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

John H. Cochrane[1]

University of Chicago Booth School of Business

March 3 2011

[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."

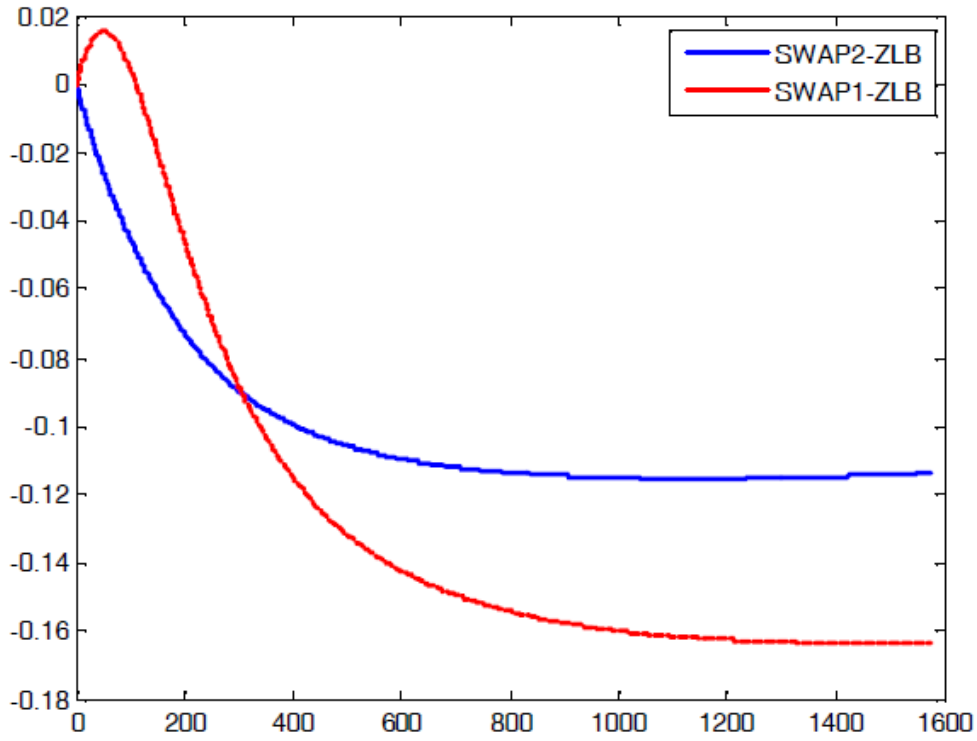


Figure 13. Effects of two different maturity swaps when implemented at the zero lower bound. Dashed curve: Fed sells all its holdings of less than 1-year maturity and retires debt at the longest end of the maturity structure (plot of $5200b_n^{*'}\phi\Delta$ as a function of n). Solid curve: Fed sells all its holdings of less than 1-year maturity and retire debt evenly across 2-1/2 to 10 year maturities (plot of $5200b_n^{*'}\phi\Delta_2$).

