Aggregate Supply in the United States: Recent Developments and Implications for the Conduct of Monetary Policy

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Context:
Why the question that we address is important

The canonical optimal control problem

$$L_{t0} = E_{t0} \sum_{j=0}^{N} \beta^j \left\{ \alpha_1 \left(y_{t0+j} - y_{t0+j}^* \right)^2 + \alpha_2 \left(\pi_{t0+j} - \pi^* \right)^2 \right\}$$

- The central bank can specify π^*

- But y_t^* is an estimate of "normal" or "sustainable" activity… a concept like "potential output" or "the natural rate of unemployment"

- Thus, the policymaker must, as part of the policy problem, estimate a latent variable defining the objective with respect to real activity

- Typically, that latent variable is taken to be *exogenous with respect to monetary policy*—an assumption that we call into question

- Various approaches to estimating y_t^*; we use a production-function approach

Overview

1. <u>Substantial damage</u> to the productive capacity of the economy appears to have resulted from the financial crisis and recession… About a 7% reduction in potential GDP

2. Much of that damage plausibly was an <u>endogenous response</u> to weak aggregate demand

3. Endogeneity of aggregate supply has strong <u>implications for the conduct of countercyclical policy</u>, including monetary policy

4. Other considerations could militate toward <u>policymaker restraint</u>

1. Estimating the damage: A state-space model

- A production function
$$y_t \equiv \Sigma x_{it}$$

- A decomposition of each factor of production:
$$x_{it} = \lambda_i(L)cyc_t + x_{it}^* + \mu_{it}$$

- A specification of the time-series behavior of cycle and trend
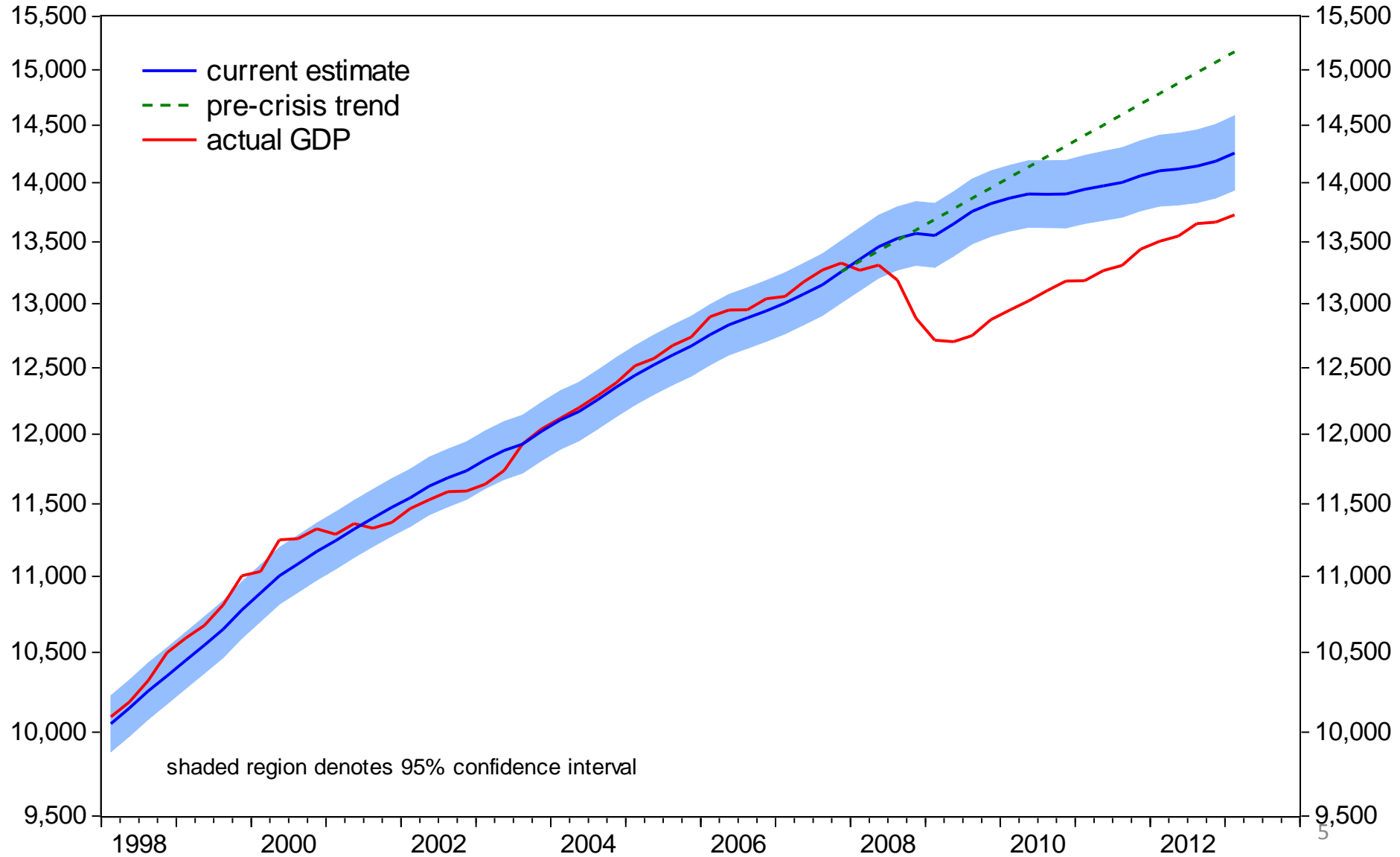$$cyc_t = \delta_1 cyc_{t-1} + \delta_2 cyc_{t-2} + \xi_t$$

