Is there a trade-off between inflation and output stabilization?

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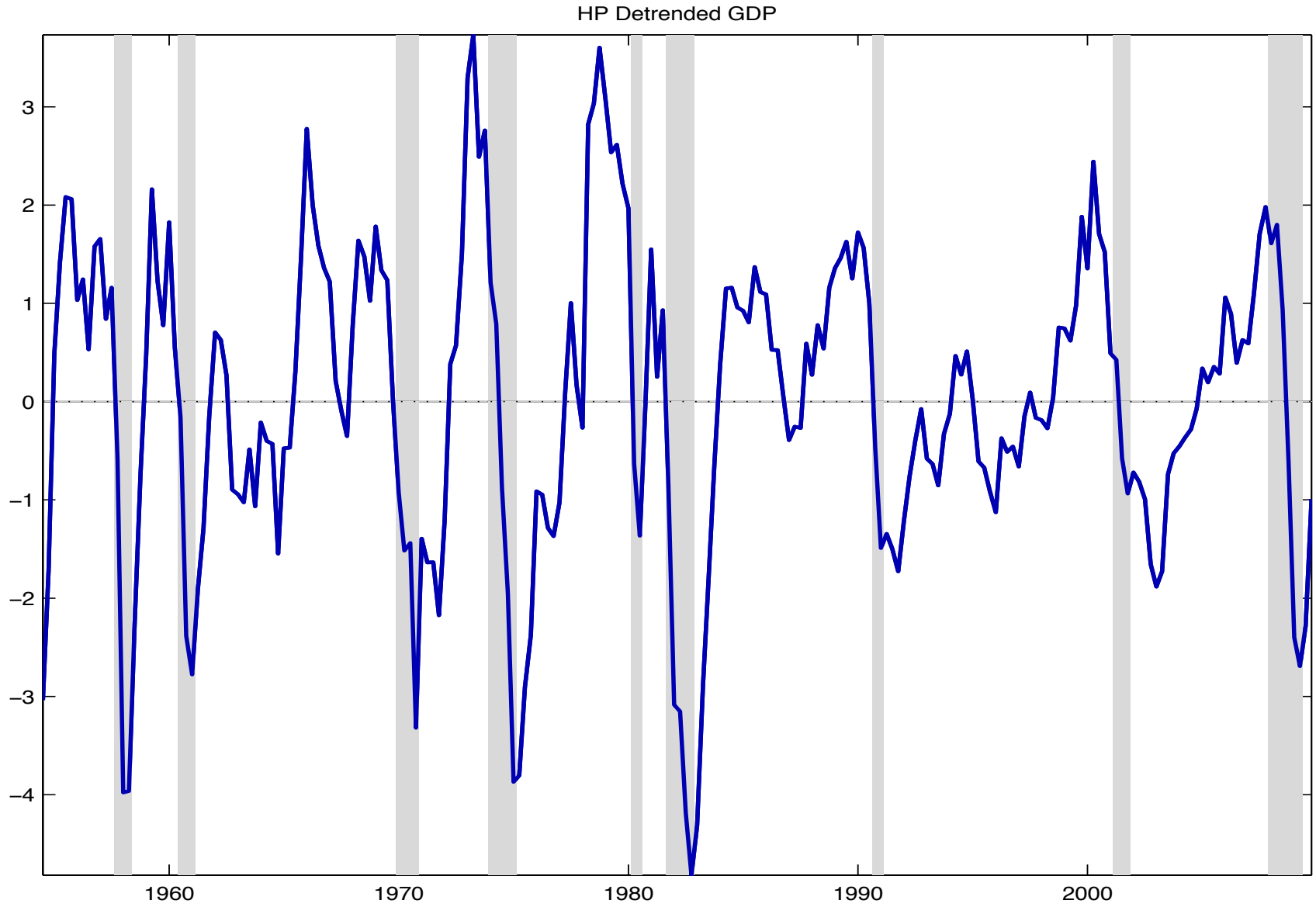
Federal Reserve Bank of Minneapolis
May 4, 2012

HP-detrended GDP in the US



Imperfect competition and inefficient fluctuations

- Modern business cycle models feature imperfect competition

- Market power in goods / labor markets implies
  - Price markups over MC
  - Wage markups over the MRS

Imperfect competition and inefficient fluctuations

- Markups vary over time for 2 reasons:
  - ① Sticky prices and wages ➔ endogenous markup variation
  - ② Direct shocks to markups ➔ exogenous markup variation

Imperfect competition and inefficient fluctuations

- Markups vary over time for 2 reasons:
  - ① Sticky prices and wages ➔ endogenous markup variation
  - ② Direct shocks to markups ➔ exogenous markup variation

- Markups variation contributes to fluctuations
  - ➢ Inefficient fluctuations
  - ➢ Would not be observed in a competitive economy

The questions that we address

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② Should a monetary authority counteract these inefficient fluctuations?

➠ Yes, because policy faces a minor trade-off between output gap and inflation stabilization

Outline

1. Motivating questions

2. Model

3. What is the share of inefficient fluctuations?
   - Estimates of counterfactual output under constant markups

4. Is there a trade-off between output and inflation stabilization?
   - Compare optimal allocation to allocation with constant markups

5. Key to the no-trade-off result:
   - Treatment of wages in the estimation
   - Assumption about sources of low frequency labor supply shifts

The model: summary

- Medium-scale DSGE model of the US business cycle
  - Christiano, Eichenbaum and Evans (2005, JPE)
  - Smets and Wouters (2007, AER)

- Stochastic growth model + Shocks + “Frictions”

The model: summary

- "Frictions"

1. Preferences
   - Habit in consumption

2. Technology
   - Adjustment costs in investment
   - Variable capital utilization

3. Market structure: Imperfect competition
   - Monopolistic competition in products and labor markets
   - Price and wage stickiness (endogenous markups)

Exogenous disturbances

- Tastes & technology
  - Neutral technology → growth rate is AR(1)
  - Investment specific → AR(1)
  - Inter-temporal preference shock → AR(1)
  - Intra-temporal preference shock → AR(1)
- Shocks to markets competitiveness
  - Markup shock in wages → *i.i.d.*
  - Markup shock in prices → AR(1)
- Policy
  - Government spending → AR(1)
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  - Inflation target shock → persistent AR(1)

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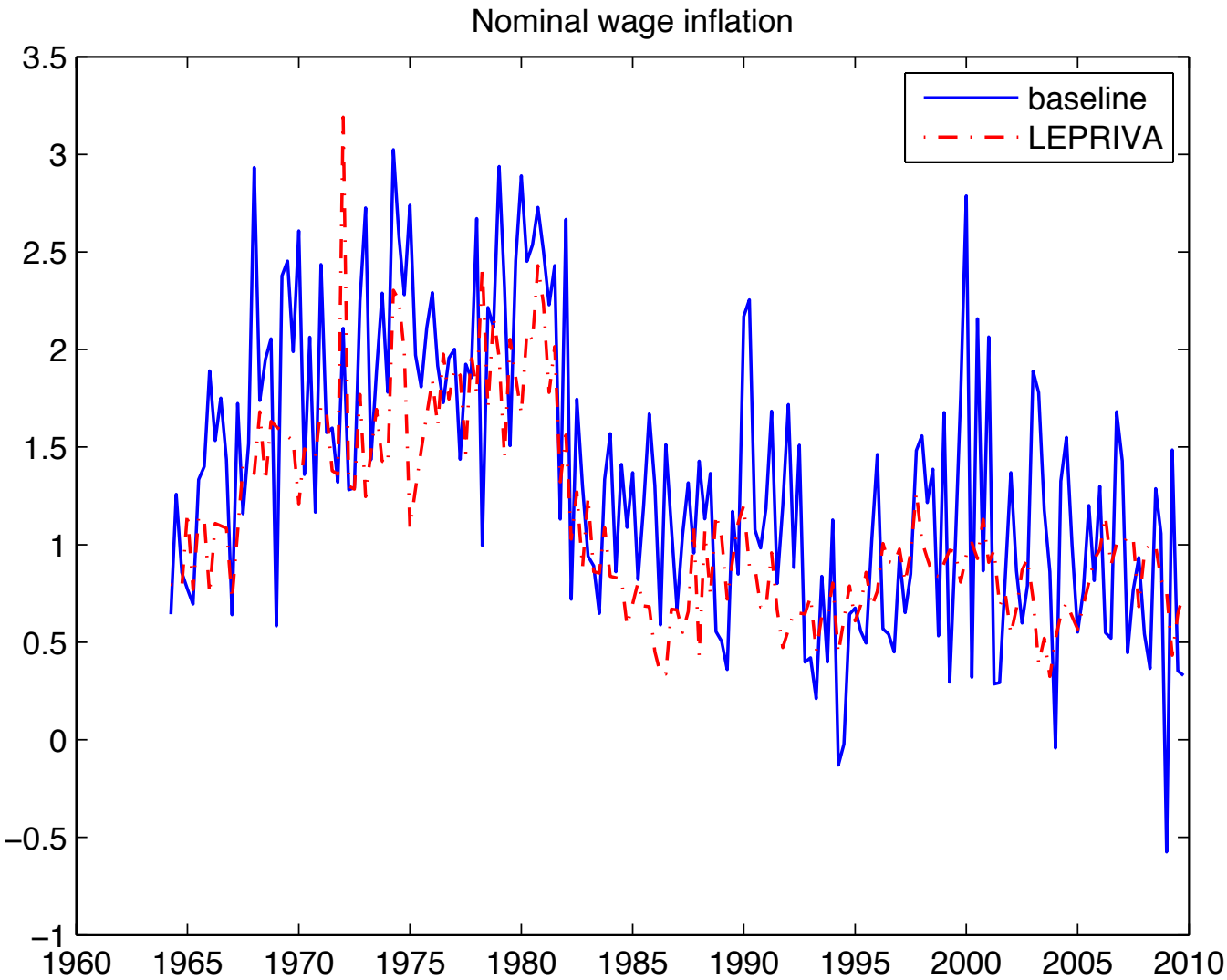
Data and estimation

- Observable variables

1. GDP
2. Consumption
3. Investment
4. Hours
5. Inflation
6. Federal funds rate
7. Wages (compensation, total economy)
8. Wages (earnings, non-supervisory and production workers)

Two wage inflation measures



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- Quarterly data from 1964:I to 2009:IIII