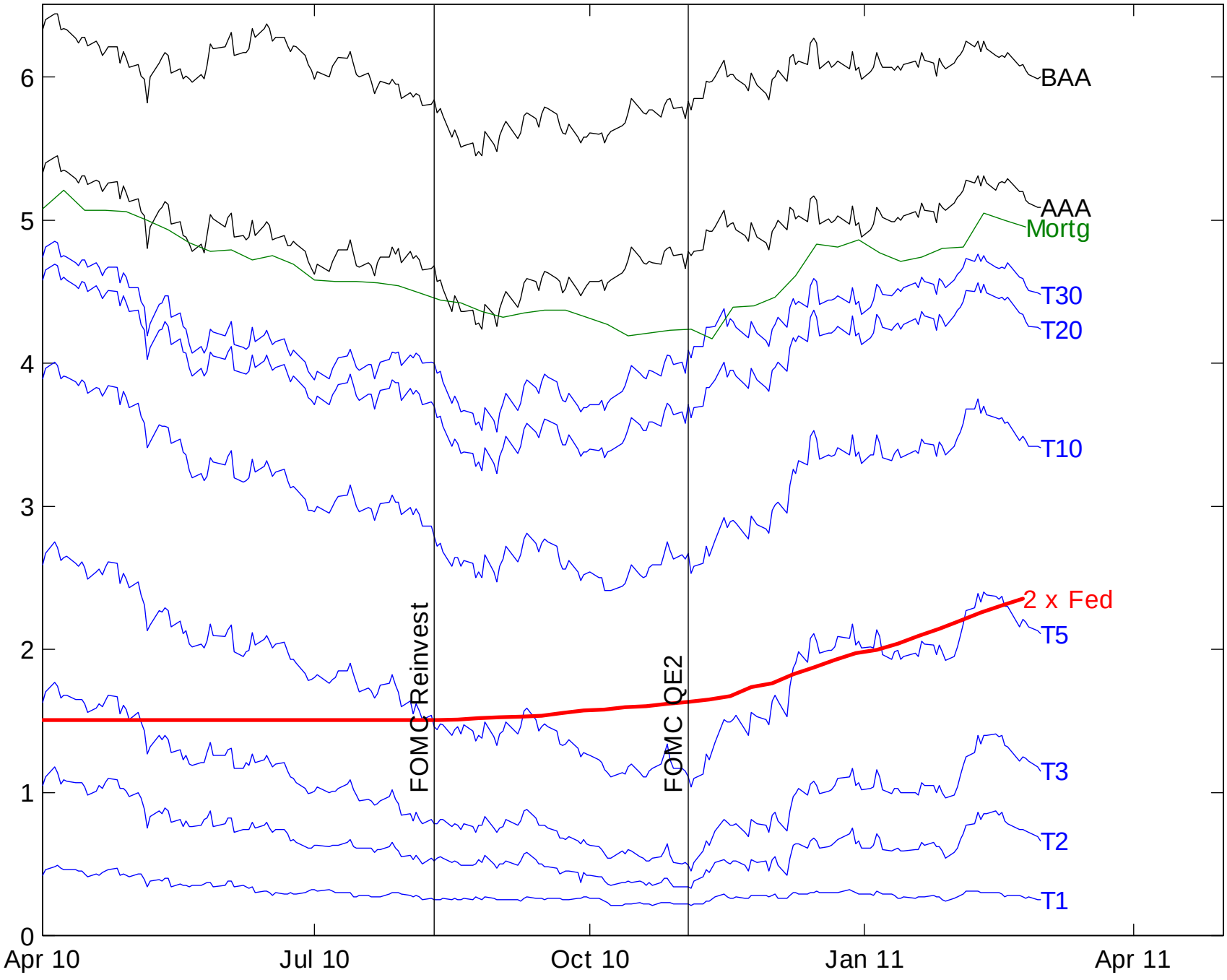
