Inside the Black Box: Hamilton, Wu, and QE2.

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1“Quantitative Easing” November 24 2010; "Understanding fiscal and monetary policy in the great recession: Some unpleasant fiscal arithmetic." European Economic Review 55 2-30.(2011); http://faculty.chicagobooth.edu/john.cochrane/research/Papers/
Abstract: “at the zero lower bound, buying $400 billion in long-term maturities outright with newly created reserves...could reduce the 10-year rate by 13 basis points without raising short-term yields.”

Figure 13. Effects of two different maturity swaps when implemented at the zero lower bound. Dashed curve: Fed sells all its holdings of less than 1-year maturity and retires debt at the longest end of the maturity structure (plot of $5200b_n \phi \Delta$ as a function of $n$). Solid curve: Fed sells all its holdings of less than 1-year maturity and retires debt evenly across 2-1/2 to 10 year maturities (plot of $5200b_n \phi \Delta_2$).
Figure 3. Intra-day Yields and Trading Volume on QE2 Event Days

Panel A. Yields

Source: Krishnamurthy and Vissing-Jorgensen
Effect on yields, economy?

- **Yellen**: 25 bp. 700,000 jobs. All QE: 3m jobs
- **Bernanke**: Stock prices up, volatility down, bond spreads down, inflation up.
- **Plosser**: No employment effect, big risk of inflation from extra reserves.
- **This paper**: At $i = 0$, reserves are the same as debt. QE2 is exactly the same as a maturity shortening.
- **Ricardo / Barro / Modigliani and Miller**: 0 effect.
- **Non-Ricardo** (Cochrane, “Understanding policy”). $>0$
- Also required:
  - Additional “segmentation,” otherwise 600b is still small.
  - Liquidity (allows “arbitrage,” limited to treasuries) vs. limited risk bearing (in this paper).
Table 2: Responses of U.S. Interest Rates to News about the Second Round of Asset Purchases

<table>
<thead>
<tr>
<th>Date</th>
<th>10-Year Treasury Yield</th>
<th>10-Year TIPS Yield</th>
<th>30-Year MBS Yield</th>
<th>10-Year BBB Corporate Bond Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 10, 2010</td>
<td>-7</td>
<td>-9</td>
<td>-2</td>
<td>-1</td>
</tr>
<tr>
<td>Aug. 11 to Nov. 2, 2010</td>
<td>-11</td>
<td>-47</td>
<td>-9</td>
<td>-23</td>
</tr>
<tr>
<td>Nov. 3, 2010</td>
<td>3</td>
<td>2</td>
<td>-2</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: The table displays basis point changes from close of business on the day before the announcement to close of business on the day of the announcement, with the exception of Aug. 11 to Nov. 2, 2010, which shows the interperiod change. Changes in the 10-year nominal Treasury yield are computed using a smoothed yield curve estimated by staff from off-the-run Treasury coupon securities. Changes in the yield on 10-year Treasury inflation-protected securities (TIPS) are computed by staff using a smoothed inflation-indexed yield curve. Changes in the yield on 30-year mortgage-backed securities (MBS) are computed using Bloomberg data on securities issued by Fannie Mae. Changes in the yield on 10-year BBB corporate bonds are computed using a smoothed yield curve estimated by staff using Merrill Lynch data.

Source: Janet Yellen, AEA speech Jan 2011
Procedure:

1. Run regression

\[ f_{t+1} = c + \rho f_t + \phi q_t + \epsilon_{t+1} \]
\[ f_t = \begin{bmatrix} \text{level}_t & \text{slope}_t & \text{curve}_t \end{bmatrix} \]
\[ q_t = \text{function of bond supply} \]

2. Calculate \( q_t \) of QEII operation. Simulate the regression. Calculate.

\[ \text{yield}^{(n)}_t = b_n f_t \]

Problem 1: If the ATSM is right, \( f_t \) should incorporate all \( q_t \) information, \( \phi = 0. \) (p. 20, 21). \( P = E(m \times 1 | \text{all information}) \).