- Bayesian inference

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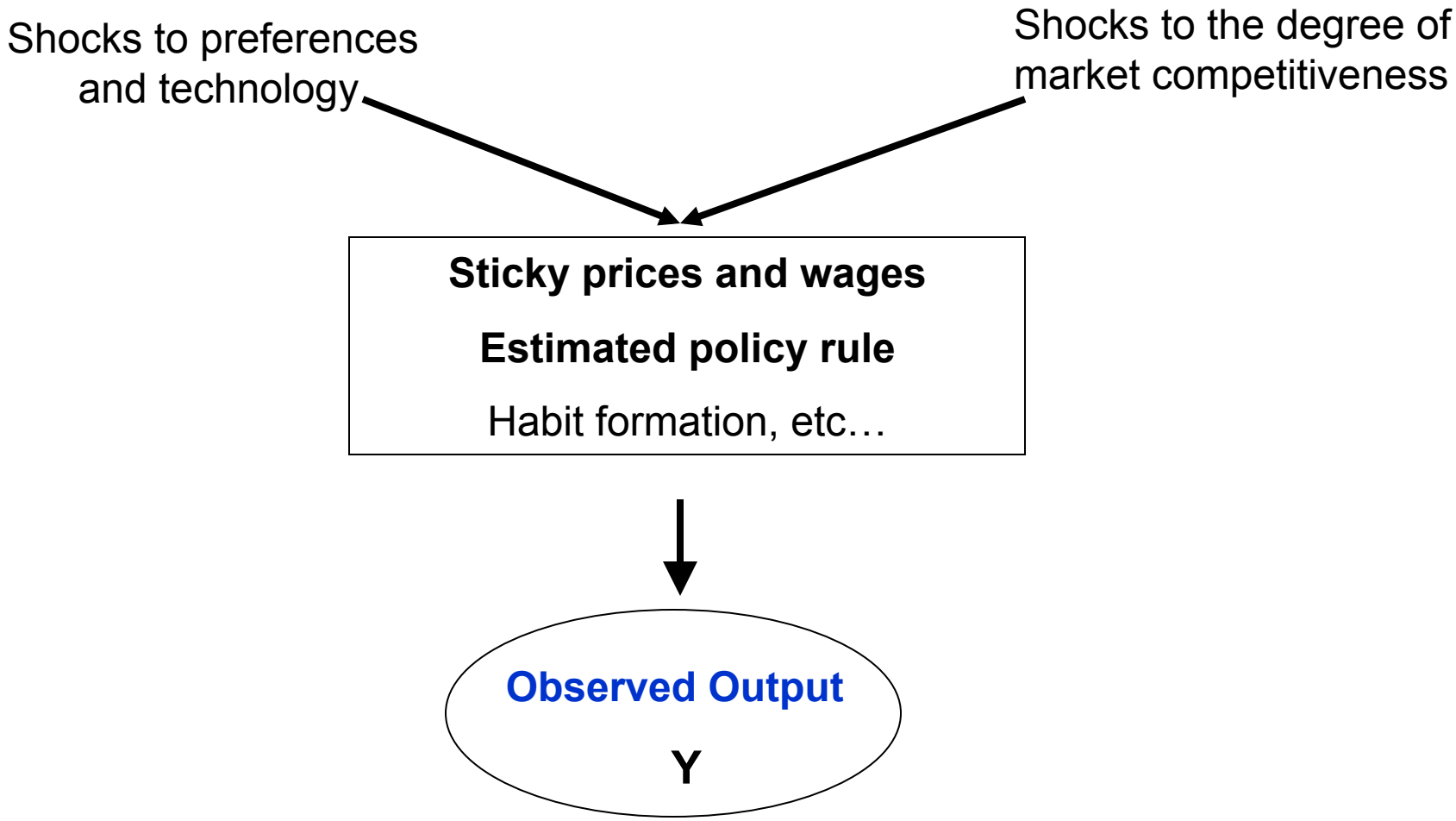
What is the share of inefficient fluctuations?

- Compare actual output to potential output

- Potential output
  - Level of output that would prevail under constant markups
  - Almost same log-linear dynamics of efficient output (i.e. output under perfect competition)

Model economy



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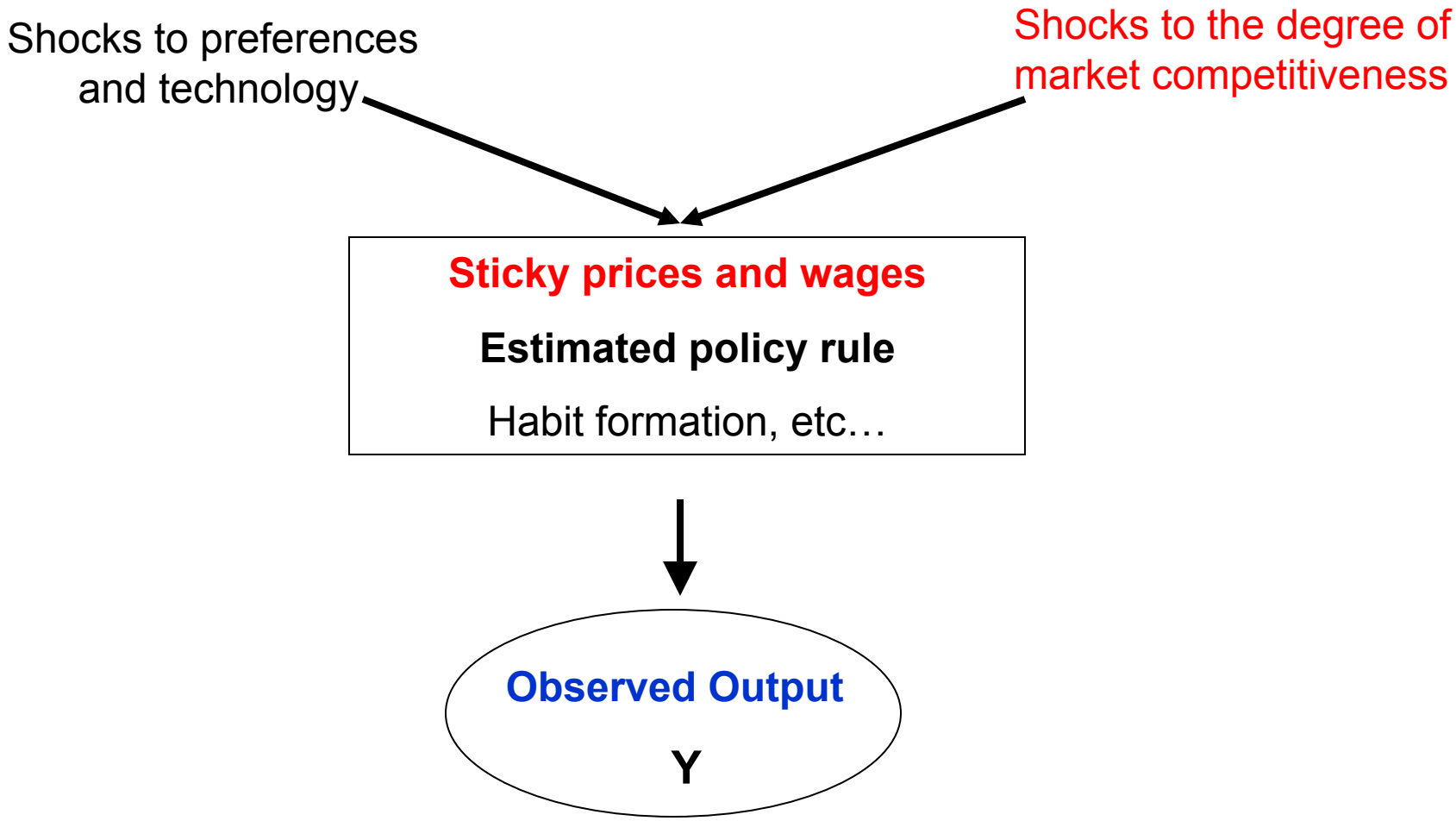
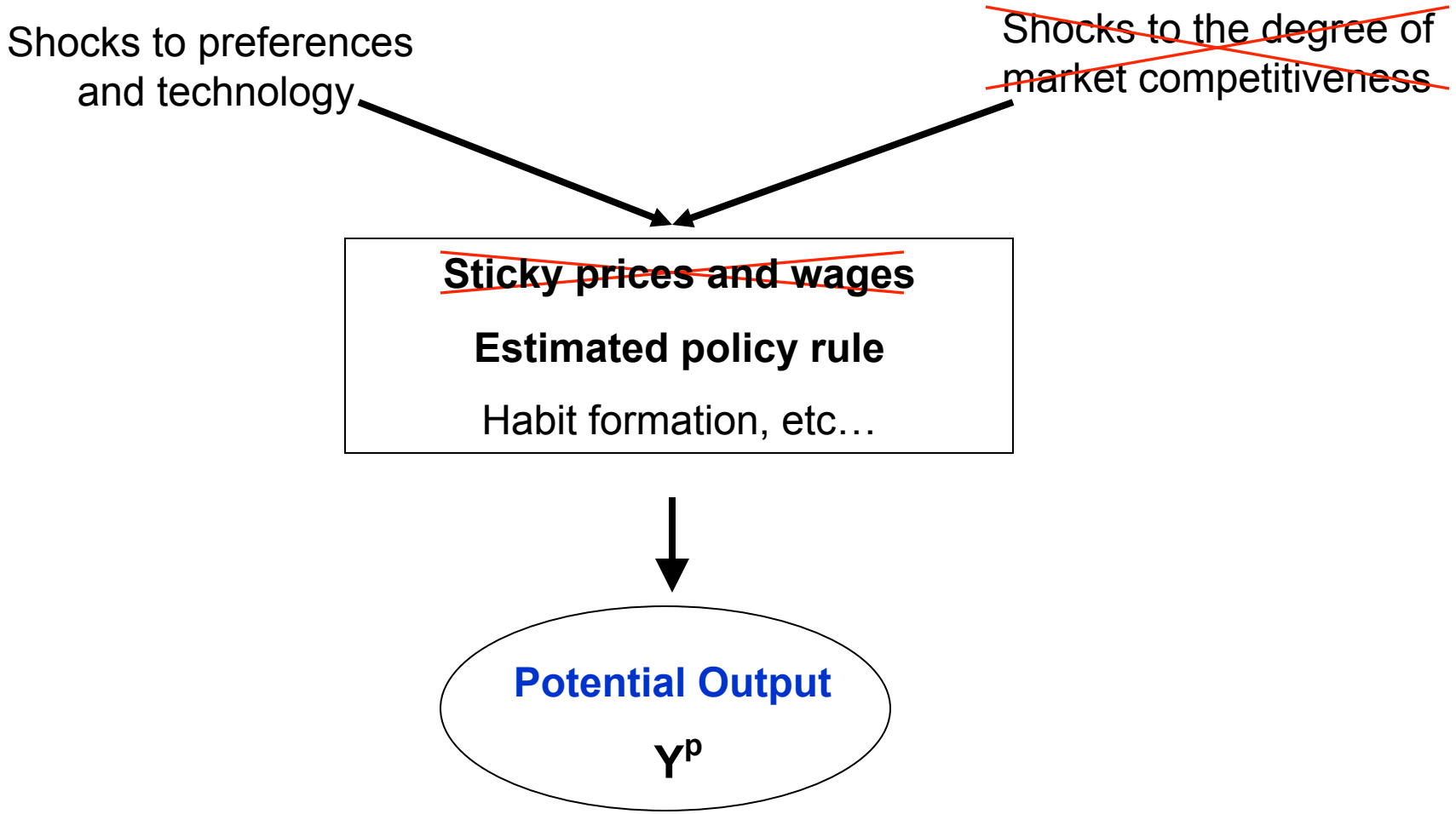
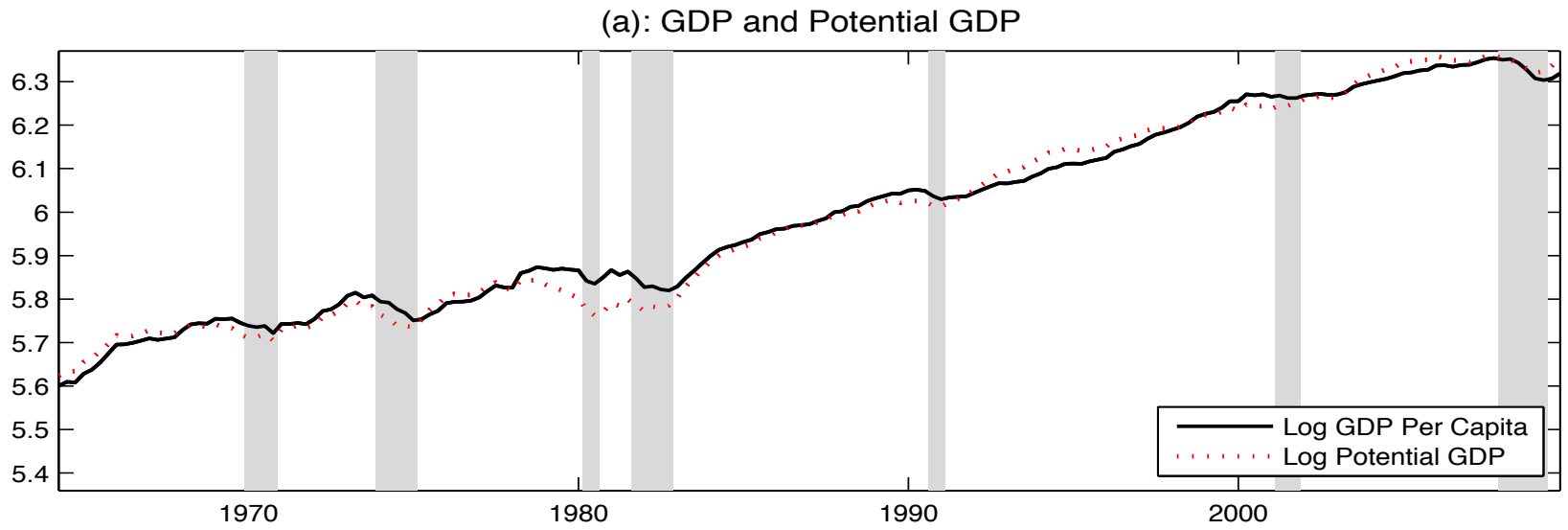