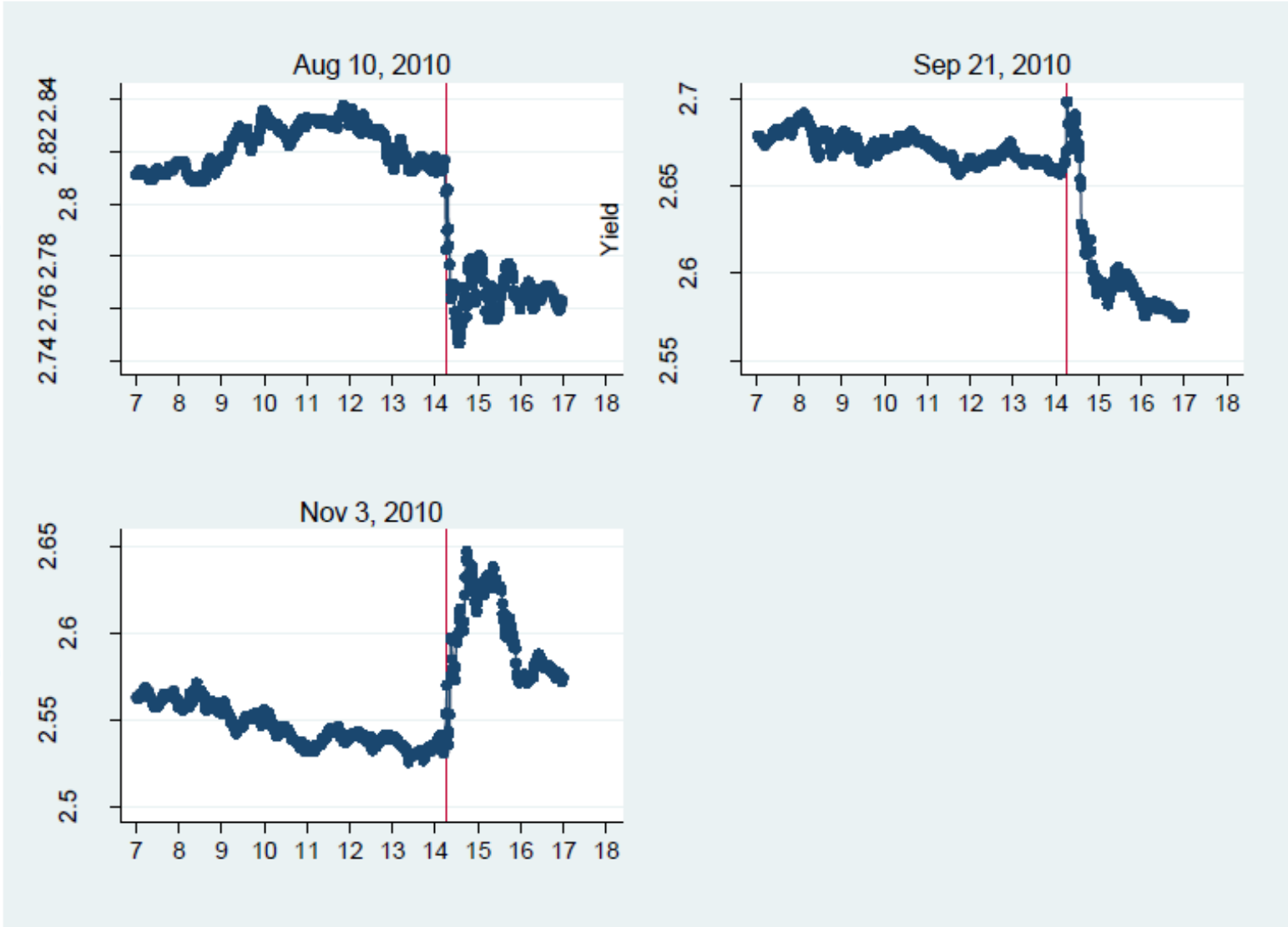

