Monetary Policy – Conventional and Otherwise

Kalamazoo College
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The views expressed are my own and not those of the Federal Reserve
Bank of Chicago or the Federal Reserve System

Outline

- **Monetary policy goals**

- **How are we doing relative to those goals?**

- **Monetary policy operations**
  - Monetary policy as usual
  - Nontraditional policies when at the Zero Lower Bound (ZLB)
  - Risk management
  - Monetary policy environment today

Monetary Policy Goals

The Federal Reserve's Dual Mandate

■ **Federal Reserve Act: Section 2a. Monetary Policy Objectives**

■ **… the Federal Open Market Committee shall maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates.**

Long Run Goals and Policy Strategy Principles

- **Price stability**
  - Goal: 2% inflation in price index for total personal consumption expenditures (PCE)
  - Target is symmetric: an average over medium term, not a ceiling

- **Full employment**
  - Employment goal may change over time for non-monetary reasons
  - Most FOMC participants see 4.8-5.0% unemployment as consistent with mandate (current forecast of long-run "normal" unemployment)
  - Seek an economy operating at its level of potential output

- **Balanced approach**
  - Balanced approach to achieving both goals if they are in conflict
  - Takes account of lags and other limits in effects of monetary policy

Monetary Policy Goals: Output and Employment

- **We would like to see fully utilized productive resources**
  - Help close gaps between actual and "potential" output and employment
  - Okun's Law: $y = \bar{y} <=> u = u^n$

- **But if over-stimulate the economy eventually results in inefficiencies and increasing inflation**

$$\pi = E\pi + \frac{1}{\alpha}\left(y - \bar{y}\right) + v$$

- **In the long run:**
  - Potential output is the best can do on a sustainable basis
  - In the long run, the Fed can't make the economy grow faster than its potential (classical dichotomy)

Monetary Policy Goals: Price Stability

■ **Price stability provides the environment necessary to meet all the other goals of monetary policy**

■ **An environment of price stability makes planning easier**

– Price stability improves the workings of the price system -- high and variable inflation jam signals sent by relative prices

– Price stability may also lower long-term interest rates by reducing uncertainty

■ **Usually discussed in terms of cost of inflation being too high or too low**

How Are We Doing In Achieving Monetary Policy's Goals?

GDP Growth
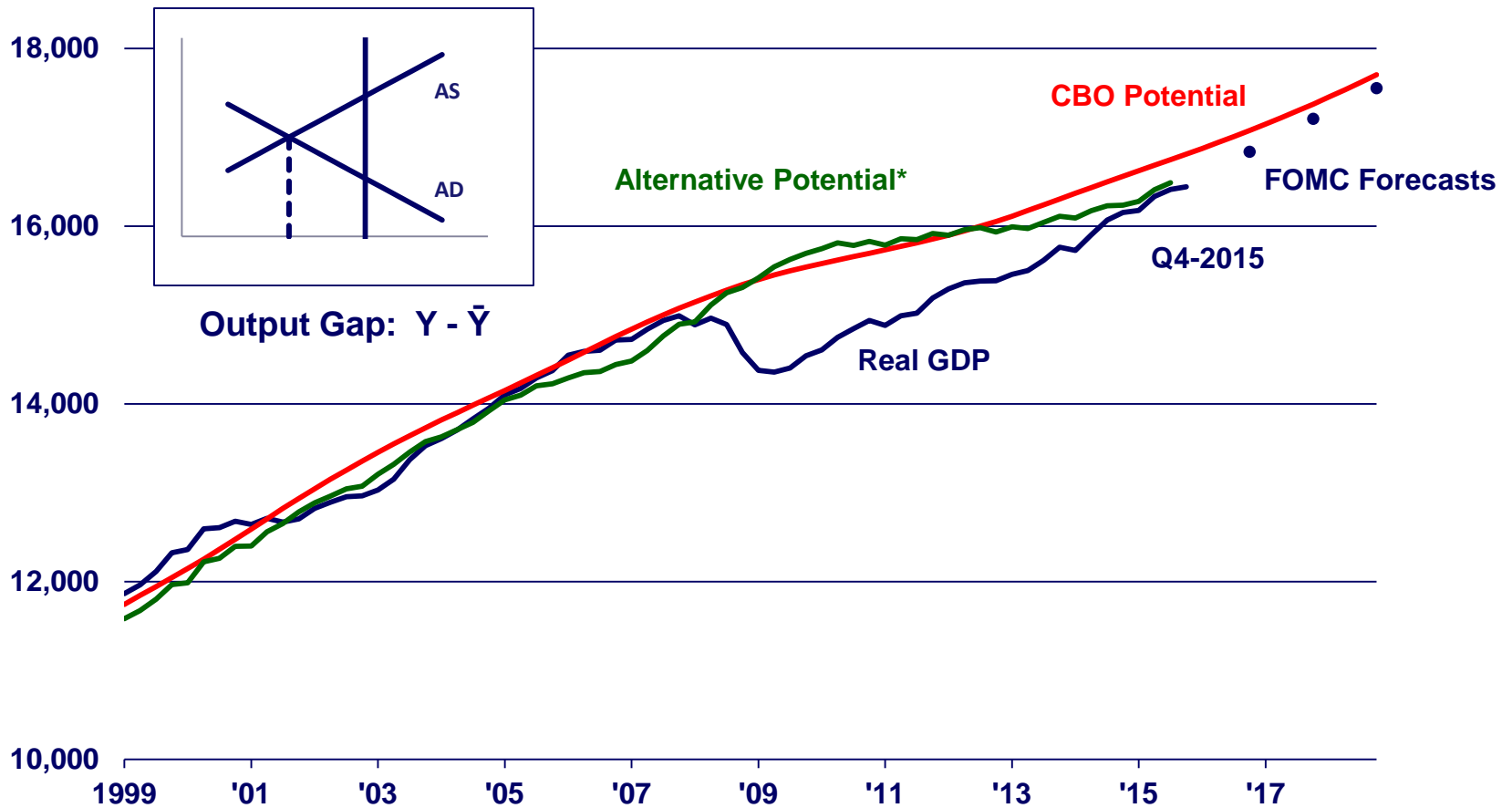
Real GDP Growth
(year-over-year percent change)
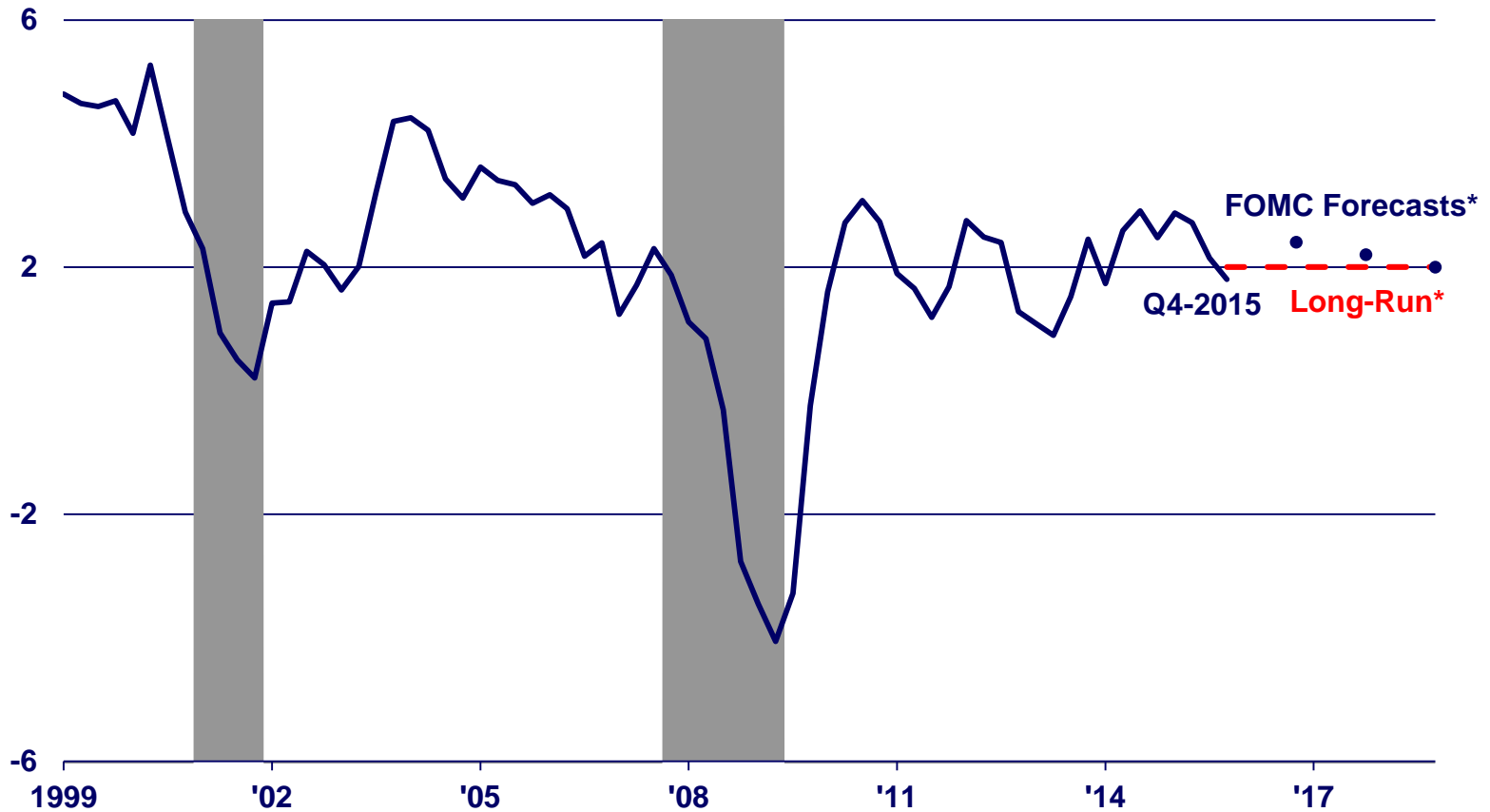
"Median" of the Q4-Q4 forecasts made by the FOMC participants as of December 16, 2015.

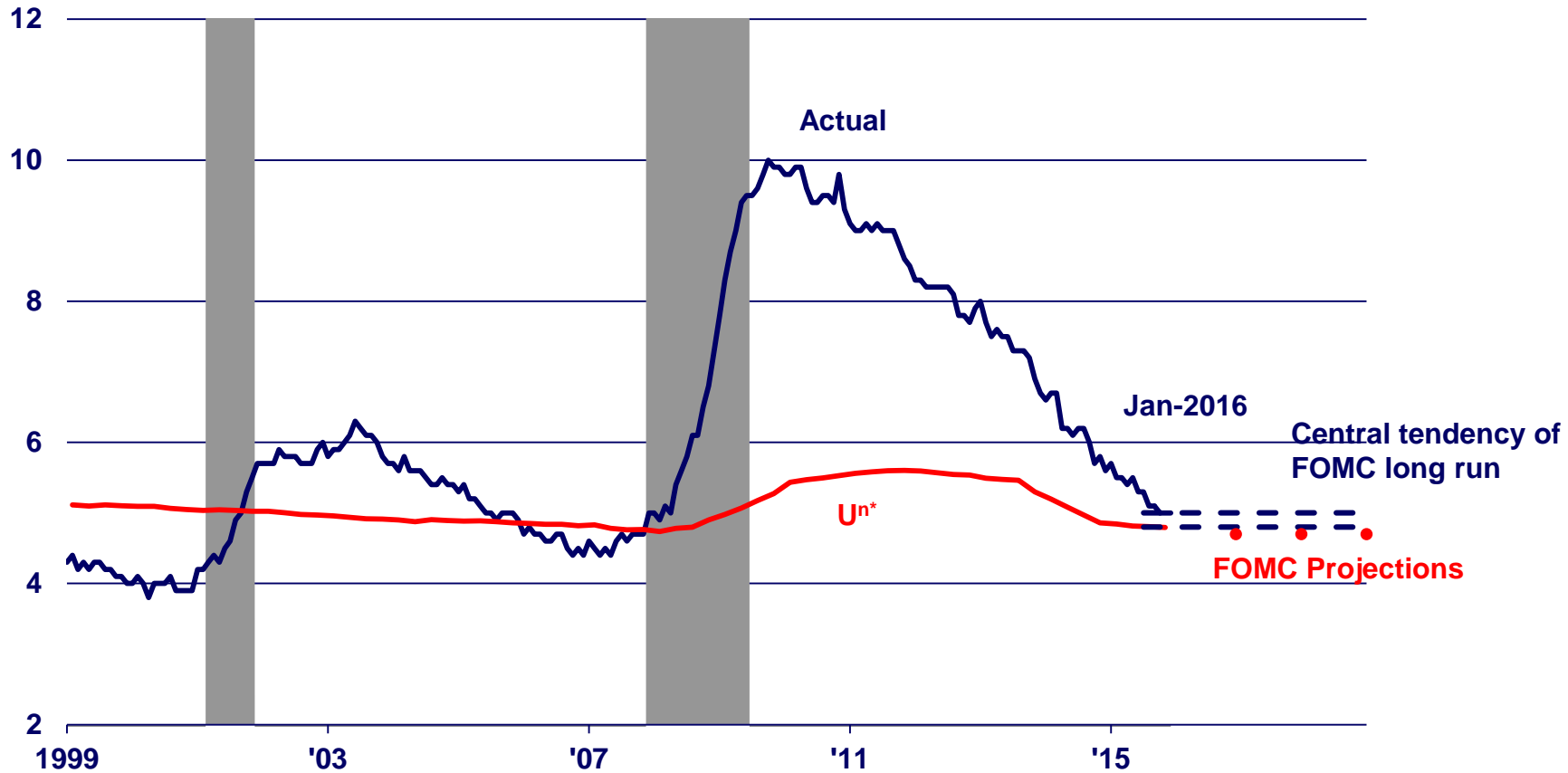# Actual and Potential GDP Level

Actual and Potential GDP
(Bils. 2009$)

Potential calculated from FRBUS output gap and actual GDP.

Unemployment Rate

Unemployment Rate
(percent)

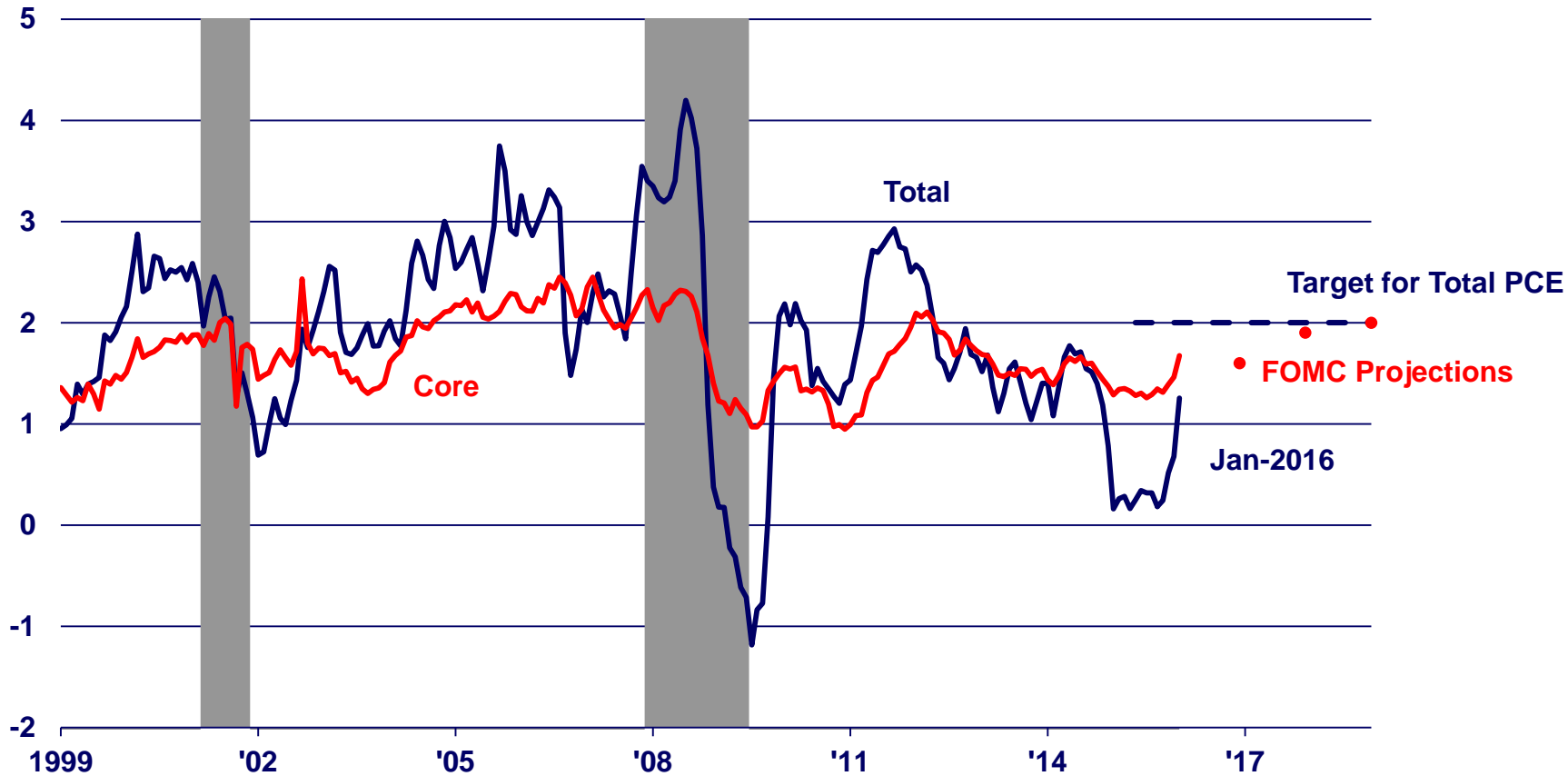**FRBCHI staff estimate of natural rate of unemployment*
FOMC projections are the median of projections from December 2015.
Source: Haver Analytics and Economic Projections of the Federal Reserve Board Members and Bank Presidents.