Model economy under constant markups



Potential output = level of output that would have been observed in the absence of inefficient markup variation

Actual and DSGE-potential output



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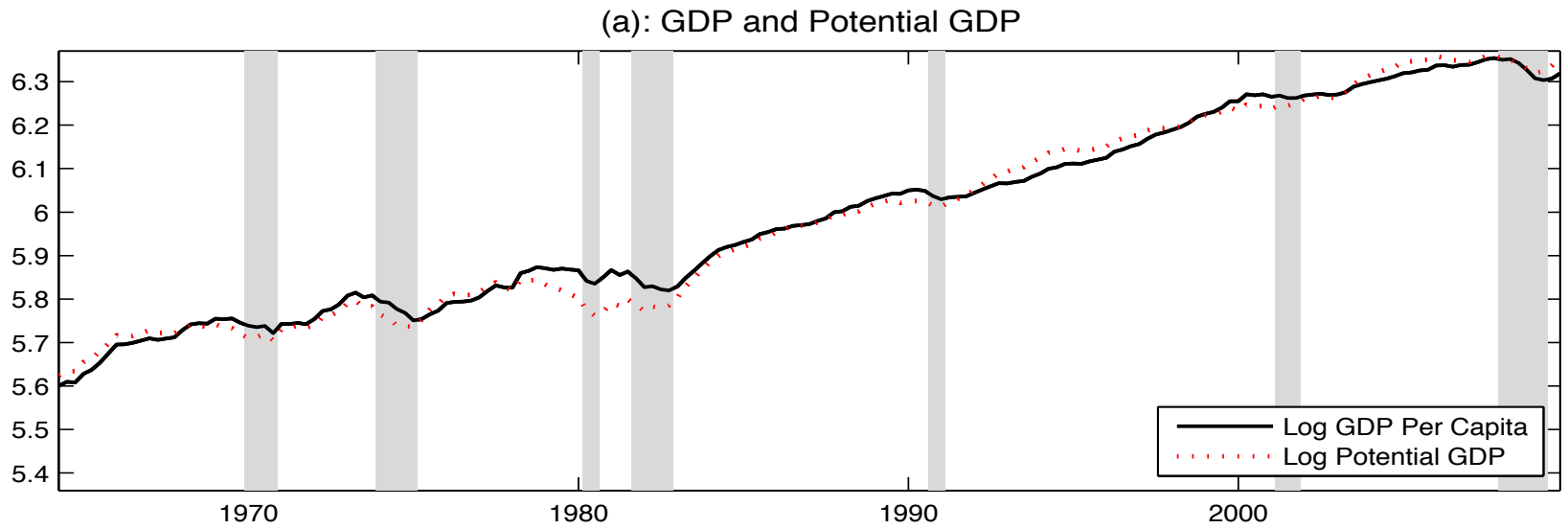

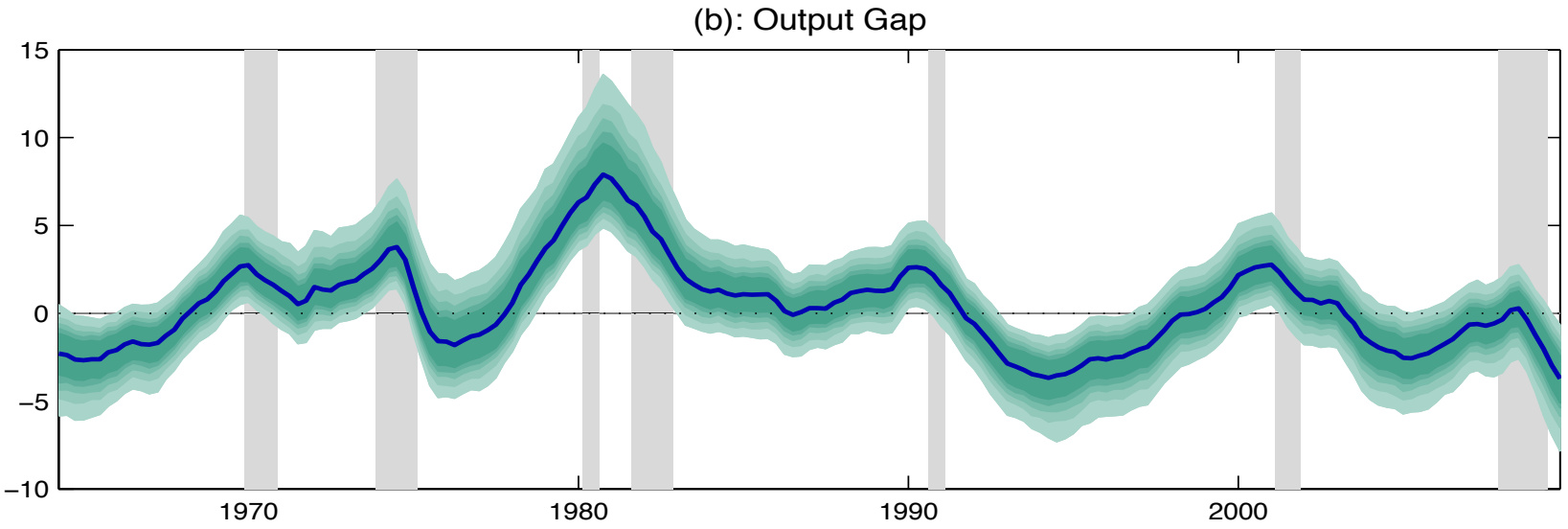

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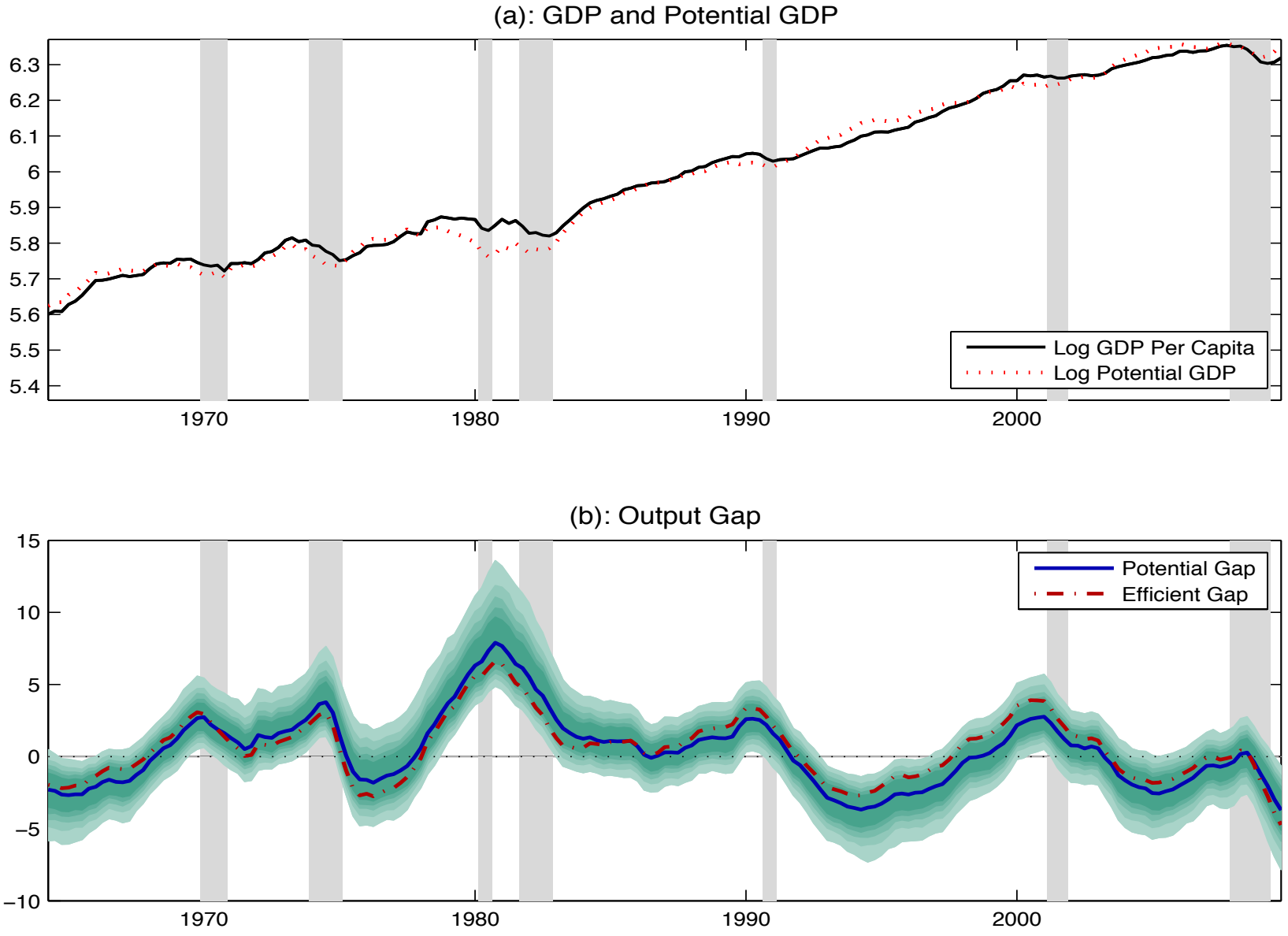


