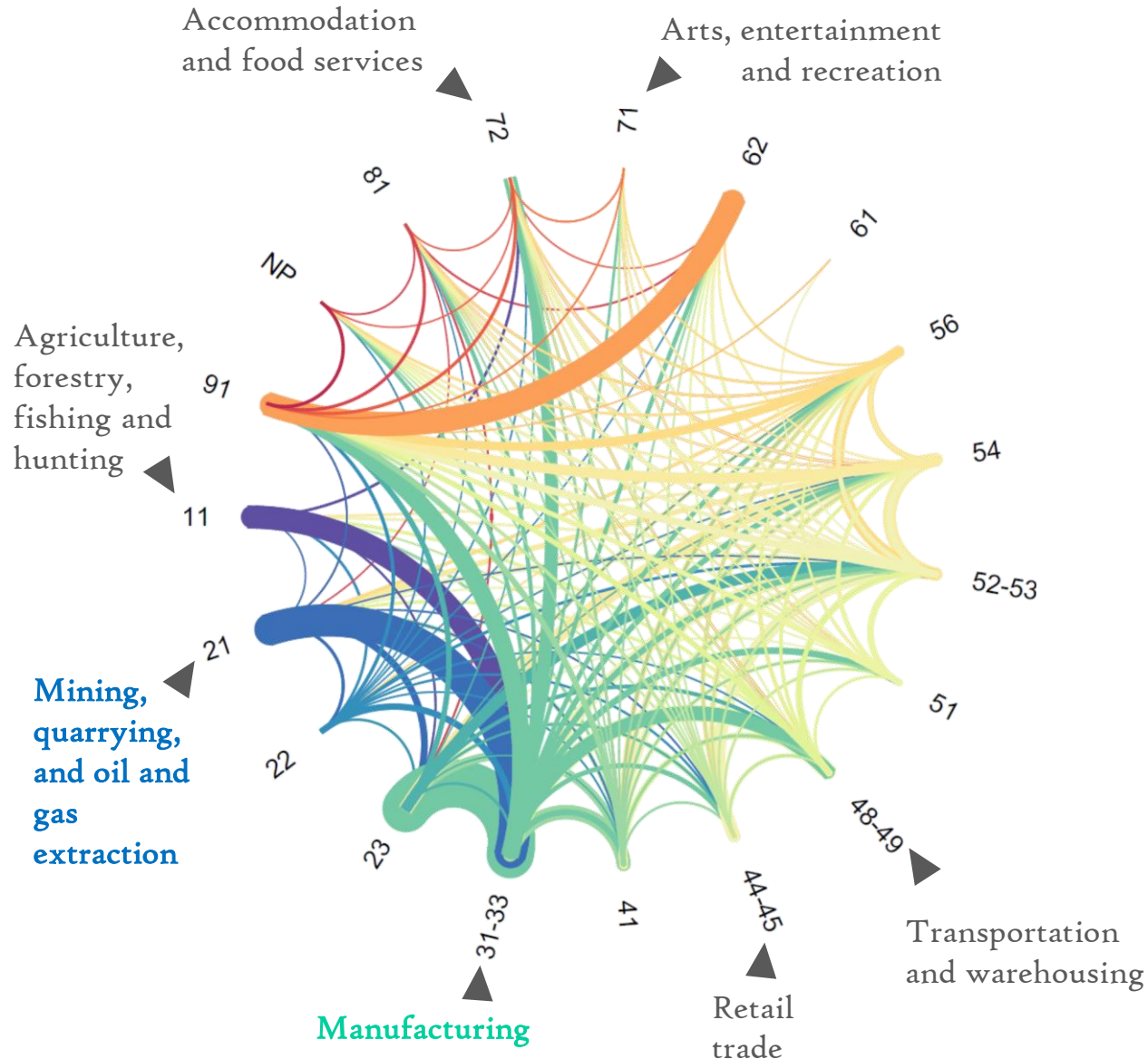
Households exhibit adaptive learning behaviour from survey evidence



More extrapolation could lead to prolonged ELB episodes and deflationary spirals



Theme 3: Think “Network”