$$x_{it}^* = \alpha_{i,t} + x_{i,t-1}^* + \eta_{it}$$
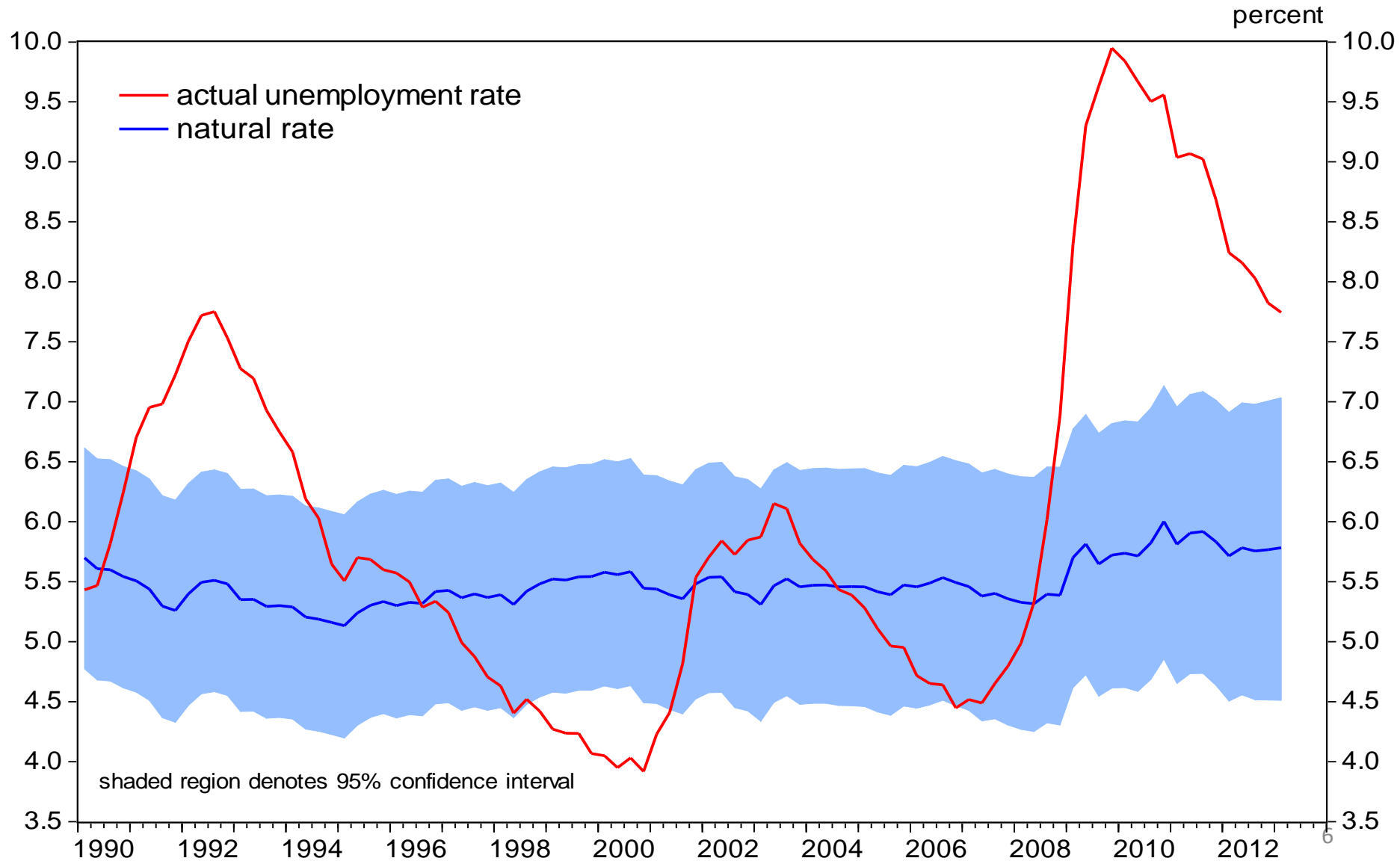
- A new-Keynesian Phillips Curve:
$$\Delta p_t = \omega \Delta p_t^e + (1-\omega)\Delta p_{t-1} + \beta cyc_t + Z_t\Gamma + \varepsilon_t$$

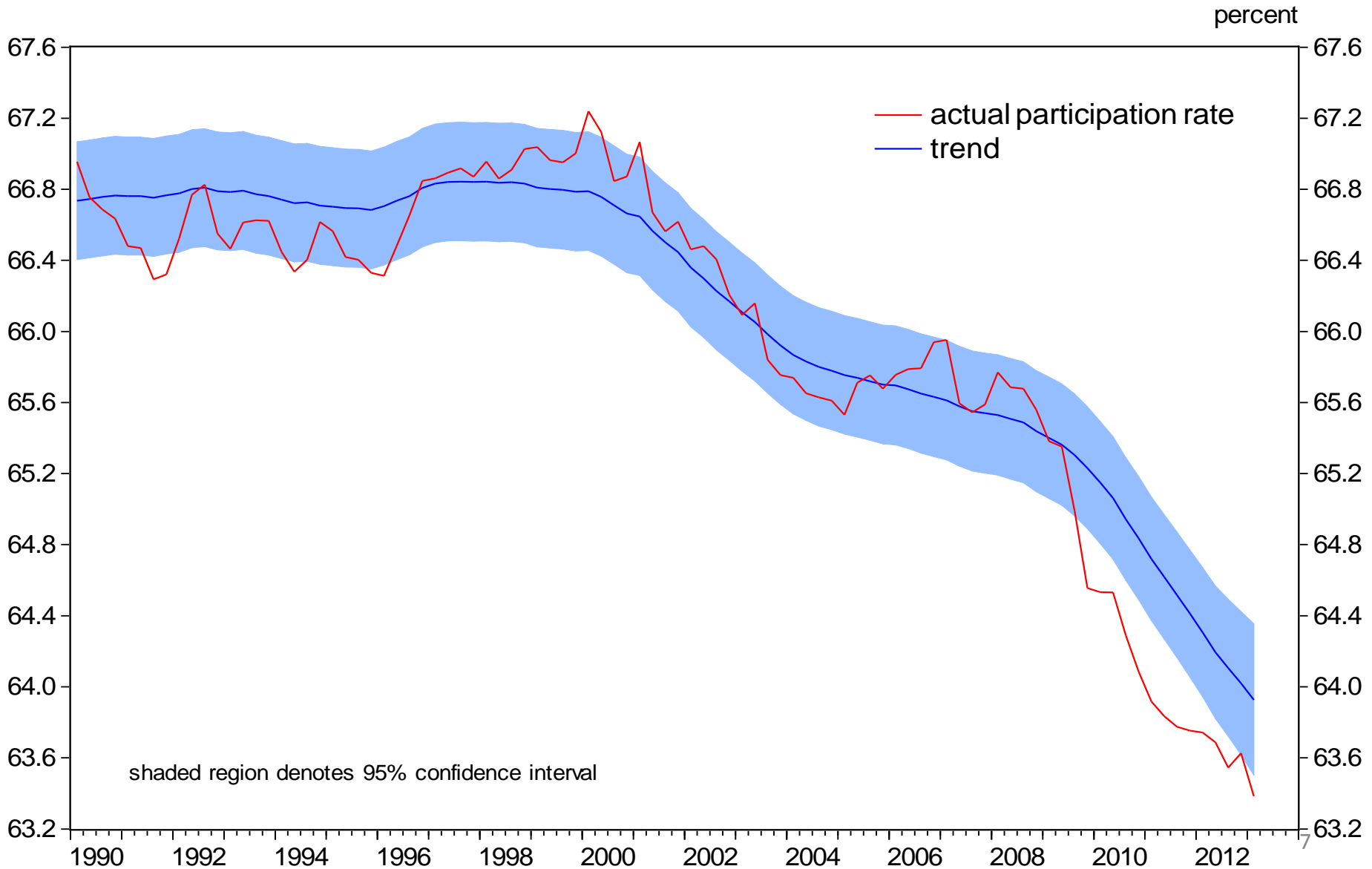# Results from the state-space model:
Potential GDP