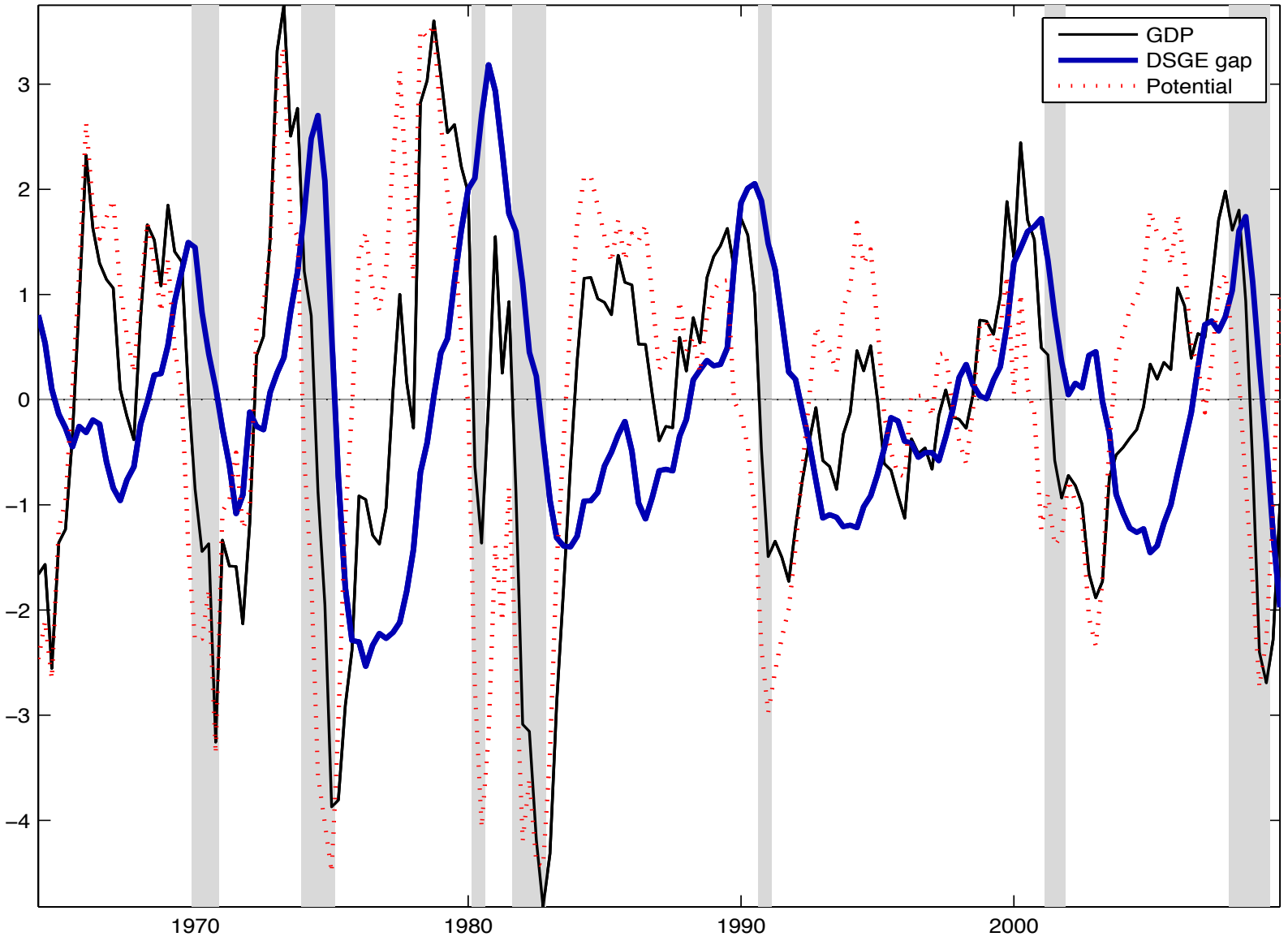
Decomposing the business cycle

$$y_t = y_t^* + g_t$$

Decomposing the business cycle

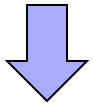
$$y_t - y_t^{hp} = y_t^* - y_t^{*hp} + g_t - g_t^{hp}$$

Output Gap and Business Cycles



Summary of results about inefficient fluctuations

- Potential output is quite volatile, as in RBC
- The output gap is cyclical and also quite volatile



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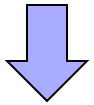

Inefficient fluctuations are large

- Next question ➔ **What should policy do about it?**

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The policy tradeoff

- Efficient allocation
  - $MRS_t = MPL_t = \frac{W_t}{P_t}$
  - $Y_{it} = Y_t \quad \forall i$
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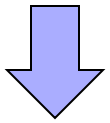

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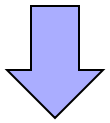

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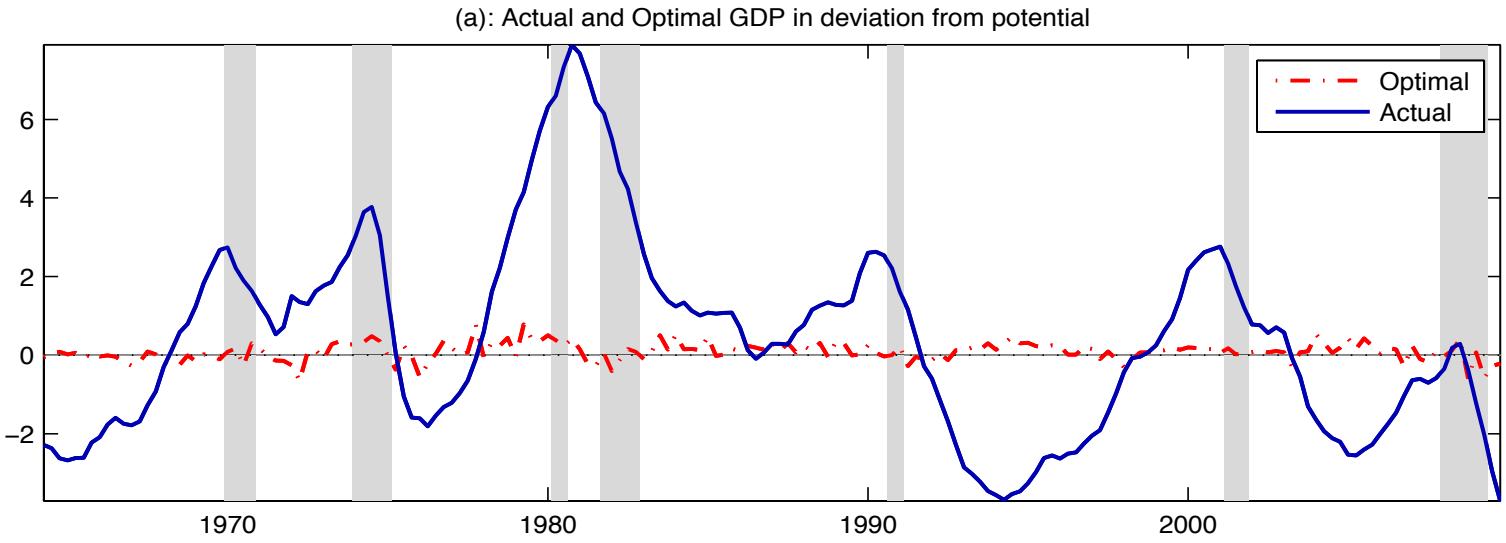
- Sources of trade-off
  - Sticky prices and wages
  - Markup shocks

The optimal allocation

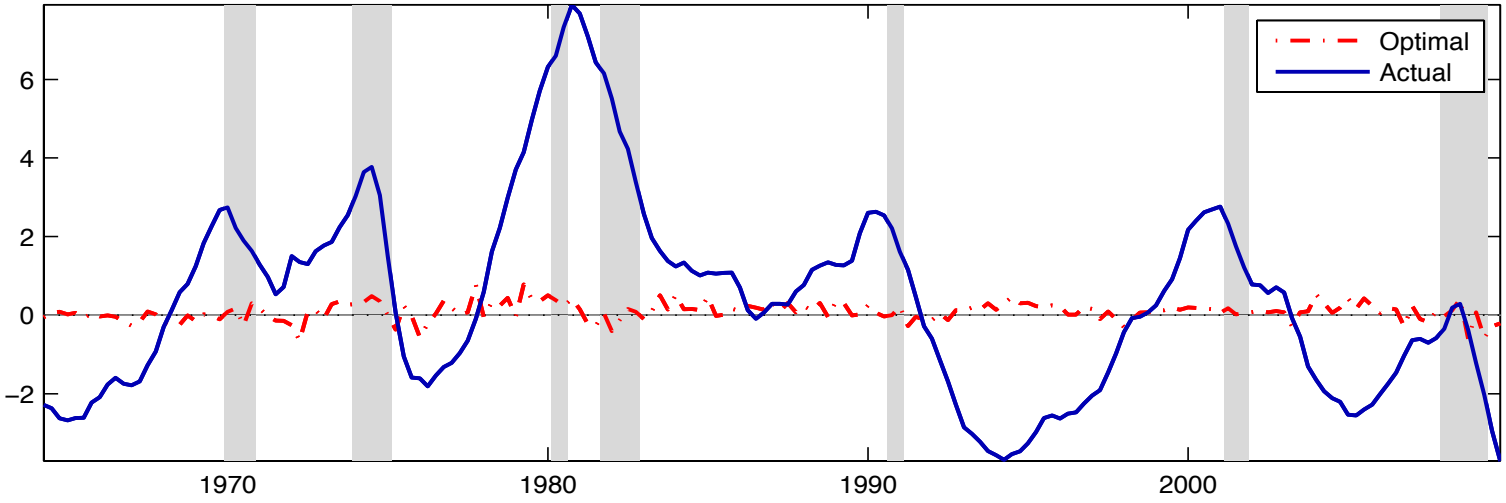
- Maximize the utility of the average HH
  - Subject to the (nonlinear) constraints represented by the equilibrium behavior of private agents
- Compute a first order approximation to the dynamics under optimal policy
- Plot the path of variables in a counterfactual economy hit by the same shocks, but with Ramsey policy since the beginning of time

