Recent Developments in Forecasting with DSGE Models

Michael Cai, Marco Del Negro, Marc P. Giannoni, Abhi Gupta, Pearl Li, Erica Moszkowski
Federal Reserve Banks of New York and Dallas, and HBS

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Disclaimer: The views expressed here do not necessarily reflect those of the Federal Reserve Bank of New York and Dallas or the Federal Reserve System
The Questions

1. Did modern structural macroeconometric models (DSGEs) live up to their promise? A *post-mortem* ("DSGE Forecasts of the Lost Recovery")

2. Why? What features affected their performance?
Forecasts in the Aftermath of the Great Recession

• The years following the Great Recession have been challenging – also from a forecasting point of view

  • Deep recession not followed by a swift recovery — unlike in previous post-war deep recessions. Instead, *large and persistent output gaps* (*lost recovery*)

  • These large gaps were however not associated with negative inflation, as a traditional Phillips curve relationship would have predicted (*“missing deflation”*)
Forecasts in the Aftermath of the Great Recession

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• These large gaps were however not associated with negative inflation, as a traditional Phillips curve relationship would have predicted ("missing deflation")

• Short term interest rates stuck at the ZLB

• Unconventional monetary policy: QE and forward guidance
How Did DSGE Models Fare?

• How did actual DSGE models used in central banks — such as the *NY Fed DSGE* model — fare?

  • **Real real time forecasts**: *Actual forecasts* produced regularly as part of the policy process — since 2014 the *NY Fed Liberty Street Blog* publishes these forecasts regularly.
How Did DSGE Models Fare?

Liberty Street Economics

SEPTEMBER 08, 2017

The New York Fed DSGE Model Forecast—August 2017

Michael Cai, Marc Giannoni, Abhi Gupta, Pearl Li, and Argia Sbordone

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<td>GDP growth (Q4/Q4)</td>
<td>2.0</td>
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<td>2.1</td>
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<td>Core PCE inflation (Q4/Q4)</td>
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<td>1.5</td>
<td>1.3</td>
<td>1.5</td>
<td>1.5</td>
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<td>Real natural rate of interest (Q4)</td>
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<td>1.0</td>
<td>1.0</td>
<td>1.1</td>
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Forecasts of Output Growth

Four-quarter percentage change

Quarter-to-quarter percentage change, annualized

Current Forecast

Forecasts Compared
How Did DSGE Models Fare?

- How did actual DSGE models used in central banks — such as the *NY Fed DSGE* model — fare?

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- What **features** matter for forecasting accuracy? What class of DSGE models performed better in terms of **pseudo real time out-of-sample forecast accuracy** (extend the results in Edge and Gürkaynak (BPEA, 2010), Del Negro and Schorfheide (Handbook of Economic Forecasting II, 2013)?
How Did DSGE Models Fare?

ECONOMICS

Economics Struggles to Cope With Reality

By Noah Smith

“... most people outside the discipline who take one look at these models [DSGEs] immediately think they’re kind of a joke. They contain so many unrealistic assumptions that they probably have little chance of capturing reality. Their forecasting performance is abysmal. Some of their core elements are clearly broken. Any rigorous statistical tests tend to reject these models instantly, because they always include a hefty dose of fantasy.”
How Did the NY Fed DSGE Models Fare?

**RMSEs** vs Blue Chip/SPF/SEP (FOMC); Jan 2011-Jan 2016

### Output Growth

<table>
<thead>
<tr>
<th>Model</th>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
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### Core PCE Inflation

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<tr>
<td>SEP</td>
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**Legend**

- Blue Chip
- SPF
- SEP
“Real” Real Time Forecasts from NY Fed DSGE

Output Growth

Core PCE Inflation

2011Q1

- Unlike the SEP participants, the NY Fed DSGE model projects a slow recovery from the financial crisis (Reinhard and Rogoff, 2009)
- Because it attributes the crisis to a financial shock
“Real” Real Time Forecasts from NY Fed DSGE