billions of chained 2005 dollars

- current estimate
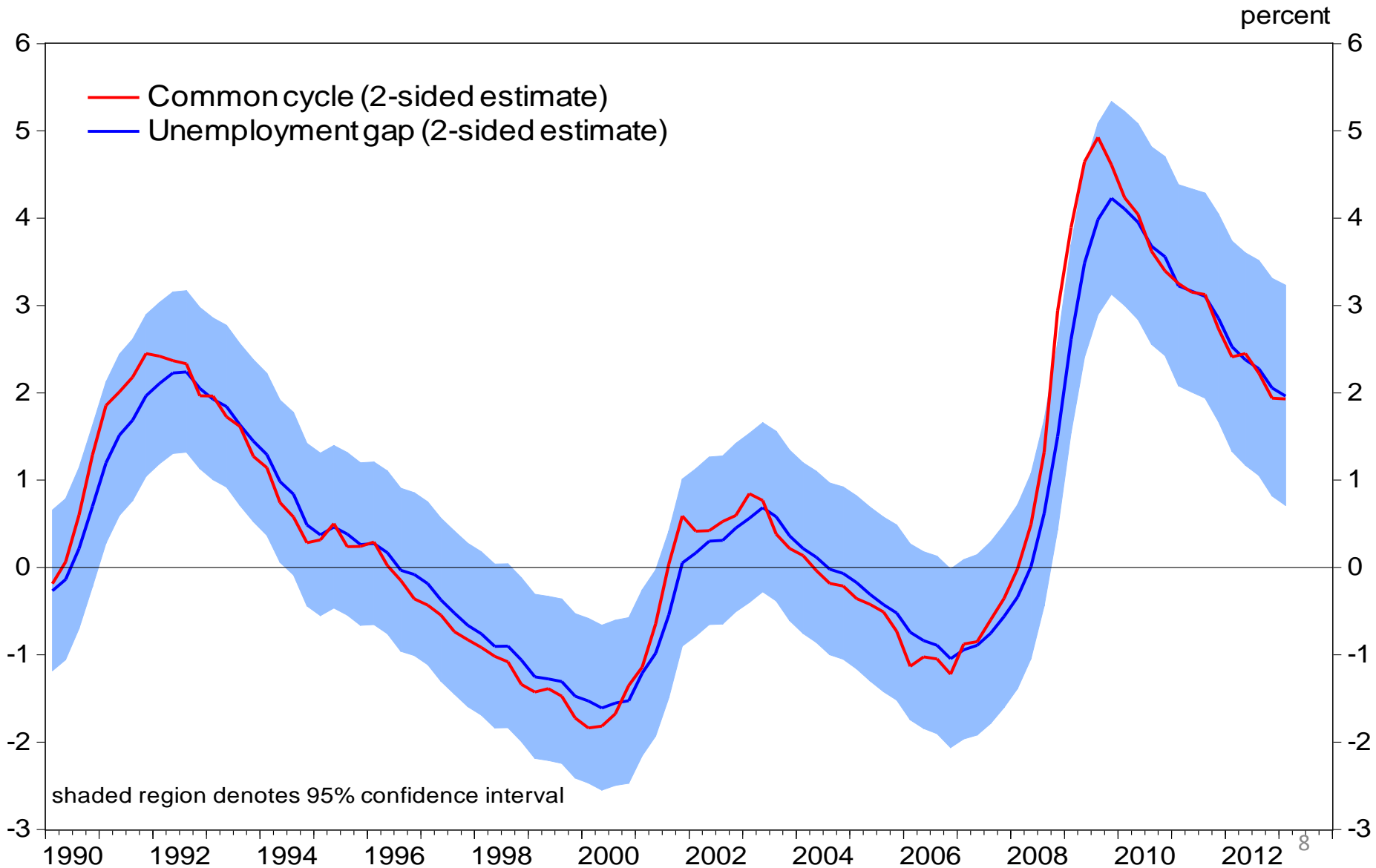- pre-crisis trend
- actual GDP

shaded region denotes 95% confidence interval

Results from the state-space model:
The natural rate of unemployment

percent

- actual unemployment rate
- natural rate

shaded region denotes 95% confidence interval

Results from the state-space model: The labor force participation rate

percent

- actual participation rate
- trend

shaded region denotes 95% confidence interval

Results from the state-space model:
The unemployment rate gap

percent

- Common cycle (2-sided estimate)
- Unemployment gap (2-sided estimate)

shaded region denotes 95% confidence interval

Results from the state-space model:
The evolution of natural-rate estimates in real time