The optimal allocation



The optimal allocation

(a): Actual and Optimal GDP in deviation from potential



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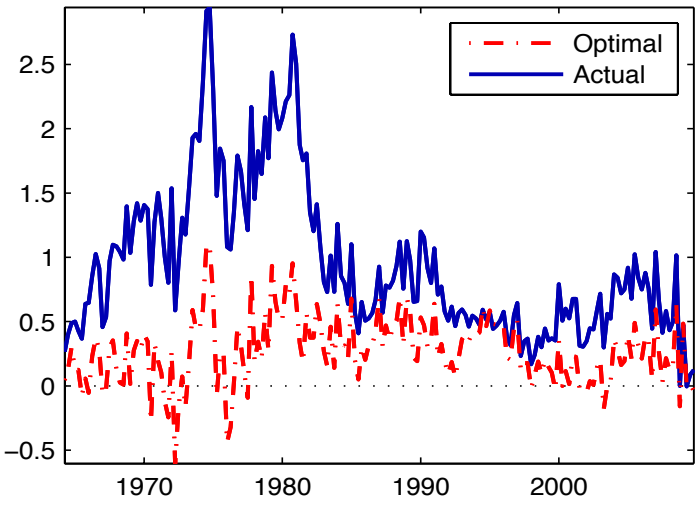
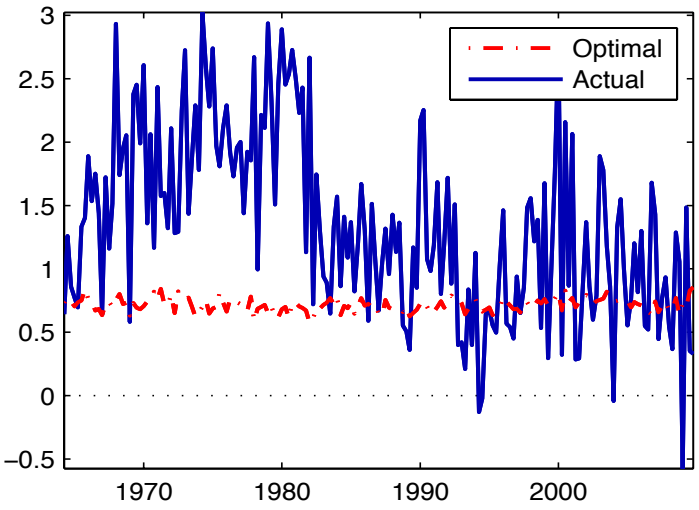
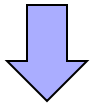


(c): Wage Inflation



Summary of results about the optimal allocation

- Optimal ≈ potential output
- Optimal inflations are quite stable



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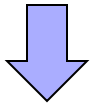

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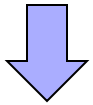

1. Little trade-off between output and inflation stabilization
2. A large fraction of fluctuations should have been avoided

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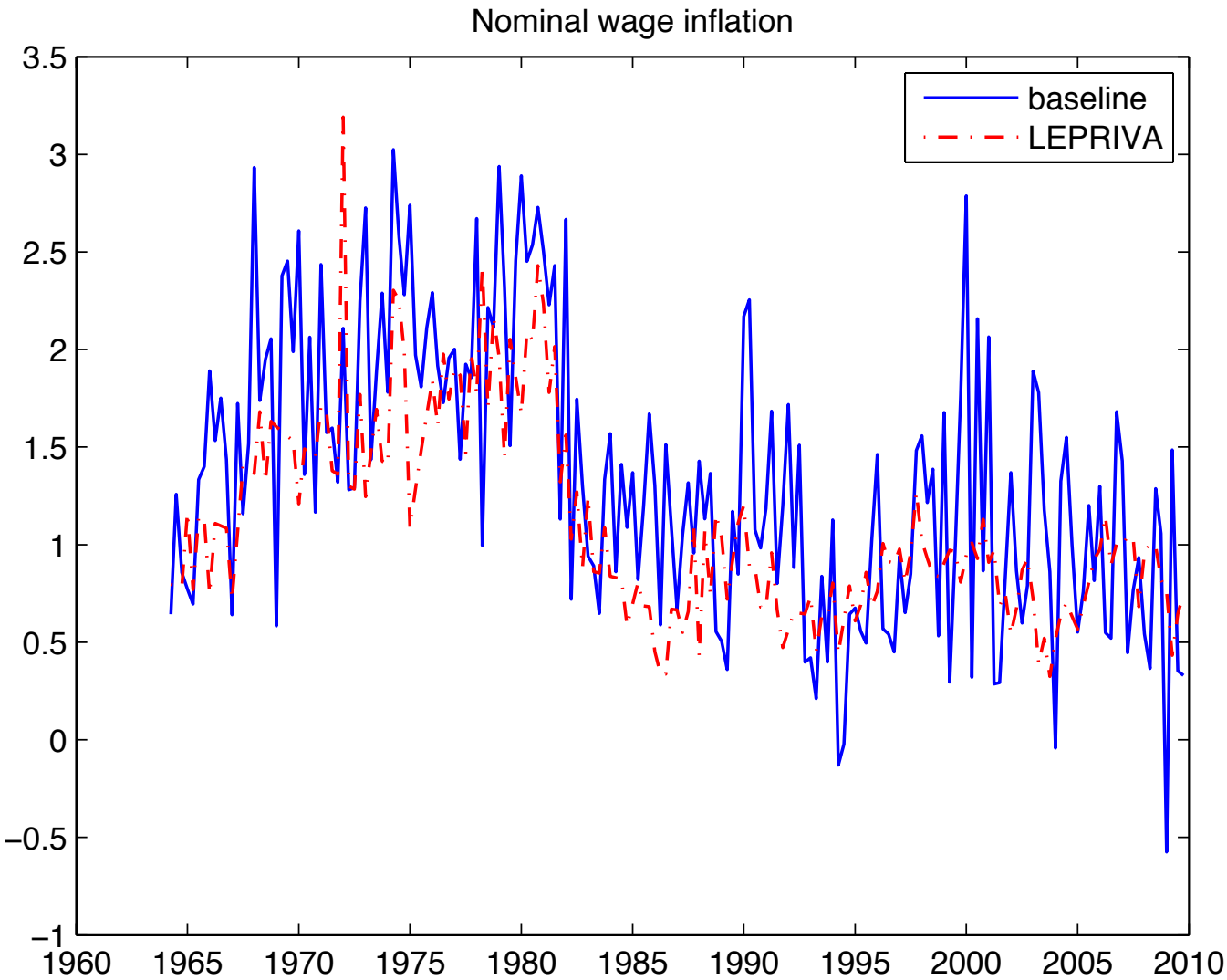
Importance of measurement of wages

Two wage inflation measures



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  - Resemble noise
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  - Explain negligible shares of BC variance in all real series
- Compute the optimal allocation in this model

The optimal allocation in a model estimated with one wage series

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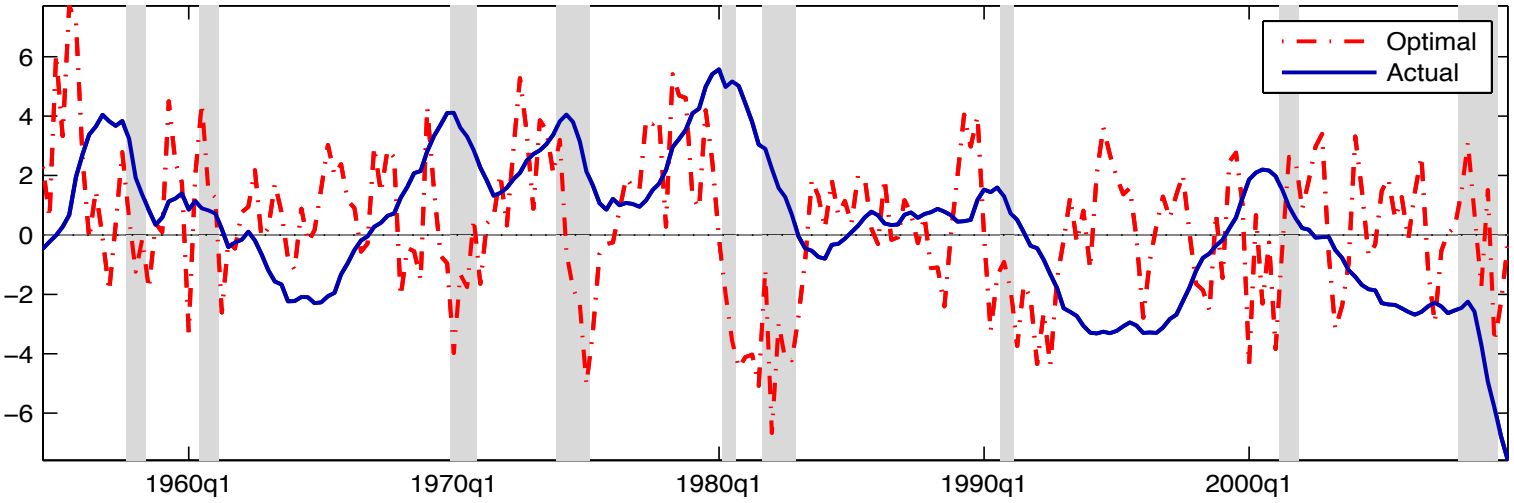

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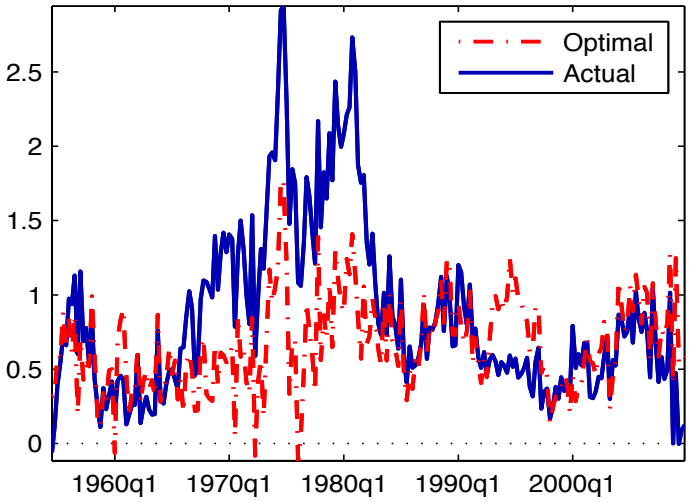

