Forward Guidance in the Yield Curve: Short Rates Versus Bond Supply
by Greenwood, Hanson and Vayanos

Discussant: Annette Vissing-Jorgensen, UC Berkeley

Question:

• What’s the impact of forward guidance about bond supply on yields?
• How does it compare to forward guidance about the short rate?
• Did markets view QE announcements as being about supply or short rate?

Model with two policy channels:

• Supply guidance works via duration risk premium
• Short-rate guidance works via expectations hypothesis
Findings:

- **Supply guidance** tends to have **hump-shaped effect** on yield curve:
  Even if supply change peaks 1 year out, yield effect peaks at much longer maturity (11.5 years in benchmark example)

- **Short rate guidance** may also have **hump-shaped effect** on yield curve
  But the hump from short rate guidance tend to be at shorter maturity.

- Since actual humps were around 10 years (for zero-coupon Treasuries and expansionary announcements), they probably were **mainly due to supply guidance**.
Objective of discussion:

1. Help you understand how supply guidance affects yields. Why is the effect hump-shaped? What are the moving parts?

2. QE channels. Other evidence suggests duration risk channel may be smaller than argued here.

3. UK evidence suggest that arbitrageurs don’t integrate markets as much as current paper suggests: Very maturity specific effects for bonds (gilts) to be purchased – local safety demand effects.

4. Why should policy makers care how QE works?

5. Thoughts on QE effects in US being larger than found from event studies.
How does supply guidance affect yields in this type of model?

To get the intuition, consider a much simpler version:

- One shock only, to the current short rate.
- Supply is exogenous and non-stochastic.
- Consider comparative statics for supply path.

**Instantaneous expected excess return** on $\tau$-period zero coupon bond:

\[
\mu^\tau_t - r_t = A_r(\tau) \lambda_{r,t}: \text{Sensitivity of price to short-rate shocks} \\
\times \text{Risk premium for short-rate shocks}
\]

\[
\lambda_{r,t} = a \sigma_r^2 \times \int_0^T x_t^\tau A_r(\tau) d\tau \\
= a \sigma_r^2 \times \text{Total sensitivity of arbitrageur’s portfolio to short-rate shocks}
\]
Assume supplies (to be held by the arbitrageur, after Fed purchases) of all maturities move based on one supply variable, $\beta_t$:

$$x_t^T = \varsigma(\tau) + \theta(\tau) \beta_t$$

Then the risk premium for short-rate shocks depends on $\beta_t$:

$$
\lambda_{r,t} = a \sigma_r^2 \times \int_0^T \left[ \varsigma(\tau) + \theta(\tau) \beta_t \right] A_r(\tau) \, d\tau
= \text{const}(\tau) + a \sigma_r^2 I_r \beta_t, \quad \text{where } I_r = \int_0^T \theta(\tau) A_r(\tau) \, d\tau
$$
The Fed controls the path of supply, $\beta_{t+h}$ for $h \geq 0$, and thus the path for the risk-premium, $\lambda_{r,t+h}$ for $h \geq 0$.

\[
\mu_{t+h}^\tau - r_{t+h} = A_r (\tau - h) \lambda_{r,t+h}
\]

\[
\frac{d}{d\beta_{t+h}} \left( \mu_{t+h}^\tau - r_{t+h} \right) = A_r (\tau - h) \frac{d\lambda_{r,t+h}}{d\beta_{t+h}} = A_r (\tau - h) a\sigma_r^2 I_r
\]

\[
P_t^\tau = e^{-\int_0^\tau \mu_{t+h}^\tau \, dh}
\]

\[
y_t^\tau = -\frac{1}{\tau} \ln P_t^\tau = \frac{1}{\tau} \int_0^\tau \mu_{t+h}^\tau \, dh
\]

\[
dy_t^\tau = -\frac{1}{\tau} d\ln P_t^\tau = \frac{1}{\tau} \int_0^\tau A_r (\tau - h) \frac{d\lambda_{r,t+h}}{d\beta_{t+h}} d\beta_{t+h} \, dh = \frac{1}{\tau} \int_0^\tau \left[ A_r (\tau - h) a\sigma_r^2 I_r \right] d\beta_{t+h} \, dh
\]
So which bond reacts more to what path of supply guidance???

- **Permanent reduction in bond supply:**
  Lowers duration risk premium at all horizons \( (\lambda_{r,t+h}) \).
  Longer bond yields move more: At each point in time they have more duration risk \( (A_{r}(\tau-h)) \)

- **Temporary (medium-term) reduction in bond supply:**
  Moves only front part of schedule of duration risk premia \( (\lambda_{r,t+h}) \)

- **Short bond:**
  1) Risk premium for duration risk shifts for its *whole life*
  2) But at each point in time, it has *low duration risk*
  \( \rightarrow \) Bond yield doesn’t move much
• **Medium term bond:**
  1) Risk premium for duration risk shifts for its *whole life*
  2) At each point in time: *More duration risk* than short bond
     → Yield moves more than yield of short bond

• **Long term bond:**
  1) Risk premium for duration risk shifts for only *part of its life*
  2) At each point in time: *More duration risk* than medium-term bond
     → Yield may move more or less than that of the medium bond
What is important here is to think of the risk premium for duration risk not just as a number, but as a whole path, determined by path of bond supply.