percent

2012 data

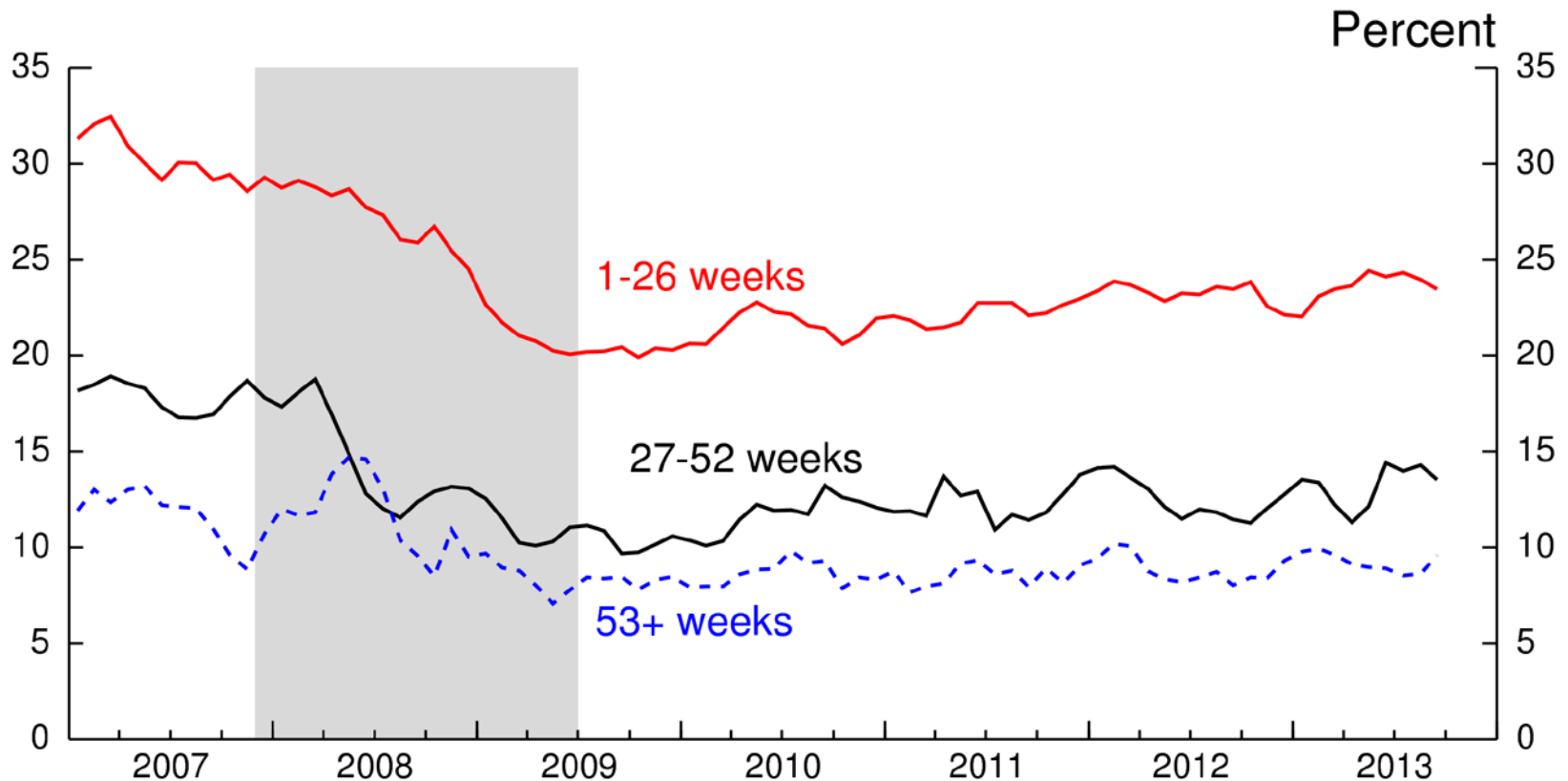2013 data

2011 data

2010 data

2009 data

2008 data
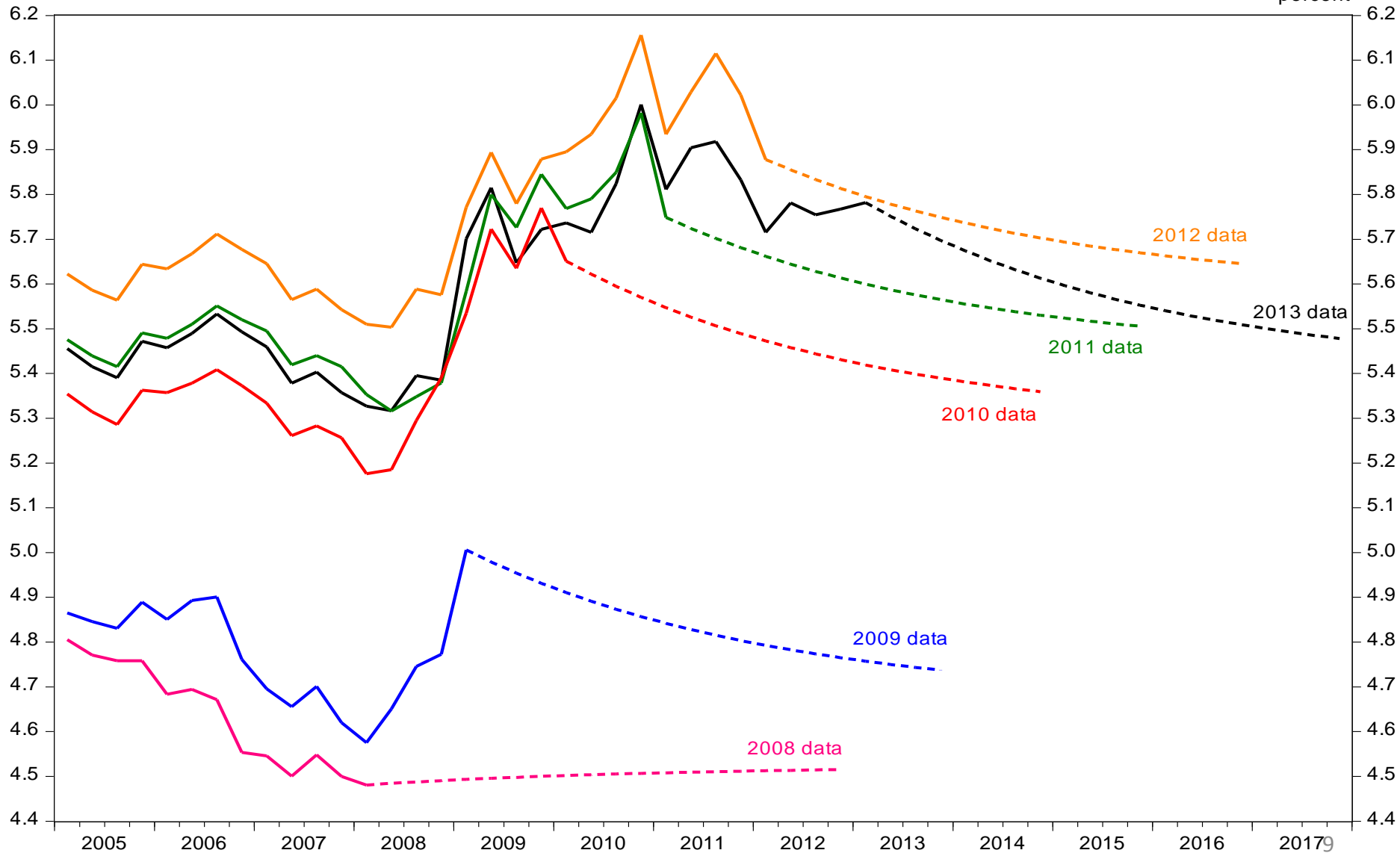
# Results from the labor market:
The Beveridge Curve
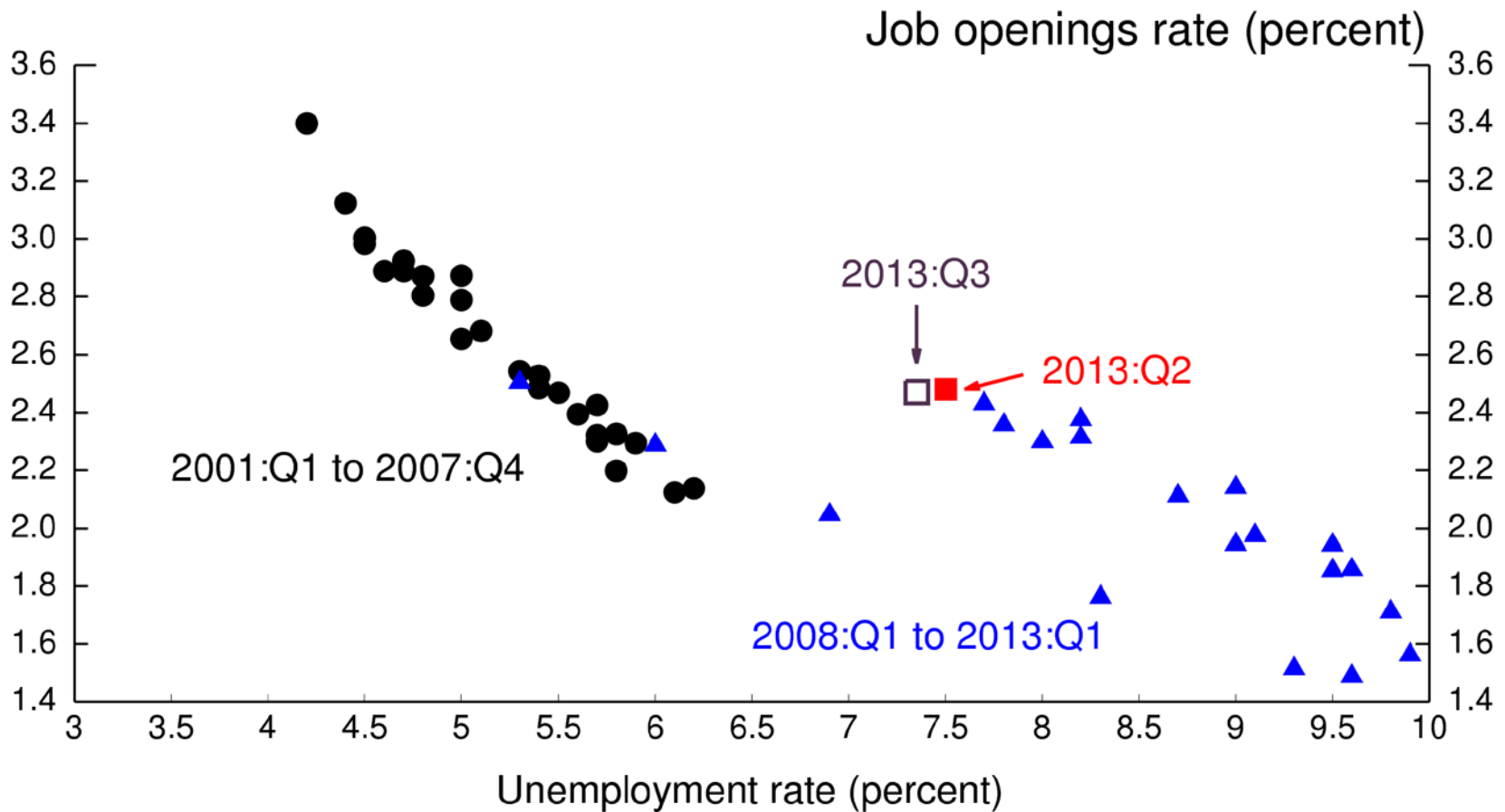
Note: Observation for 2013:Q3 is average of July and August. Source: Job Openings and Labor Turnover Survey & Current Population Survey.

Results from the labor market:
Job Finding Rates

Note: 3-month moving averages of seasonally adjusted monthly data. Shaded area indicates period of business recession as defined by the NBER. Last data plotted are for September.