HW are not using the ATSM to infer the effect of bond supply. The results are not “structural”, they are just a regression.
Bond supply matters only if it exposes you to factor risk × factor risk premium. ("Limited risk bearing" segmentation, not "liquidity".)
Forecast yield changes with three linear combinations of supply, giving exposure of entire US govt bond portfolio to “level” “slope” and “curvature” shocks respectively.

Good idea in theory but let’s look at $q$...
Figure 7. Values of the three elements of $q_r - 100 \sum_{n=1}^{N} z_{nr} \beta_{nr}$ monthly from Jan 31, 1990 to July 31, 2007.
Only one forecasting factor here, not 3.

Results = a regression of yields on average maturity.

\[
\begin{bmatrix}
  y_{t+1}^{(10)} \\
  y_{t+1}^{(5)} \\
  y_{t+1}^{(1)}
\end{bmatrix}
= \rho
\begin{bmatrix}
  y_t^{(10)} \\
  y_t^{(5)} \\
  y_t^{(1)}
\end{bmatrix}
+ \phi(\text{av. Maturity}_t) + \epsilon_{t+1}
\]
Regression: 1990, 2000, 2003 maturity $\Rightarrow$ spreads. Structural?
### 74% Return-forecast R2?

<table>
<thead>
<tr>
<th>( r_{t+1}^{(2)} )</th>
<th>level</th>
<th>slope</th>
<th>curve</th>
<th>q1</th>
<th>q2</th>
<th>q3</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t )</td>
<td>3.26</td>
<td>-0.55</td>
<td>-3.34</td>
<td>33.56</td>
<td>-34.55</td>
<td>10.24</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>(0.9)</td>
<td>(-0.5)</td>
<td>(-0.7)</td>
<td>(-1.9)</td>
<td>(2.2)</td>
<td>(-0.8)</td>
<td></td>
</tr>
</tbody>
</table>

The table above shows the components of the forecast for different time periods. The graph below illustrates the trend over the years from 1992 to 2005, showing the projection of different components of the forecast.
A Few More Problems

- HW ignores market price of risk. Only supply corresponding to $\lambda > 0$ should affect yields.

- CP: Only level risk is priced. HW: only slope supply factor matters $\Rightarrow$ The right answer is zero!

<table>
<thead>
<tr>
<th></th>
<th>$F$ test</th>
<th>$\phi_2'\Delta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>level</td>
<td>3.256</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.112)</td>
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<tr>
<td>slope</td>
<td>4.415</td>
<td>-0.250</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.116)</td>
</tr>
<tr>
<td>curvature</td>
<td>2.672</td>
<td>-0.073</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.116)</td>
</tr>
</tbody>
</table>

Table 3: Granger-causality tests and scenario impact estimates for factor vector autoregression. First column reports $F$ test ($p$-value in parentheses) of null hypothesis that $\phi_2 = 0$ in regression $f_2 = c_2 + \phi_2 f_{t-1} + \phi_2'\Delta_{t-1} + \epsilon_t$. Second column reports estimate of $\phi_2'\Delta$ for that regression (with standard error) for $\Delta$ the average change in $\Delta$ under the alternative scenario.

- $z_{nt} =$ entire Treasury supply and no supply of other bonds.
The hidden danger of QEII

“For reasons having to do with management of fiscal risks, the Treasury is willing to pay a premium to arbitrageurs for the ability to lock in long-term borrowing cost. If the treasury has good reasons to avoid this kind of interest-rate risk it is not clear why the Federal Reserve should want to absorb it.” (p. 26)

Translation:

1. Long term debt is a wonderful buffer against fiscal or interest rate shocks. Prices of long term bonds can absorb shocks.
2. The major effect of QEII is that it shortens the maturity structure, and makes the US more exposed to roll-over risk.
3. Greece
4. (“Understanding Policy...”)

Greece