- **What we have:**

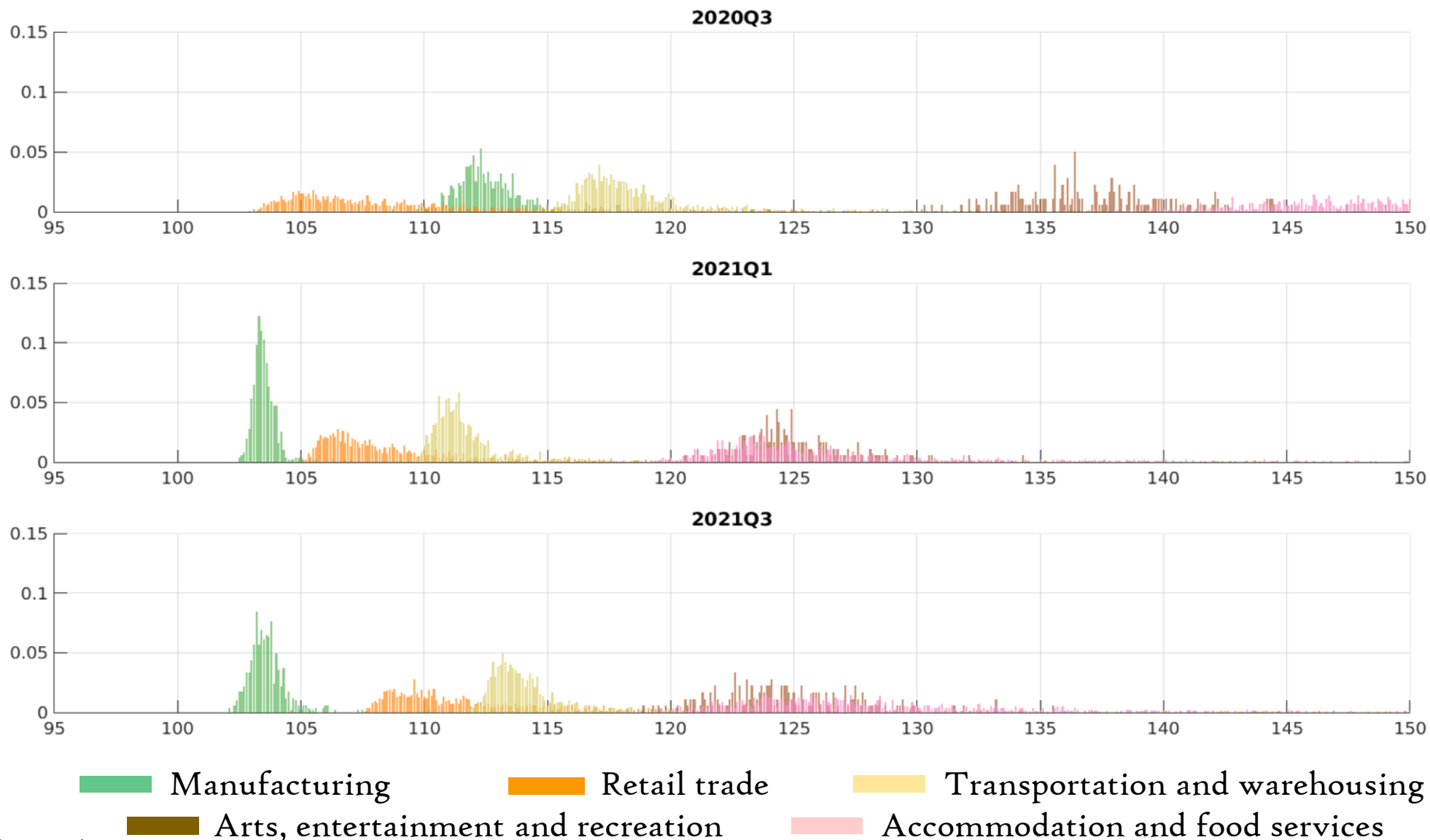
- Multi-sector DSGE models with production network: ToTEM, BoC-GEM-Fin

- **In development:**

- **Open economy macro model:** roles of domestic and international production network linkages for commodity price shocks – [Cao and Dong\(2020\)](#)
- **Agent-based models:** allows for analyzing impacts of COVID and supply chain effect – Poledna, Hommes and Zhang (2021).