Inflation

PCE Price Index
(12-month percent change in the price index for personal consumption expenditures)

FOMC projections are the median of projections from December 2015.
Source: Haver Analytics and Economic Projections of the Federal Reserve Board Members and Bank Presidents.

Monetary Policy in Usual Times

Monetary Policy In Usual Times

- **Target the federal funds rate**

- **Changes in fed funds rate move other short-term interest rates**

- **Changes in short-term interest rates influence**
    - Longer-term interest rates
    - Exchange rates
    - Asset values

- **These then affect saving and investment decisions, which in turn influence employment and output**

- **Inflation influenced by these and factors**

Policy and Long term Interest rates

- **Longer-term interest rates roughly equal expected average future short-term rates plus a term premia (tp)**

$$r_t^{10} \approx \frac{1}{10} E_t \left[r_t^1 + r_{t+1}^1 + r_{t+2}^1 \ldots + r_{t+10}^1 \right] + tp_t^{10}$$

  - tp reflects risk of holding a long-term bond relative to rolling over a series of short-term bonds
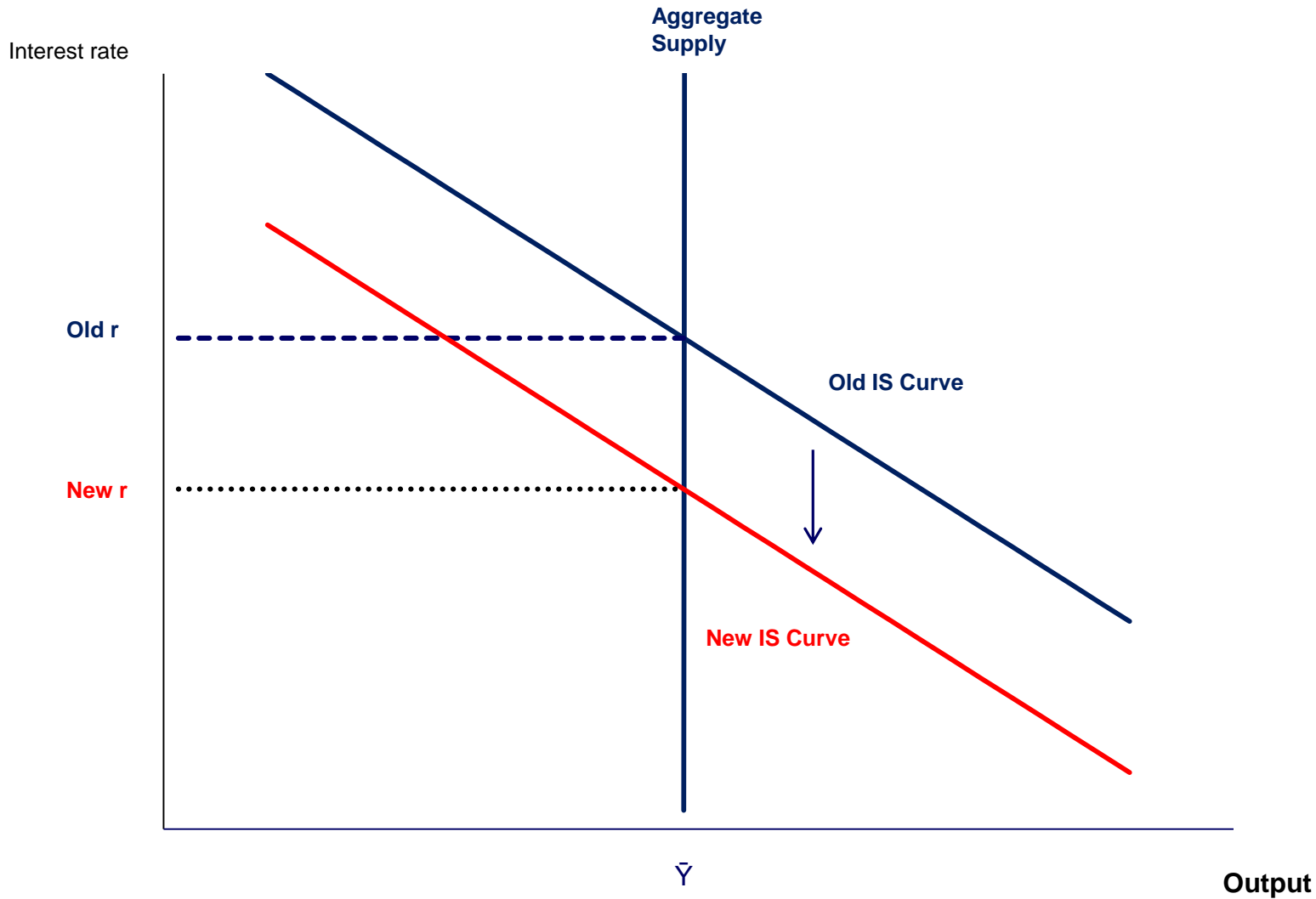
- **Fed controls the overnight federal funds rate, r_t**

$$r_t^1 \approx \frac{1}{365} E_t \sum_{t=1}^{365} r_t + tp_t^1$$

14

Aggregate Demand Decline Policy Response

Assume $\pi = 0$

Normal Adjustment

Simple Monetary Policy Rules

- **A description of how policy "usually" works**

- **Taylor's 1999 rule**

$$r = 2 + \pi + 0.5(\pi - \pi^*) + 1.0(y - \overline{y})$$
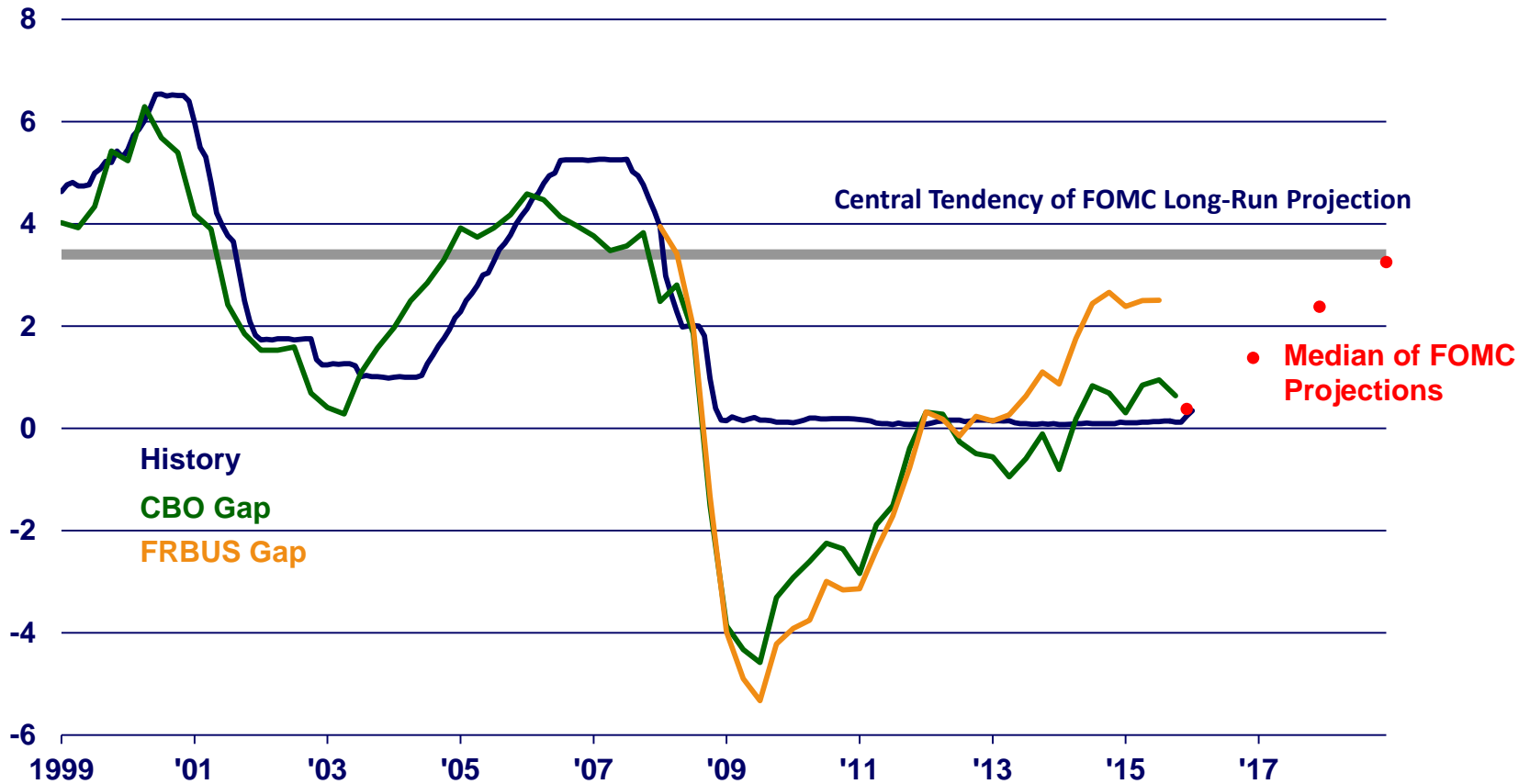
- **Such simple rules are descriptive, but they are not "optimal policy"**

- **Numerous factors can cause deviation from simple rules**

Policy Rate Constrained By Zero Lower Bound

Fed Funds Rate
(percent)

Taylor Rule: $r_t = 2.0 + \pi_t + 0.5(\pi_t - 2) + 1.0\,(y_t - y_t^*)$

Central Tendency of FOMC Long-Run Projection

Median of FOMC Projections
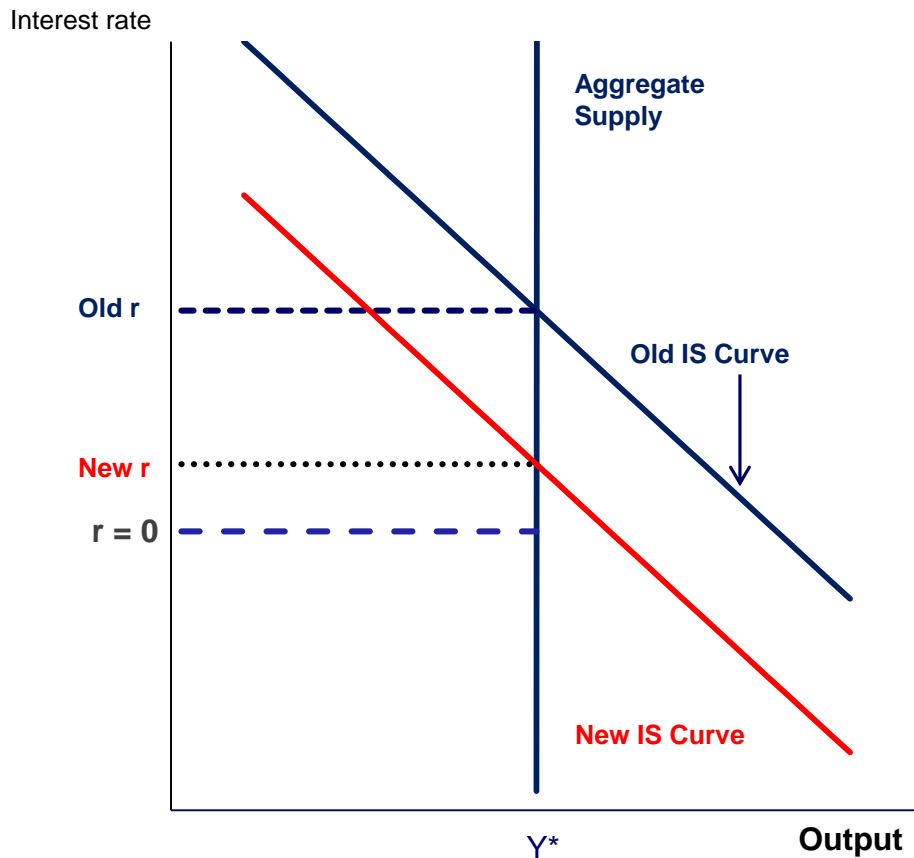
History
CBO Gap
FRBUS Gap

Taylor Rules use core inflation. Alternative gap based on alternative potential output shown above.
CBO potential derived from CBO estimates, February 2013.
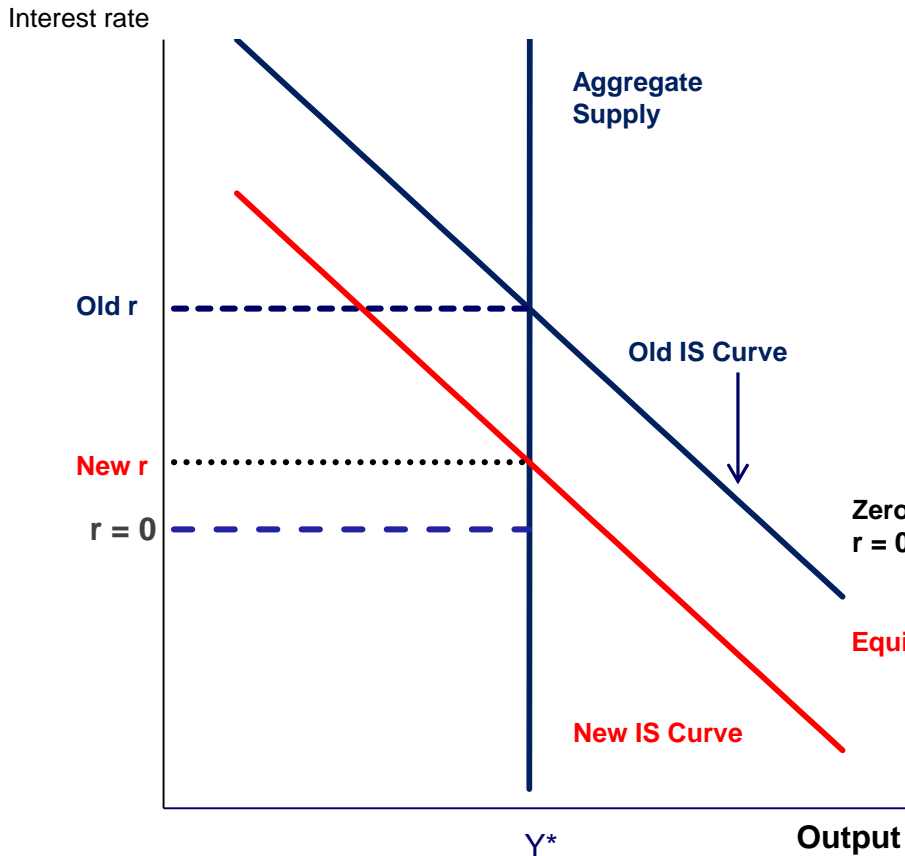
17