6
5
4
3
2
1
0
Apr 10
Jul 10
Oct 10
Jan 11
Apr 11
BAA
AAA
Mortg
T30
T20
T10
T5
T3
T2
T1
2 x Fed
FOMC Reinvest
FOMC QE2

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

Date	10-Year Treasury Yield	10-Year TIPS Yield	30-Year MBS Yield	10-Year BBB Corporate Bond Yield
Aug. 10, 2010	-7	-9	-2	-1
Aug. 11 to Nov. 2, 2010	-11	-47	-9	-23
Nov. 3, 2010	3	2	-2	2

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

This paper. 13bp?

- Procedure:
  1. Run regression

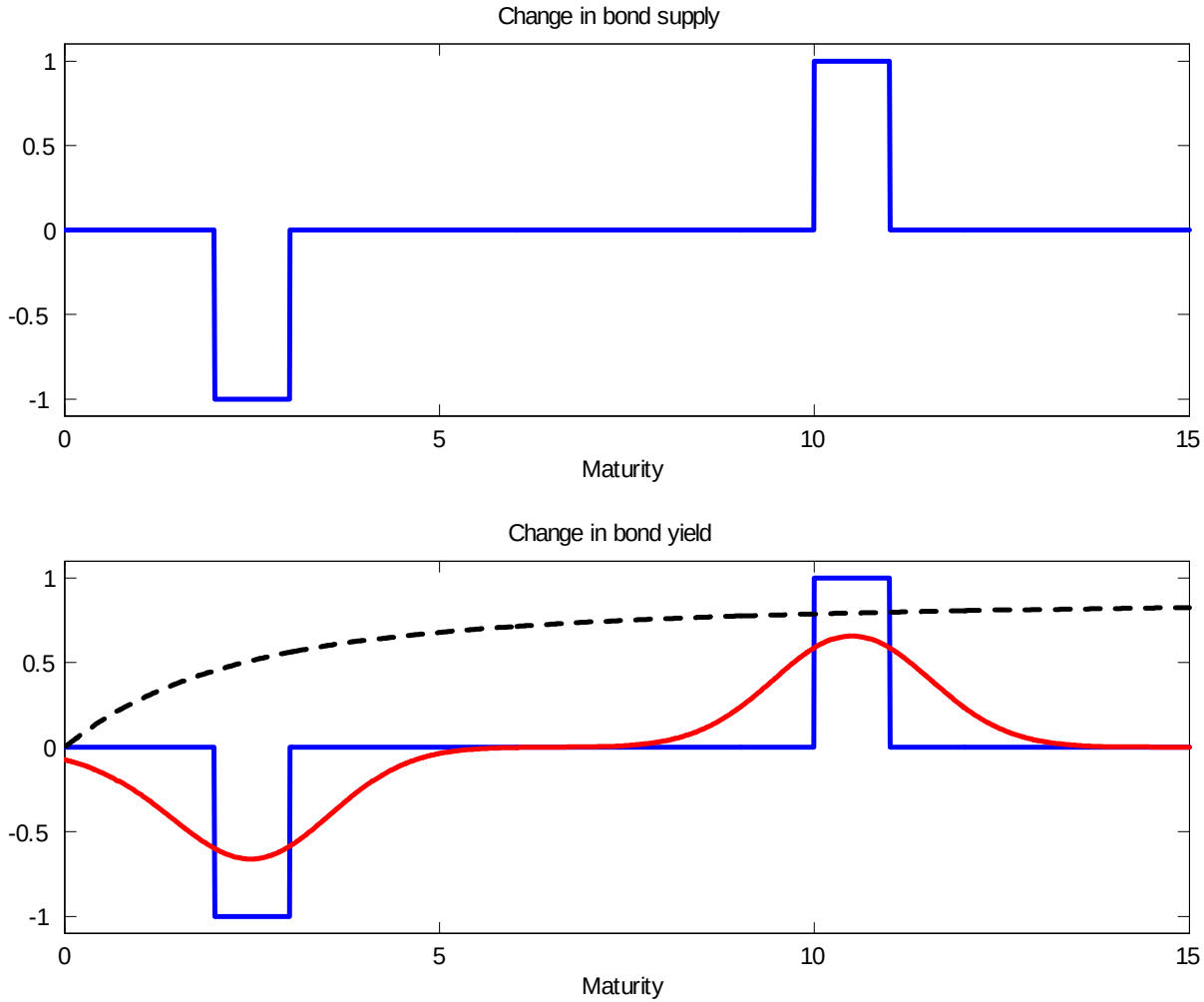
$$\begin{aligned} f_{t+1} &= c + \rho f_t + \phi q_t + \varepsilon_{t+1} \\ f_t &= \left[\begin{array}{ccc} \text{level}_t & \text{slope}_t & \text{curve}_t \end{array} \right]' \\ q_t &= \text{function of bond supply} \end{aligned}$$

  2. Calculate q_t of QEII operation. Simulate the regression. Calculate.

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

- Problem 1: If the ATSM is right, f_t should incorporate all q_t information, $\phi = 0$. (p. 20, 21). ($P = E(m \times 1 |$ 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 variable and Vayanos-Vila



- *Bond supply matters only if it exposes you to factor risk* $\times$ *factor risk premium.* ("Limited risk bearing" segmentation, not "liquidity".)

Bond supply variable and Vayanos-Vila

$$f_{t+1} = c + \rho f_t + \phi q_t + \varepsilon_{t+1}$$

$$\begin{aligned}
q_t &= 100\Sigma\Sigma' \sum_n z_{nt}\bar{b}_{n-1} \quad (3 \times 1) \\
\bar{b}_{n-1} &= \text{exposure of maturity } n \text{ return to factor } f_t \ (3 \times 1) \\
z_{nt} &= \text{fraction of bonds at maturity } n \\
\sum_n z_{nt}\bar{b}_{n-1} &= \text{how much supply } z_{nt} \text{ forces you to bear factor risk}
\end{aligned}$$

- 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...