- Prior work (myself and Arvind included) and even subsequent work thought of the duration risk effects of QE as increasing in maturity.
- This implicitly assumed quite persistent QE bond holdings.

The hump-shaped yield effect of supply insight is in Greenwood-Vayanos.

- Novelty in current paper is to add stochastic targets for bond supply and the short rate and compare yield impacts of those shocks.
(2) QE channels. Other evidence on the size of the duration risk channel

\[ r_{\text{long-term, real}} \]

\[ = E[r_{\text{safe, liq, short-term, nominal}}] \text{: Signaling channel} \]

\[ + \text{Duration} \times P_{\text{Duration Risk}} \text{: Duration risk channel} \]

\[ + \text{Reden. risk} \times P_{\text{Reden. risk}} \text{: ``Grexit'' channel} \]

\[ - \pi^e \text{: Inflation channel} \]

\[-\text{Degree of extreme safety} \times P_{\text{Safety}} \text{: Safety channel} \]

\[-\text{Liquidity} \times P_{\text{Liquidity}} \text{: Liq. channel} \]

\[ + \text{Default Risk} \times P_{\text{Default Risk}} \text{: Default channel} \]

\[ + \text{Prepayment Risk} \times P_{\text{Prep. Risk}} \text{: Prep. risk channel} \]

\[-\text{Degree of prod. MBS scarcity} \times P_{\text{Scarcity}} \text{: MBS scarcity channel} \]
• **Current paper says:**
  If you ignore all but the first two channels, the duration risk channel can explain the impact of QE better than the signaling channel.

• **But Treasury yields are also affected via some of the other channels:**
  - **Safety channel:** Preferred habitat demand for particular maturities, but potentially only for low-default risk securities. Treasury-QE makes Treasuries even more scarce than they already were.
  
  - **Liquidity effects:** QE paid for with reserves which are more liquid $\rightarrow$ liquidity yield discounts get smaller $\rightarrow$ *increases* yields on more liquid securities (modeled carefully in Moritz Lenel’s job market paper)

• We have evidence of these but we **don’t have a good sense of the term structure of these other channels.** Too early to conclude that hump-shape means duration risk is the dominant channel.
Evidence from less safe bonds suggest duration risk channel may be small, both for US and Eurozone QE

**US:** Corporate bonds are informative about duration risk channel (less affected by safety and liquidity channels)

\[
 r_{\text{long-term,nominal}} = E[r_{\text{safe, liq, short-term,nominal}}] \quad : \text{Signaling channel} \\
 + \text{Duration} \times P_{\text{DurationRisk}} \quad : \text{Duration risk channel} \\
 + \text{DefaultRisk} \times P_{\text{DefaultRisk}} \quad : \text{Default channel}
\]
<table>
<thead>
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<td><strong>Fed Funds Futures</strong></td>
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<td>12\textsuperscript{th}  month</td>
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<td>-4</td>
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<td>24\textsuperscript{th}  month</td>
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<td><strong>Implied Signaling Effect</strong></td>
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<td>5-year</td>
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Source: Krishnamurthy and Vissing-Jorgensen (2013)
• For lower-grade bonds, **CDS-adj. yield changes capture signaling +duration risk channels**: Based on Baa bonds all but perhaps 20 bps can be accounted for by signaling.

• Larger effects on CDS-adjusted safer bonds (Aaa, Aa, A corporates for QE1 and Treasuries for QE1 and QE2) likely driven by **safety effects**.

<table>
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<tr>
<th>QE1, 2-day changes</th>
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Eurozone: Non-German bonds are informative about duration risk channel (less affected by safety and liquidity channels)

\[
\begin{align*}
\hat{r}_{\text{long-term, nominal}} &= E[r_{\text{safe, liq, short-term, nominal}}] \quad : \text{Signaling channel} \\
&+ \text{Duration} \times P_{\text{DurationRisk}} \quad : \text{Duration risk channel} \\
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&+ \text{DefaultRisk} \times P_{\text{DefaultRisk}} \quad : \text{Default channel}
\end{align*}
\]
From Altavilla, Carboni and Motto (2015):

- Size of ECB QE is about 11% of GDP, comparable to US QE1.

Higher risk bonds react more – there’s more to this than duration risk.
For non-safe haven bonds, this is signaling+duration risk+redenom. channels: Based on 2-day changes for Italy and Spain, these are small (+9 bps, -12 bps)

Larger effect for safe-haven bonds (Germany -23 bps, France -20 bps), likely driven by safety effects.

