The Dynamic Effects of Forward Guidance Shocks

Brent Bundick & A. Lee Smith
Federal Reserve Bank of Kansas City

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The opinions expressed herein are those of the authors and do not reflect the views of the Federal Reserve Bank of Kansas City or Federal Reserve System.
Forward Guidance Shocks at the Zero Lower Bound

What are the dynamic effects of forward guidance shocks on macroeconomic aggregates at the zero lower bound?

Can a standard DSGE model generate these estimated dynamics?
Forward Guidance Shocks at the Zero Lower Bound

What are the dynamic effects of forward guidance shocks on macroeconomic aggregates at the zero lower bound?

⇒ Forward guidance shocks which lower expected future policy rates increase economic activity and prices.

Can a standard DSGE model generate these estimated dynamics?

⇒ Yes, a small scale New-Keynesian model can generate similar impulse responses.

⇒ Key is to use interest rate futures contracts to discipline the size of the forward guidance shock in the model.
Our Empirical Approach

We combine a high-frequency event study approach with traditional monetary VARs.

⇒ Isolate the surprise component of monetary policy from interest rate futures.

⇒ To measure the macroeconomic effects we input our high-frequency policy surprises into a monthly VAR.
High-Frequency Identification

Well-suited to extract forward guidance surprises.

⇒ We use a daily event window.

⇒ Implied interest-rate expectations are extracted from federal funds futures markets.

⇒ We scale the monthly policy surprises to convert them into FOMC meeting frequency surprises.
VAR Model

We input our high-frequency policy surprises into a monthly VAR with macroeconomic aggregates.

⇒ Sample is December 2008-December 2014.

Macroeconomic Data: GDP, GDP deflator, Investment, and Capacity Utilization.

Monetary Policy: The policy surprise associated with the expected federal funds rate after the 7th next FOMC meeting.

⇒ Order policy last in a recursive VAR.
Empirical Responses to Forward Guidance Shock
Forward guidance shocks which lower rates are stimulatory

We have found this result to be robust to:

⇒ Using longer-dated OIS and Eurodollar interest rate futures.

⇒ Using principle components from a vector of interest-rate futures.

⇒ Using other measures of economic activity and prices.

⇒ Including the release of the minutes and the FOMC chair’s bi-annual congressional testimony in our event set.

⇒ Alternative VAR orderings.
Mapping results into a DSGE Model

We now estimate a small three variable VAR.

⇒ Consumption and Core PCE prices

⇒ Policy surprise is extracted from the 12-month ahead federal funds future contract.

These components can be mapped into a small-scale New-Keynesian model.
Mapping forward guidance shocks into a DSGE Model

Consumption

Price Level

12–Month Ahead Futures

Impulse Response

80% Credible Set
Can a standard business cycle generate these estimated dynamics?

New-Keynesian sticky price model without capital
⇒ Shares features with models by Ireland (2003, 2010).

Firms employ labor & produce
⇒ Quadratic cost of adjusting prices.

Household consumes, works, & receives firm dividends
⇒ External habits in consumption.
⇒ The household’s SDF prices federal funds futures contracts.
Monetary Policy

\[ r^d_t = \phi_r r^d_{t-1} + \left(1 - \phi_r\right) \left( r + \phi_\pi \left( E_{t-1} \pi_t - \pi \right) + \phi_x E_{t-1} x_t \right) + \nu_t \]

\[ r_t = \max\left(0, r^d_t\right) \]

\[ \nu_t = \rho_\nu \nu_{t-1} + \sigma_\nu \varepsilon_t^\nu \]

At ZLB: Forward guidance shock.

Away from ZLB: Conventional monetary policy shock.
The non-linear model is solved using the OccBin toolkit
⇒ Efficient algorithm allows for model estimation.
⇒ A good approximation to the global solution.

Estimate the key model parameters using IRF matching
⇒ Minimize the distance between the data and the model counterparts following a forward guidance shock.

