Unconventional Monetary Policies in NK Model

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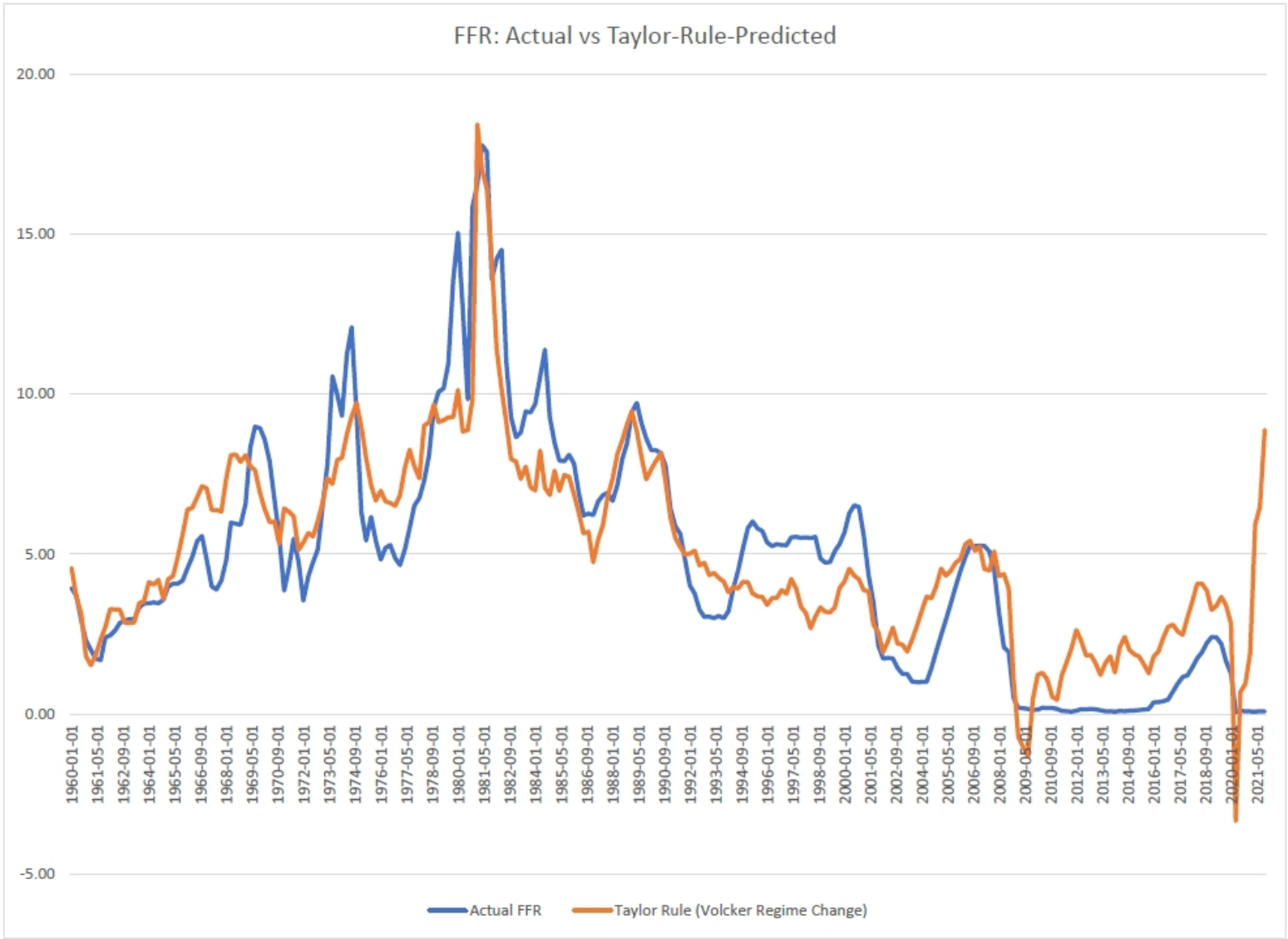
  - actual FFR different from what advocated by Taylor rule

Unconventional Policies in the U.S.

Actual vs Taylor-Rule-Predicted Interest Rate



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  - QE $\Longrightarrow$ longer-term interest rates
  - FG $\Longrightarrow$ market's expectations of future short-term interest rates

Quantitative Easing

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- Simplified banks' balance sheet (m = reserve requirement)
  Banks received liquid cash reserves ($ER \uparrow$), in exchange for risky MBS and LTB

Bank Assets	**Bank Liabilities**
Required Reserves ($RR = mD$)	Deposits (D)
Excess Reserves ($ER \approx 0$)	Net Worth (NW)
ST T-Bills (STB, riskless)	
LT T-Bonds (LTB, low risk)	
Business Loans (BL, some risk)	
MBS (high risk)	

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Yield Curve

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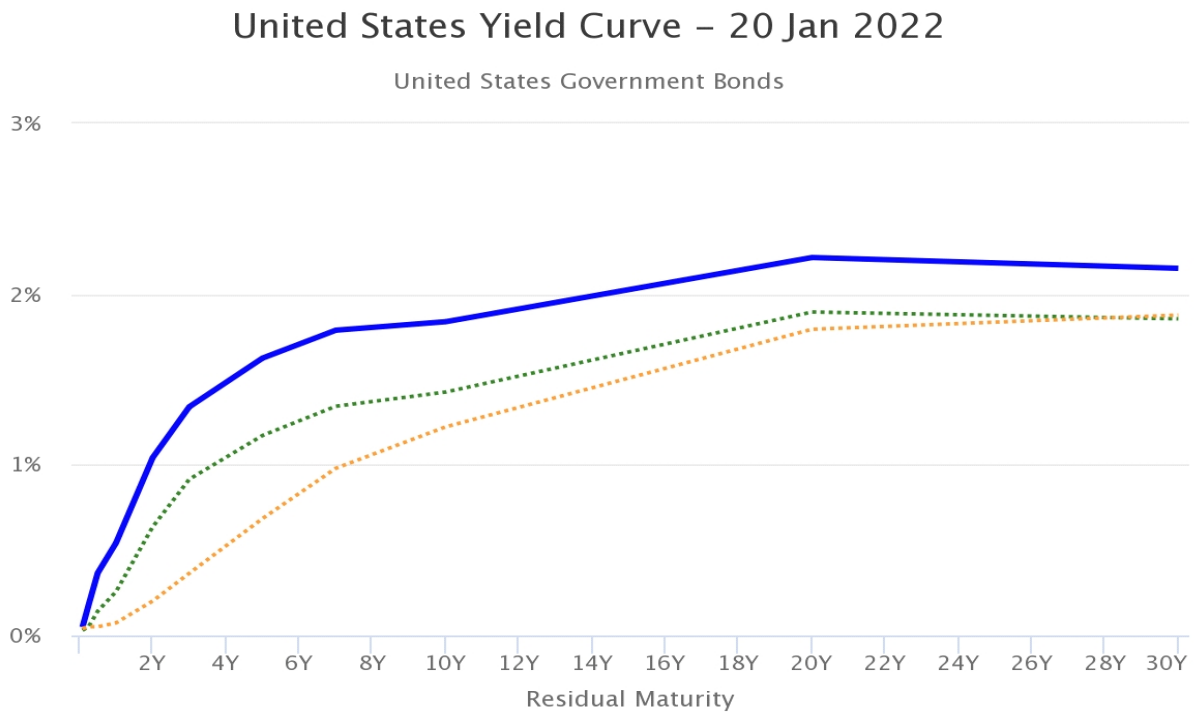
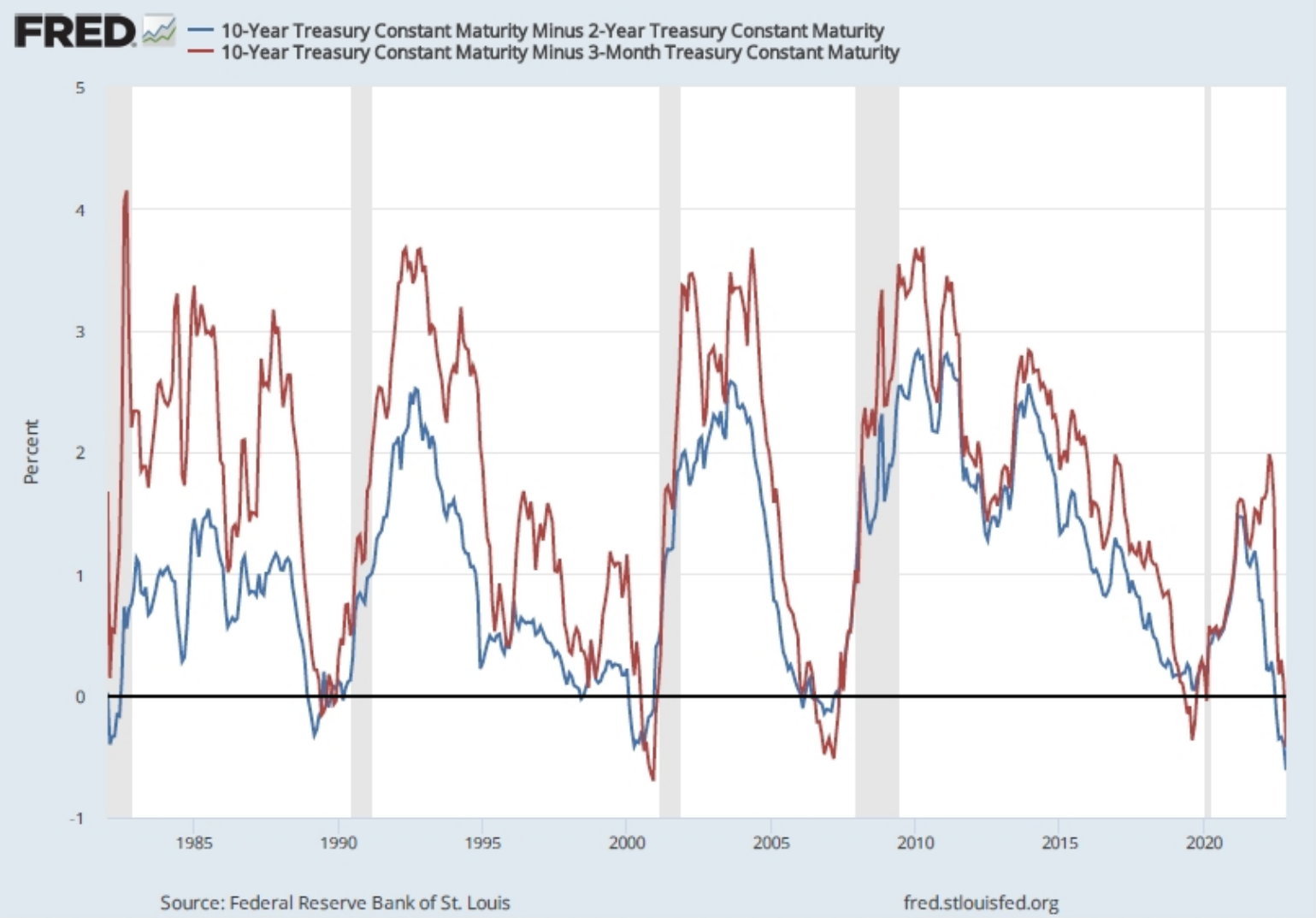
- Yield curve changes daily