Evolution of 4Q forecasts

Output Growth

2012Q1

Core PCE Inflation

2013Q1

2012 2013 2014 2015
1.2 1.4 1.6 1.8 2.0
Real GDP Growth

2012 2013 2014 2015
1.2 1.4 1.6 1.8 2.0
Core PCE Inflation
“Real” Real Time Forecasts from NY Fed DSGE
Evolution of 4Q forecasts

Output Growth

Core PCE Inflation

2014Q1

2015Q1
“Real” Real Time Forecasts from NY Fed DSGE

Evolution of 4Q forecasts

Output Growth

Core PCE Inflation

2016Q1
DSGE Models

- **SW** – Smets & Wouters (2007)
  - Observables: the growth rate of real output, consumption, investment, and real wages, hours worked, GDP deflator inflation, FFR

- **SW_{\pi}** – Del Negro and Schorfheide (2013) *Handbook of Economic Forecasting chapter*
  - Features: TV inflation target
  - Observables: SW + long run inflation expectations

  - Features: SW_{\pi} + financial frictions as in Bernanke, Gertler, and Gilchrist, 1999/Christiano, Motto, and Rostagno (2014)
  - Observables: SW_{\pi} + Baa/Treasury Spreads
Are All DSGEs the Same?  RMSEs: Jan 2011-Jan 2016

**SWFF**

- **Real GDP Growth**
- **GDP Deflator Inflation**
- **Nominal FFR**

**SW**

- **Real GDP Growth**
- **GDP Deflator Inflation**
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What’s Wrong with Smets and Wouters? (The Model)

1) Expects the Gaps to Close Fast
What’s Wrong with Smets and Wouters? (The Model)

1) Expects the Gaps to Close Fast

2) Fwd guidance puzzle: Conditioning on FFR Expectations makes forecasts worse
The Financial Friction Model Instead ...

1) Expects the Gaps to Close Only Very Slowly

[Graphs showing real GDP growth, GDP deflator inflation, and nominal FFR from 2010 to 2015]
The Financial Friction Model Instead ...

1) Expects the Gaps to Close Only Very Slowly

2) Effects of Conditioning on FFR Expectations More Muted
Impulse Responses of Real GDP Growth

\( b \) (Risk Premium)

\( \mu \) (MEI)

\( r \) (Monetary Policy)
SWFF Forecast of the 1982 Recession

Real GDP Growth

-7.5
-5.0
-2.5
0.0
2.5
5.0
7.5
Conditioning on FFR Path Hurts SW On Average

Without ...

And With Conditioning on FFR Expectations
Does Conditioning on FFR Expectations Help?

SWFF Model: Jan 2011-Jan 2016

No Conditioning

Conditioning on FFR Expectations
Does Conditioning on Nowcasts Help?
SWFF Model: Jan 2011-Jan 2016

No Conditioning

Conditioning on Nowcast
Whole Sample vs Post-Great Recession
SWFF vs Blue Chip RMSEs

Whole Sample: Jan 1992-Jan 2016

Post Great Recession: Jan 2011-Jan 2016
Conclusions

• Arguably medium-scale DSGE models kept some of the promises made in early 2000s (Smets and Wouters): Theory-based models flexible enough to fit the data out-of-sample, and useful in many dimensions for policy analysis (e.g., tracing the macroeconomic impact of financial shocks, ...)

• DSGEs with financial frictions in general, and the NY Fed DSGE model in particular, do not seem to fare too poorly in terms of forecasting output growth and inflation — even in the difficult post-Great Recession period

• This is the case for both pseudo and real time projections

• ... and even conditioning on FFR projections (forward guidance)

• A good starting point helps forecasting accuracy, especially for inflation

• Financial friction DSGEs still see open gaps as of 2017, hence project inflation to remain below 2%
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