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

\[ \pi_t^V = \beta_{M,V}^{M,V} \pi_{t+1|t,M,V}^e + \alpha_{M,V}^{M,V} \left( y_t^V - z_t^{M,V} \right) + \varepsilon_t^{M,V} \]

\( \pi \): inflation, \( y \): output, \( z \): potential/natural output
\( \alpha \): parameter, \( \varepsilon \): 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
Quarterly Inflation Forecasts

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.

1972:1

\[ \text{Smets and Wouters (wages, hours unobs.)} \]
\[ \text{Simple NK model} \]
\[ \text{CEA} \]
\[ \text{Linear trend} \]
\[ \text{HP filter} \]
1979:1
Smets and Wouters
(wages, hours unobs.)
Simple NK model
CEA (ann.)
Linear trend
HP filter

1982:3
Smets and Wouters
(wages, hours unobs.)
Simple NK model
FED
Linear trend
HP filter
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

Output Gap Dispersion 2008
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.