Quantitative Easing

Yield Curve Proxy



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  2. lower supply of long-term bonds available in secondary market (banks buy/sell LT securities on daily basis)
     $\Longrightarrow$ higher price for LT bonds $\Longrightarrow$ **lower yield on LT bonds** (flatter term structure)

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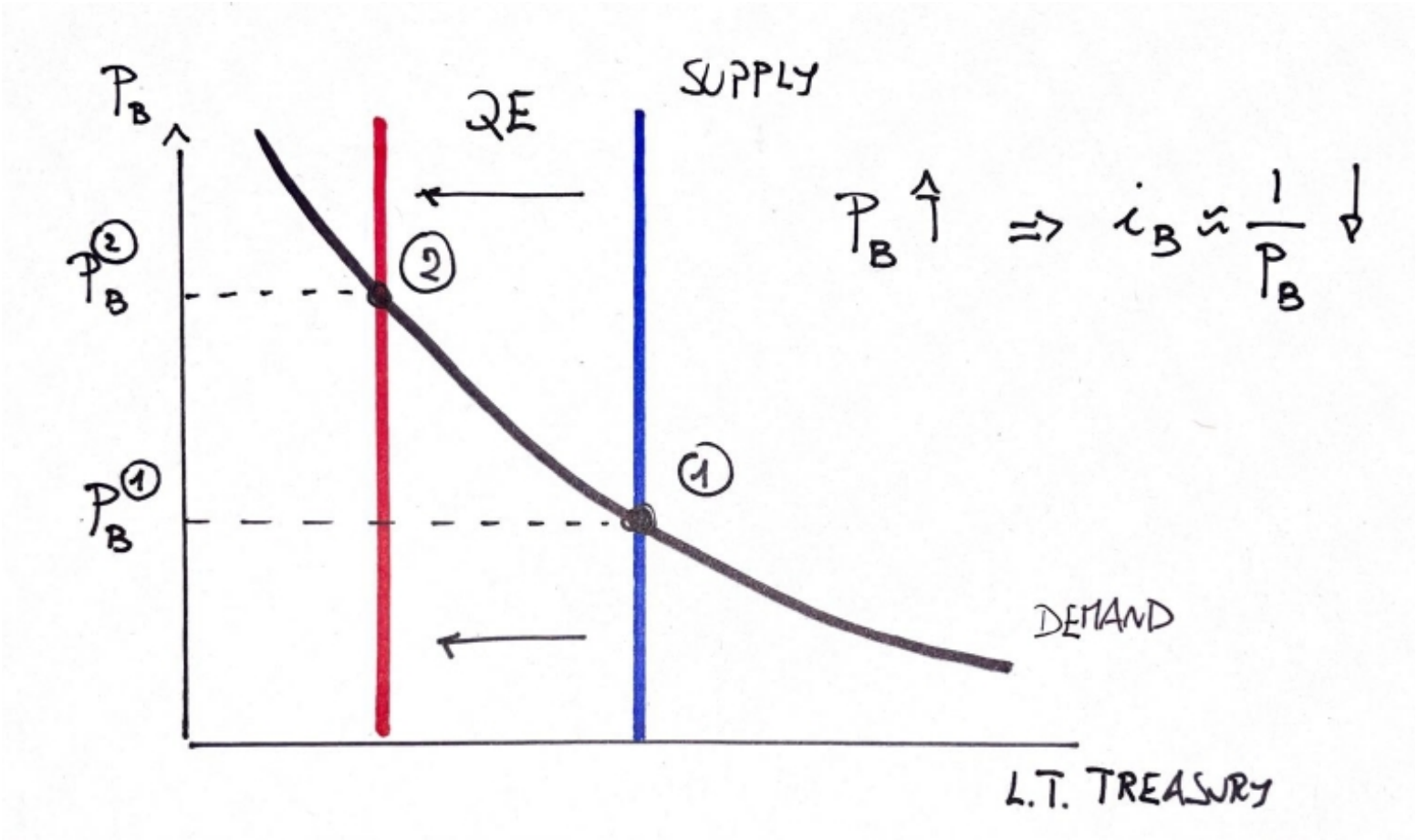
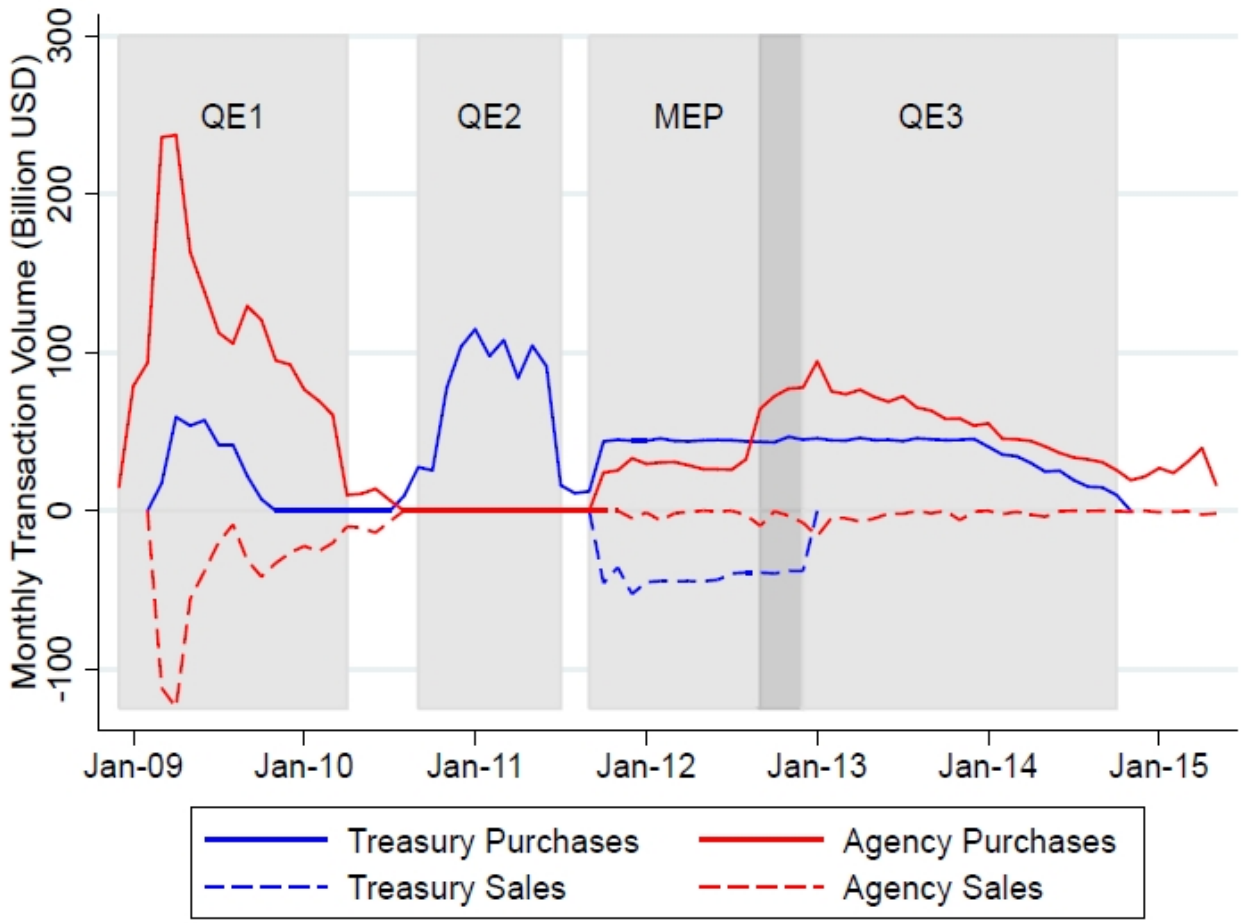