Results from the labor market:
# Labor-force Exit Rates
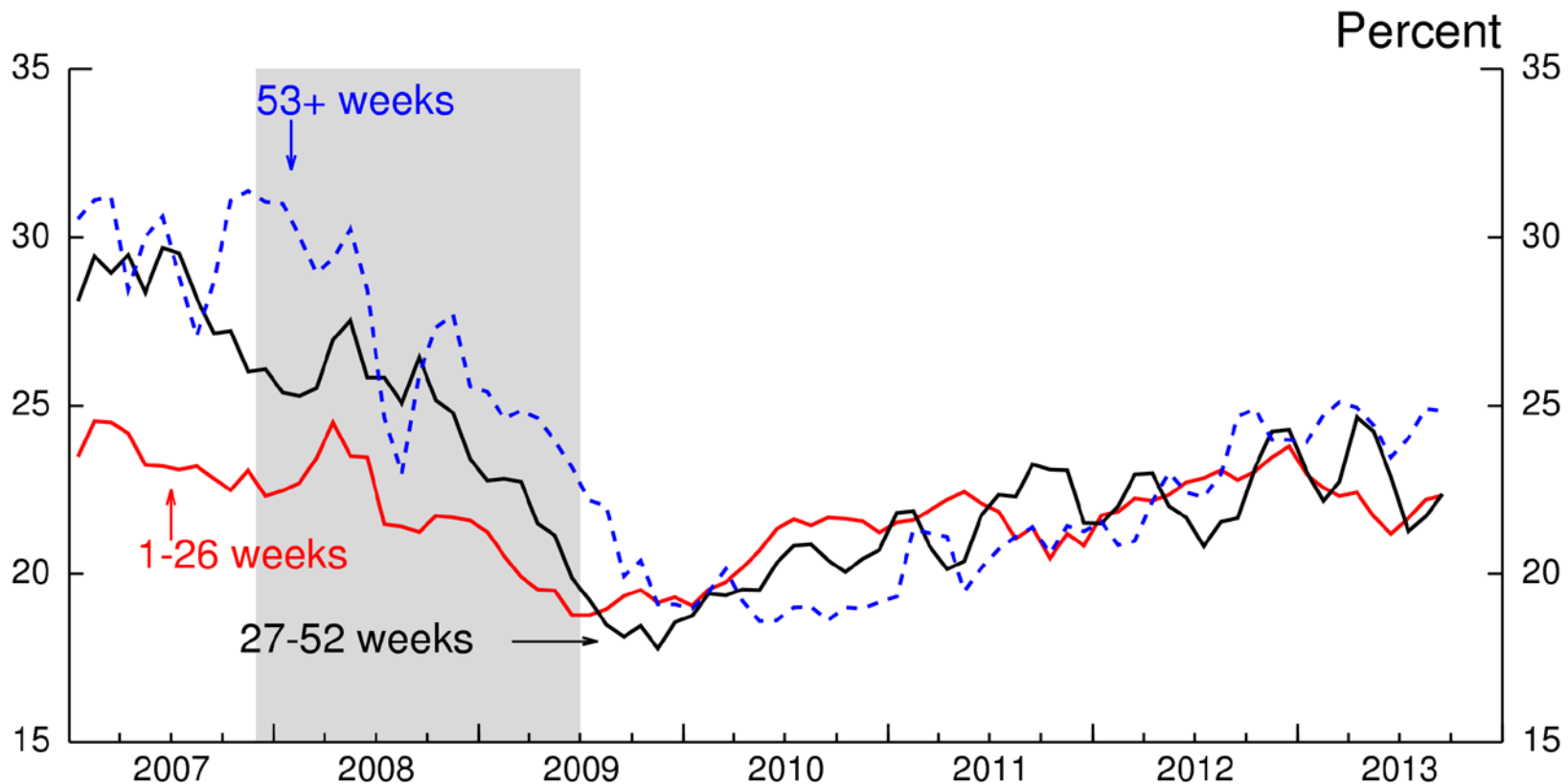
Note: 3-month moving averages of seasonally adjusted monthly data. Shaded area indicates period of business recession as defined by the NBER. Last data plotted are for September.

2. Much of the damage plausibly was endogenous

- Three mechanisms that could cause weakness in aggregate demand to be reflected in diminished aggregate supply:

    - *Labor input:* A high level of long-term unemployment weakens labor force attachment, erodes workers' skills, and stigmatizes the unemployed

    - *MFP:* Weak sales and restrictive credit discourage R&D outlays and start-ups, two engines of innovation

    - *Capital deepening:* Weak investment spending reduces capital deepening and hence the flow of capital services