Aggregate Demand Decline and the ZLB
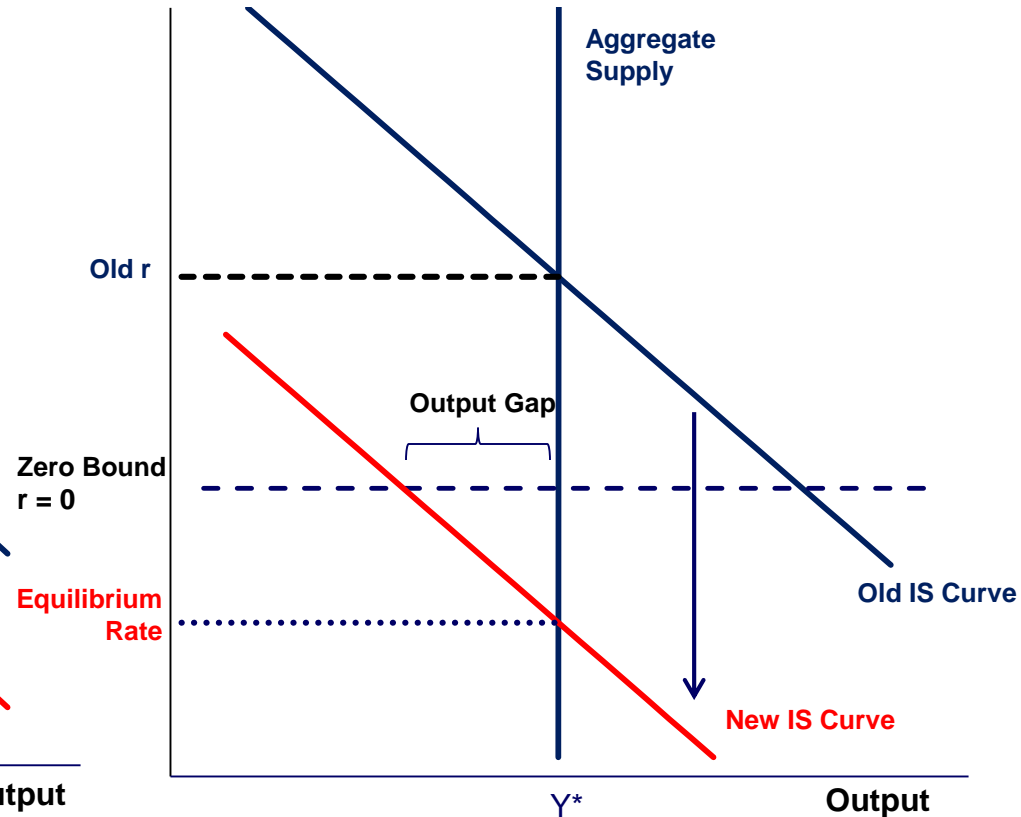
Assume $\pi = 0$

Normal Adjustment

Interest rate

Aggregate Supply

Old r

Old IS Curve

New r

r = 0

New IS Curve

Y*

Output

Aggregate Demand Decline and the ZLB

Assume $\pi = 0$

Monetary Policy Near the Zero Lower Bound

Monetary Policy At The Zero Lower Bound

■ **What to do when can't cut <u>current</u> short-term rate any further?**

■ **Lower medium and longer-term interest rates**

 – Most spending decisions rely on medium and longer-term interest rates

 ◆ Auto loans

 ◆ Mortgages

 ◆ Bonds and many business bank loans

 – Exchange rates and asset prices are influenced by medium and longer-term interest rates

Monetary Policy At The Zero Lower Bound

■ **Longer-term interest rates roughly equal expected average future short-term rates plus a term premia (tp)**

$$r_t^{10} \approx \frac{1}{10} E_t \left[r_t^1 + r_{t+1}^1 + r_{t+2}^1 ... + r_{t+10}^1 \right] + tp_t^{10}$$

■ **Option 1: Lower expectations of average <u>future</u> short-term rates through "forward guidance" on future policy rates**

■ **Option 2: Buy long-term bonds to**

– Buying bond raises its price and so lowers its interest rate

♦ Reduce term premium

♦ Reinforce option 1

Option 1: Forward Guidance on Funds Rate

- **Economic conditions likely to warrant exceptionally low level of the funds rate:**

  - **December 2008: "for some time"**

  - **March 2009: "for an extended period"**

  - **August 2011: "at least through mid 2013"**

  - **January 2012: "at least through late 2014"**

Forward Guidance on Funds Rate cont.

- **September 2012: "…the Committee expects that a highly accommodative stance of monetary policy will remain appropriate <u>for a considerable time after the economic recovery strengthens</u>….at least through mid-2015."**

- **Make up for period of constraint by ZLB by committing to a lower rate path for rates in the future then you would "normally" do.**

Forward Guidance on Funds Rate cont.

■ **December 2012:   "Economic conditions likely to warrant exceptionally low level of the funds rate at least as long as <u>the unemployment rate remains above 6-1/2 percent</u>, <u>inflation</u> between one and two years ahead is projected to be <u>no more than a half of a percentage point above</u> the Committee's <u>2 percent</u> long-run goal, and longer-term <u>inflation expectations</u> continue to be <u>well-anchored</u>."**

Policymaker's Optimization Problem

Minimize a loss function in ($\pi_t - \pi^*$, $u_t - u^n$):

$$\min_{r_t} L = \frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t \, (\pi_t - \pi^*)^2 + (u_t - u^n)^2 \quad s.t. \; r_t \geq 0$$
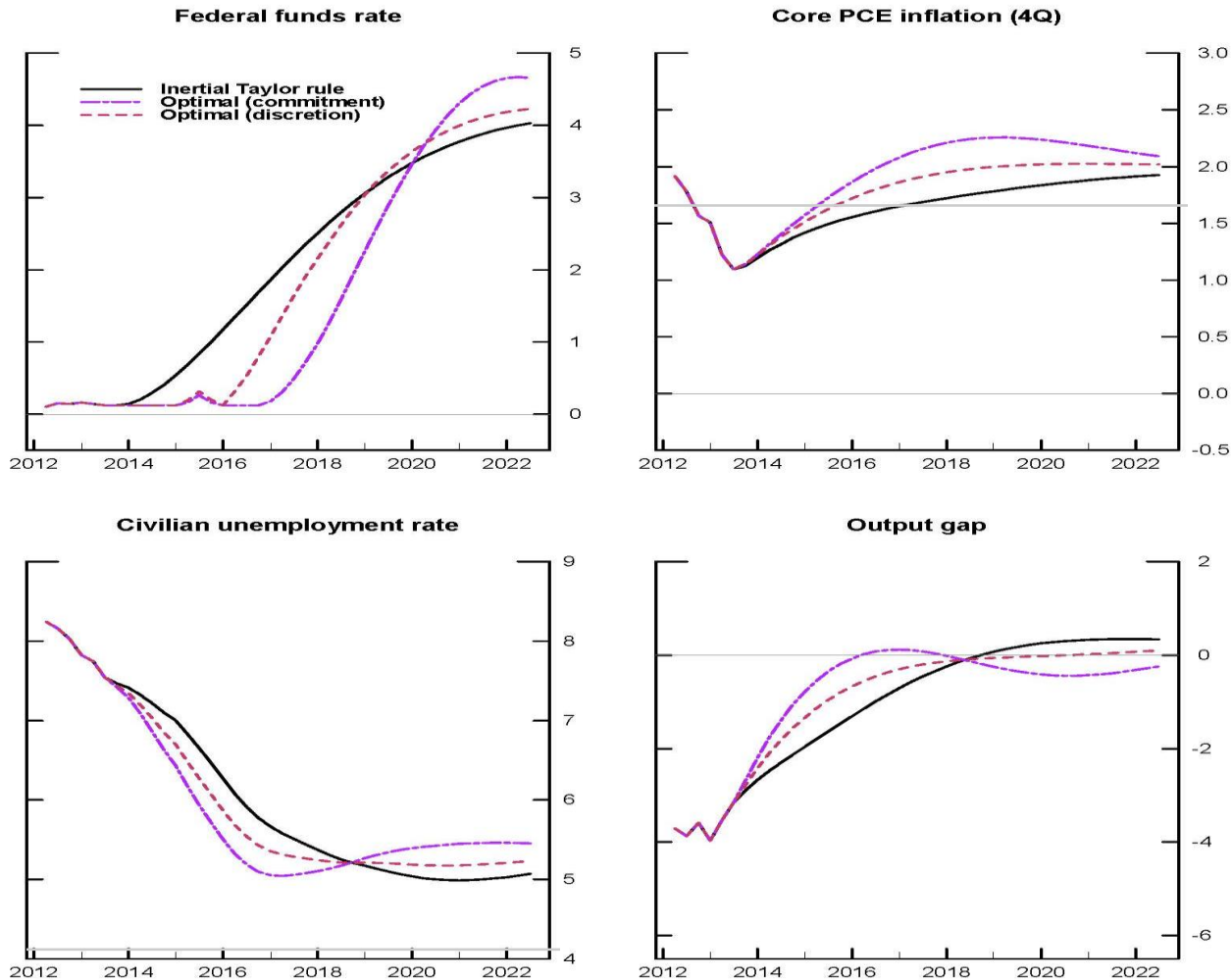
π - Actual inflation rate

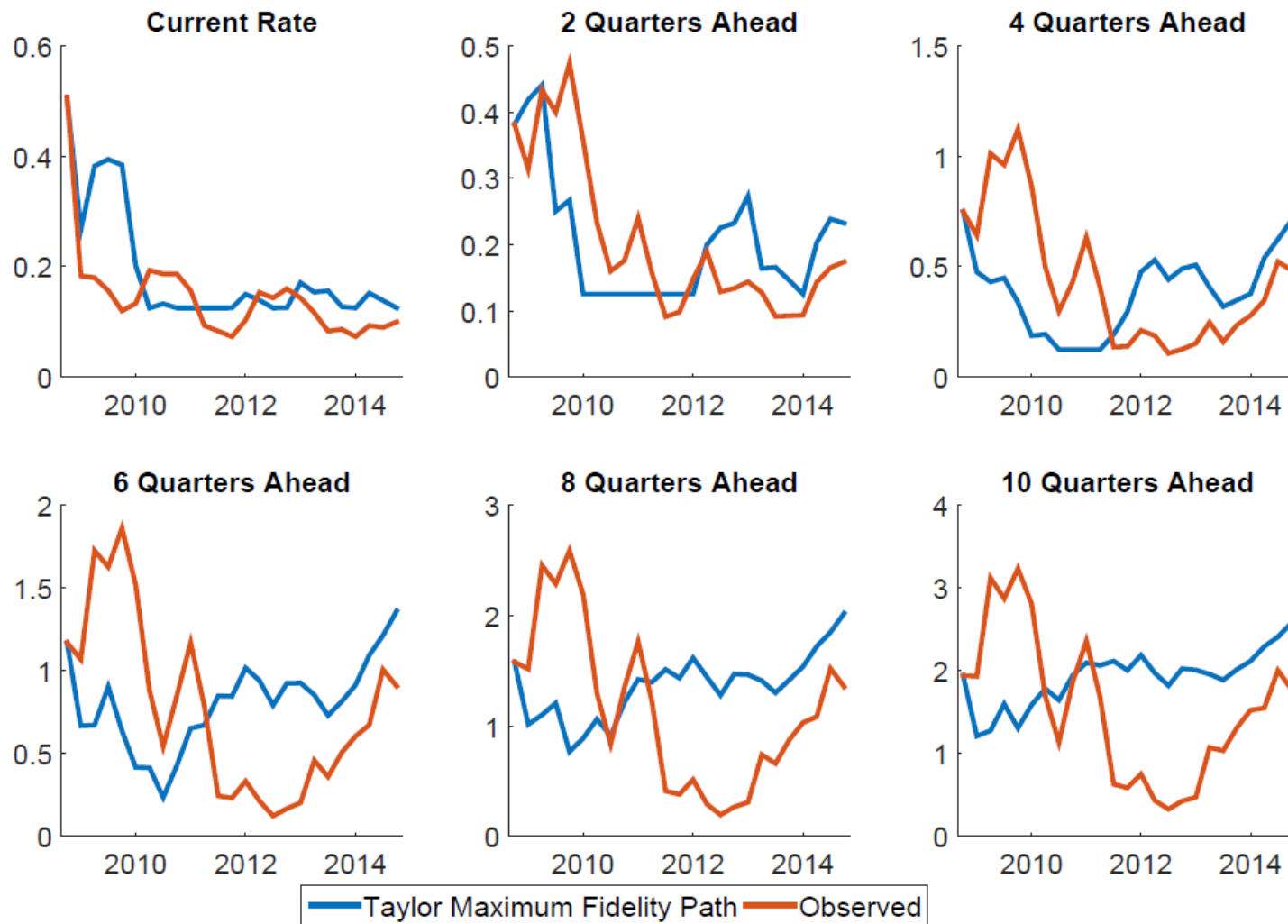**π^* - Inflation target**

u - Unemployment rate

u^n - NAIRU

Some Optimal Control Monetary Policies

Figure 4
Optimal policies versus the inertial Taylor (1999) rule
(Baseline conditions)

The Federal Reserves Framework for Monetary Policy: Recent Changes and New Questions;
English, Lopez-Salido, and Tetlow, FEDS Discussion series, 2013

Forward Guidance

Campbell, Fisher, Justiniano, Melosi, forthcoming NBER Macroannual

Option 2: Large Scale Asset Purchases (LSAP)

- **LSAP I (11/08): $600 bill agency debt/MBS**

- **LSAP Ia (3/09): $850 bill agency debt/MBS; $300 bill Treas.**

- **LSAP II (11/10): $600 bill Treas.**

- **MEP (9/11): Exchange $400 bill short-term for $400 bill long-term Treas.**

- **MEP extension (6/12): Extend MEP through end of 2012**

- **LSAP III (9/12): $40 bill per month MBS, no fixed end date -- "until labor market outlook improved substantially"**