Quantitative Easing

QE Operations

Figure 3. Federal Reserve Asset Purchases & Sales (Gross)



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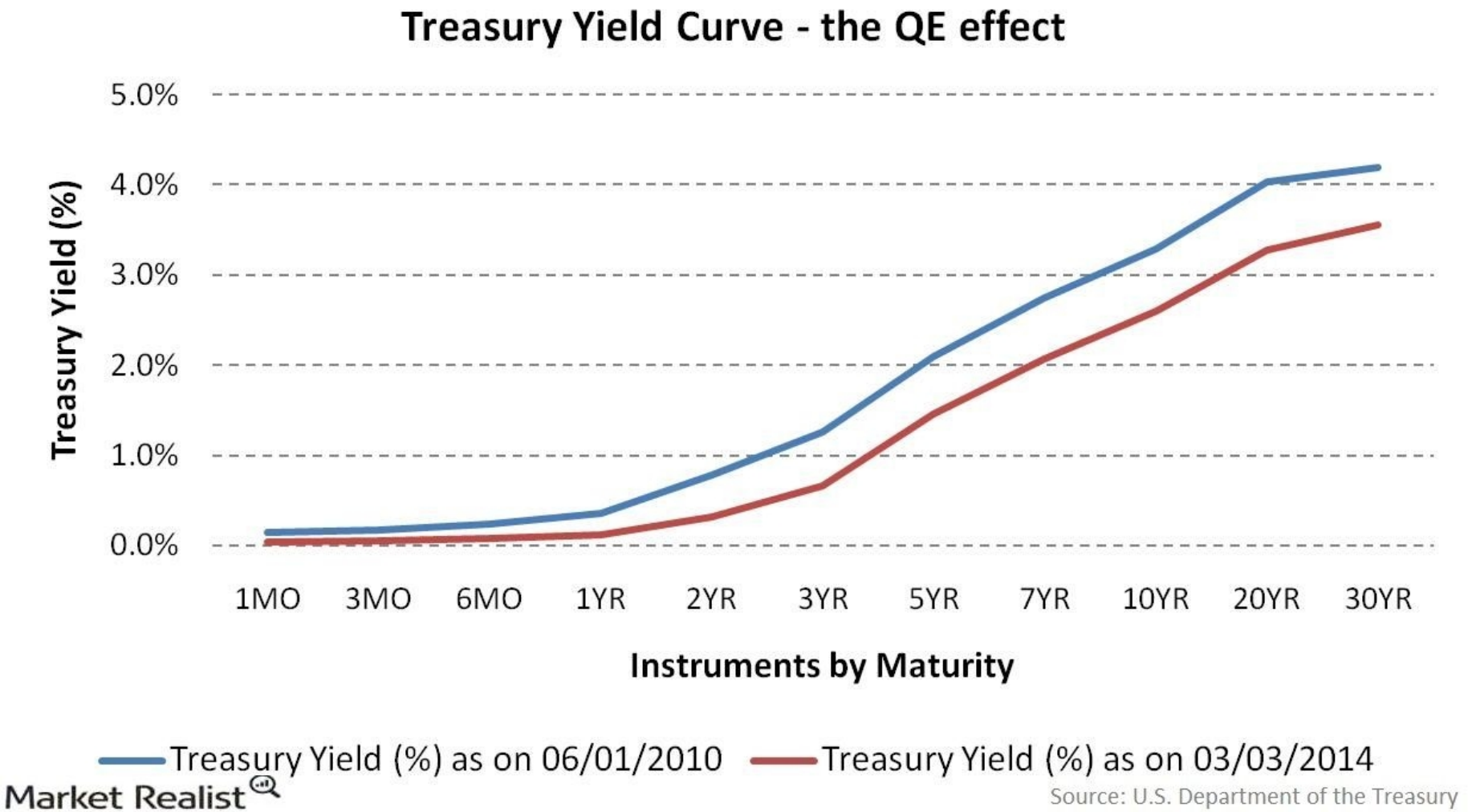
QE and the Yield Curve



Quantitative Easing

QE and the Yield Curve

Source: "The Macroeconomic Effects of LSAP Programmes" (Economic J., '12) by Chen, Curdia and Ferrero

Table 1

Estimated Impact of LSAPs on the 10-Year Treasury Yield in the Literature

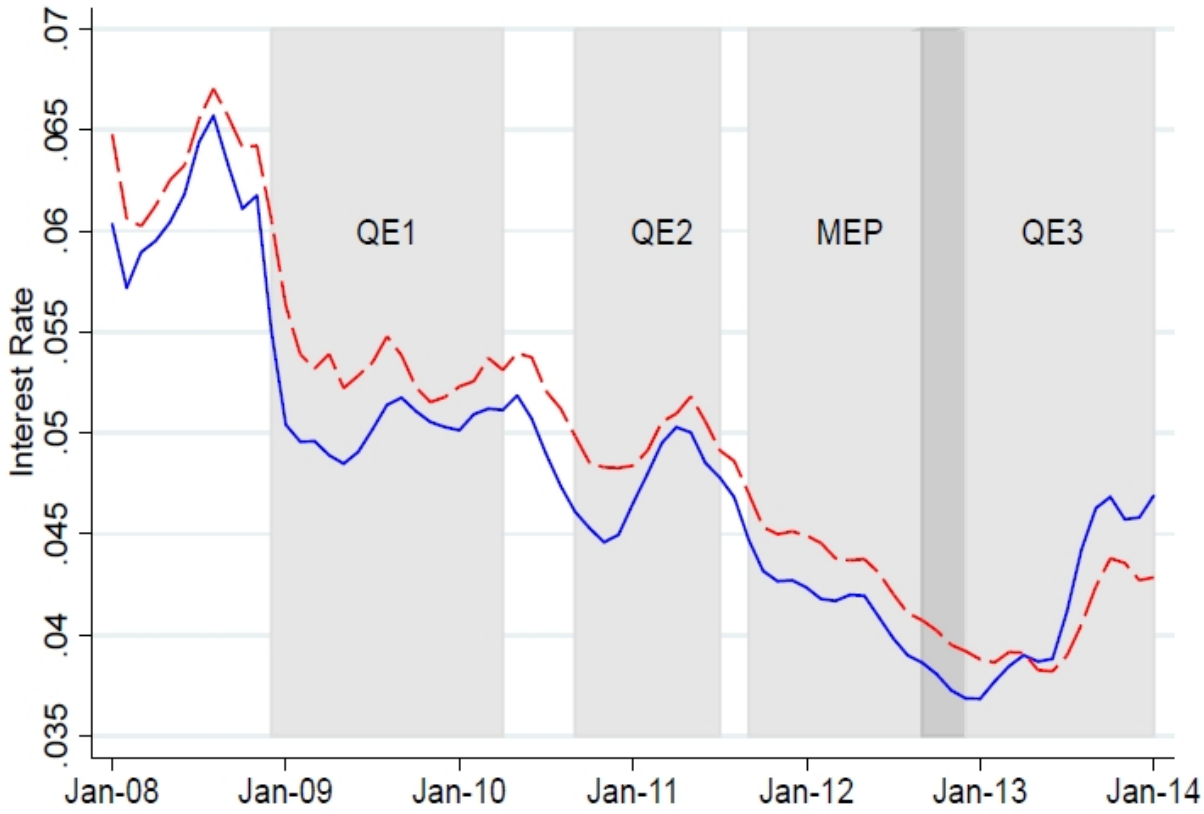
Papers	Total impact	Impact per $100 Bil
Hamilton and Wu (2010)	−13 bp	−3 bp
Doh (2010)	−39 bp	−4 bp
D'Amico and King (2010)	−45 bp	−15 bp
Bomfim and Meyer (2010)	−60 bp	−3 bp
Gagnon *et al.* (2011)	−58 bp to−91 bp	−3 bp to−5 bp
Neely (2011)	−107 bp	−6 bp
Krishnamurthy and Vissing-Jorgensen (2011)	−33 bp (LSAP II)	−5 bp
D'Amico *et al.* (2011)	−55 bp (LSAP II)	−9 bp
Swanson (2011)	−15 bp (Twist)	