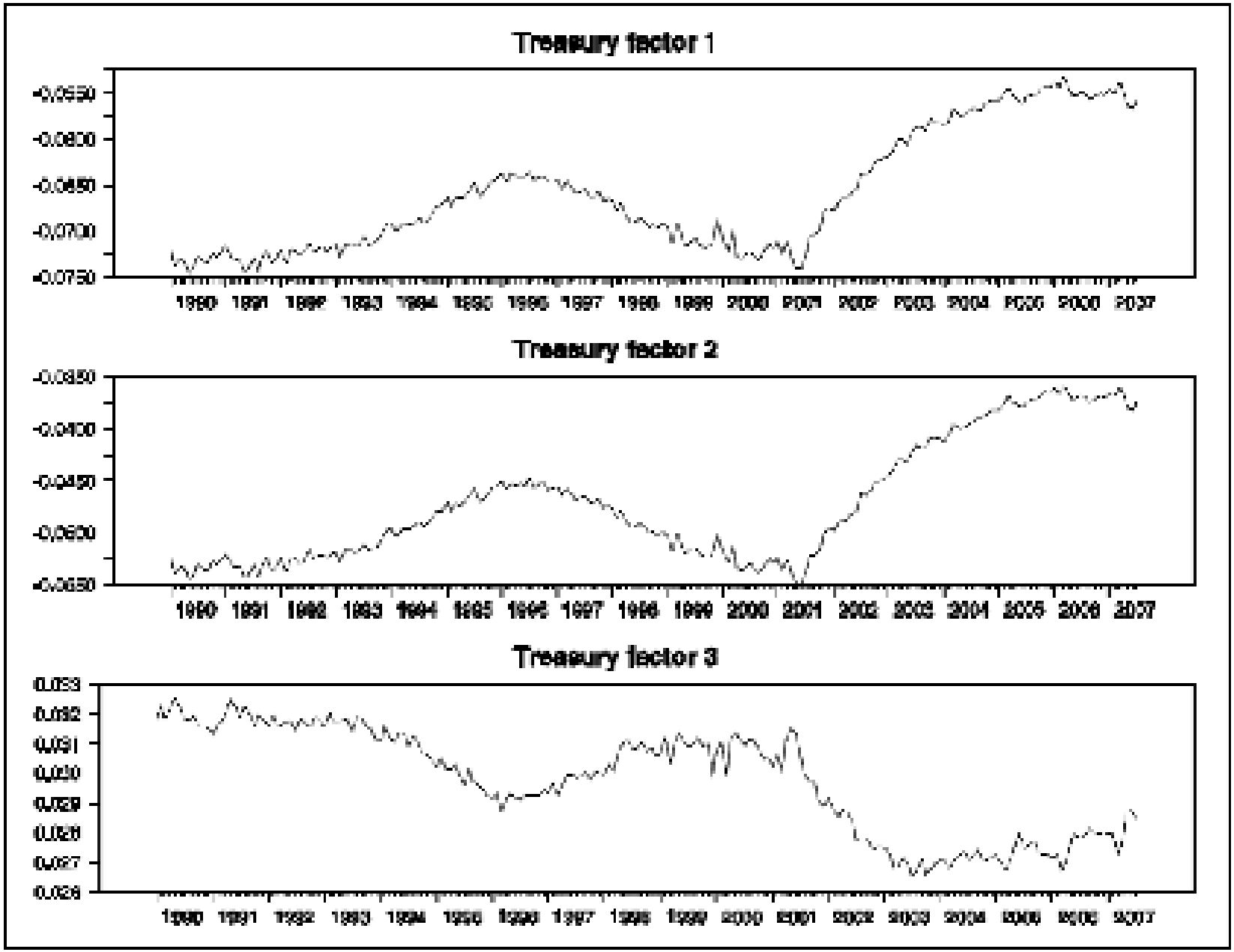


Figure 7. Values of the three elements of $q_t - 100\Omega\Sigma' \sum_{n=1}^{N} z_{nt}\bar{b}_n$, monthly from Jan 31, 1990 to July 31, 2007.