Slower growth of MFP:
The reduced role of start-ups
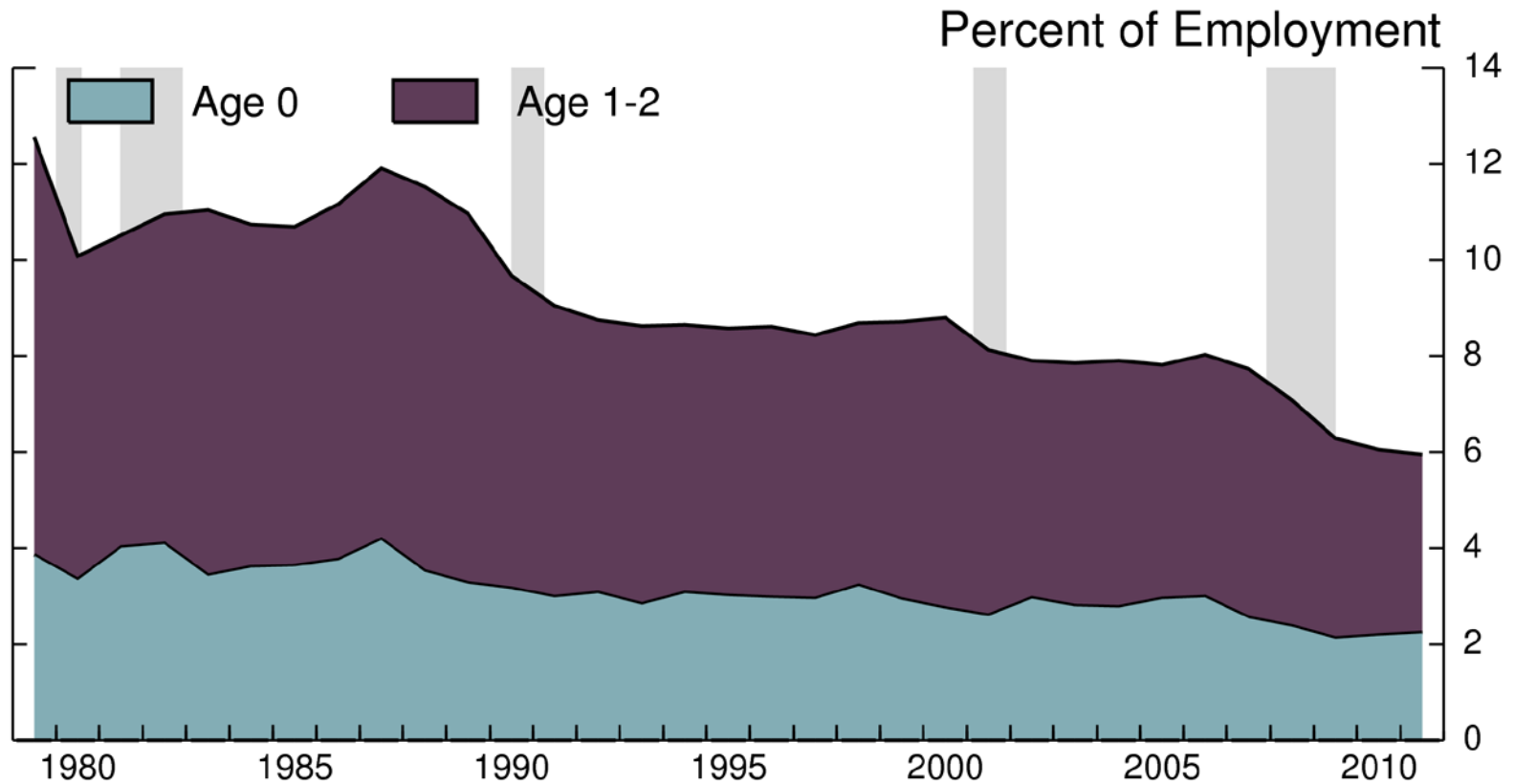
Note: Shaded areas are NBER dated recessions. Data are shown through 2011 - the latest available from the Business Dynamics Statistics. Source: U.S. Census Bureau, Business Dynamics Statistics.

2. Much of the damage plausibly was endogenous

- Reasons why not *all* of the decline in potential GDP relative to its pre-crisis trend reflects weak aggregate demand:
  - Demographic factors explain some of the decline in trend LFPR
    - A separate model maintained by Board staff suggests that demographic factors account for perhaps half of the decline in trend LFPR
  - Higher tax rates and UI have reduced the return to working
    - But elasticities would have to be awfully high for tax rates to account for much
    - And changing the generosity of UI does not have large effects on LFP behavior
  - Maybe the housing bust and financial fallout amounted to a big productivity shock
    - But structural impairments to the production process seem limited
  - Maybe the return to investment has fallen markedly
    - But if so, why are profits high?
- Overall assessment: Can't be certain, but an appreciable portion of the recent supply-side damage likely was endogenous. The damage would have been worse if policy had been less aggressive.