Quantitative Easing

QE and Mortgages Rates

Source: "How Quantitative Easing Works: Evidence on the Refinancing Channel" (NBER WP #22638) by Di Maggio, Kermani, Palmer

Figure 5. Interest Rates for Conforming and Jumbo Refinance Loans



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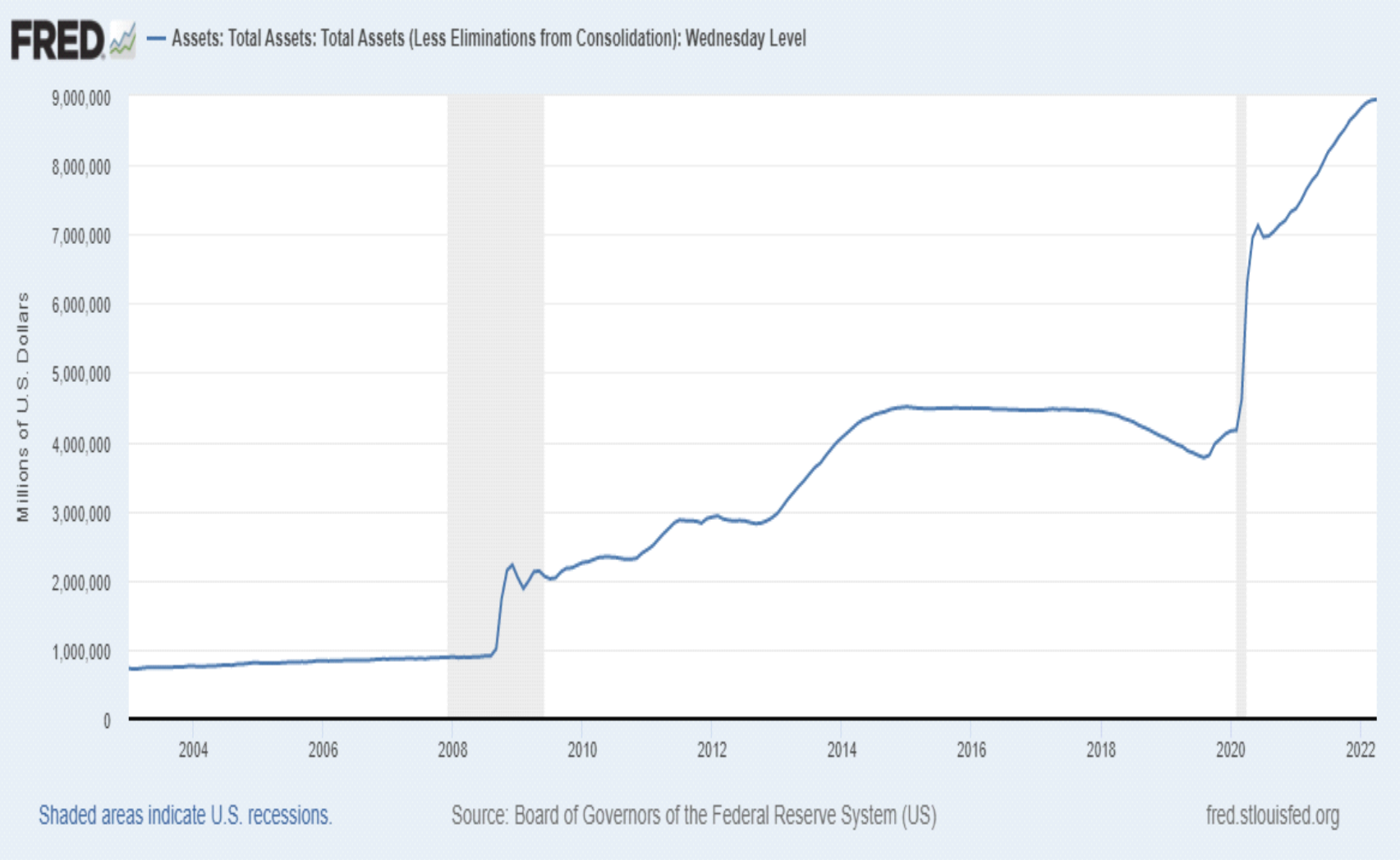
QE and the Fed's Balance Sheet

NOTE: huge expansion of overall size!



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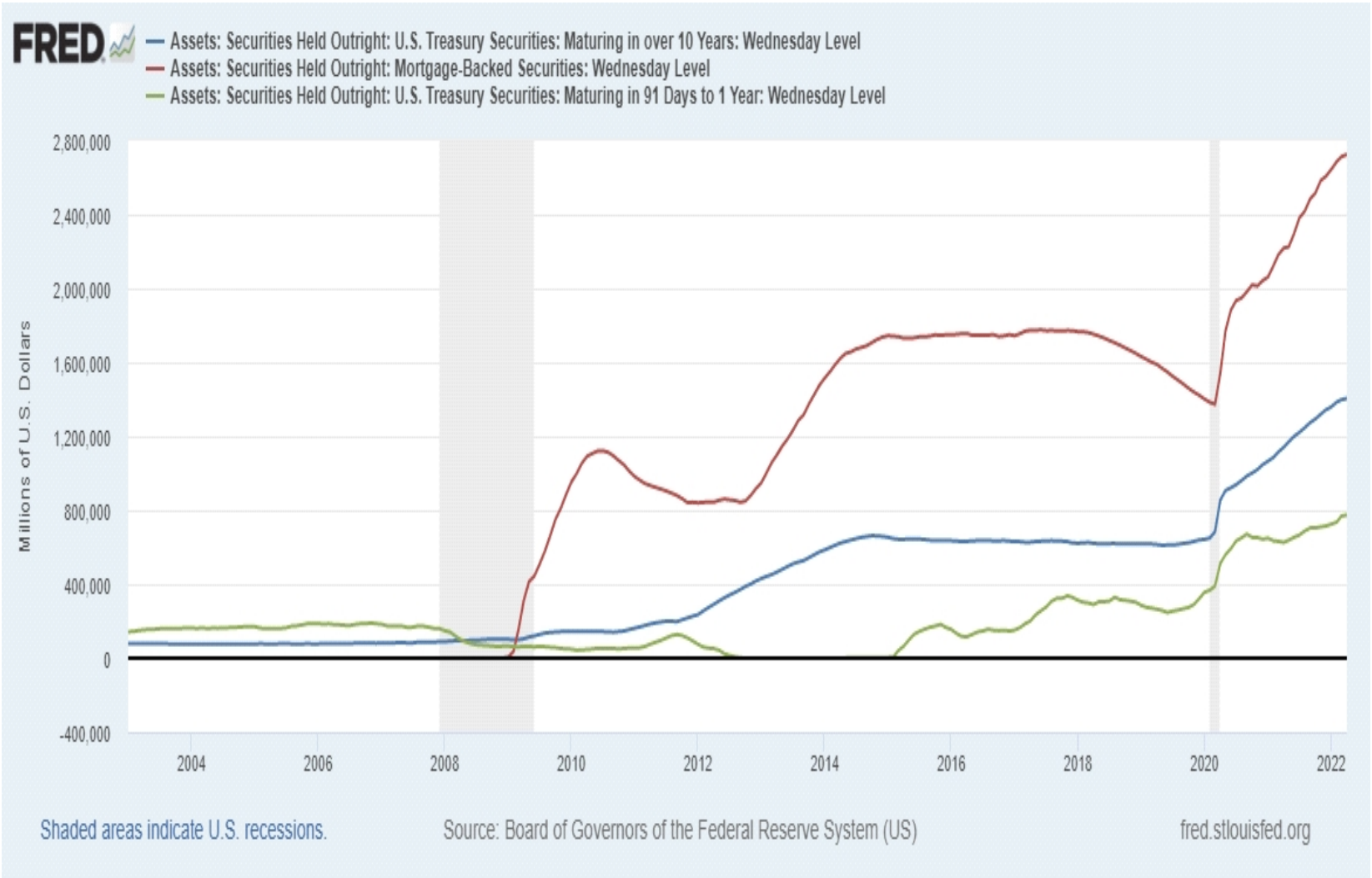
NOTE: larger share of riskier longer-term assets!