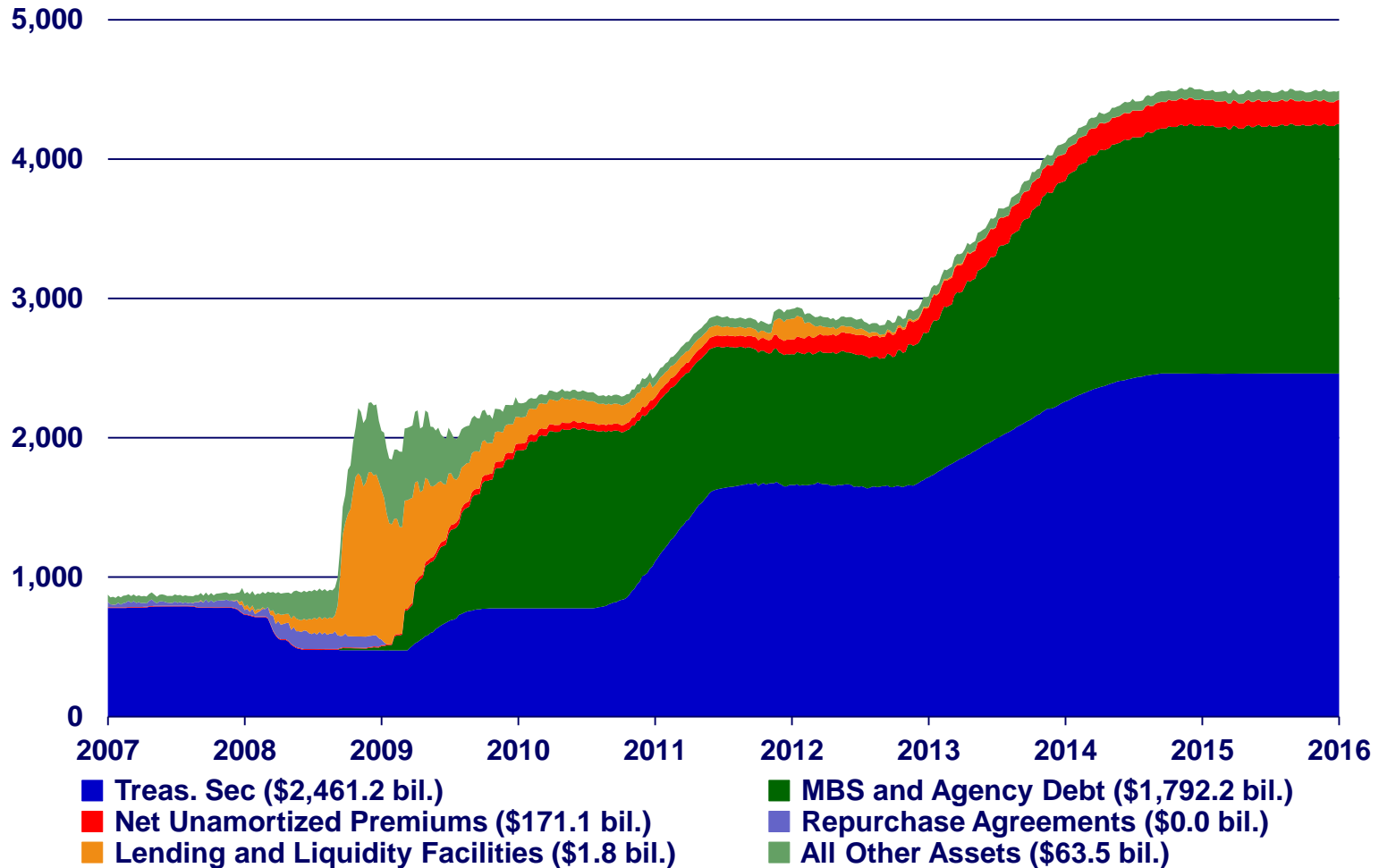- **LSAP IIIa (12/12): $40 bill per month MBS and $45 bill per month long-term Treas; no fixed end date**

Large-Scale Asset Purchases cont.
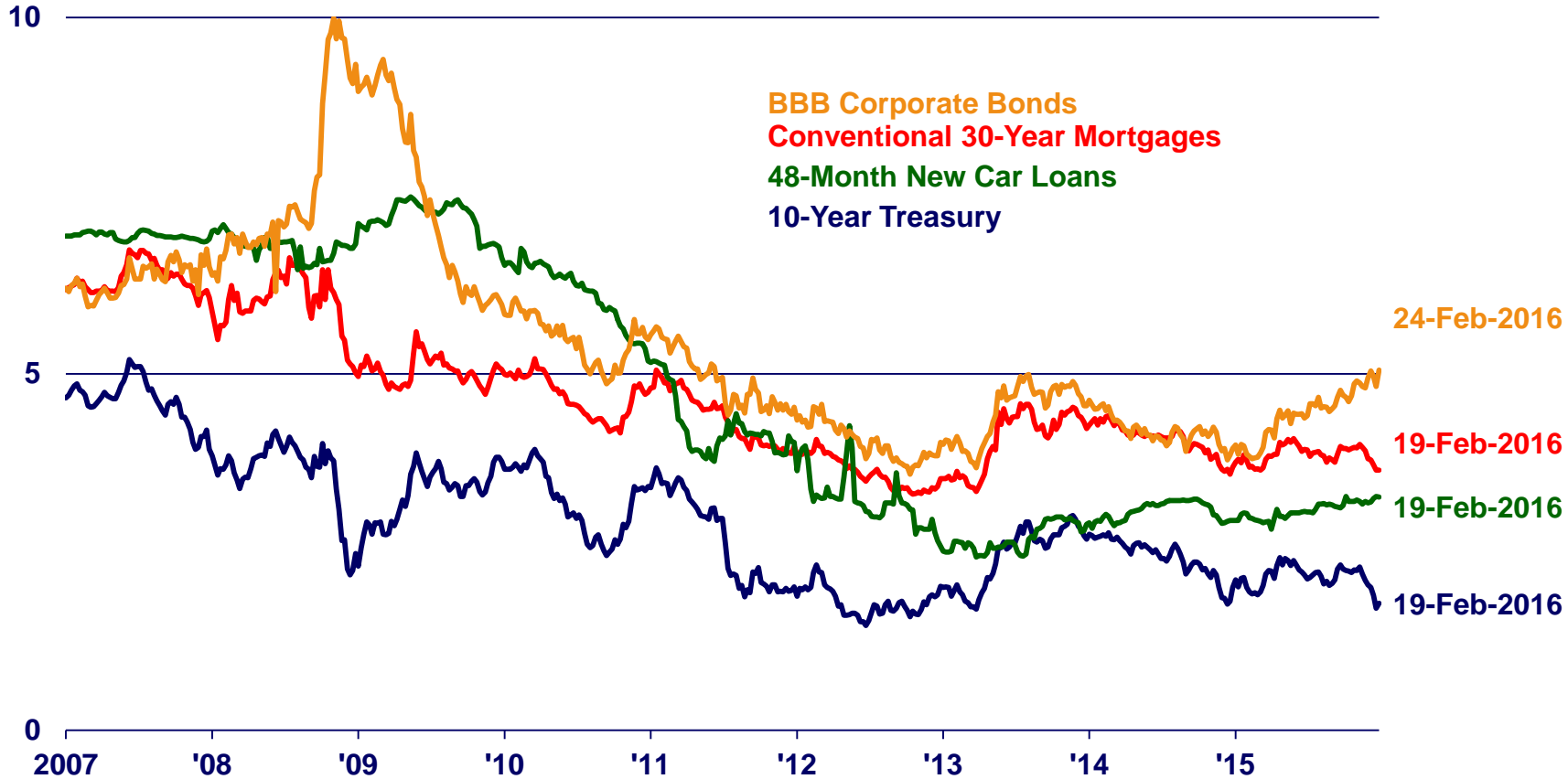

Federal Reserve Assets
(Bil. $)

Wide range of estimates:
$500 billion LSAP ≈ 20-25 bps
on 10-year Treasury

**Total Assets
($4,489.8 bil.)**

- **Treas. Sec ($2,461.2 bil.)**
- **Net Unamortized Premiums ($171.1 bil.)**
- **Lending and Liquidity Facilities ($1.8 bil.)**
- **MBS and Agency Debt ($1,792.2 bil.)**
- **Repurchase Agreements ($0.0 bil.)**
- **All Other Assets ($63.5 bil.)**

Long-Term Rates Down Significantly

Long-Term Rates
(percent)

BBB Corporate Bonds
Conventional 30-Year Mortgages
48-Month New Car Loans
10-Year Treasury

24-Feb-2016
19-Feb-2016
19-Feb-2016
19-Feb-2016

Estimates of Term Premia Effects: Ihrig et al.

Figure 3
Estimated Term Premium Effects of the FOMC's Asset Purchases
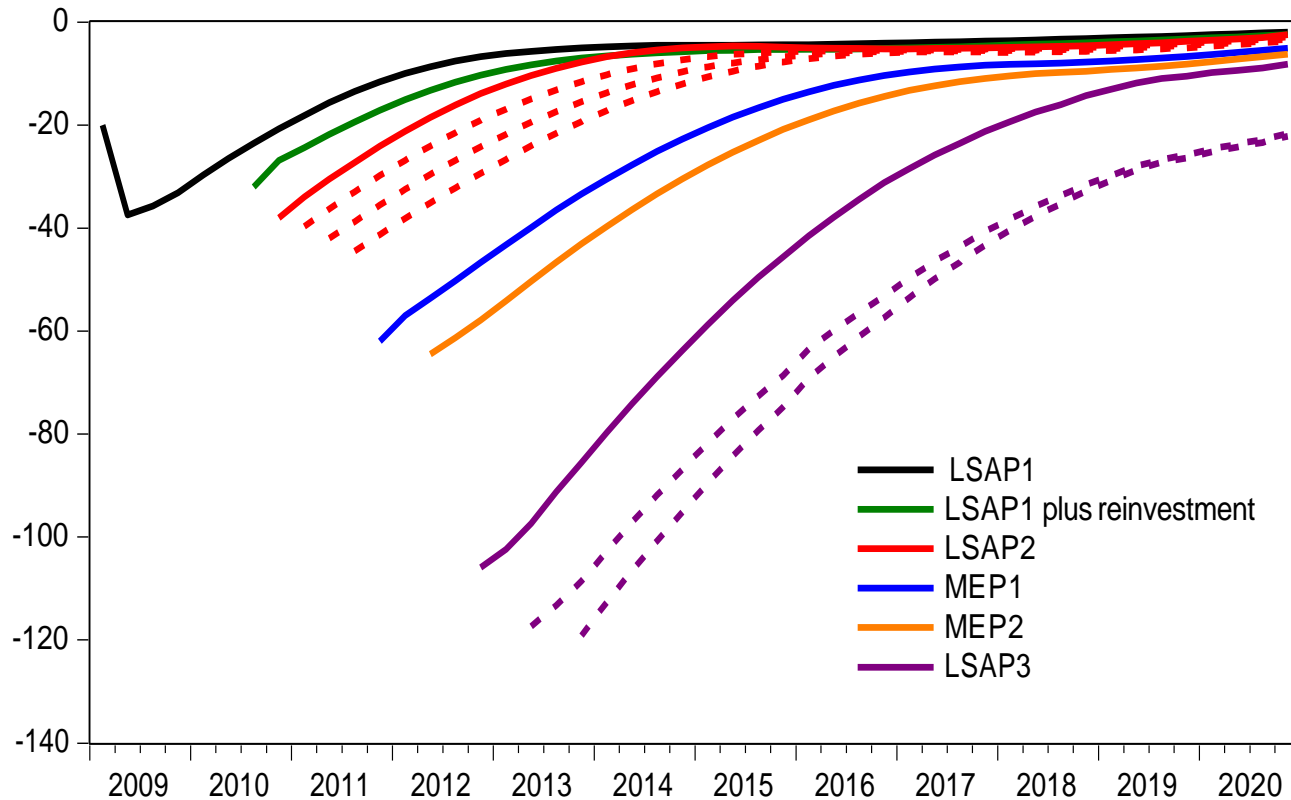
Source: Ihrig et al. (2012). Effects of LSAP3 program computed by the authors; see text for details.

Estimates of Unconventional Policy

Figure 9. Predicted Evolution of the Economy in the Absence of Unconventional Policy


— no actions (version 1) — no actions (version 2) — history with Oct-2013 Blue Chip projections
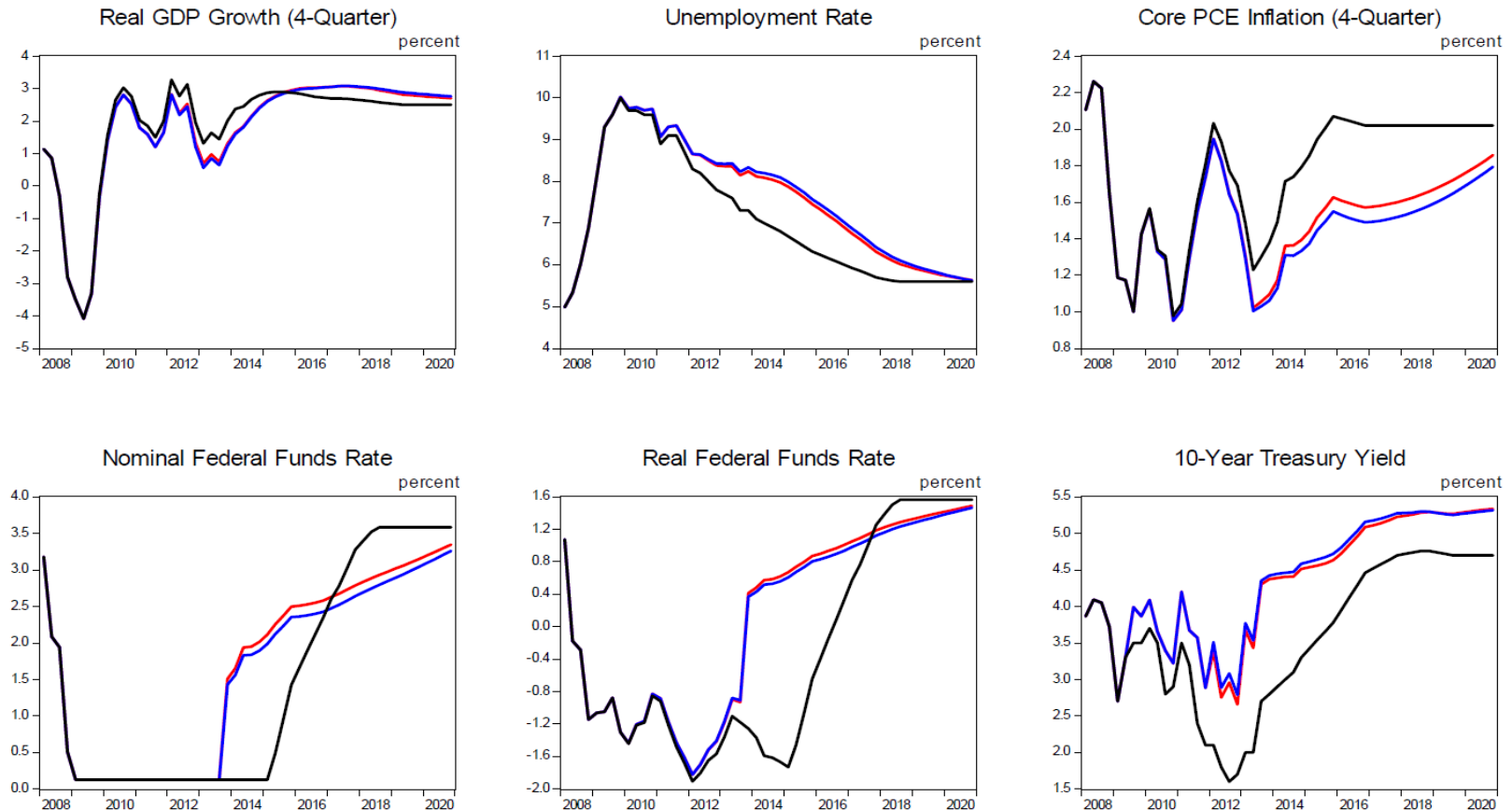
Note: The version 1 simulation assumes that agents in the historical baseline always view the fund rate rule as non-inertial. In the version 2 simulations, agents in the baseline perceive the funds rate rule becoming inertial (lambda=0.8) beginning in 2012.