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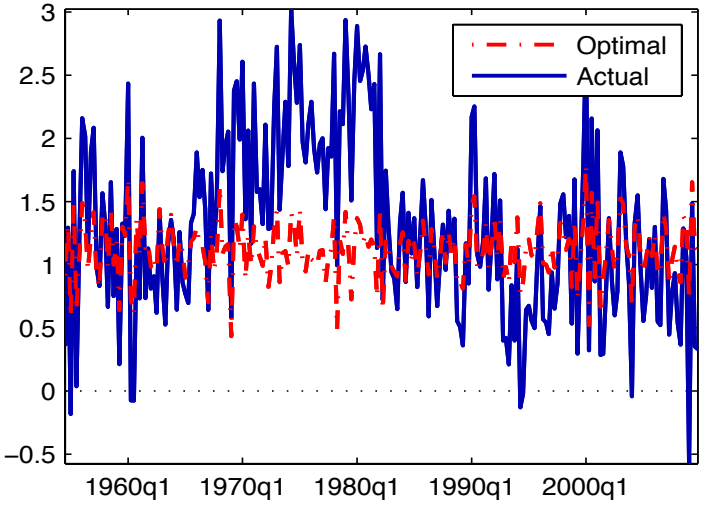

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The optimal allocation without wage markup shocks

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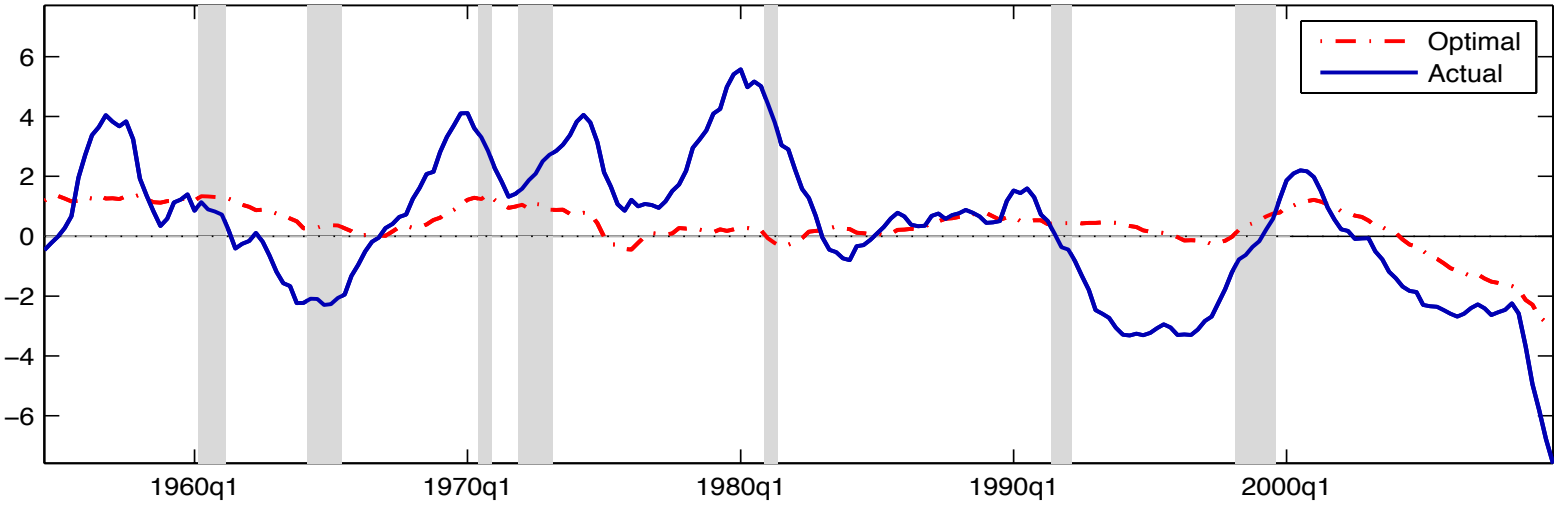

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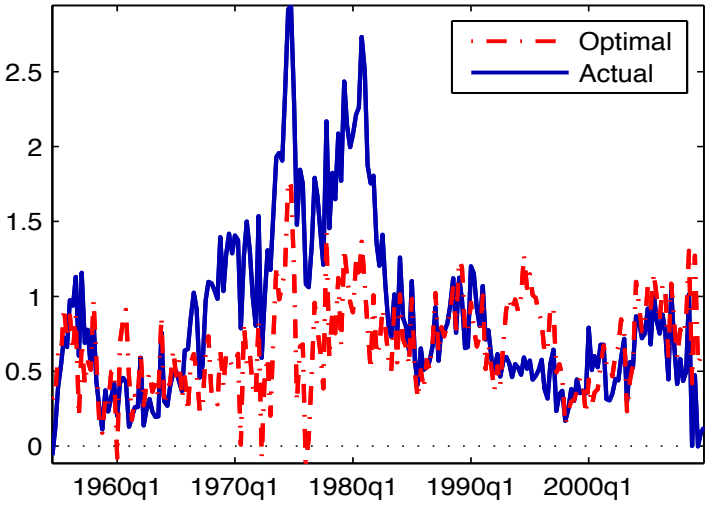

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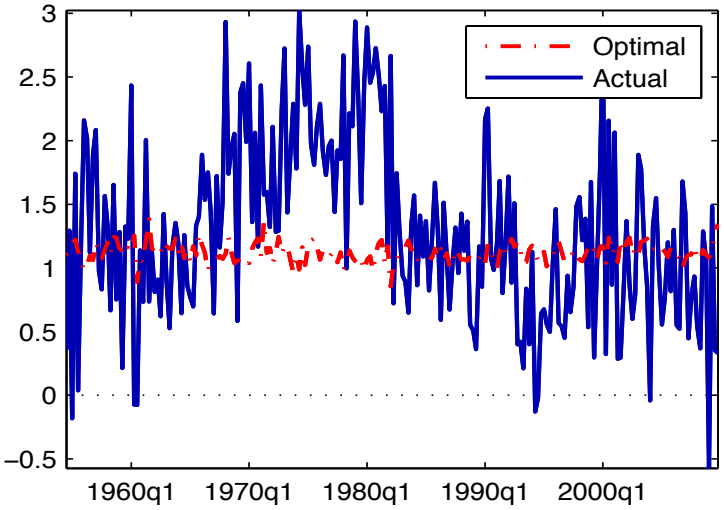
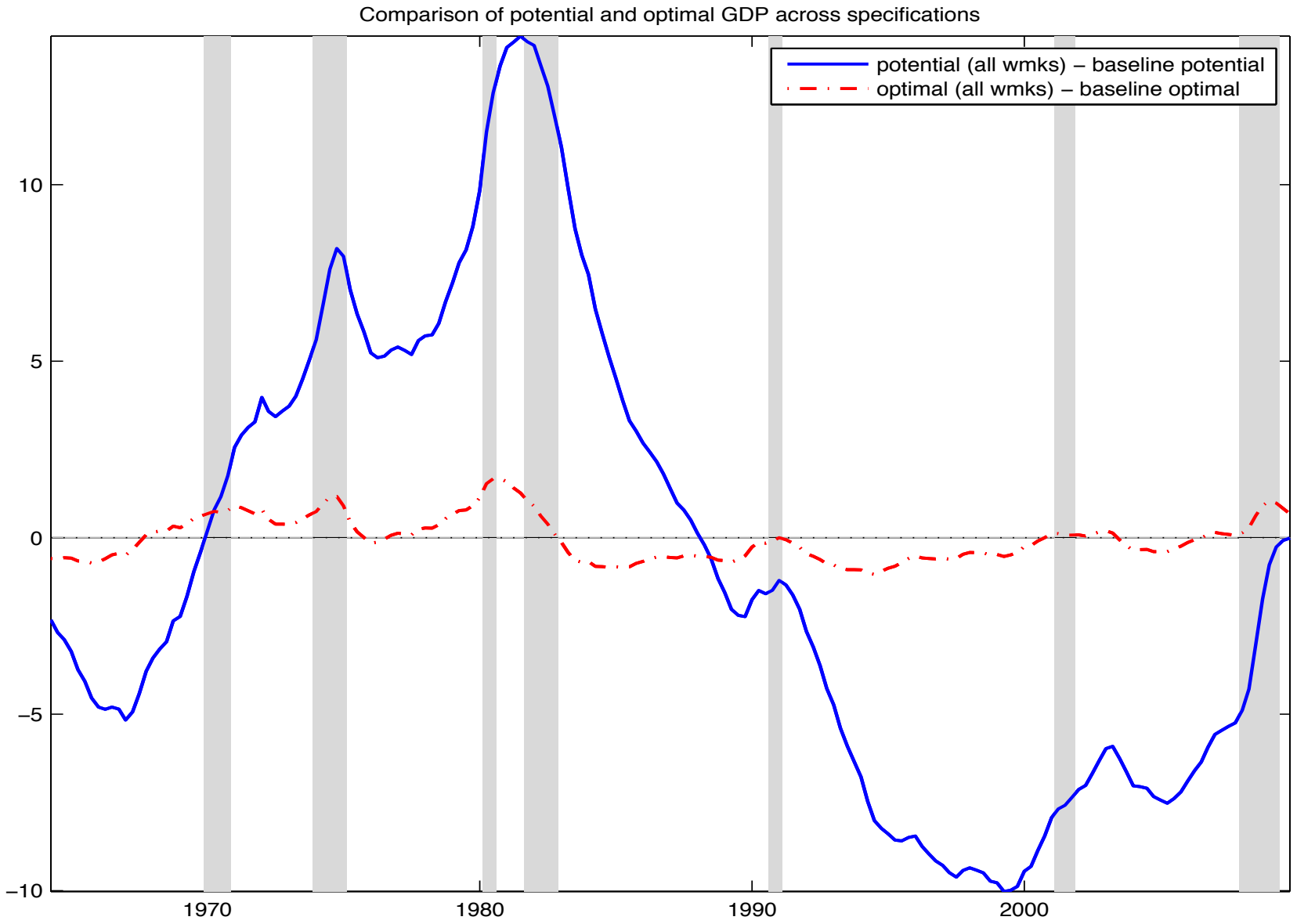


Importance of measurement of wages

- Model estimated with one wage series:
  - Strong tension between real and nominal stabilization
  - Optimal policy de-stabilizes output to stabilize wages
  - Tension driven by large high frequency variation in desired markups, which seems questionable
  - So much weight on nominal stabilization that optimal output is nearly invariant to the interpretation of labor supply shocks

Potential and optimal output under two interpretations of labor supply shocks



Conclusions

- Inefficient fluctuations are large
- Optimal output ≈ potential output
  - A substantial fraction of fluctuations should have been avoided
  - Negligible trade-off between output and inflation stabilization
- Key to the no-trade-off result:
  - Treatment of wages in the estimation
  - Assumption about sources of low frequency labor supply shifts
- Lack of identification of labor supply shocks has only a minor impact on the normative implications of the model (cf. CKM 2010)