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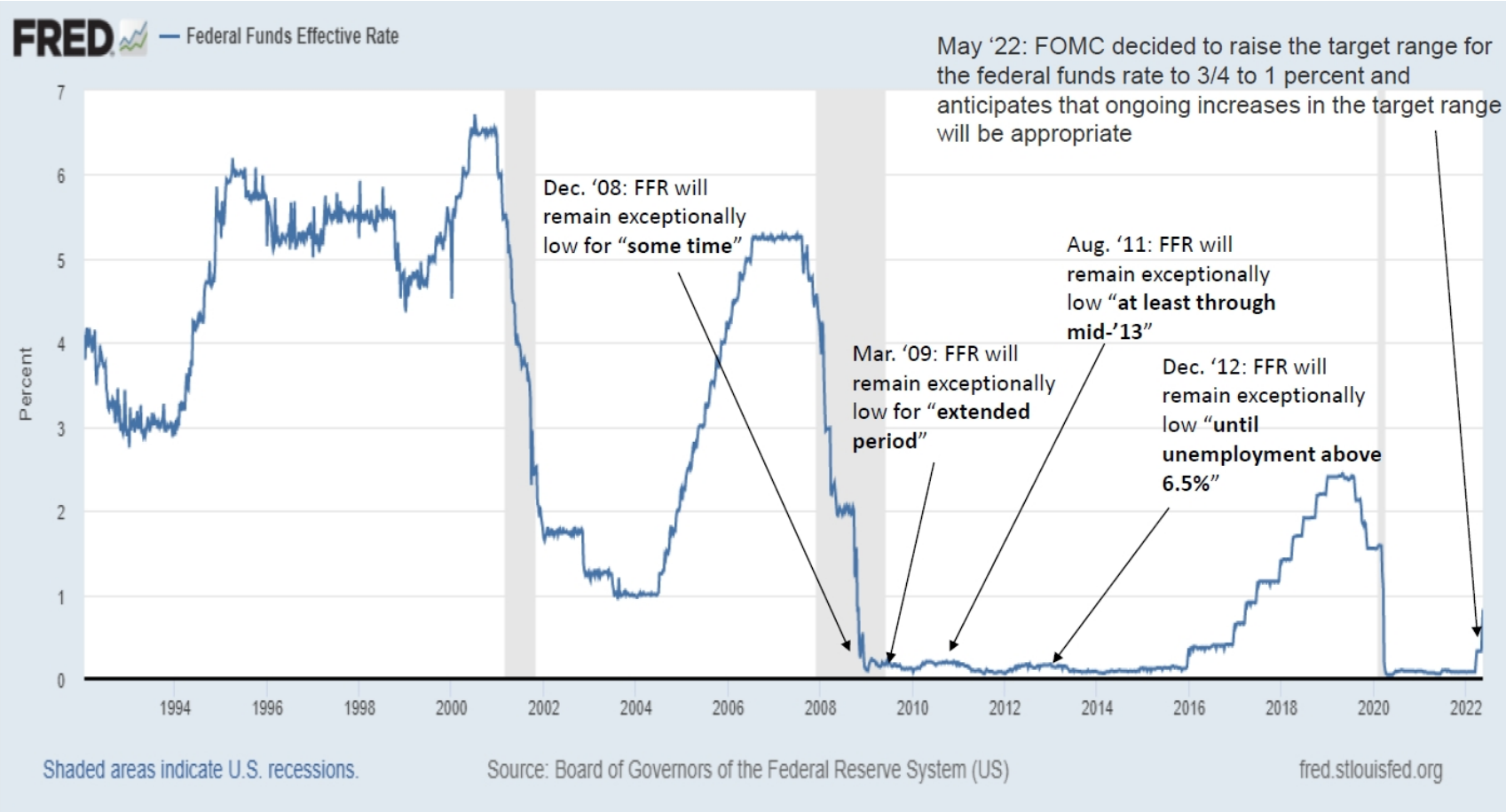
  1. guide market's expectations about future policies
  2. signal Fed's commitment to extending expansionary monetary policy
  3. flatten the term structure of interest rates, as

$$\text{LT interest rate} \approx \text{weighted avg. of expected future ST rates}$$

(Expectations Theory of LT Rates)

Forward Guidance

Forward Guidance Announcements



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  - **Odyssean FG:** explicit commitment to future policy
    $\Longrightarrow$ PRO: transparency
    CON: lack of flexibility, time-inconsistent (credibility issues)

Source: Del Negro et al. (NY Fed WP, '15)

Table 2: Evidence from Financial Markets

	Treasury Yields (constant maturity)					Agency Yields (Fannie/Freddie)				MBS Yields	
Maturity (years)	30	10	5	3	1	30	10	5	3	30	15
8/9/2011	-14	-23	-18	-12	-3	-19	-23	-27	-25	-24	-26
1/25/2012	-5	-12	-15	-8	0	-10	-13	-18	-14	-16	-18
9/13/2012	17	11	2	2	0	10	5	0	1	-13	-11

	Corporate Yields											
	Intermediate term						Long term					
	Aaa	Aa	A	Baa	Ba	B	Aaa	Aa	A	Baa	Ba	B
8/9/2011	-8	-6	-8	-8	2	16	-11	-9	-5	-5	26	33
1/25/2012	-10	-13	-11	-16	-9	-13	-12	-15	-17	-13	-16	-10
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The Forward Guidance: Evidence

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  - reduction in volatility of expected interest rates at short-horizons
- However, effects appear not very large in magnitude and quite short-lived

  Campbell et al. (BPEA, '12), Del Negro et al. (NY Fed WP, '15), Swanson (JME, '20)

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- QE operations affect LT rate $\Longrightarrow$ affects consumption of *restricted*

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     Ex: a FFR interest rate cut announced to occur N quarters ahead has a larger impact on *current* real activity than a cut happening today!
- This unreasonable outcome has been named the *Forward Guidance Puzzle*

  Del Negro et al. (NYFed WP, '15), McKay et al. (AER, '16), Kiley (RED, '16)

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$$\text{Euler Equation}: \hat{y}_t = E_t\hat{y}_{t+1} - \delta\hat{r}_t^{\text{real}}$$

  - By forward iteration

$$\begin{aligned}\hat{y}_t &= -\delta\hat{r}_t^{\text{real}} + E_t\left(E_{t+1}\hat{y}_{t+2} - \delta\hat{r}_{t+1}^{\text{real}}\right)\\ &= -\delta\left(\hat{r}_t^{\text{real}} + E_t\hat{r}_{t+1}^{\text{real}}\right) + E_t\hat{y}_{t+2} = -\delta E_t\sum_{j=0}^{\infty}\hat{r}_{t+j}^{\text{real}}\end{aligned}$$

FG in the NK Model

What drives the puzzle?