The Macroeconomic Effects of the Federal Reserve's Unconventional Monetary Policies; Eric M. Engen, Thomas Laubach, and David Reifschneider FEDS WP 2015-005

3

Alternative Estimates of Unconventional Policy

Figure 10. Estimated Effects of of Unconventional Policy in Diferent Specifications of the FRB/US Model
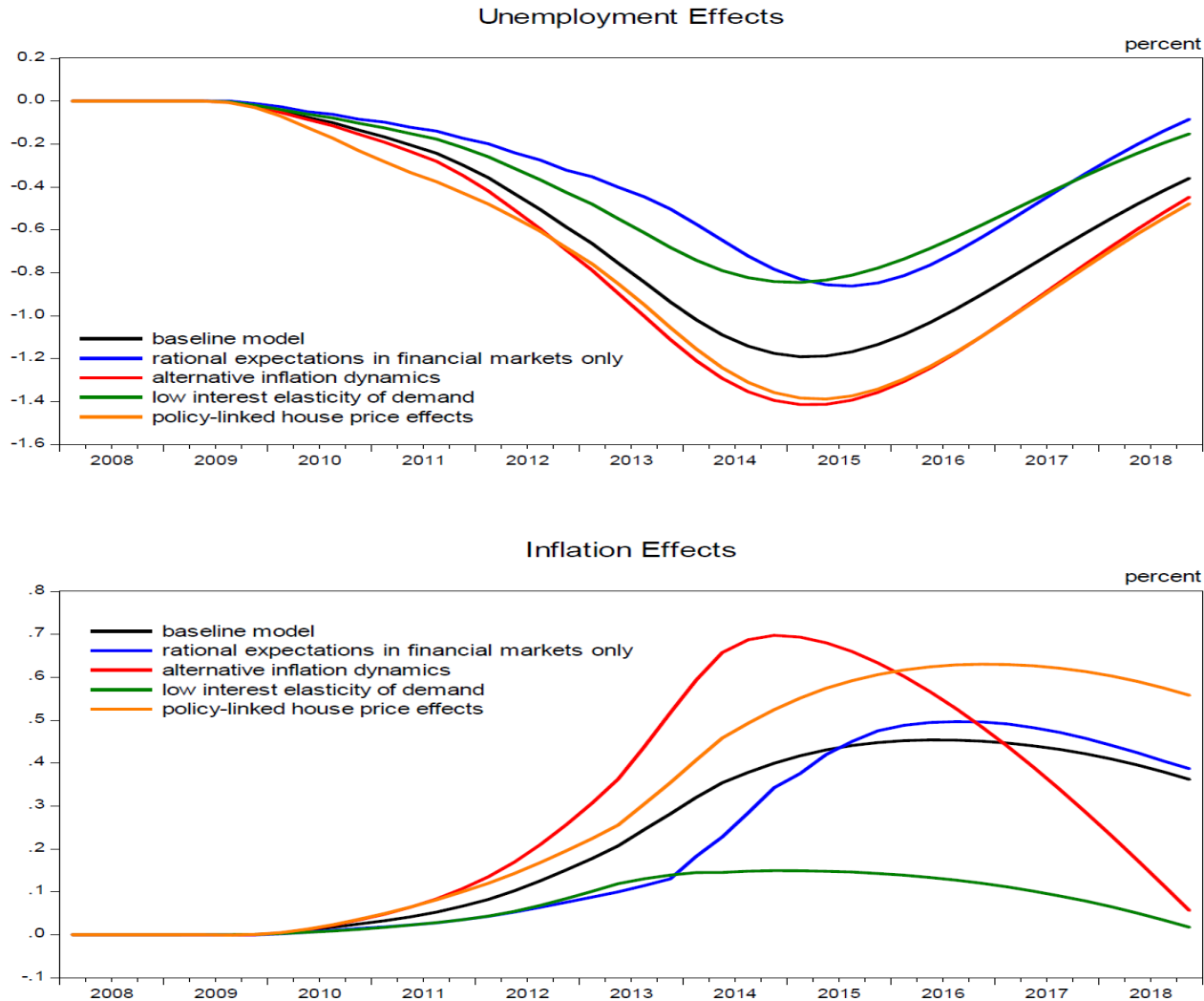
Note. Results expressed as differences from history and the October 2013 Blue Chip forecasts.

The Macroeconomic Effects of the Federal Reserve's Unconventional Monetary Policies; Eric M. Engen, Thomas Laubach, and David Reifschneider FEDS WP 2015-005

34

Alternative Policies: Necessary, but Second Best

- **Effects on the economy are more uncertain than for conventional policy**

  - Uncertain theoretical and empirical grounds

  - Complicated interactions between alternative policies and private sector expectations

- **Four common cited potential costs**

  - Increases in reserves from LSAPs risk inflation

  - Large balance sheet may make it difficult to raise rates when the time comes

  - Potential Fed balance sheet losses

  - Extended period of very low interest rates and Fed activity in long-term Treasury and MBS markets risk inefficient capital allocation and financial instability
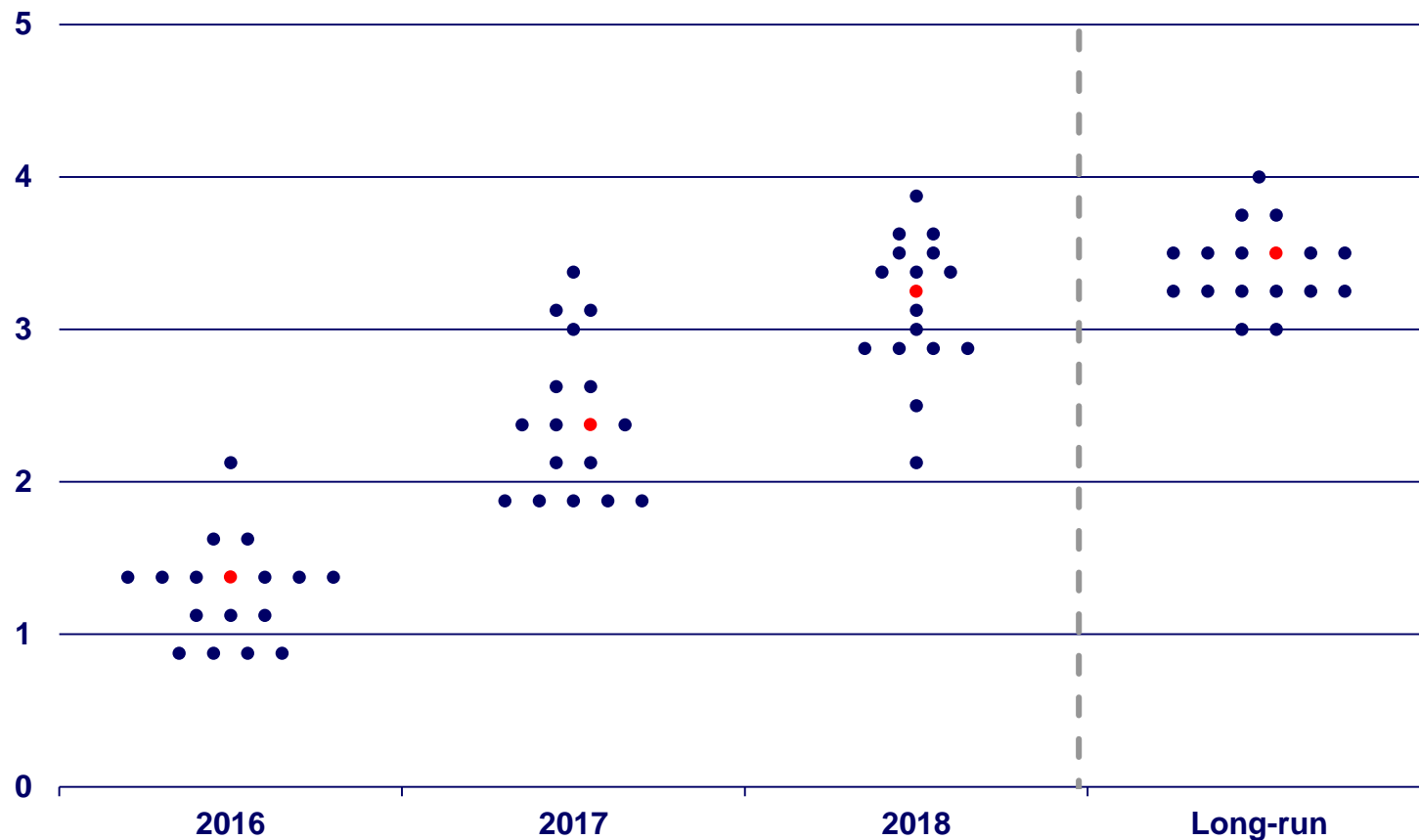
Monetary Policy Environment Today

FOMC Raised Rates in December

- **Federal Funds rate had been effectively at zero since December 2008**

- **Given improvements in labor markets and confidence that inflation would rise to target, FOMC raised the funds rate target**

- **What might the path for rates look like going forward?**
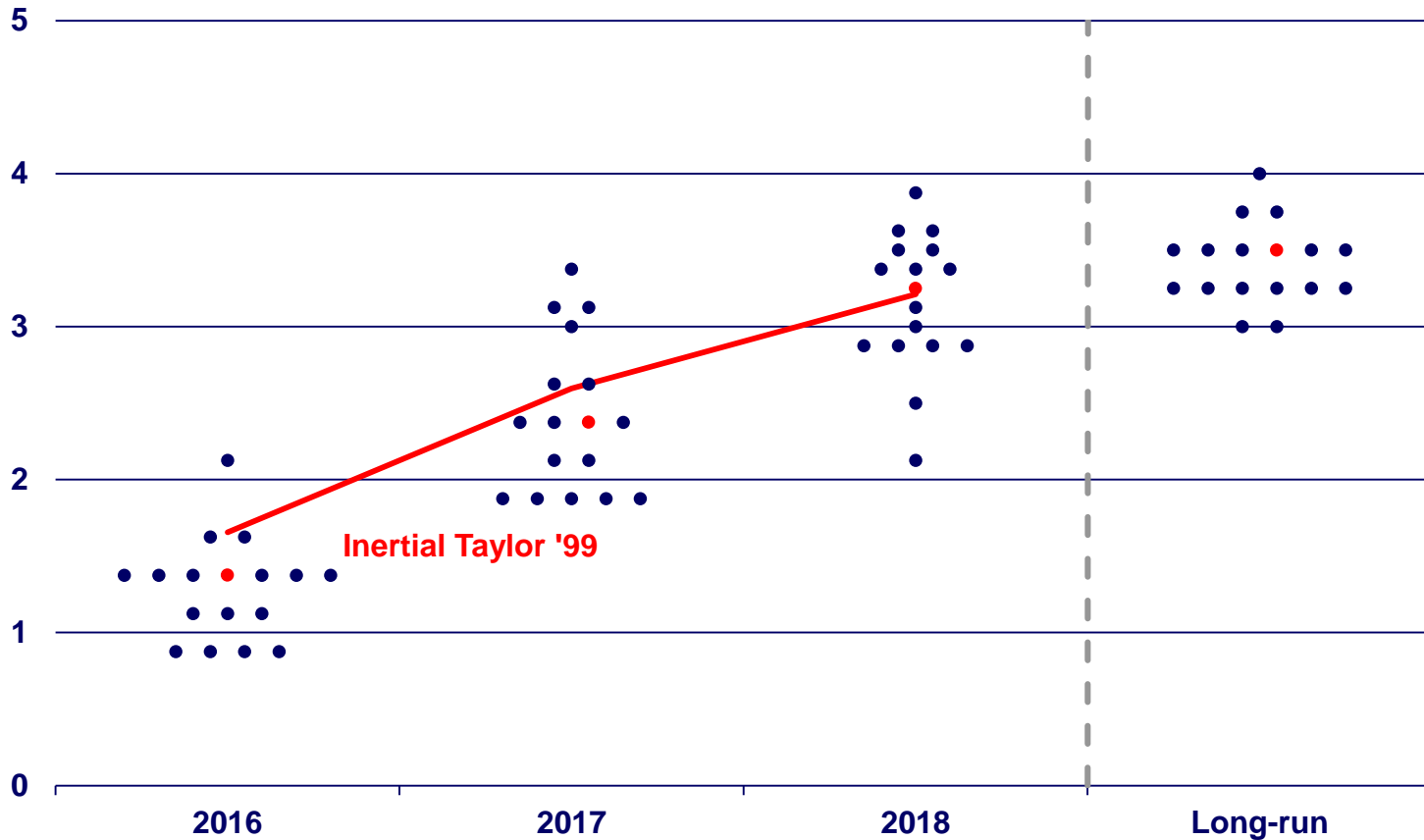
Appropriate Pace of Policy Firming

Federal Funds Rate at Year-End
(percent)

Source: Interest rate projections are from the December 16, 2015 FOMC Summary of Economic Projections. Red dots indicate the median projection.

FOMC "Appropriate" Policy Rates

Federal Funds Rate at Year-End
(percent)

Inertial Taylor '99

Source: Interest rate projections are from the December 16, 2015 FOMC Summary of Economic Projections. Red dots indicate the median projection.

FOMC Communications: Data Dependence

- **The actual path of the federal funds rate will depend on the economic outlook as informed by incoming data**

- **Realized and expected conditions relative to maximum employment and 2 percent inflation**

- **Take account a wide range of information**
  - Labor market conditions, inflation pressures and inflation expectations, and financial and international developments

FOMC Communications: Path Likely Gradual

- **The Committee expects:**

- **that economic conditions will evolve in a manner that will warrant only gradual increases in the federal funds rate;**

- **the federal funds rate is likely to remain, for some time, below levels that are expected to prevail in the longer run.**

FOMC Communications: Is r* Low?

- **Taylor's 1999 rule**
  - r = 2 + π + 0.5(π – 2) + 1.0(Y – $\bar{\text{Y}}$)
  - 2 = r* = equilibrium real interest rate

- **But is r* = 2?**

- **Maybe not; could be below**
  - FOMC long run central tendency 1-1/4 to 1-1/2
  - And could be lower than that in short run
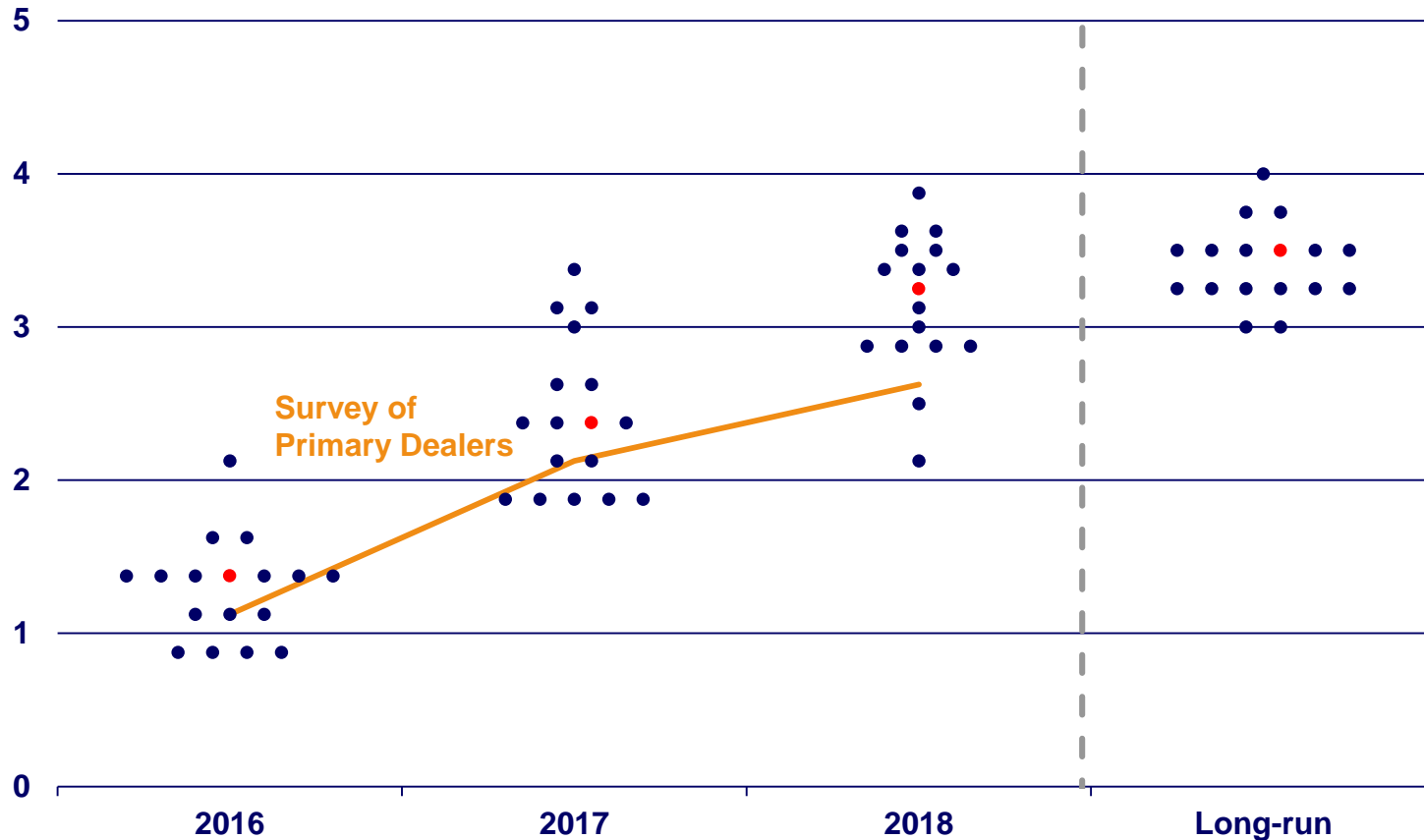
Model Estimates of r*