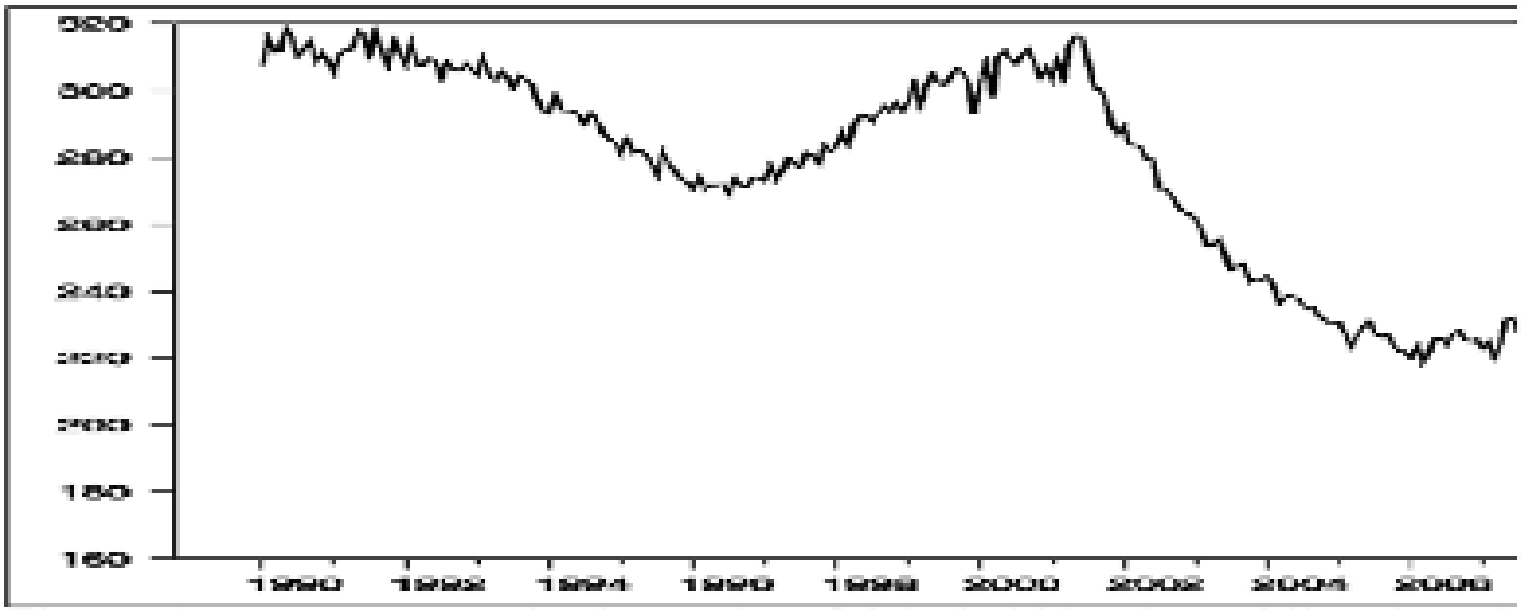