- Then

$$\frac{\partial \hat{y}_t}{\partial E_t \hat{r}^{\text{real}}_{t+j}} = -\delta, \ \forall j \geq 0 \tag{1}$$

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  2. Same outcome if Fed announced a change in the *nominal* interest rate (just more complex math)

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- **Second:** front loading of future demand conditions on current inflation in Phillips Curve

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  - Recall

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$$\hat{\pi}_t = \kappa E_t \sum_{j=0}^{\infty} \beta^j \hat{y}_{t+j}$$
  - A change in $\hat{r}^{\text{real}}_{t+K}$ will change output $\hat{y}_{t+j}$, for $j \leq K$

$$\frac{\partial \hat{\pi}_t}{\partial E_t \hat{r}^{\text{real}}_{t+K}} = \kappa \left[\frac{\partial \hat{y}_t}{\partial E_t \hat{r}^{\text{real}}_{t+K}} + \beta E_t \frac{\partial \hat{y}_{t+1}}{\partial E_t \hat{r}^{\text{real}}_{t+K}} + \beta E_t \frac{\partial \hat{y}_{t+2}}{\partial E_t \hat{r}^{\text{real}}_{t+K}} + .. \right]$$

  $\Longrightarrow$ larger change in $\hat{\pi}_t$ the larger is K (FG horizon)

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     - temptation preferences $\Longrightarrow$ myopia (Airaudo, JET'20)

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- Despite very different perspectives, these amends to baseline NK generate a key change: a *discounted Euler equation*

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- REMARK: we are still assuming *rational expectations*

Behavioral Solutions to the FG Puzzle

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- Two well-documented features
  1. Economics agents display preference reversal in intertemporal decisions
     There is a tension between *short-run urges/immediate rewards* and *long-run benefits*
     Ex 1: going to the gym vs. eating a burger
     Ex 2: consumption vs saving

- Two well-documented features (continued)

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  2. Economic agents are not very sophisticated in making forecasts
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     - they how markets clear
     - they are extremely foresighted
       $\Longrightarrow$ this allows us to solve by method of undet. coeff.

My Research

Temptation and Forward Guidance (JET, '20)

- Agents are tempted to liquidate all wealth for immediate consumption (no savings)

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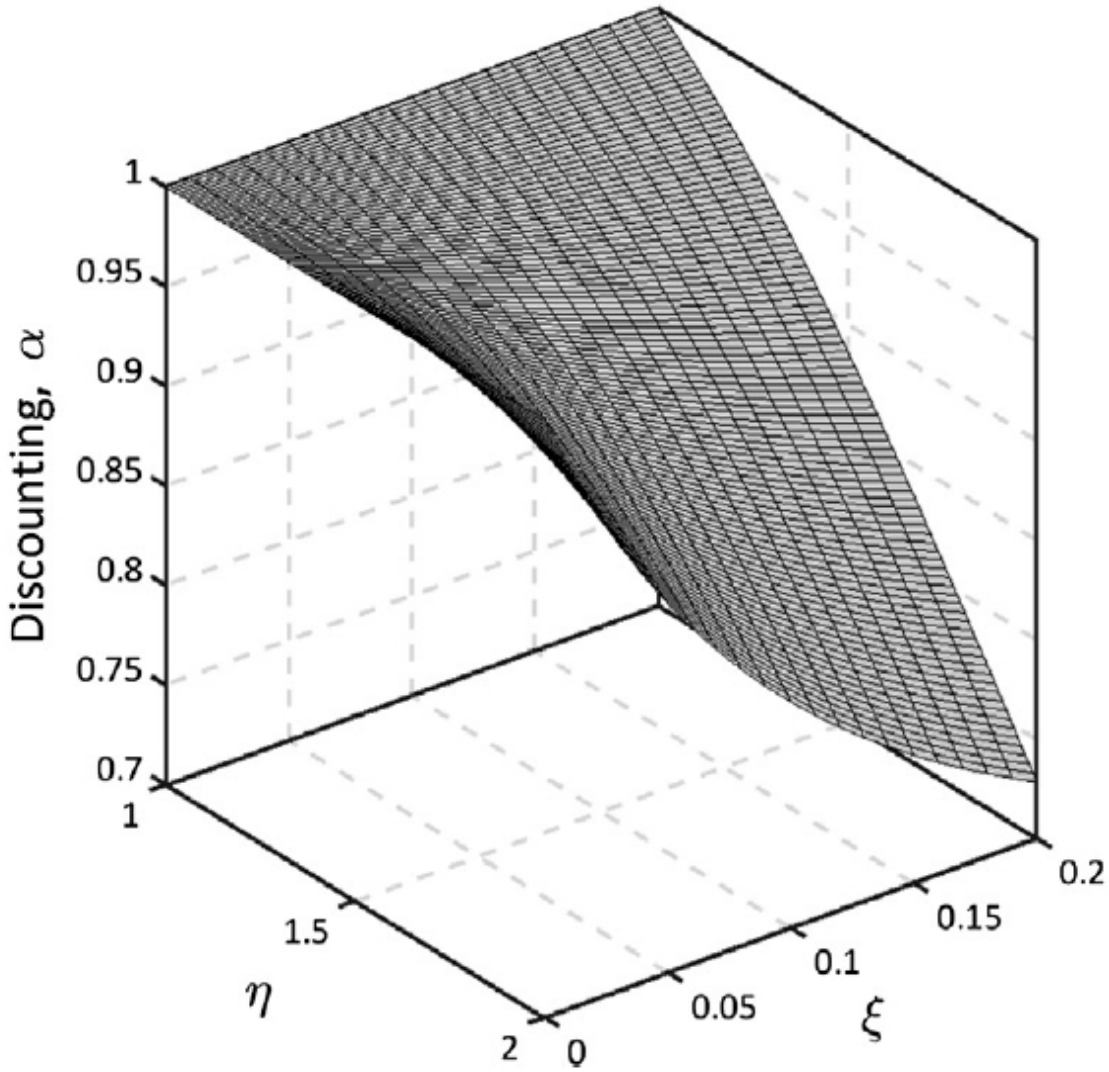
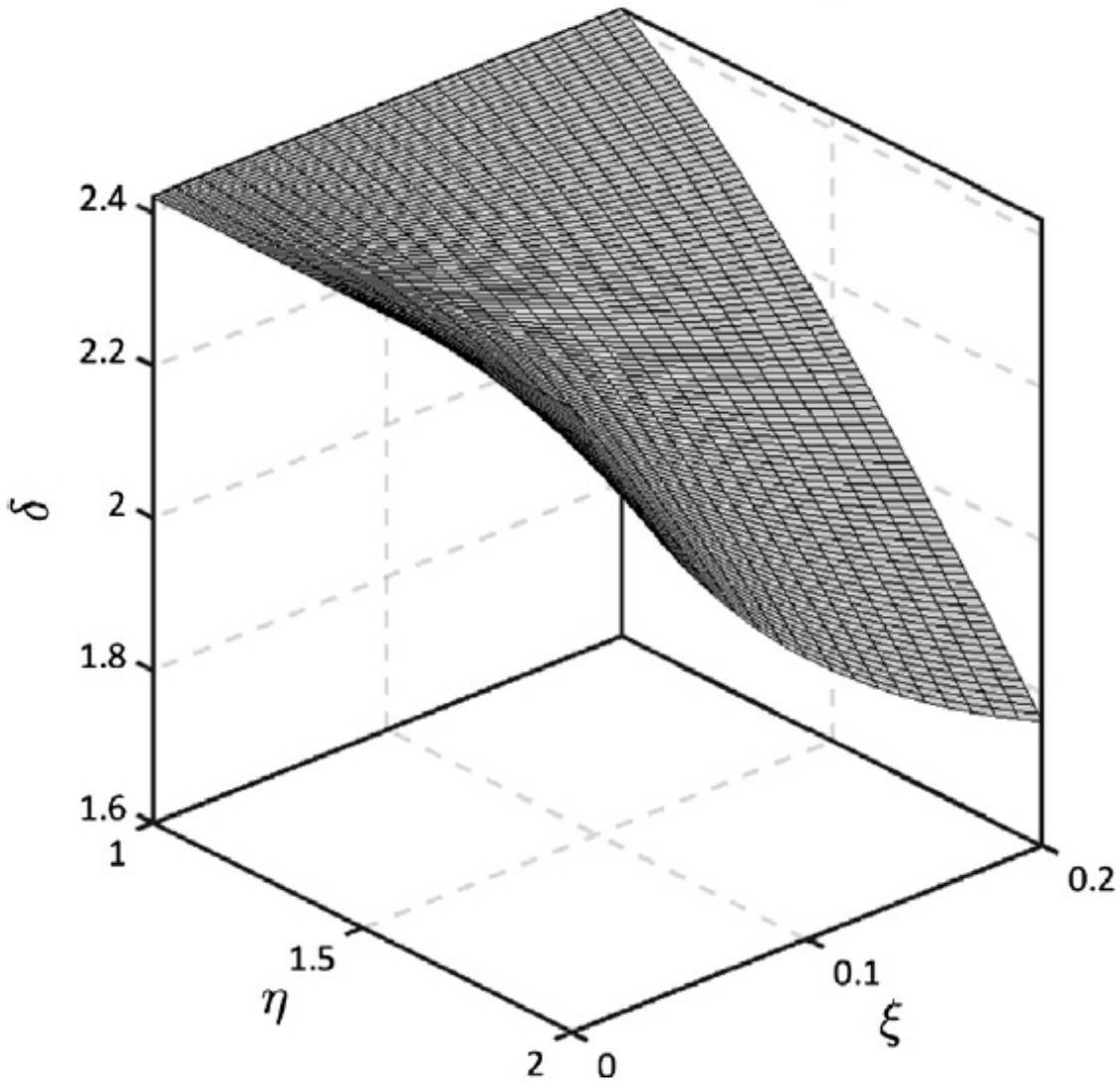
  - myopic self (not interested in saving, like hand-to-mouth)
  - forward-looking patient self (understands consumption smoothing)
- Result: Euler equation is *less forward-looking* (a discounted Euler Eq.) $\Longrightarrow$ tame/solve the FG puzzle