A. Estimates of the neutral real rate in the longer run
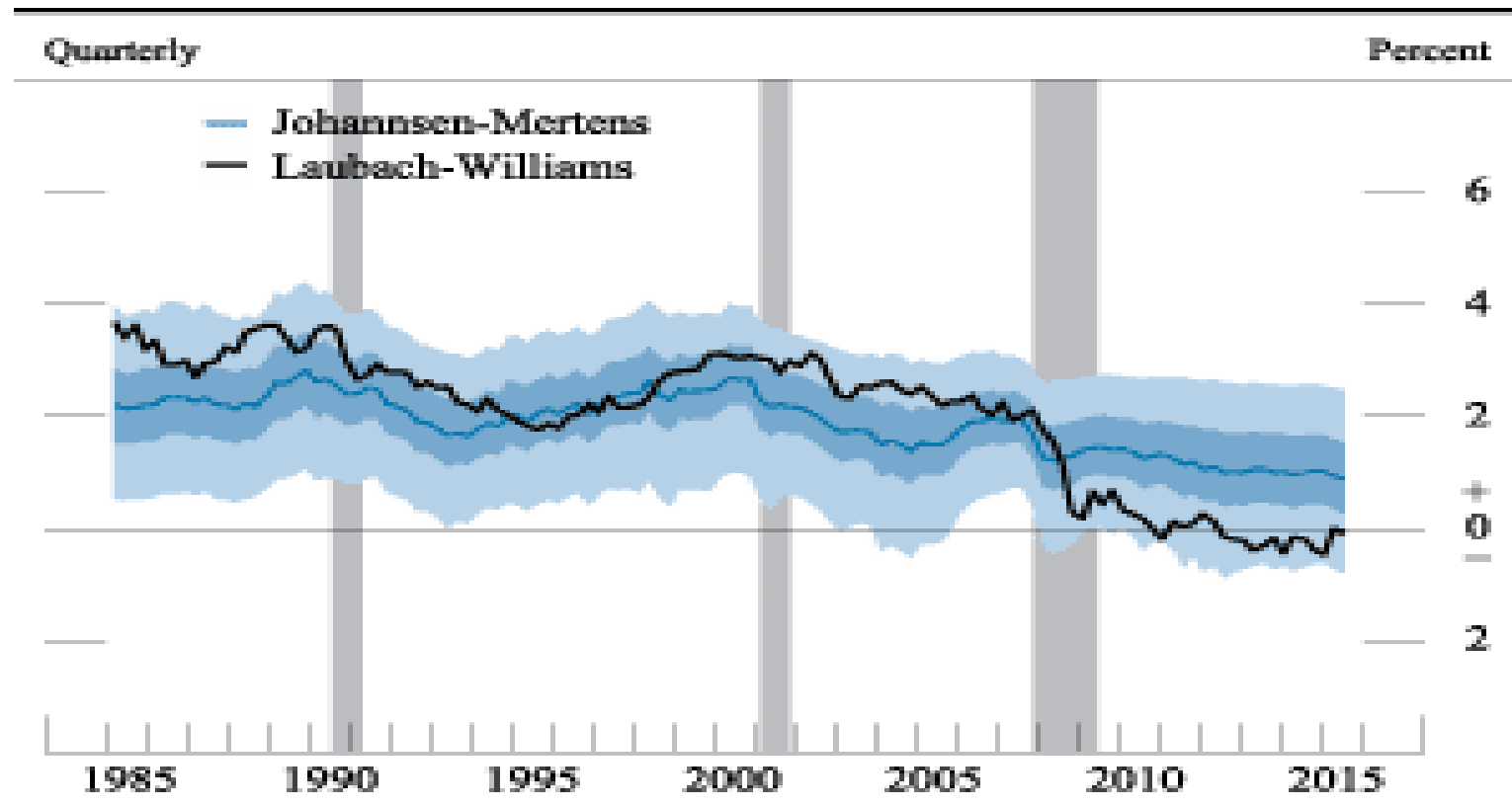
NOTE: The data extend through 2015:Q3. For the Johannsen-Mertens model, at each date, the parameters of the model and the longer-run equilibrium real rate are jointly estimated using data up to that date. For the Laubach-Williams model, the parameters are estimated on the entire data sample, but estimates of the longer-run equilibrium real rate use data only up to the date of interest. Shaded regions are 50 and 90 percent uncertainty bands from the Johannsen-Mertens model. The shaded bars indicate periods of business recession as defined by the National Bureau of Economic

43

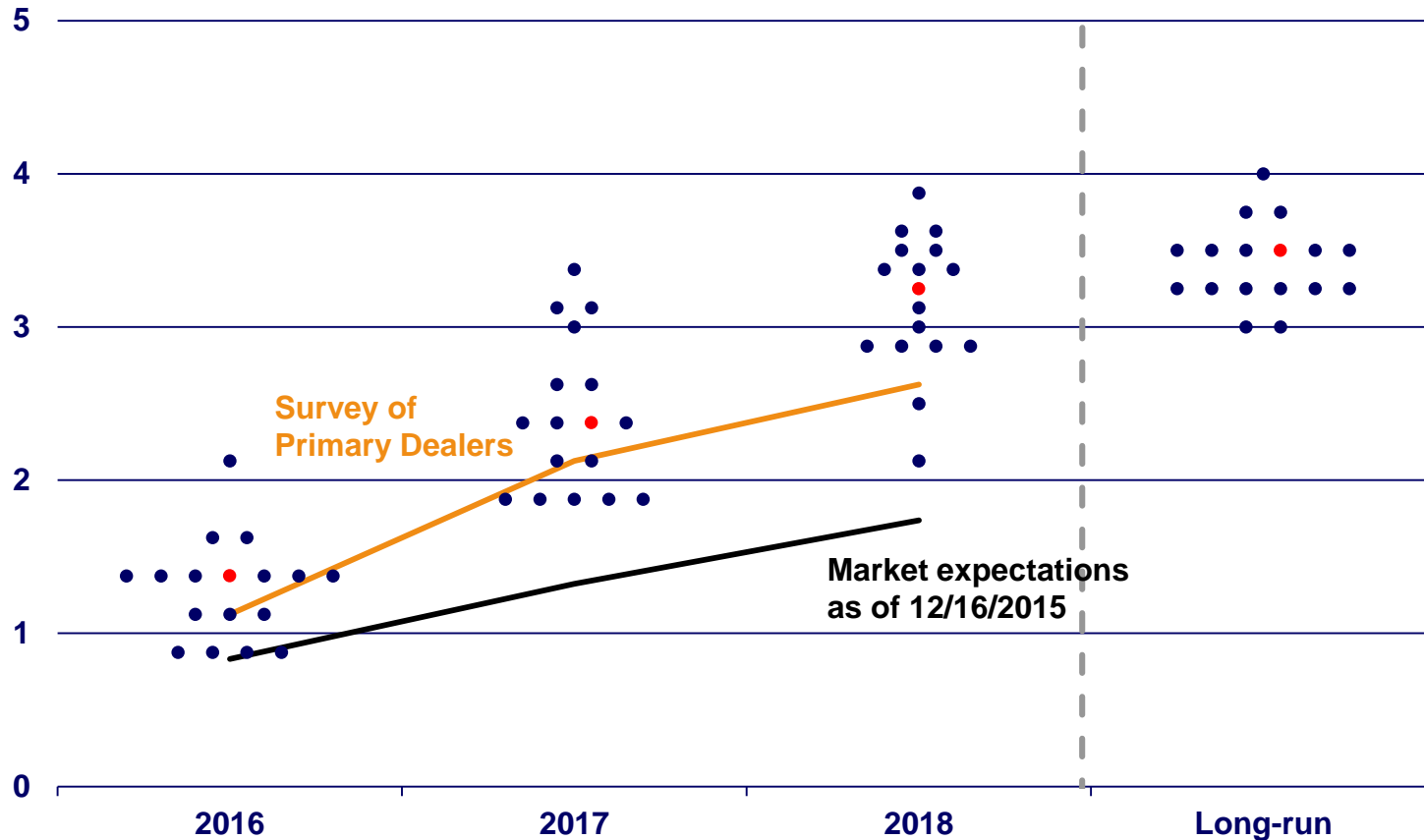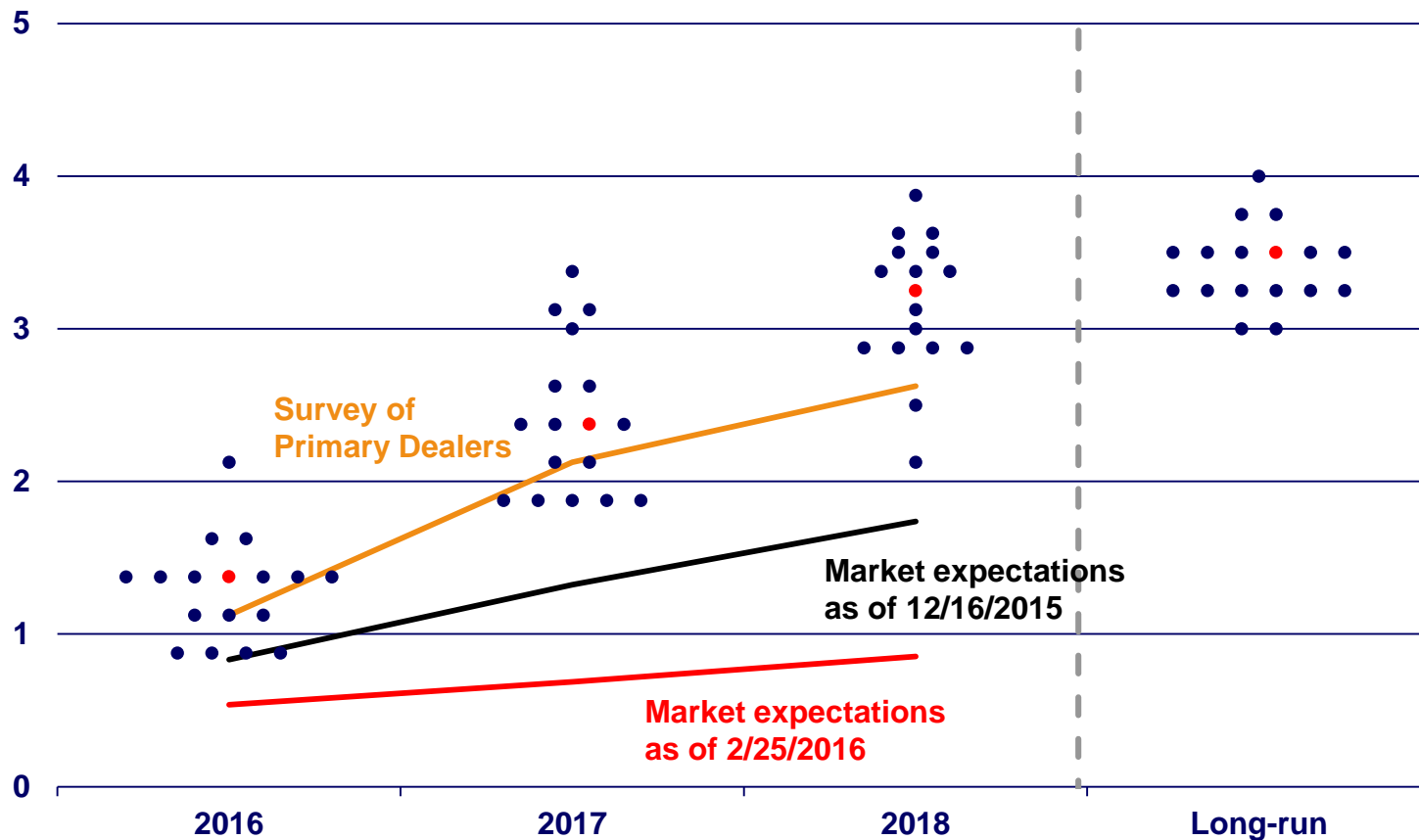# Appropriate Pace of Policy Firming

Federal Funds Rate at Year-End
(percent)

Source: Interest rate projections are from the December 16, 2015 FOMC Summary of Economic Projections. Red dots indicate the median projection. Market expectations are from OIS futures as of December 16, 2015 and February 25, 2016. Survey of Primary Dealers responses received by January 19, 2015.

Appropriate Pace of Policy Firming

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Appropriate Pace of Policy Firming

Federal Funds Rate at Year-End
(percent)

Survey of Primary Dealers

Market expectations as of 12/16/2015

Market expectations as of 2/25/2016

2016   2017   2018   Long-run

Source: Interest rate projections are from the December 16, 2015 FOMC Summary of Economic Projections. Red dots indicate the median projection. Market expectations are from OIS futures as of December 16, 2015 and February 25, 2016. Survey of Primary Dealers responses received by January 19, 2015.

Risk Management Near the Zero Lower Bound

- **Policy reaction to unexpectedly and undesirably high inflation:**
  - Can raise rates as much as necessary

- **Policy reaction to unexpected and undesirable weakness:**
  - Ability to counter by lower rates restricted by the ZLB
  - Alternative tools exist, but they are second best

- **Implications of this asymmetry:**
  - Policy is less restrictive than it otherwise would be when there is threat of hitting the ZLB
  - Increased uncertainty near the ZLB leads to less restrictive policy

Workhorse New Keynesian Model

$$x_t = \beta E_t x_{t+1} - \frac{1}{\sigma}\left(r_t - E_t \pi_{t+1} - \rho_t^n\right) \qquad \text{IS curve}$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t + u_t \qquad\qquad \text{Phillips curve}$$

π_t = deviation of inflation from target; x_t = output gap;

u_t = cost push shock;

r_t = policy interest rate; ρ_t^n = natural rate of interest rate

$$\min_{r_t} \; L = \frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t \, (\pi_t^2 + \lambda \, x_t^2) \quad s.t. \; r_t \geq 0$$

Solution

- **Under certainty:**

  – As long as $\rho^n > 0$, set $r = \rho^n$ and achieve $x = \pi = 0$.