Signaling channel is small (authors document that)
Note about redenomination: Non-G7 CDS contracts cover redenomination risk, see Krishnamurthy, Nagel and Vissing-Jorgensen (2015). So for Spain the numbers above are signaling plus duration risk channels.
UK evidence suggest that arbitrageurs don’t integrate markets as much as current paper suggests: Very maturity specific effects for bonds (gilts) to be purchased – local safety demand effects

Joyce, Lasaosa, Stevens and Tong (2011)
McLaren, Banerjee and Latto (2014)

11 February 2009  February Inflation Report and associated press conference give strong indication that gilt purchases financed using central bank money are likely. But no details on the quantity or distribution of purchases

5 March 2009  MPC statement announces that Bank Rate is to be reduced to 0.5%, and that the MPC will purchase £75 billion of assets, primarily conventional gilts, over three months financed by the issue of central bank money. Market Notice later that afternoon confirms that purchases are to be split between two auction maturity sectors for gilts with remaining maturities of:

(i) 5–10 years
(ii) 10–25 years
6 August 2009  MPC statement announces that QE asset purchases will be extended by £50 billion to £175 billion. Accompanying Market Notice announces that buying range is to be extended to all conventional gilts with residual maturity greater than three years, and that purchases are to be split between three auction maturity sectors for gilts with remaining maturities of:

(i) 3–10 years
(ii) 10–25 years
(iii) 25 years and greater

9 February 2012  MPC statement announces that QE asset purchases will be extended by £50 billion to £325 billion. Accompanying Market Notice announces that purchases are to be split between three auction maturity sectors for gilts with remaining maturities of:

(i) 3–7 years
(ii) 7–15 years
(iii) 15 years and greater
Yield changes by maturity, Feb 10 to Feb 12, 2009:
Yield changes by maturity, Mar 4 to Mar 6, 2009:
Fig. 2. Relationship Between the News in the Market Notice and Two-day Change in Gilt Yields, August 2009
Fig. 1. *Relationship Between the News in the Market Notice and Two-day Change in Gilt Yields, February 2012*
Fig. 4. Relationship Between the Local Supply News in the Market Notice and Two-day Change in Yields, February 2012
Where does this maturity-specific demand for safe assets come from?

- Probably pension funds and insurance companies with particular liability maturities.
- Greenwood and Vissing-Jorgensen (in progress) document how loser regulations on Danish pension funds and ins. co’s in terms of discounting of liabilities past 20-years massively increased 30-year forward rates relative to 10-year forward rates:
(4) Why should policy makers care how QE works?

- To the extent QE has worked via signaling channel perhaps the same could be achieved with forward guidance about the short rate, i.e. without balance sheet risks.

- If channels are mainly general:
  - Doesn’t matter what the central bank buys
  - Central banks are not meddling in the economy (purchases don’t favor those whose bonds are bought)
  - We can use macro models with just one yield curve to assess possible real effects of QE.

Signaling and inflation channels (and maybe duration risk...) have been substantial general channels of QE.
But in practice, a lot of the QE effects are due to specific channels
- Specific channels important for both Treasuries, corporates and MBS
- Stuff you buy moves more than other stuff with similar duration.

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Source: Krishnamurthy and Vissing-Jorgensen (2013)
Thoughts on QE effects likely being much larger than we have estimated in event studies

- It’s very hard to figure out what all the right event dates to use are

- This is made even harder by growing evidence that a lot of Fed news doesn’t come out via announcements or public speeches, but via informal communication between Fed officials and members of the financial sector or media (Cieslak, Morse and Vissing-Jorgensen (2016)).

President Lacker (a regional Fed president) resigned last week over an Oct 2012 leak to a for-profit $120,000/year newsletter (Medley Global Advisors). The leak was that QE3 would add Treasuries at Dec. FOMC meeting. Other Fed officials are known to talk to Medley.
The Medley leak was not that unique. Bernanke using a “trial-balloon” leak to another newsletter in Aug 2011 to get feedback on whether MEP was a good idea:

“Hours after an Aug. 15 meeting with Federal Reserve Chairman Ben Bernanke in his office, Nancy Lazar made a hasty call to investor clients: The Fed was dusting off an obscure 1960s-era strategy known as Operation Twist...Ms. Lazar is among a group of well-connected investors and analysts with access to top Federal Reserve officials who give them a chance at early clues to the central bank's next policy moves; according to interviews and hundreds of pages of documents obtained by The Wall Street Journal through open records searches.” [WSJ, Nov 22, 2011]
- Furthermore, to the extent QE is predictable by economic news, part of the effect of QE comes on days on macro announcements, making it hard to disentangle them.

- Joyce et al (2011) studying the UK QE overcome this problem by using survey evidence on expected QE just before each major public announcement:
Regression coefficients reveals true effect of £1B on avg gilt yield. Total effect of UK QE (the early part they study) increases from around 90 bps to around 125 bps.

Fed has similar survey data from **Primary Dealer surveys** (public from 2011 on):

**Example: Sep 12, 2012 QE3 announcement:**

Before: Dealers expected MBS purchases of $200B in 2013
After: Dealers expected MBS purchases of $480B in 2013

So true effect on MBS yields is not 16 bps but 16 bps\*480/280=27 bps

Would be nice if Fed would share survey data back to 2008 so we could do this systematically for the US.