The model

- Production technology of final-good producers

$$Y_t = \left[\int_0^1 Y_t(i)^{\frac{1}{1+\lambda_{p,t}}} di \right]^{1+\lambda_{p,t}}$$

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price markup shock

The model

- Production technology of intermediate goods producers

$$Y_t(i) = A_t^{1-\alpha} K_t(i)^{\alpha} L_t(i)^{1-\alpha} - A_t F$$

  - Monopolistically competitive markets
  - Optimizing firms set prices by maximizing PDV of profits
  - Calvo type stickiness: a fraction ξ_p of firms cannot re-optimize
    - index prices to ss and past inflation

The model

- Households maximization problem

$$E_0 \sum_{t=0}^{\infty} \beta^t b_t \left[\log\left(C_t - hC_{t-1}\right) - \varphi_t \frac{L_t(j)^{1+\nu}}{1+\nu} \right]$$

subject to

$$P_t C_t + P_t I_t + T_t + B_t \le R_{t-1} B_{t-1} + Q_t(j) + \Pi_t + W_t(j) L_t(j) + r_t^k K_t$$

$$K_{t+1} = (1-\delta) K_t + \left(1 - S\left(\frac{I_t}{I_{t-1}}\right)\right) \mu_t I_t$$

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- Households maximization problem

Labor supply shock

$$E_0 \sum_{t=0}^{\infty} \beta^t b_t \left[\log\left(C_t - hC_{t-1}\right) - \varphi_t \frac{L_t(j)^{1+\nu}}{1+\nu} \right]$$

subject to

$$P_t C_t + P_t I_t + T_t + B_t \le R_{t-1} B_{t-1} + Q_t(j) + \Pi_t + W_t(j) L_t(j) + r_t^k K_t$$

$$K_{t+1} = (1-\delta) K_t + \left(1 - S\left(\frac{I_t}{I_{t-1}}\right)\right) \mu_t I_t$$

- Monopolistically competitive suppliers of specialized labor
- Calvo-type stickiness: a fraction ξ_w of HH cannot re-optimize
  - index wages to ss and past inflation-productivity

The model

- Employment agencies aggregate differentiated labor into homogeneous labor

$$L_t = \left[\int_0^1 L_t(j)^{\frac{1}{1+\lambda_{w,t}}} di \right]^{1+\lambda_{w,t}}$$

wage markup shock

The model

- Employment agencies aggregate differentiated labor into homogeneous labor

$$L_t = \left[\int_0^1 L_t(j)^{\frac{1}{1+\lambda_{w,t}}} di \right]^{1+\lambda_{w,t}}$$

wage markup shock

- The wage markup shock and the labor supply shock are observationally equivalent

- …but have different implications for the behavior of the efficient economy (CKM 2009)

The model: log-linear wage Phillips curve

$$\pi_t^w = \gamma_1 \pi_{t-1}^w + \gamma_2 E_t \pi_{t+1}^w + \kappa\ \mu_t^w + \kappa\ \lambda_{w,t}$$

The model

- Monetary policy sets the short-term nominal interest rate following a Taylor-type rule

$$\frac{R_t}{R} = \left(\frac{R_{t-1}}{R}\right)^{\rho_R} \left[\left(\frac{\overline{\pi}_{t-3,t}}{\pi_t^*}\right)^{\phi_\pi} \left(\frac{(X_t / X_{t-4})^{1/4}}{e^{\gamma}}\right)^{\phi_X} \right]^{1-\rho_R} \varepsilon_{R,t}$$

Wage markup shocks: fact or fiction?

- Wage markup shocks in the log-linear version of the model
  - Wage Phillips curve:

$$\pi_t^w = \gamma_1 \pi_{t-1}^w + \gamma_2 E_t \pi_{t+1}^w + \kappa\ \mu_t^w + \kappa\ \lambda_{w,t}$$

Std ≈ 30 basis points

- Shocks to desired markup in the labor market are large

Alternative interpretation of wage markup shocks

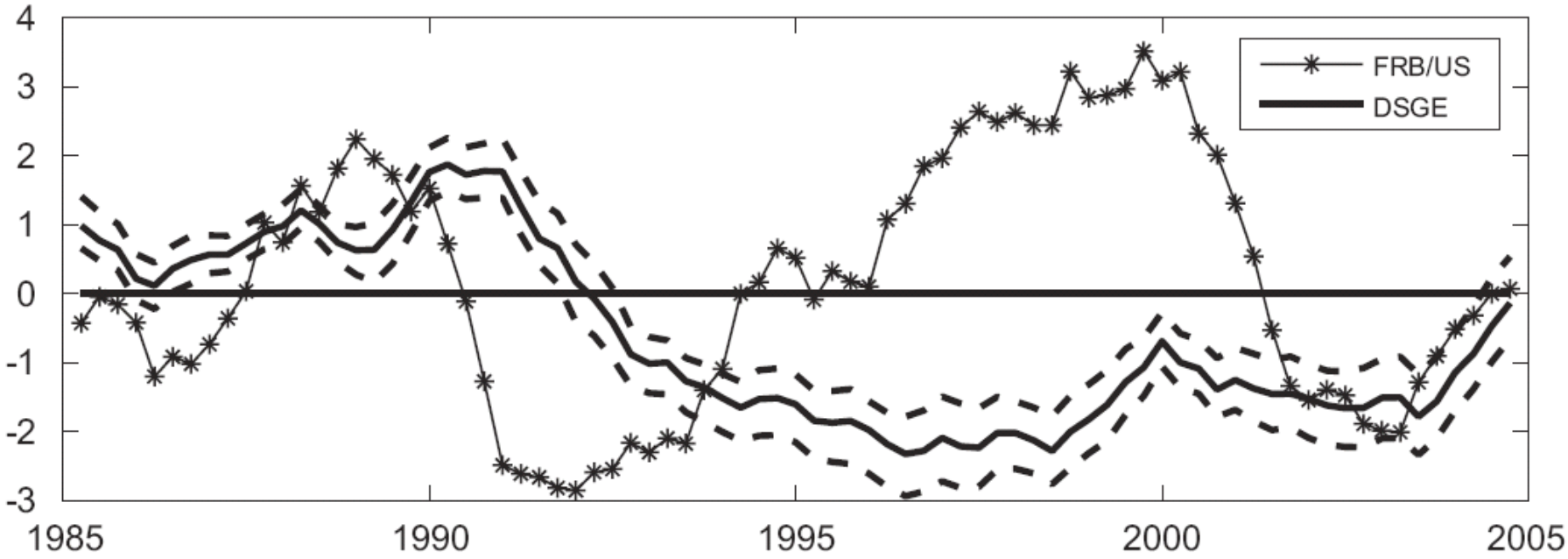
- Take seriously the idea that they might just be “noise”
- Estimate models
  - With measurement error for wages (without wage markup shocks)
    - Fits the data better
  - Without wages as observables
    - Markup shocks become very small
  - With two wage inflation measures
    - In the spirit of factor analysis (Boivin and Giannoni, 2006)
    - Helps identifying idiosyncratic errors from wage markup shocks

Markup shocks are very small

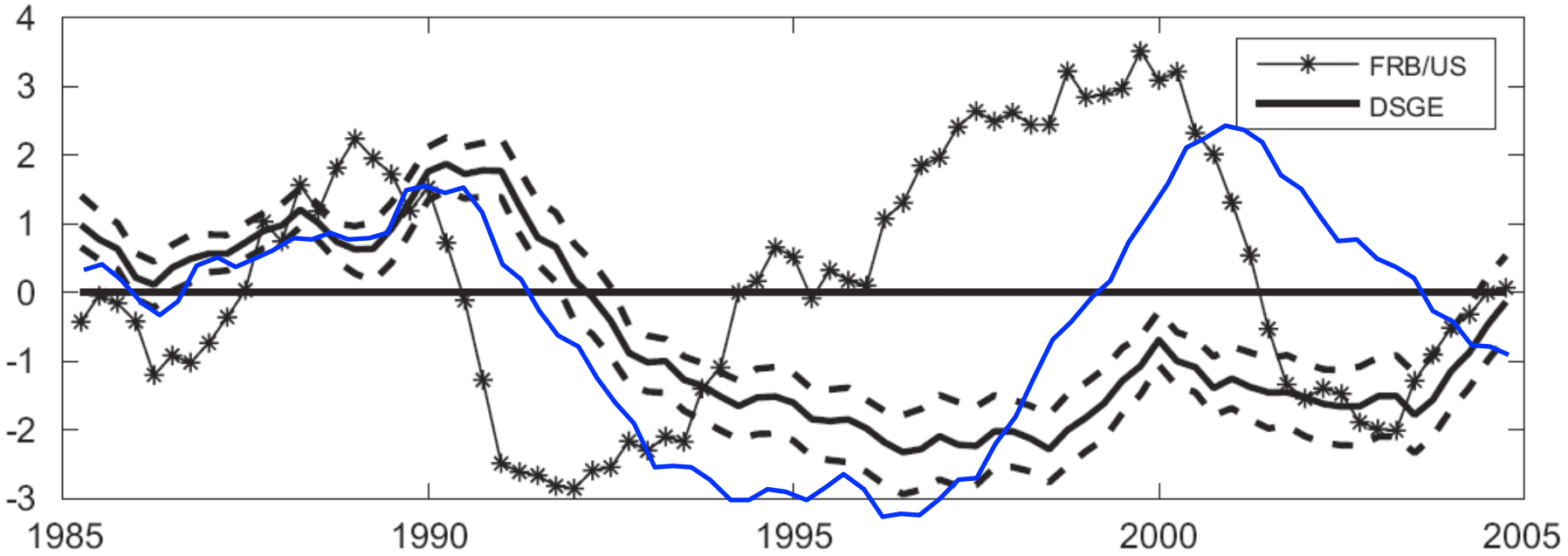
"Going after" (a subset of) the literature

- Output gap estimates differ from standard measures
  - Edge, Kiley and Laforte (2008)
  - Levin, Onatski, Williams and Williams (2005)
  - Andrés, López-Salido and Nelson (2005)

Edge, Kiley and Laforte (2008)