  – If $\rho^n \leq 0$, set $r = 0$ and end up with x and $\pi \leq 0$

- **Under uncertainty:**

  – Chance of hitting ZLB tomorrow means $E[x]$ and $E[\pi] < 0 =>$ lower x and π today

$$x_t = \beta \, E_t \overset{\downarrow}{x}_{t+1} - \frac{1}{\sigma}\left(r_t - E_t \overset{\downarrow}{\pi}_{t+1} - \rho_t^n \right)$$

$$\pi_t = \beta \, E_t \overset{\downarrow}{\pi}_{t+1} + \kappa x_t$$

Solution

- **Under certainty:**
  - As long as $\rho^n > 0$, set $r = \rho^n$ and achieve $x = \pi = 0$.
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- **Under uncertainty:**
  - Chance of hitting ZLB tomorrow means $E[x]$ and $E[\pi] < 0 =>$ lower x and π today

$$x_t = \beta\, E_t \overset{\downarrow}{x}_{t+1} - \frac{1}{\sigma}\left(\underset{\downarrow t}{r} - E_t \overset{\downarrow}{\pi}_{t+1} - \rho_t^n \right)$$
$$\underset{\uparrow}{}$$

$$\pi_t = \beta\, E_t \overset{\downarrow}{\pi}_{t+1} + \kappa\, x_t$$

  - Counteract by lowering r today => chance of hitting ZLB tomorrow => looser policy today

Solution

- **Under uncertainty:**
  - Increase in uncertainty means E[x] and E[π] are more negative so higher uncertainty => looser policy today
  - Increased variance means more weight on big ρ < 0

$$E_t x_{t+1} = \frac{1}{\sigma} \int_{-\infty}^{0} \rho^n f_\rho(\rho^n) d\rho^n \qquad E_t \pi_{t+1} = \frac{\kappa}{\sigma} \int_{-\infty}^{0} \rho^n f_\rho(\rho^n) d\rho^n$$
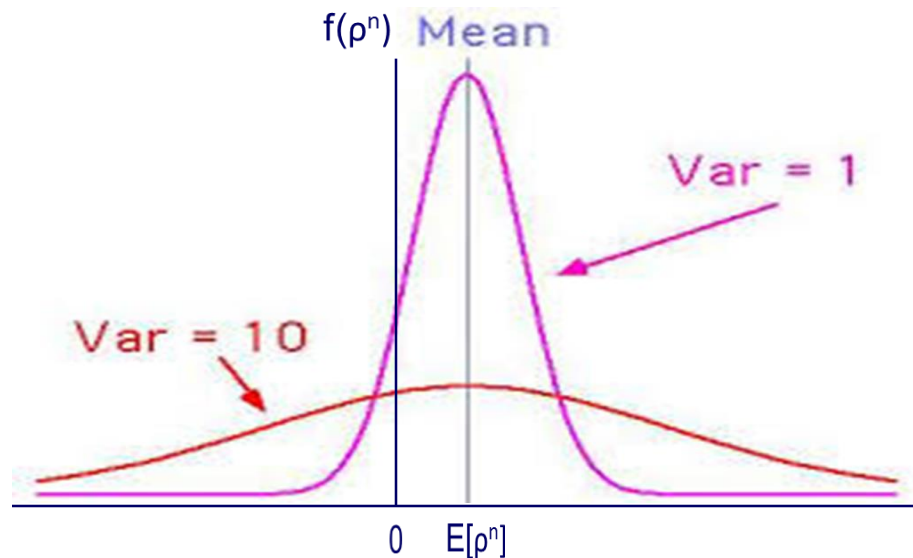
Old Workhorse Old Keynesian Model

$$x_t = \delta x_{t-1} - \frac{1}{\sigma}\left(r_t - \pi_{t-1} - \rho_t^n\right) \qquad \text{IS curve}$$

$$\pi_t = \xi \pi_{t-1} + \kappa x_t + u_t \qquad\qquad \text{Phillips curve}$$

- **The lower ρ_t^n, x_{t-1}, π_{t-1}, the greater the odds of hitting ZLB today**

- **Likelihood and cost of hitting ZLB tomorrow increases the lower x_t, π_t today**

- **An increase in uncertainty over ρ_{t+1}^n leads to lower r_t today**

$$\int_{-\infty}^{\rho_{t+1}^*(x_t,\pi_t)} g(x_t,\pi_t,\rho_{t+1})\,\mathrm{f}_\rho(\rho_{t+1})\,d\rho_{t+1}$$

$$\rho_{t+1}^*(x_t,\pi_t) \text{ decreasing in } x_t,\pi_t \quad g(\circ) \text{ increasing in } \rho_{t+1}^2$$

Lift-off in the forward-looking model
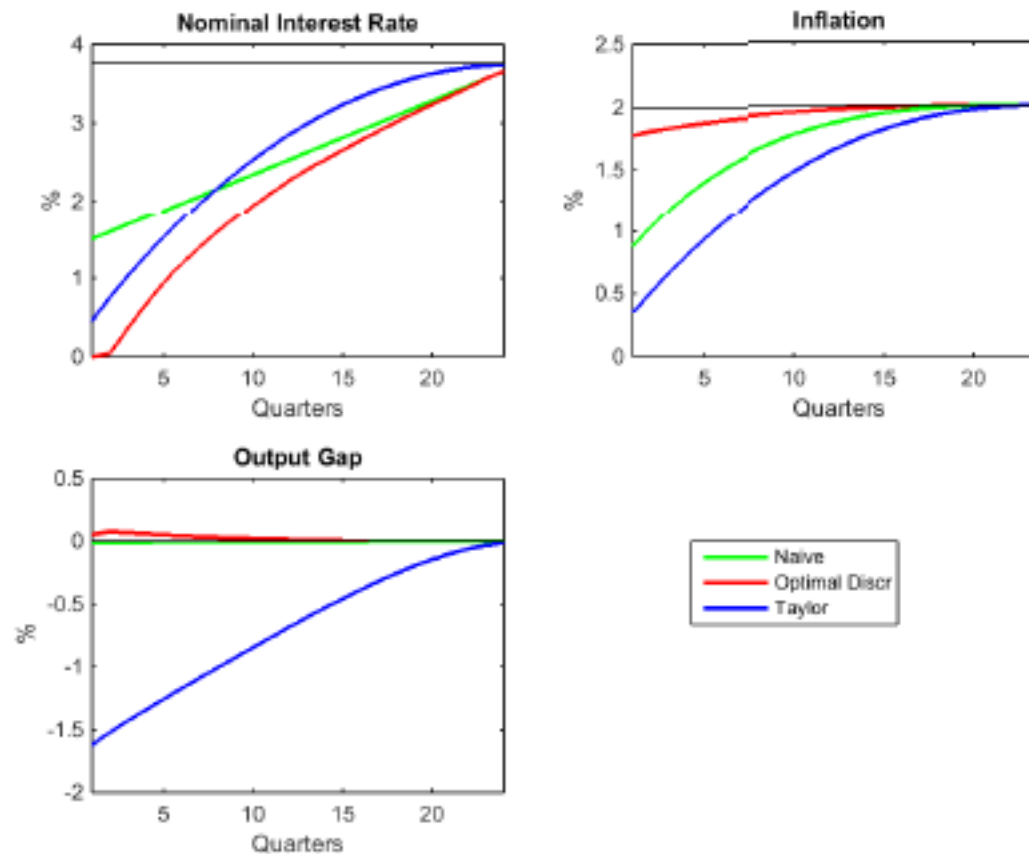
Risk Management for Monetary Policy Near the Zero Lower Bound. Charles Evans, Jonas Fisher, Francois Gourio, and Spencer Krane, Brookings Papers on Economic Activity, Spring 2015.
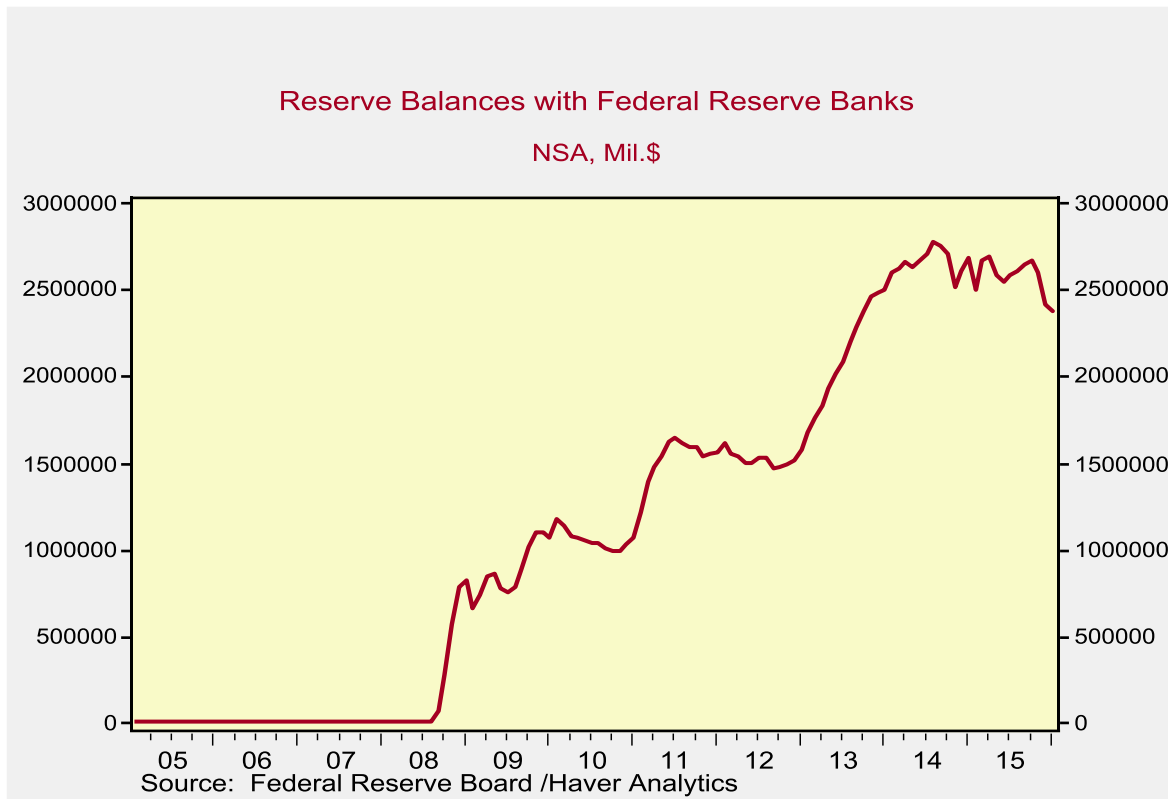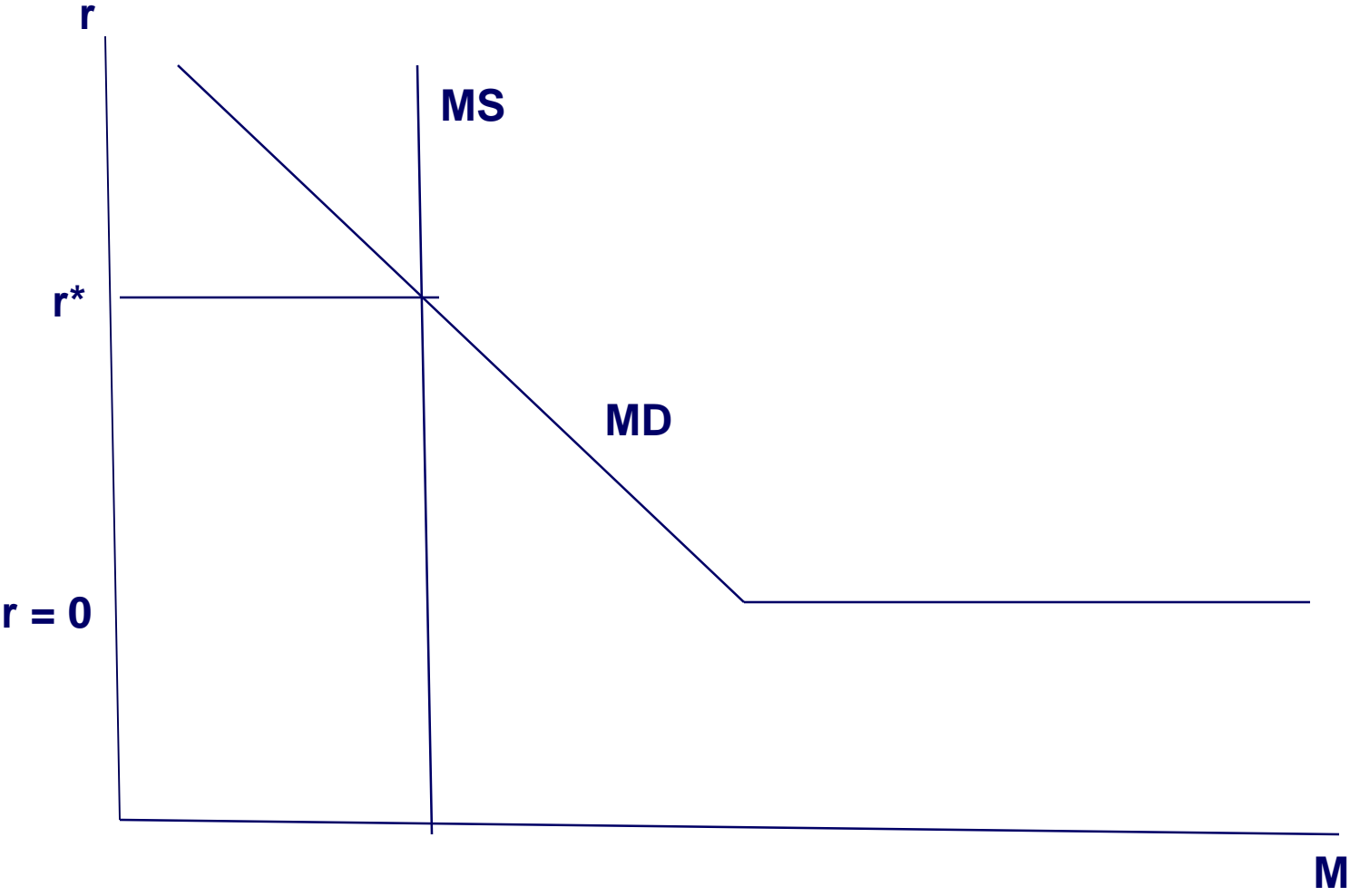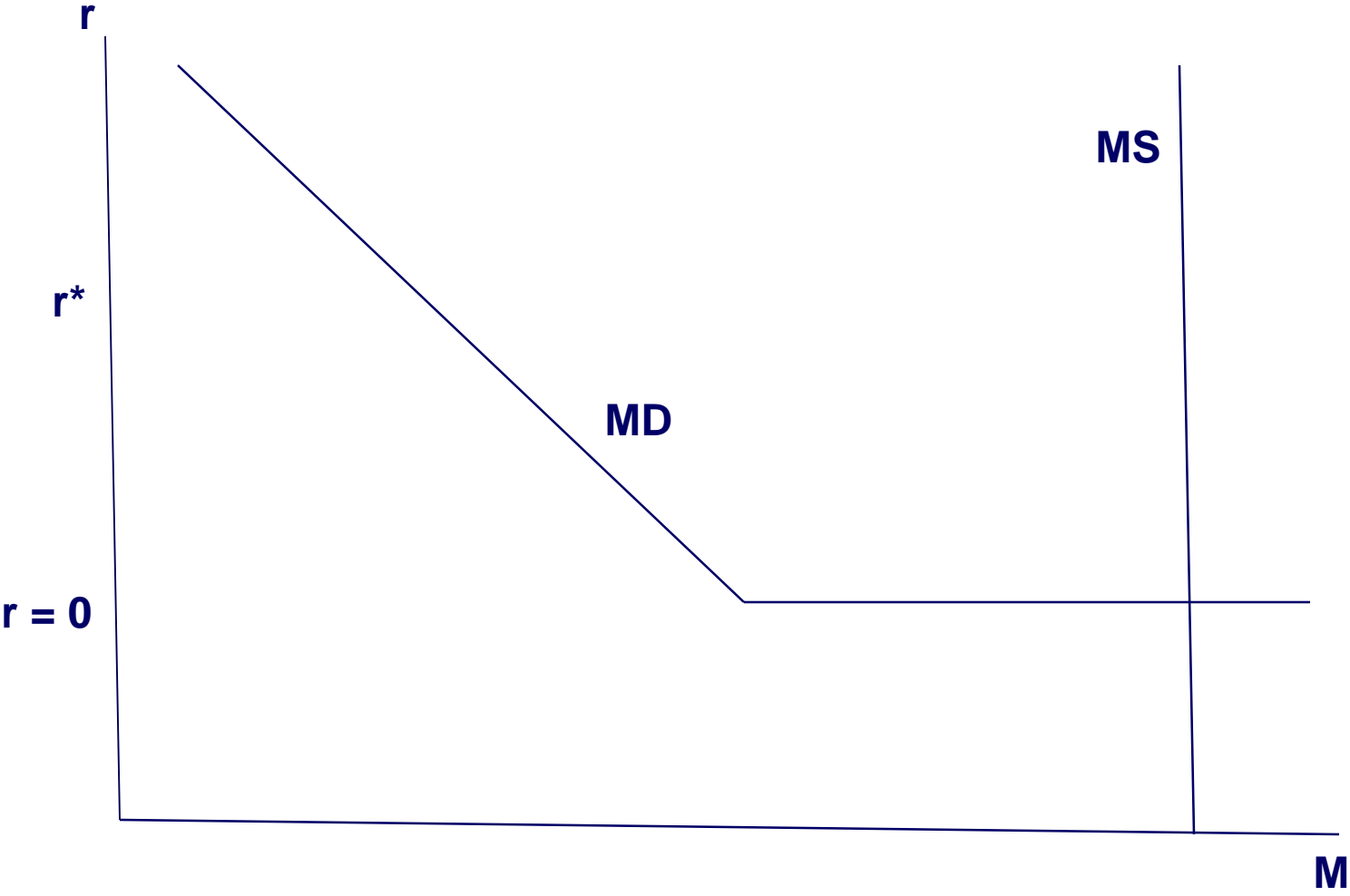
53

