Panel Discussion on Uses of Models at Central Banks

ECB Workshop on DSGE Models and Forecasting
September 23, 2016

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How are models used at the Board of Governors?

• For forecasting
• For alternative scenarios and policy simulations

Disclaimer: The views expressed are my own and are not necessarily shared by other members of the staff or by the Board of Governors.
Key questions

1. What models are used at various horizons?
2. Will DSGE models eventually improve enough to replace semi-structural models?
3. How is nonstandard data used at the BoG?
4. How to interpret the “regime-based” approach?
1. Forecasting at the Federal Reserve Board of Governors

- Approach is ultimately judgmental
- Consult many models
- No single “core” model
Models used to aid judgmental forecast

1. Near-term
   • Non-structural, time series

2. Medium-term
   • Reduced-form and semi-structural

3. Longer-term
   • A model-based approach
   • Relatively structural
1.1 Near-term models

• Bottom-up, decentralized approach

• Example: GDP
  • Now-casting attempts to replicate BEA (statistical agency) procedure
    • Decentralized specialist forecasts of spending components
  • Factor models provide a cross-check
    • In practice, given a low weight
Decentralized approach leads to a very diverse set of models

• Labor-market flows
  • Exploiting persistence in flows to predict unemployment rate

• Residential construction
  • Permit issuance predicts housing starts
  • Housing starts predict residential construction

• Business equipment spending
  • Two approaches:
    1. Order books of capital-goods producers (adjusted for exports and imports)
    2. Reduced-form models, focused on sentiment and financial conditions
1.2 Medium-term forecast

- Ultimately judgmental
- Both bottom-up and top-down model input

Top-down:
  - Use of FRB/US and other multipliers to calibrate GDP responses to changes in financial and fiscal conditions

Bottom up:
  - Decentralized
  - Reduced-form and semi-structural models used to inform judgment
  - Top-down and bottom-up tensions resolved through negotiation
Examples of medium-term models

• Okun’s Law
  • Linking GDP and labor-market forecasts

• Reduced-form consumption models
  • Relating consumer spending to income, financial conditions, consumer sentiment, and other factors

• Semi-structural models of investment
  • Relating investment to business output and the user cost of capital
  • “Accelerator”

• Reduced-form Phillips-curve models of inflation
1.3 The Long-Term Forecast

• We recently adopted a simple semi-structural model to generate our long-term forecast.
  • Core is a New Keynesian “three-equation model.”
• This model is close in spirit to a DSGE model.
• It is calibrated to have properties similar to our main large-scale semi-structural model, FRB/US.
Experience with our long-term model

• In use since beginning of 2016.
• Difficult to evaluate forecast performance of a long-term model.
• In our view, simple structure is a virtue:
  ➢ Very easy to use and explain.
2. **Will DSGE models eventually improve enough to replace semi-structural models?**

DSGE models can be assessed on two key dimensions:

1. Forecasting
2. Story telling
2.1 EDO’s forecast performance

- EDO is the Board staff’s oldest domestically oriented DSGE model: In use since 2009.
- As a reminder, the Board staff doesn’t use EDO—or any other one model—to generate its baseline forecast.
- It is nonetheless of interest to compare EDO’s real-time forecasting performance with that of the Survey of Professional Forecasters (SPF).
Real GDP, Trillions of 2009 Dollars

EDO (red) vs. SPF (blue) GDP forecasts

Year

2009 Dollars, Trillions

2009
2010
2011
2012
2013
2014
2015
2016
EDO has performed somewhat less well

• Four-quarter-ahead RMSE is about 12 percent higher than the SPF.

But

• SPF is an average over many forecasts—an advantage in forecasting.
• A disadvantage in story-telling.
2.2 Models and stories

• In principle, DSGE models are well-suited to story-telling.
  • Because they are structural.
• Many practical policymakers disagree.
  Blanchard: *DSGE models are bad communications devices.*
Models and stories, continued

• Greater flexibility in model structure is an advantage of semi-structural models.
  • Don’t need to wait for theory to catch up.

• Example: Wealth effect on labor supply.
  • Some more-recent DSGE models have dropped it.

• There are lessons in both directions.
  • For example, in FRB/US, all dynamics are determined by adjustment costs. Would probably want to allow for serially correlated errors.

• Possible outcome: Eventual convergence.
  • Theoretical stories catch up with reality.
  • Better understanding of theoretical stories.
2.3 How we use structural models at the FRBOG

- Not for forecasting
- But we have long used our workhorse semi-structural model, FRB/US, for many other purposes.
  - Alternative scenarios
  - Assessment of policy strategies
    - *We currently use DSGE models alongside FRB/US for these purposes.*
- As just noted, we recently moved away from FRB/US, toward a simpler semi-structural model, for our long-term forecast.
  - Closer to a DSGE model
3. Nonstandard data at the FRBOG

• Looking at a broad range of new data sources
• Current view is that search data are not very helpful.
• The experience of an early experiment in this area, Google Flu Trends
  ➢ Top search result:
WHAT WE CAN LEARN FROM THE EPIC FAILURE OF GOOGLE FLU TRENDS
Nonstandard data, continued

• More promising are transactions data.
  • Credit-card transactions
  • Payroll processing data
• Working with traditional statistical agencies to improve timeliness, coverage, sample sizes.
• Evolutionary, not revolutionary
4. The regime-based approach

• Forecasting approach recently adopted by the St. Louis Fed
• While the St. Louis forecast is formally judgmental, it has many points of contact with a **Markov-switching approach**.
  • Focus on infrequent changes in regime.
• Will therefore consider some issues with forecasts in a formal Markov-switching approach
Forecasting in the face of nonlinearities

• Casually, Board staff would characterize their forecast as a mode rather than a mean.
  • Prompted by desire to have a narrative.
  • Brexit either happens or it doesn’t.
• In linear models with normal errors, the mean and the mode are the same, so there is no tension.
• But (U.S.) business cycle appears to be nonlinear.
  • Change in the unemployment rate is highly skewed.
Nonlinearities, continued

• One useful nonlinear model is the Markov-switching model.
• In a two-state Markov-switching model, mean and modal forecasts can differ substantially.
  • If the states are persistent, the modal forecast will initially involve staying in one of the states.
  • The mean forecast will instead be a weighted average of the two states.
• After a while, however, the probability of staying in the initial state becomes very low.
Preliminary assessment of regime approach

• Promising, because it recognizes the world isn’t linear.
• Unresolved issues about interpretation of longer-horizon forecasts.