The Diversity of Beliefs in Real Time: Estimates of Business Cycle Dynamics from Macroeconomic Models

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The Diversity of Beliefs about Business Cycle Dynamics

- Theoretical research emphasizes the potential importance of belief heterogeneity for explaining asset price and business cycle dynamics.
  - Kurz & co-authors, other papers in this workshop.
- Empirical applications use survey data to measure belief heterogeneity.
The Diversity of Beliefs about Business Cycle Dynamics

- But surveys provide no insight on why beliefs differ. The models of the forecasters are not available.
  - Potential sources of diversity across models and over time: different modeling assumptions/paradigms, different estimation methods, different data vintage and range.

- This talk:
  - Explore the use of a new database of empirical macroeconomic models to provide examples of representative beliefs and study sources of diversity.
  - Illustrate the effect of modeling assumptions, data revisions and new data on real-time estimates of business cycle dynamics. (Example: output gaps and forecasts).

A New Database for Comparative Analysis of Macroeconomic Models

- Economy-wide dynamic stochastic models that may be used
  - by central banks and finance ministries for designing monetary and fiscal stabilization policies that help reduce macroeconomic fluctuations.
  - business economists to assess macroeconomic fluctuations and likely policy responses,
  - as an input for decision analysis by asset managers, banks, other large enterprises.
Overall Research Agenda

- All models wrong. Some may be particularly biased. But to beat a model, you need one. Competition is good.
- Create an archive of macro models and a platform for easy comparison (*Dynare/Matlab*) .
  - Comparative instead of insular approach to model development.
  - Useful for evaluating the robustness of policies. Discretionary actions as well as rules.
  - Provides a new perspective on the diversity of model-based estimates and forecasts.

Earlier Comparison Projects

- Brookings Institution:
  Bryant, Currie, Frenkel, Masson, Portes, (eds.) (1989), and Bryant, Hooper, Mann (eds) (1993) (Taylor rule)
- NBER:
  Taylor (ed.) (1999)

*Note! Comparisons involved researcher teams, each working with its own model. Instead, we build a platform that makes a large range of models usable for individual researchers and adding models easy.*
Models in the Data Base (July 09)

- Estimated or calibrated macroeconomic models of the U.S. economy.
- Estimated or calibrated models of the euro area economy.
- Some estimated or calibrated multi-country models (G-3, G-7).
- Some simple, calibrated textbook-style models.

Models of the U.S. Economy

- Taylor (1993) (G7)
- Smets and Wouters (AER 2007)
- FRB SIGMA: Erceg et al 2008 (2 countries)
Models of the Euro Area Economy

- Smets and Wouters (JEEA 2003)
- Coenen and Wieland (EER 2005)
- Laxton and Pesenti (JME 2003) (2 countries)
- EU-Quest: Ratto, Roeger, in’t Veld, (2009)

Papers Using the Data Base

- “Surprising comparative properties of monetary models: Results from a new model data base“, Taylor, Wieland, NBER WP 14849, April 2009.
- “Keynesian government spending multipliers and spillovers in the euro area“, Cwik, Wieland, CEPR DP 7389, August 2009.
Estimating the Business Cycle in Real Time

M. Wolters & V. Wieland, work in progress.

1. Consider multiple models (of beliefs) regarding the U.S. economy.
3. Re-estimate models on successive data vintages.
4. Compare key characteristics of the business cycle (e.g. the output gap) across models, over time and across vintages.

U.S: Models and Output Gaps

- Compare:
  - Simple New-Keynesian model (explains output, inflation and interest rates).
  - Medium-sized New-Keynesian DSGE model (Christiano, Eichenbaum and Evans (2005), version of Smets and Wouters (2007)).
  - Simple trend-based models of output gap for traditional Phillips curves (linear trend, HP filter, quadratic trend).
  - Expert views: Congressional Budget Office, CEA and Federal Reserve staff estimates.
Output Gaps and Business Cycle Dynamics

- Gaps plays key role in shaping beliefs and output and inflation forecasts based on Keynesian-style models and thinking.

\[ \pi_t^V = \beta^{M,V} \pi_{t+1|t,M,V}^e + \alpha^{M,V} (y_t^V - z_t^{M,V}) + \epsilon_t^{M,V} \]

\( \pi \): inflation, \( y \): output, \( z \): potential/natural output
\( \alpha \): parameter, \( \epsilon \): shock
subscripts: \( t \) = time period
superscripts: \( e \) = expectations
\( M \) = estimates depend on model
\( V \) = estimates depend on data vintage

Medium-Sized New-Keynesian DSGE Model


- Micro-foundations, i.e. cross-equation restrictions from optimizing behavior of representative households & firms.
- Rational expectations.
- Model labor supply and capital accumulation explicitly and allow for technology shocks.
- Price and wage rigidities due to Calvo contracts and indexation.
- Serial correlation of economic shocks.
Estimation Methods


- For simple and medium-sized NK model, we apply the Bayesian estimation methodology to successive data vintages.
  - Posterior distributions and parameters calculated as in Schorfheide (2000).

- Simple gap models are estimated recursively by least squares and HP filter.

Data Series, Ranges and Vintages

- Up to 7 data series: real GDP/GNP, GNP/GDP deflator, personal consumption, fixed private investment, hours and employment data, wages, federal funds rates.

- We use data vintages from 1972 to 2008. The sample begins in 1964.

- End of vintage data is spliced with now-cast from the Fed staff.
  - Model-based gaps are calculated based on information that is comparable to the information underlying the Expert views (CBO, FED, CEA).
Diverse Output Gap Estimates: Vintage 08:4

Output Gap Estimates: 05:1-08:4
Some Historical Real-Time Analysis

- Quantify differences in output gap estimates due to choice of model, data revision, new data!

  VINTAGE PERSPECTIVE: Focus on interesting vintages. Compare models.

  REVISION VS HORIZON EFFECT: Look at impact of data revision and extension of data horizon.

  BELIEF DISPERSION: Measure time-varying dispersion of (end-point) output gap estimates.
Select Vintages

1972:1: first oil shock
1979:1: oil price shocks, two recessions and productivity decline
1982:3: Volcker disinflation and recession
1987:3: up to stock market crash
1991:1: up to credit crunch recession
2008:4: 02 recession, great moderation continued up to financial crisis.
Some Findings

- **1972-82**: CEA-FED expert views substantially lower than model-based estimates in recessions.
- Output gap estimates are quite diverse, particularly at the end points.
- Output gap estimates vary over time and are positively correlated.
- Output gap estimates are also strongly correlated with NBER business cycle dates.
Data Revision vs Horizon Effect: 79:1

Smets and Wouters

Linear Trend Gap

Data Revision and Horizon Effect: 82:3

Smets and Wouters

HP Filter Gap
Data Revision and Horizon Effect: 82:3

Simple NK Model

Expert View

Output Gap Dispersion 2008
Output Gap Dispersion
Vintages 79:1 and 82:3

Conclusions

- Model database offers perspective on diversity of beliefs regarding output gaps (or other unobservable characteristics of business cycle and policy) due to modelling assumptions.
- Matching with real-time data base allows to study the effect of data revisions, re-definitions, and data range on the time-varying beliefs.
- Economically significant diversity of output gap estimates, gap estimates are correlated, also with NBER dates.
- Data revisions and data range effects are economically significant.
Plan for Model Data Base

- Publish modelbase along with paper and applications.
- Make platform widely available via website for download.
- Create self-sustaining protocol for inclusion of new models by model authors.