Lift-off in the backward-looking model

54

Monetary Policy Normalization

■ **How can the Fed raise interest rates when there are so many reserves out there?**

Reserve Balances with Federal Reserve Banks

NSA, Mil.$

Source: Federal Reserve Board /Haver Analytics
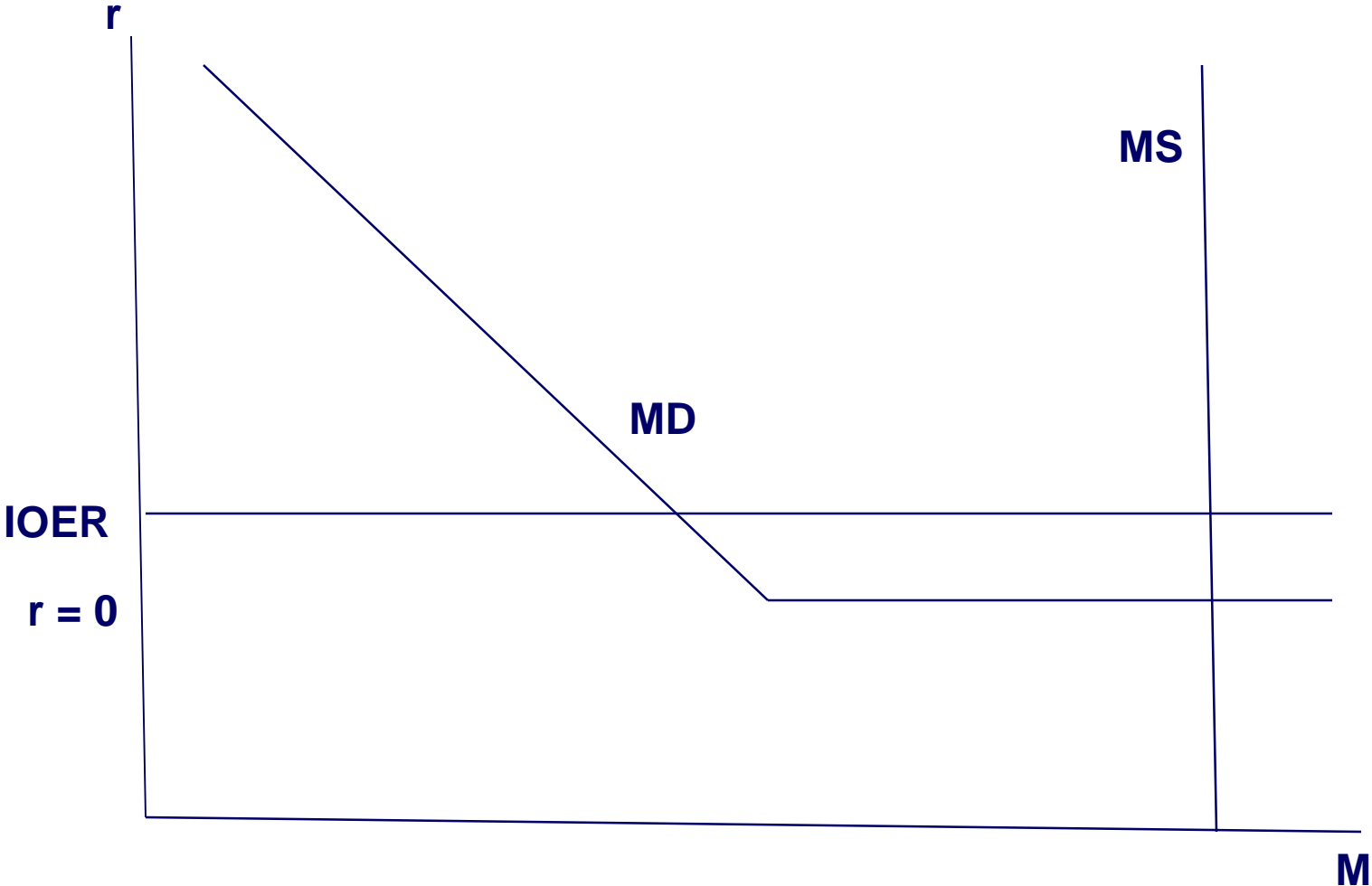
Money Demand, Money Supply

r

MS

r*

MD

r = 0

M

Money Demand, Money Supply

Monetary Policy Normalization

- **Fed funds rate will continue to be the key policy rate**
  - Target a 25bp range initially instead of single number

- **Interest paid on excess reserves likely primary tool to raise rates**
  - Overnight Reverse Repo Facility to play temporary supporting role to provide floor on federal funds rate and other money market rates

- **Sometime after renormalization is well underway, begin to reduce balance sheet gradually and predictably**
  - Reducing reinvestments (major sales unlikely)
  - In the long-run, the balance sheet should be the smallest level for efficient implementation of monetary policy
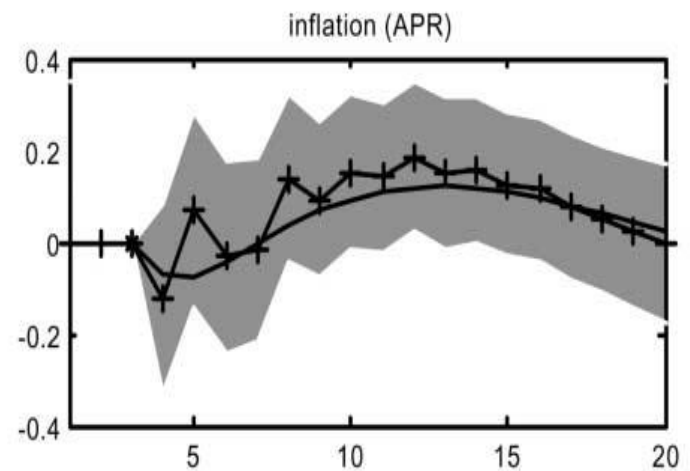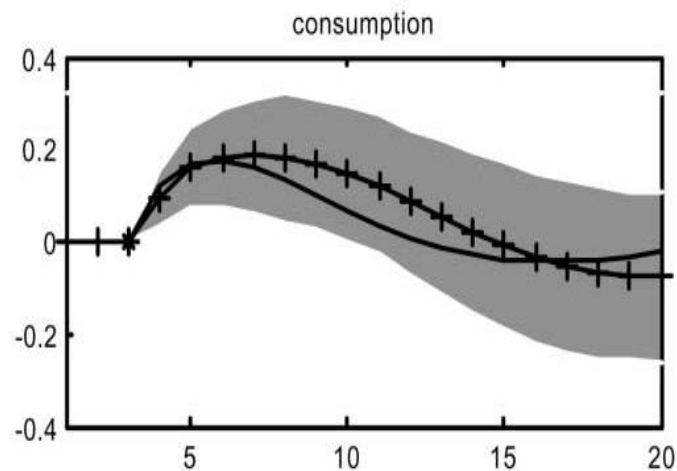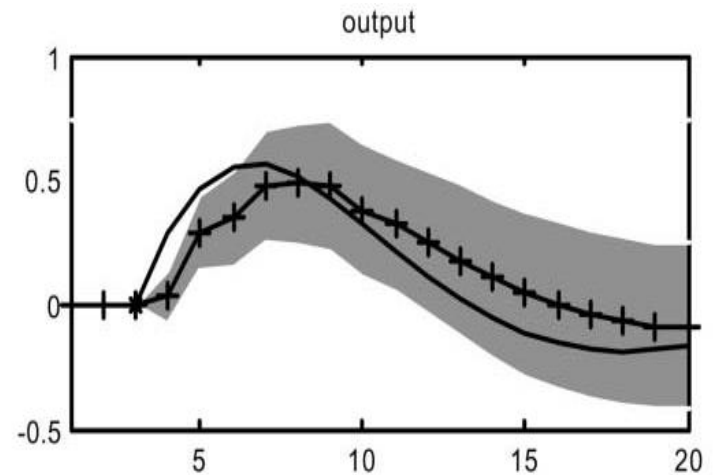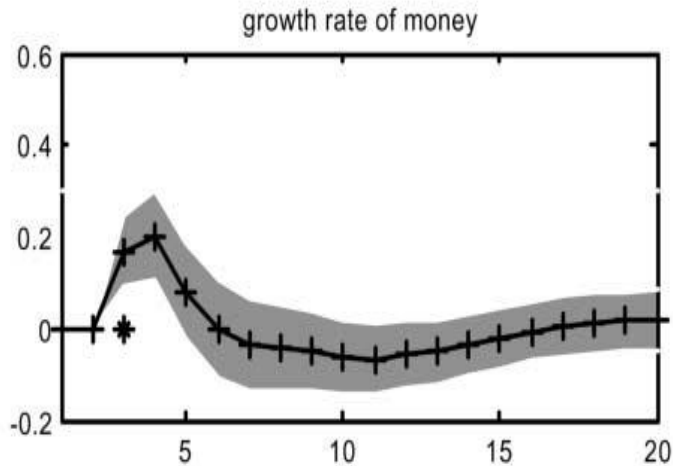
Money Demand, Money Supply

r

MS

MD

IOER

r = 0

M

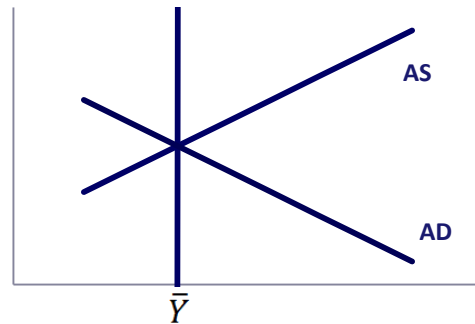# Money Demand, Money Supply
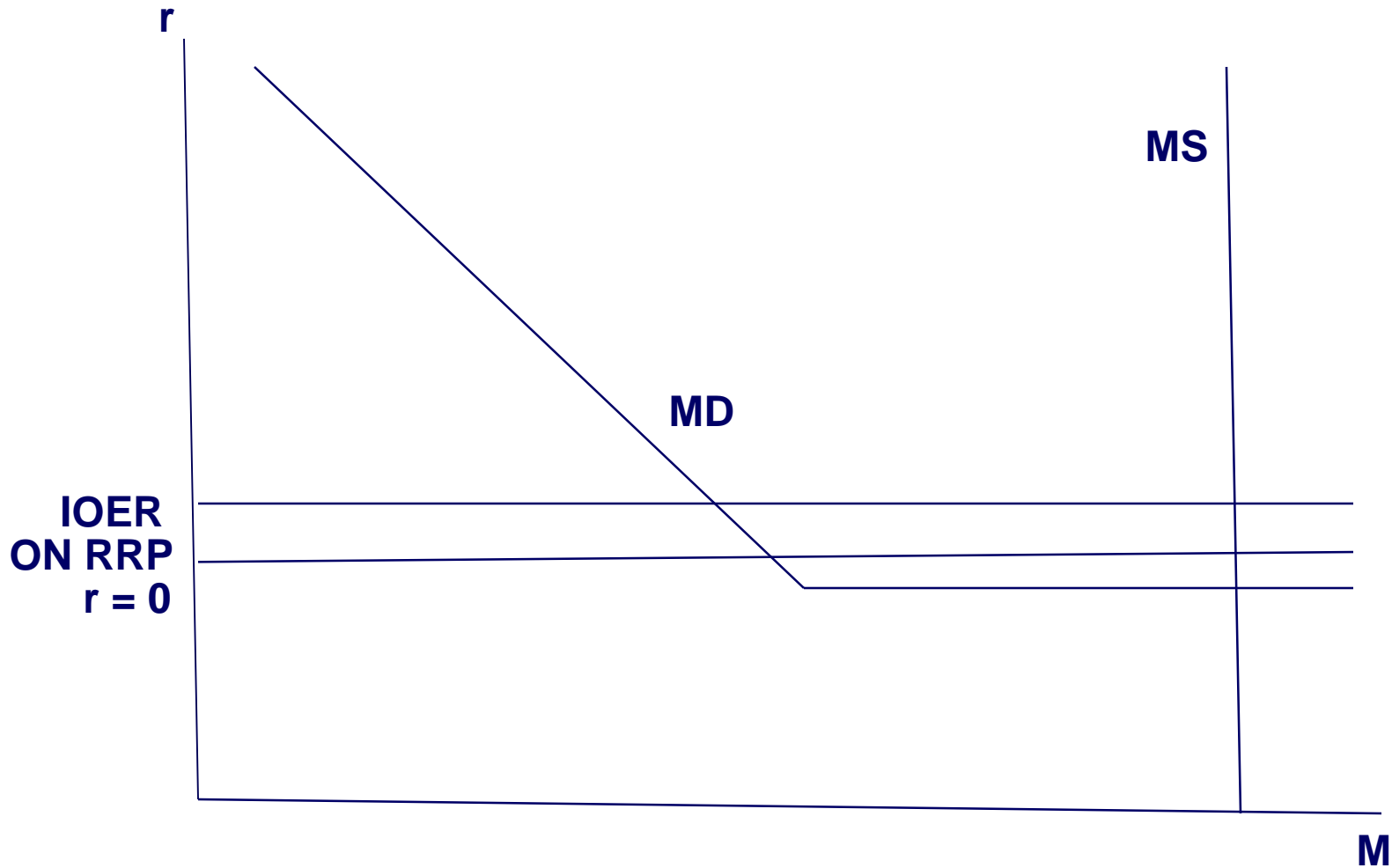
Appendix

Short-Run Monetary Non-Neutrality

- **Evidence from Christiano, Eichenbaum, and Evans (2005)**

What is the Benchmark? Potential Output

- **Potential output = natural level of output = full employment level of output**

$$\overline{Y} = \overline{A}\,\overline{K}^{\alpha}\,\overline{L}^{1-\alpha}$$

- **Y = GDP   K = Capital   L = Labor;**

  A = multi-factor productivity = total factor productivity

  (mfp or tfp)

- **"—" = full employment level**

Estimating Potential Output

- **Growth Accounting: Estimate "—" from data on K, L, and factor income shares for α**

  - e.g.

    $$L = Labor\ Force - Unemployed$$

    $$\overline{L} = Pop\ \overline{LFP}\left(1 - u^n\right)$$

    LPF = labor force participation rate; u^n = natural rate of unemployment

- **Okun's Law:** $\Delta u = -0.5\left(\Delta Y - \Delta \overline{Y}\right)$

- **Phillips Curve:** $\pi = E\pi - \beta\left(u - u^n\right) + v$

    $$\pi = E\pi + \frac{1}{\alpha}\left(Y - \overline{Y}\right) + v$$

How Did We Get In This Situation?

- **Housing market boom and bust**

  – Period of rapidly rising home prices, loose lending, and booming construction

  – Unwind was big drag on economy

- **Financial market disruption**

  – Surprising financial market fragility

  – Banks and "shadow banks" both highly stressed

  – Reduced credit availability slowed economy

- **Business and consumer pessimism**

  – Many disturbing events

  – Businesses and consumers become cautious; reduce spending

- **As a result we got a very bad recession in 2008-2009 followed by a very slow recovery**

65

Why Was the Recovery so Disappointing?

- **Long-lasting damage from the recession**
  - Difficult balance sheet restructuring by households, nonfinancial businesses and financial institutions
  - Scars from long-term unemployment, low capital formation

- **Additional shocks**
  - European crisis
  - Fiscal issues in U.S.

- **Continued business and consumer pessimism and uncertainty**
  - Precautionary behavior

- **Monetary policy runs into the zero lower bound (ZLB)**

Policy Rate Constrained By Zero Lower Bound

Fed Funds Rate
(percent)

History
CBO Gap
FRBUS Gap
FRBUS Gap Inertial Rule

Median of FOMC Projections