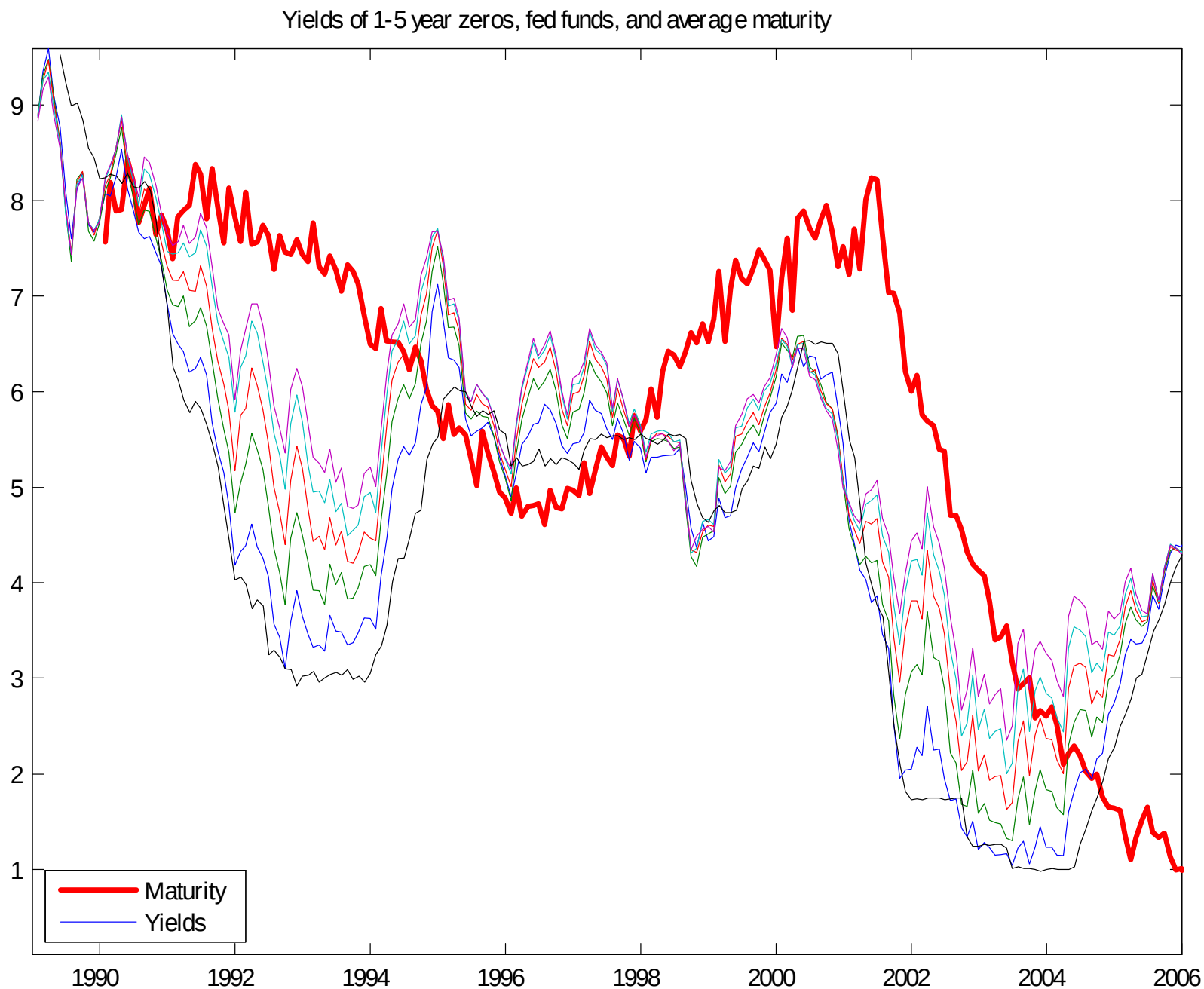