Simulating a forward guidance shock at the ZLB:
1. Use an aggregate demand shock to drive economy to ZLB.
2. Simulate an innovation to the C.B.’s desired rate.
Can a standard model generate the estimated dynamics?

Consumption

Price Level

12-Month Ahead Futures
Conclusion

We find no disconnect between empirical evidence of the dynamic effects of forward guidance shocks and a standard DSGE model.

⇒ Forward guidance shocks revealing lower expected rates at the zero lower bound are stimulatory.

⇒ A fairly standard model can generate these dynamics.

Key to our approach is using interest rate futures contracts to link the forward guidance shocks in the data and the model.
Additional Details
Additional Model-Implied Responses

**Consumption**

**Price Level**

**Real Interest Rate**

**1-Month Ahead Futures**

**6-Month Ahead Futures**

**12-Month Ahead Futures**
Global Solution and OccBin Solution

![Graphs showing consumption, price level, nominal interest rate, 1-month ahead futures, 6-month ahead futures, and 12-month ahead futures.](image-url)
36 Month USD OIS

- **GDP**: Indicates a steady increase in the percentage over time, peaking around the 36-month mark.
- **Core Capital Goods**: Shows a slight initial rise followed by a decrease, stabilizing around the 36-month mark.
- **Capacity Utilization**: Displays a gradual increase with a slight fluctuation, reaching a plateau near the 36-month mark.
- **GDP Deflator**: Exhibits a consistent rise, peaking at the 36-month mark.
- **36-Month USD OIS**: Demonstrates a decline trend with a significant drop at the 36-month mark.

Each graph includes an impulse response and an 80% credible set, providing a range of possible outcomes.
Industrial Production

- Industrial Production
- Core Capital Goods
- Capacity Utilization
- Core PPI Finished Goods
- Funds Rate After 7th Meeting

Impulse Response
80% Confidence Interval
Policy Ordered First

GDP

Core Capital Goods

Capacity Utilization

GDP Deflator

Funds Rate After 7th Meeting

Impulse Response

80% Credible Set
Forward Guidance Pre-ZLB

GDP

Core Capital Goods

Capacity Utilization

GDP Deflator

GSS Path Factor

Impulse Response 80% Credible Set
Relationship to previous work
The Forward Guidance Puzzle

One-Month Extension of Zero Lower Bound Duration

- **Consumption**
- **Price Level**
- **Nominal Interest Rate**

One-Year Extension of Zero Lower Bound Duration

- **Consumption**
- **Price Level**
- **Nominal Interest Rate**
<table>
<thead>
<tr>
<th>Forecast</th>
<th>Differences</th>
<th>Levels</th>
<th>Levels</th>
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<tr>
<td></td>
<td>Levels</td>
<td>Lags of Depended</td>
<td>Lags of Each</td>
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<td><strong>Unemployment Rate</strong></td>
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<td>Next Quarter</td>
<td>$\Delta M P_{t-1}$</td>
<td>$-1.32^{***}$</td>
<td>$M P_{t-1}$</td>
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<td>$M P_{t-2}$</td>
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<td>2 quarters ahead</td>
<td>$\Delta M P_{t-1}$</td>
<td>$-1.09^{***}$</td>
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<td>3 quarters ahead</td>
<td>$\Delta M P_{t-1}$</td>
<td>$-0.89^{***}$</td>
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<td>4 quarters ahead</td>
<td>$\Delta M P_{t-1}$</td>
<td>$-0.66^{***}$</td>
<td>$M P_{t-1}$</td>
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Forward Guidance Shocks & Blue Chip Forecasts

B.C. 4–Q Urate Forecast

B.C. 4–Q GDP Deflator Forecast

GSS Path Factor

Impulse Response
80% Credible Set
Data
Policy Surprises

High-Frequency Policy Surprises

- 7th Next FOMC Meeting
- GSS Path Factor
- 36 Month USD OIS