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

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The views expressed in this presentation are solely those of the author and may differ from official Bank of Canada views. No responsibility for them should be attributed to the Bank of Canada.
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)

Home equity lines of credit
Residential mortgages
Collateralized household debt to disposable income

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).
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

Source: Model simulation, see MacGee, Pugh and See (2020)
**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)*
  - **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)
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

**MIT-EPPA**

**Model Features**
- All greenhouse-relevant gases
- Flexible sectors
- Energy sector
- Welfare costs of policies

**Mitigation Policies**
- Emission limits
- Carbon prices
- Energy taxes
- Tradeable permits
- Technology regulation

**ToTEM III**
- Carbon tax revenue as % of GDP
- Energy commodity prices and production

**BoC-GEM-Fin**
- Foreign Activity
- Non-energy commodity index

Source: Chen et al (2020)
Overview: Modelling Priorities

Heterogeneous Households

Heterogeneous Firms

Fiscal Policy

Canadian Financial firms

Monetary Policy

Expectations

Global activity and commodity prices