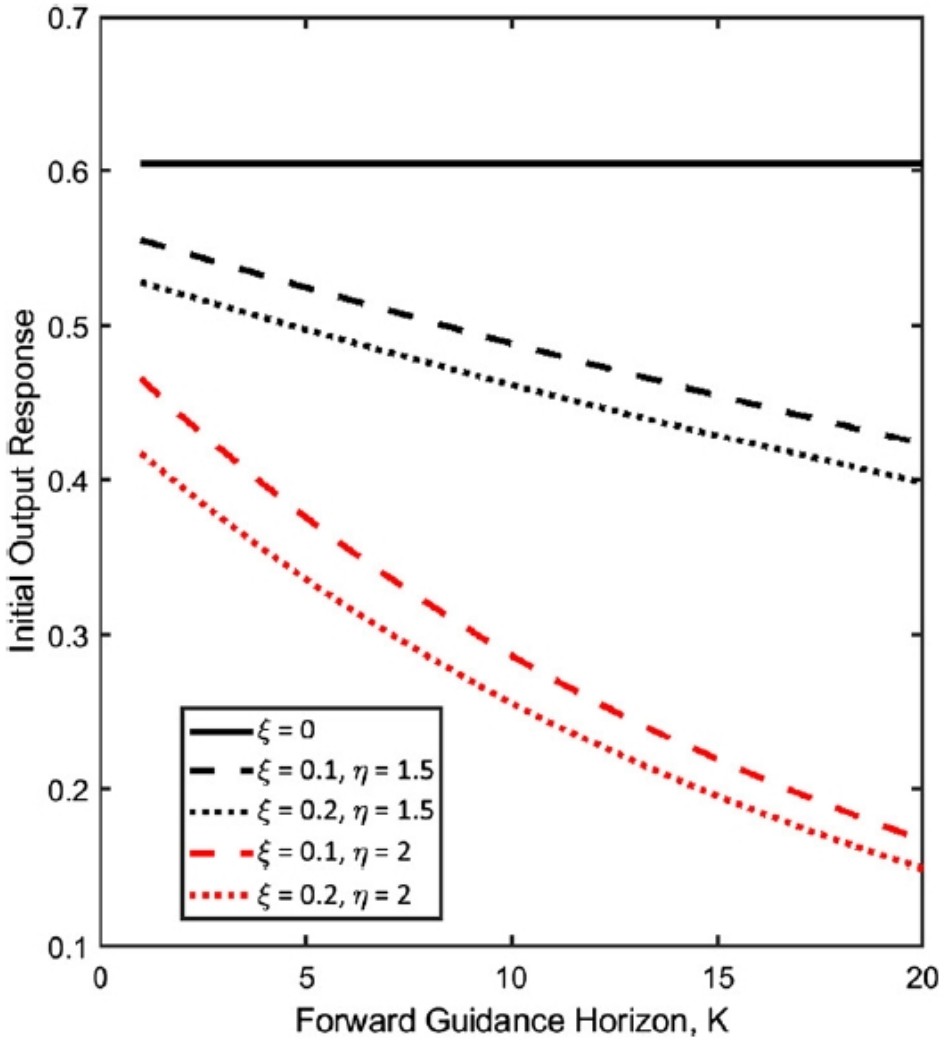
Discounting in Euler equation



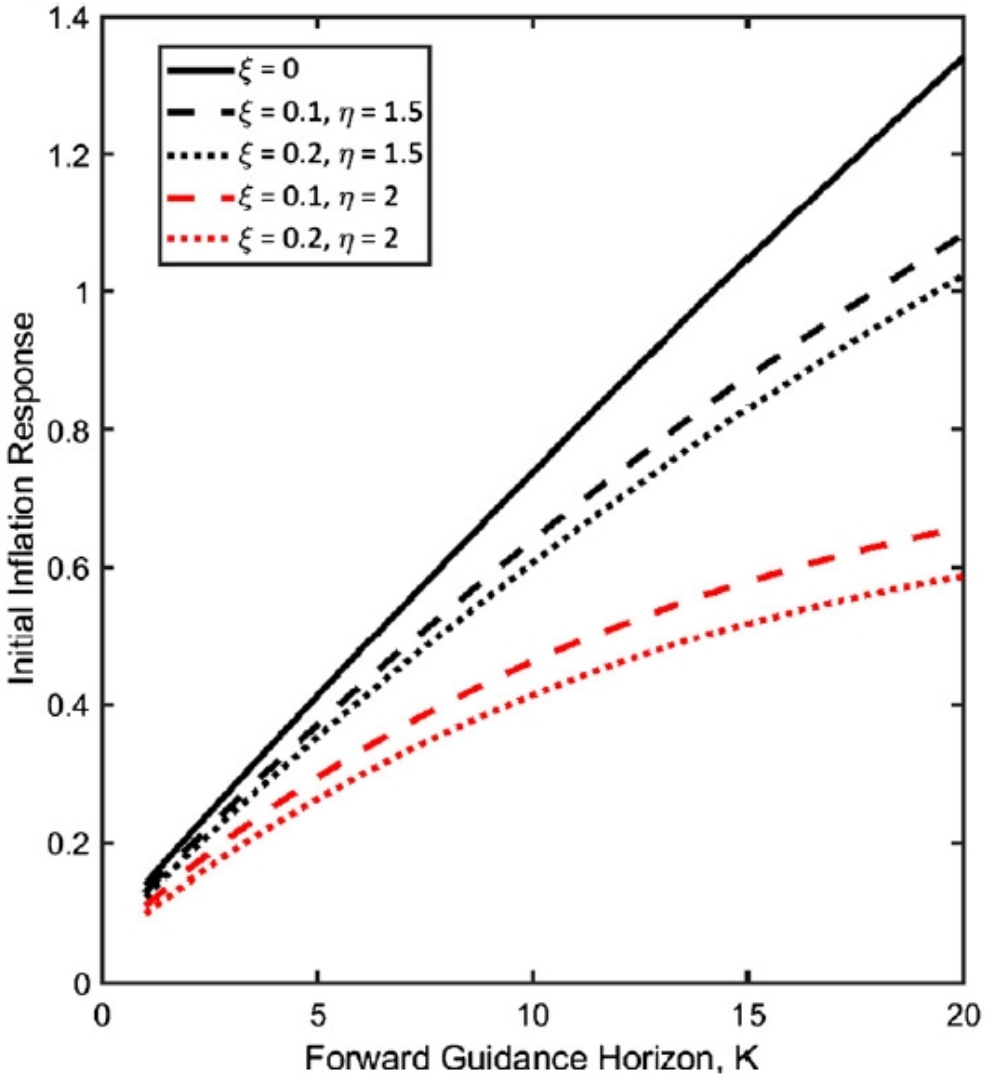
Interest rate elasticity in Euler Equation