Persisting impact of early pandemic on prices

Simulated Price Distribution (2019Q4 = 100)

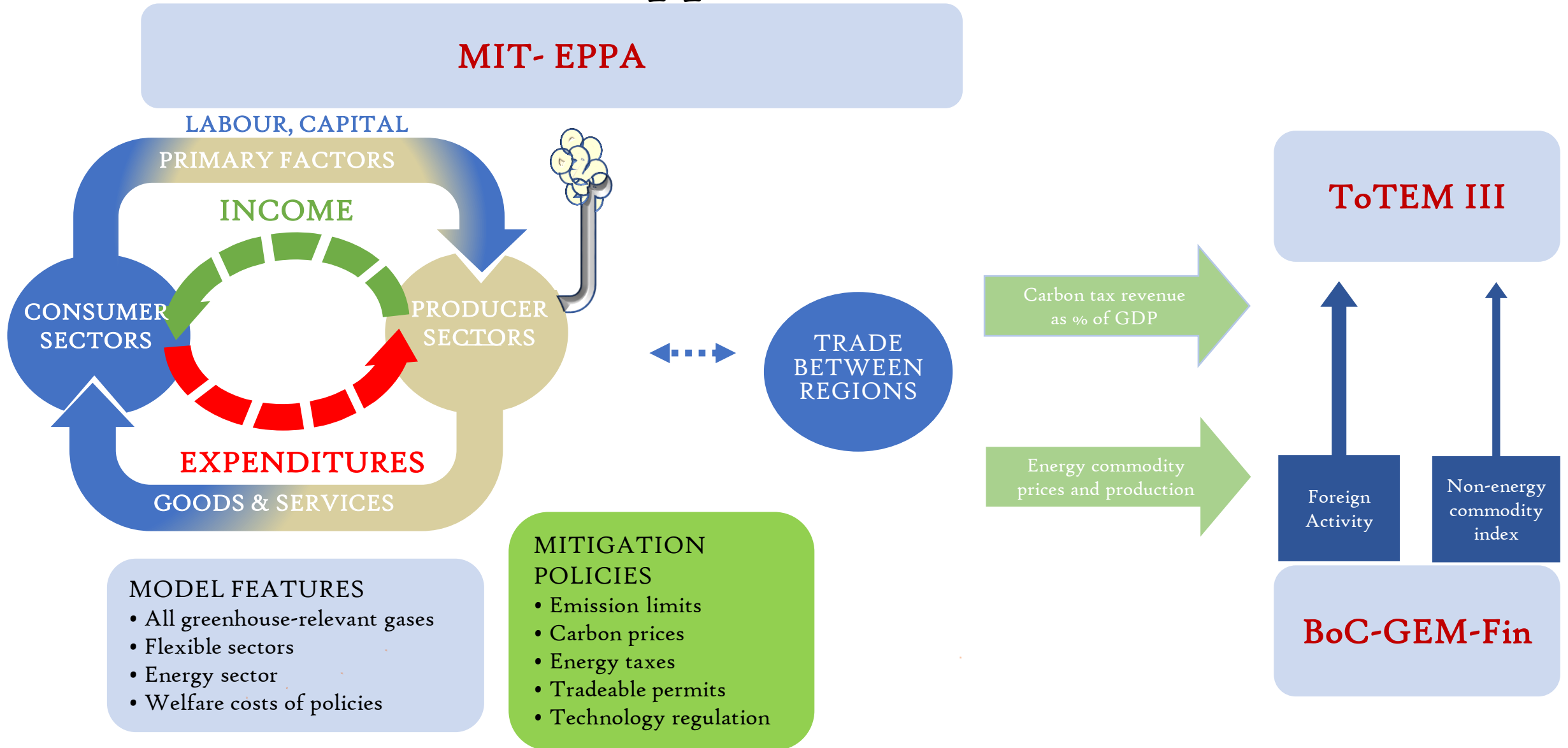


Source: Model simulations

Theme 4: Long-run trends and climate change

- **What we have:**
 - Current modelling approach for R^*
 - A suite-of-model for climate scenario assessment
- **Needed:**
 - Understanding drivers of long-term growth
 - Advancing our R^* models
 - Expand climate macro modelling

A suite-of-model approach for climate scenarios



Overview: Modelling Priorities