3. Endogenous supply-side damage motivates a strong countercyclical response

- Modify FRB/US model to incorporate calibrated hysteresis effects
  - Persistent slack causes U* to rise and LFPR* to fall nonlinearly
  - Policy cannot reverse damage but must wait for it to fade
- Simulate a financial crisis under three different monetary policies:
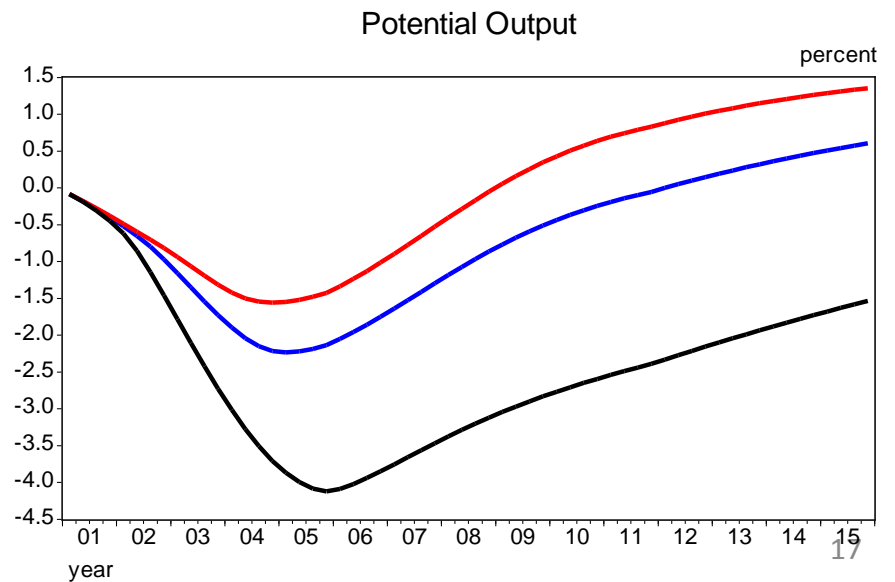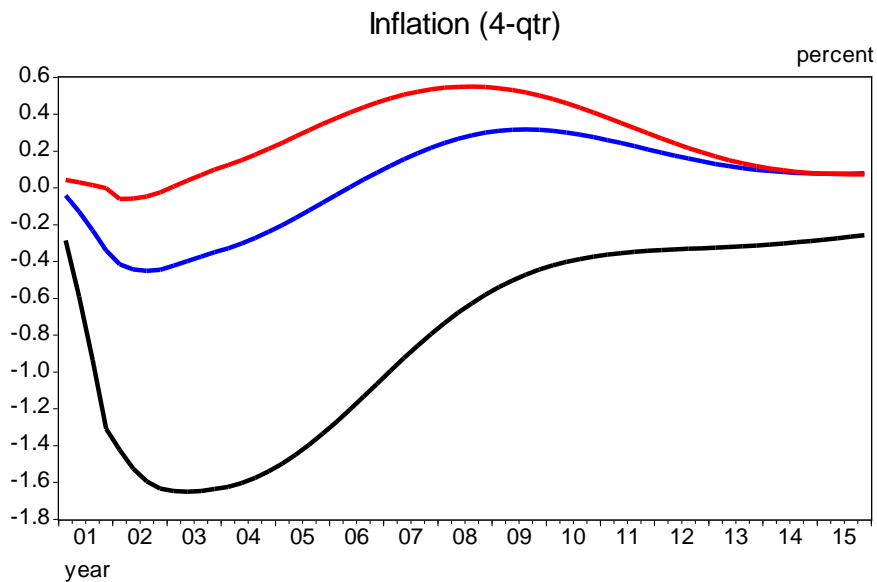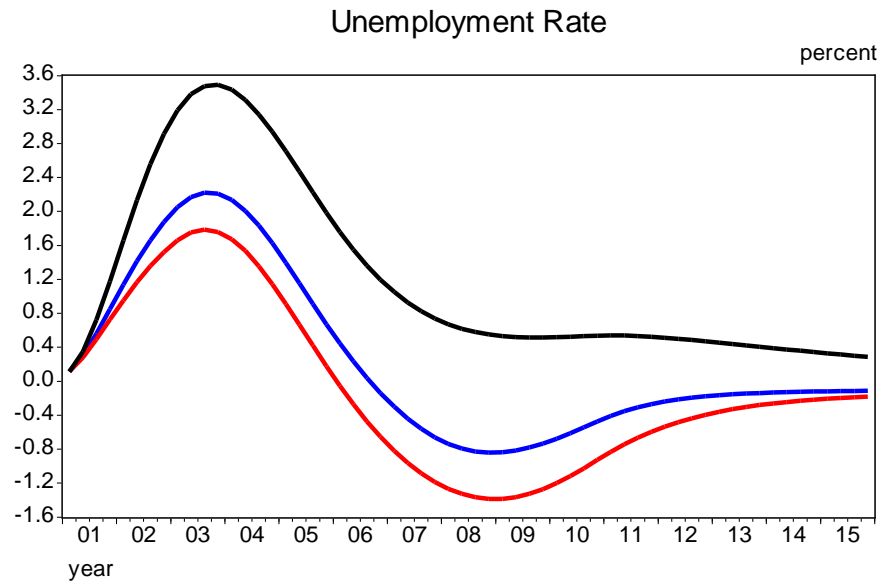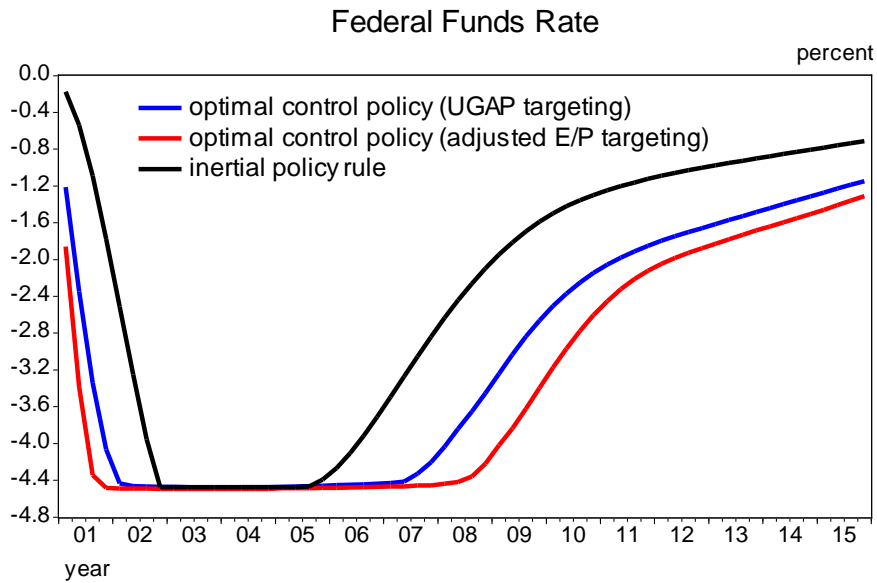 - An inertial rule

    $$R_t = .85R_{t-1} + .15\{R* + \pi_t + 0.5[\pi_t - \pi^*] + 1.0[y_t - y^*_{t+j}]\}$$

  - An optimal control exercise that minimizes:

    $$L_{t0} = E_{t0} \sum_{j=0}^{N} \beta^j \left\{ \left(gap_{t0+j}\right)^2 + \left(\pi_{t0+j} - \pi^*\right)^2 + (\Delta R_{t0+j})^2 \right\}$$

  - Case 1: gap ≡ U-U*, where U* is influenced by hysteresis effects
  - Case 2: gap ≡ (E/Pop) − (E**/Pop), where E**/Pop is immune from hysteresis effects

"Optimal" Responses to a Financial Crisis with Hysteresis Effects: Targeting the Unemployment Gap Vs. the Adjusted E/P Gap

Federal Funds Rate

Unemployment Rate

Inflation (4-qtr)

Potential Output

optimal control policy (UGAP targeting)
optimal control policy (adjusted E/P targeting)
inertial policy rule

17

4. Other considerations could rationalize policymaker restraint

- A very aggressive policy response could cause investors and others to increase leverage and reach for yield, thereby decreasing financial stability

- Or a very aggressive policy response could cause an unmooring of inflation expectations that could be costly to stop

  - In contrast to endogenous supply-side damage, these risks pull policy responses in a more moderate direction

- Uncertainty

  - All estimates of supply-side conditions are highly uncertain, as is the ability of monetary policy to influence those conditions

  - The likelihood and costs associated with endogenous financial instability and inflation expectations instability also highly uncertain

- Depending on the weights they attach to these various considerations, policymakers will be more or less aggressive in response to a recession