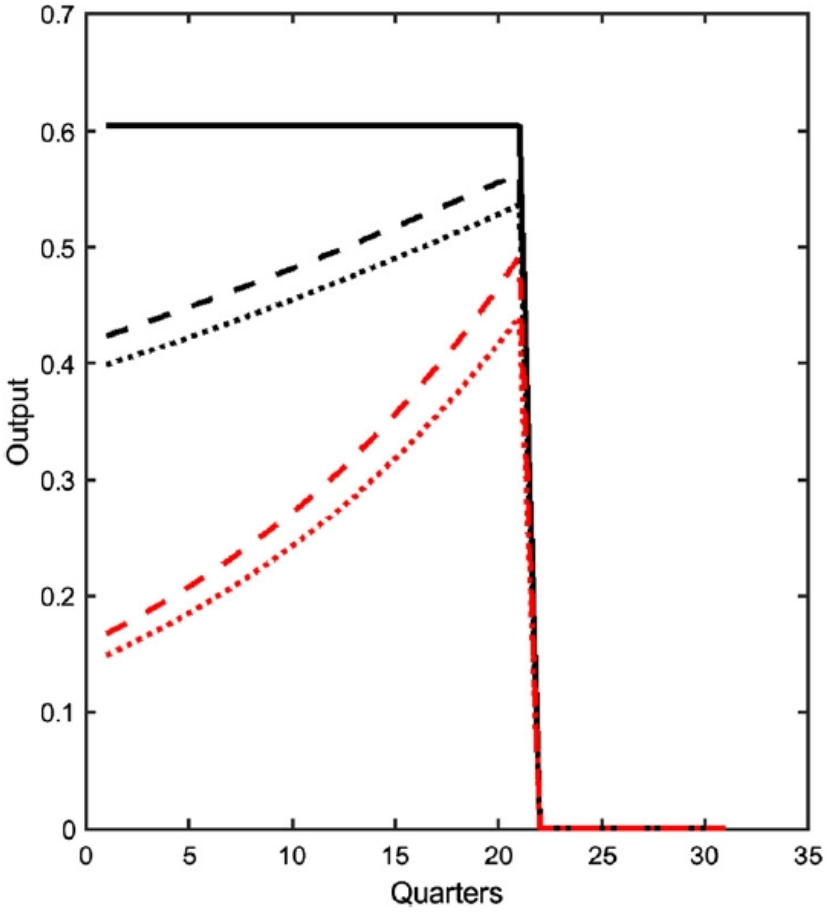
On-Impact Output Response to 1% real rate cut

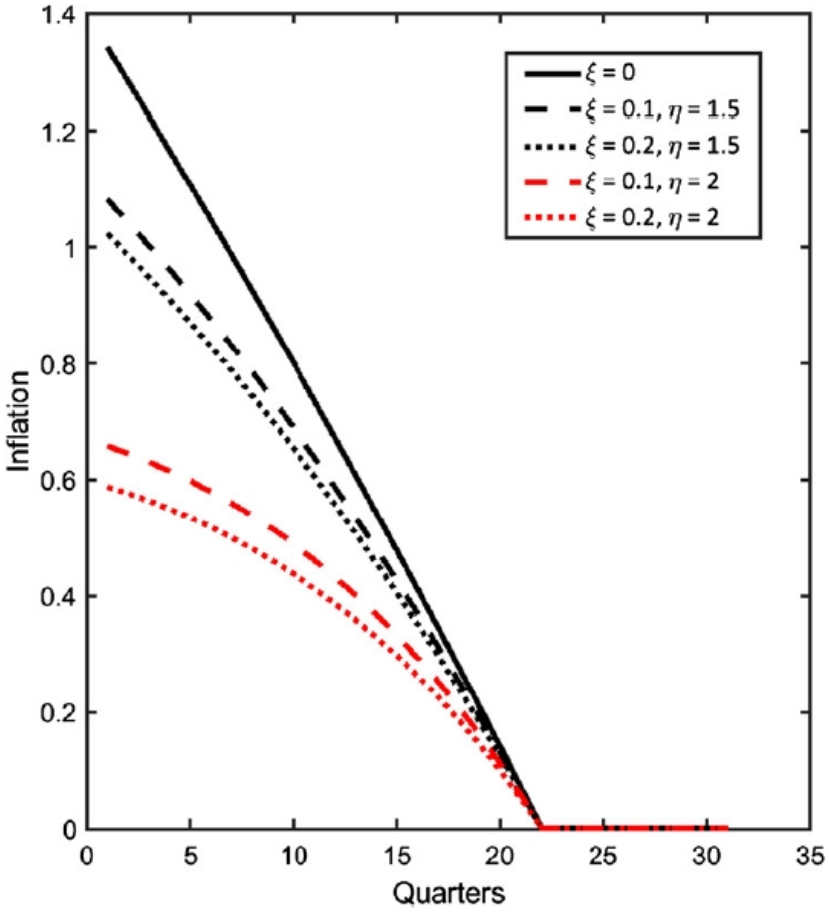


On-Impact Inflation Response to 1% real rate cut



Dynamic responses to 1% real rate cut (20 qrts ahead)





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Forward Guidance with Restricted Perceptions (in progress)

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- Agents will form expectations based on *mis-specified* perceived laws of motion for economic variables

- This is consistent with experimental/empirical evidence on expectation formation about macroeconomic and financial variables following simple AR(1) rules
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- That is: both inflation and output are simple AR(1) processes, with believed persistence γ_y and γ_π

- Hence, for $T \geq t$

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- As for RE, we match coefficient...but we DO NOT match the entire distribution of variables (only some moments)

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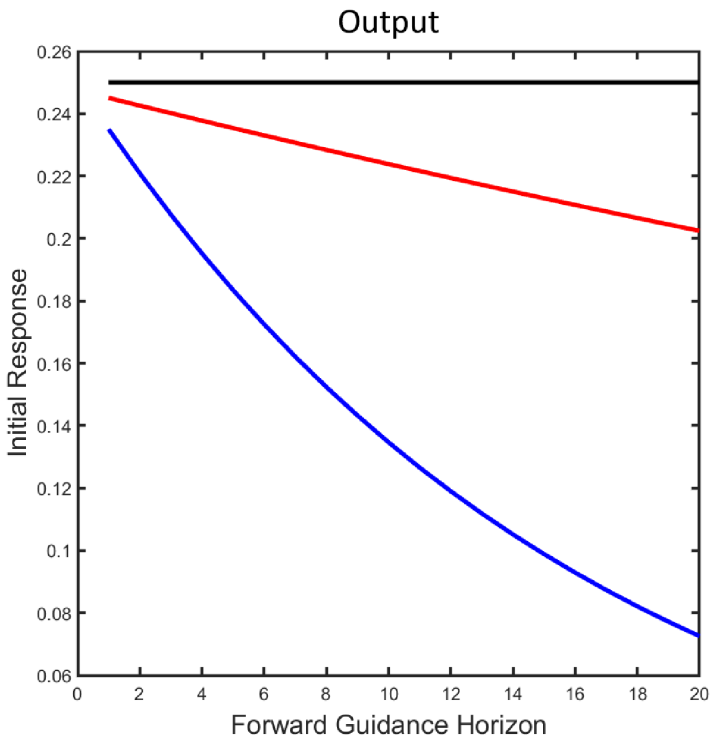
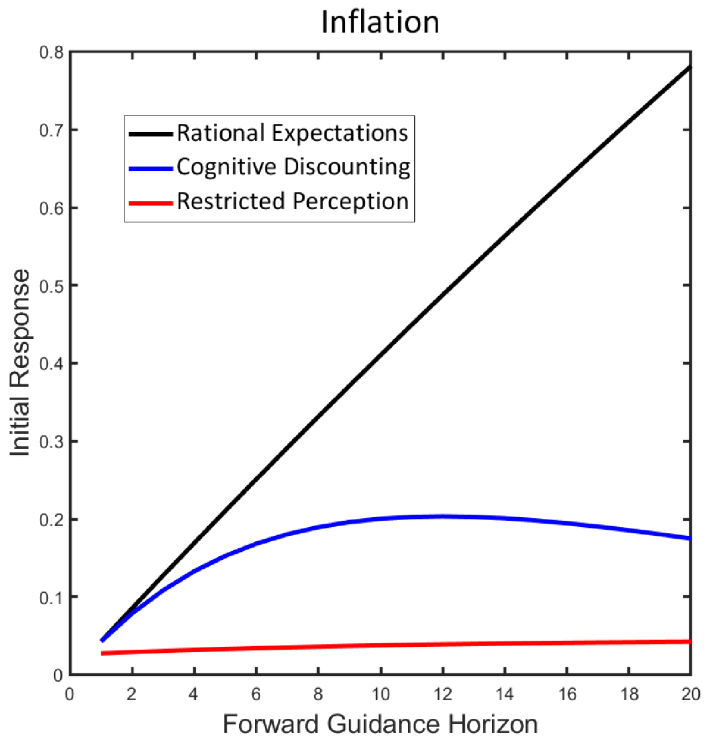
Experiment: announced 0.25% real rate cut to occur K qrts later





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