Figure 4. Average maturity in weeks of debt held by the public, plotted 31, 1990 to Jan 31, 2011.

- Only one forecasting factor here, not 3.
- Results = a regression of yields on average maturity.

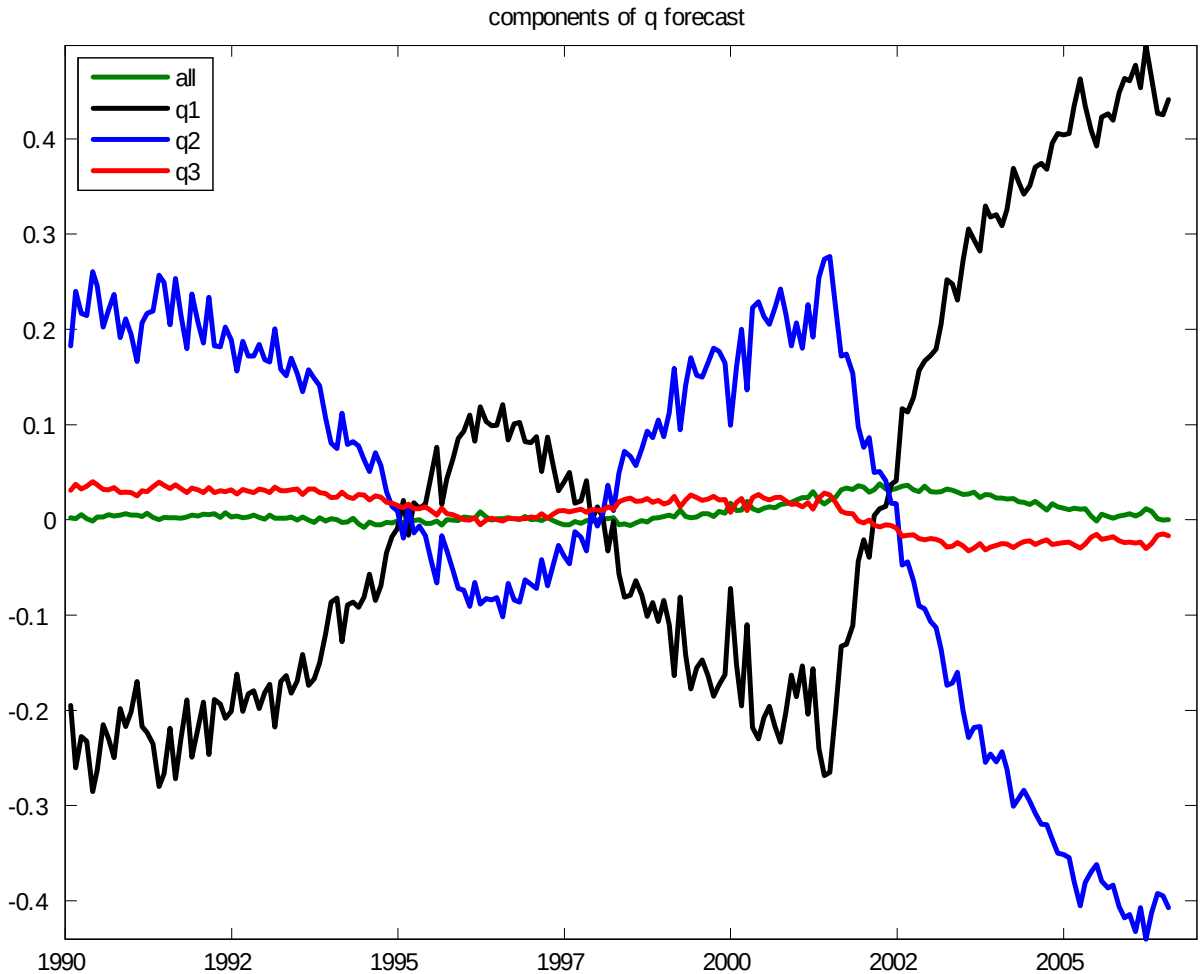
$$\begin{bmatrix} y_{t+1}^{(10)} \\ y_{t+1}^{(5)} \\ y_{t+1}^{(1)} \end{bmatrix} = \rho \begin{bmatrix} y_t^{(10)} \\ y_t^{(5)} \\ y_t^{(1)} \end{bmatrix} + \phi(\text{av. Maturity}_t) + \varepsilon_{t+1}$$

- Regression: *1990, 2000, 2003 maturity* $\Rightarrow$ *spreads.* Structural?



74% Return-forecast R2?

	level	slope	curve	q1	q2	q3	R^2
$rx_{t+1}^{(2)}$	3.26	-0.55	-3.34	**33.56**	**-34.55**	10.24	0.74
t	(0.9)	(-0.5)	(-0.7)	(-1.9)	(2.2)	(-0.8)	



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!

	F test	$\phi_x'\Delta$
level	**3.256**	0.005
	(0.023)	(0.112)
slope	**4.415**	−0.250
	(0.005)	(0.116)
curvature	**2.672**	−0.073
	(0.049)	(0.116)

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 $\phi_x = 0$ in regression $f_{it} = c_i + \rho_i' f_{t-1} + \phi_{xi}' q_{t-1} + \varepsilon_{it}$. Second column reports estimate of $\phi_x'\Delta$ for that regression (with standard error) for Δ the average change in q 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 if interest-trate 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...")