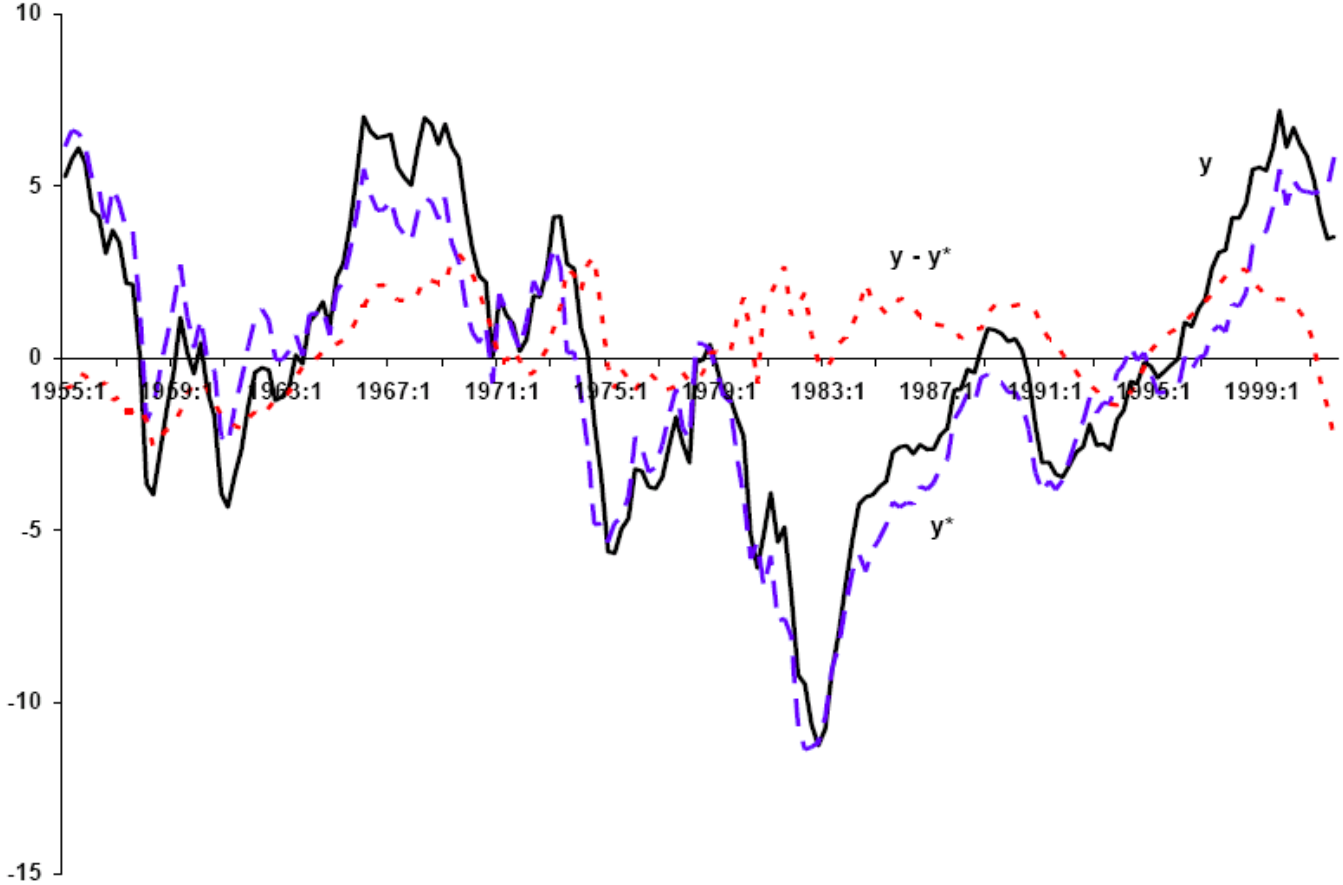


Edge, Kiley and Laforte (2008)



"Our" gap without π^*

LOWW (2005)


10
5
0
-5
-10
-15
1955:1
1959:1
1963:1
1967:1
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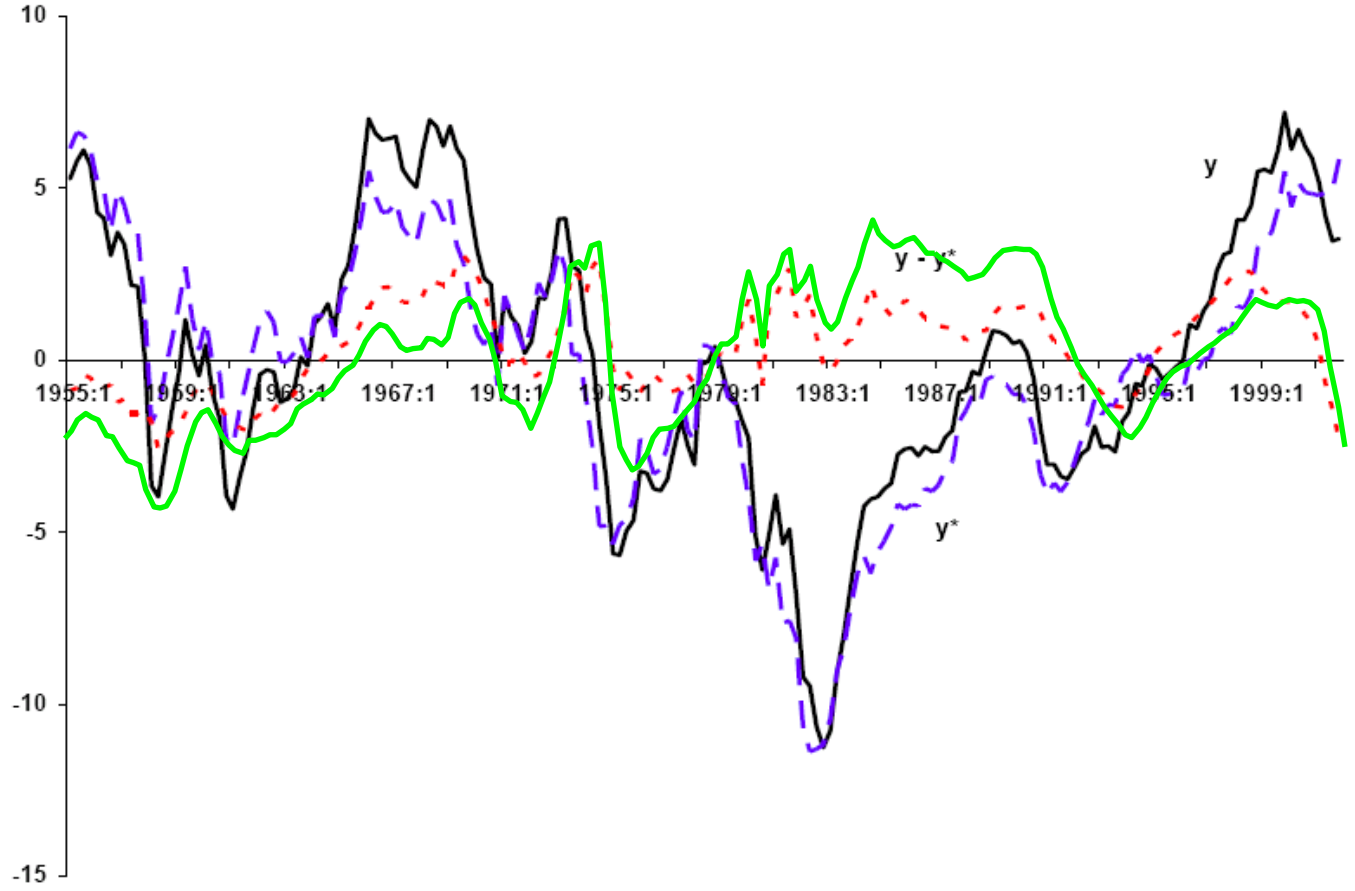
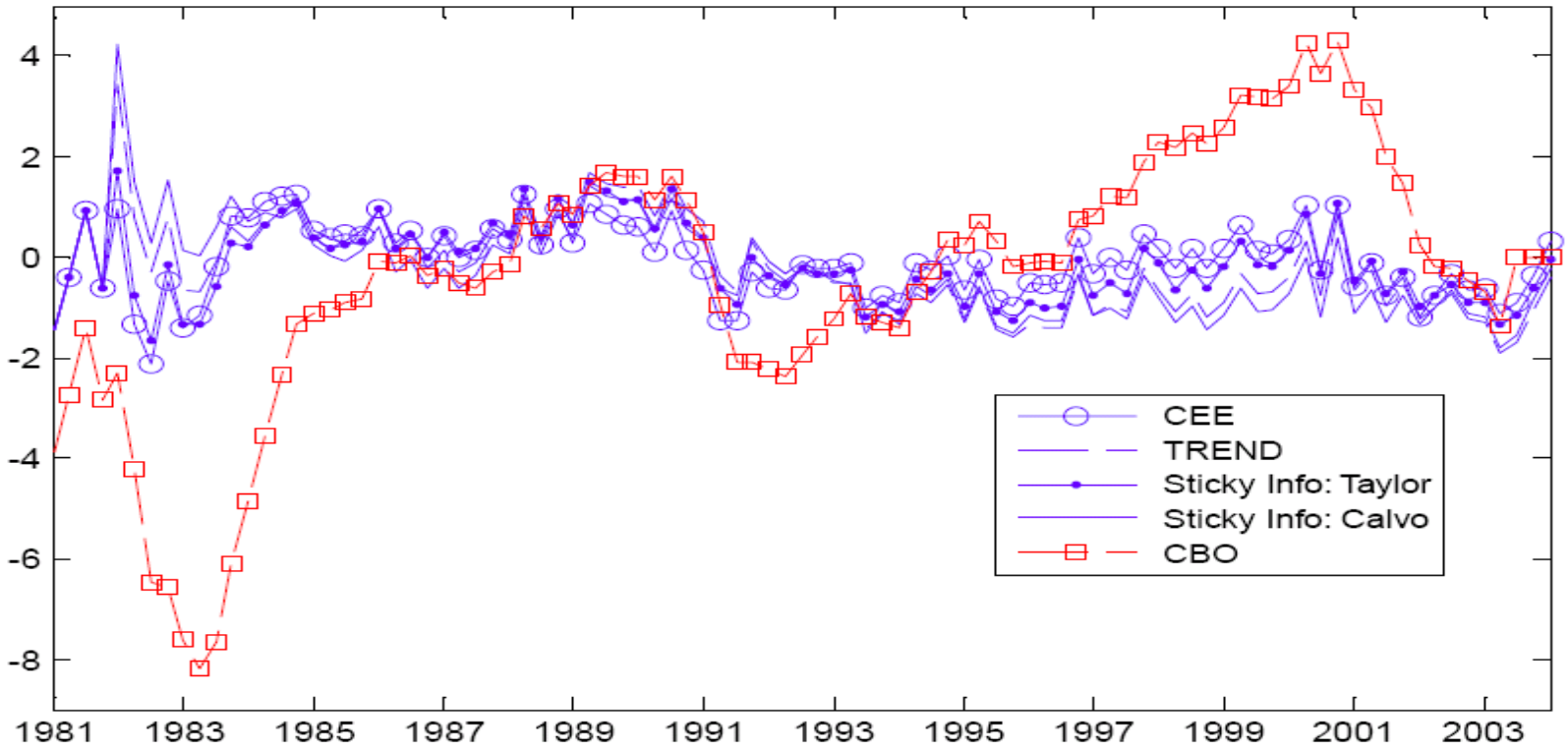
1979:1
1983:1
1987:1
1991:1
1995:1
1999:1
y
y - y*
y*

LOWW (2005)

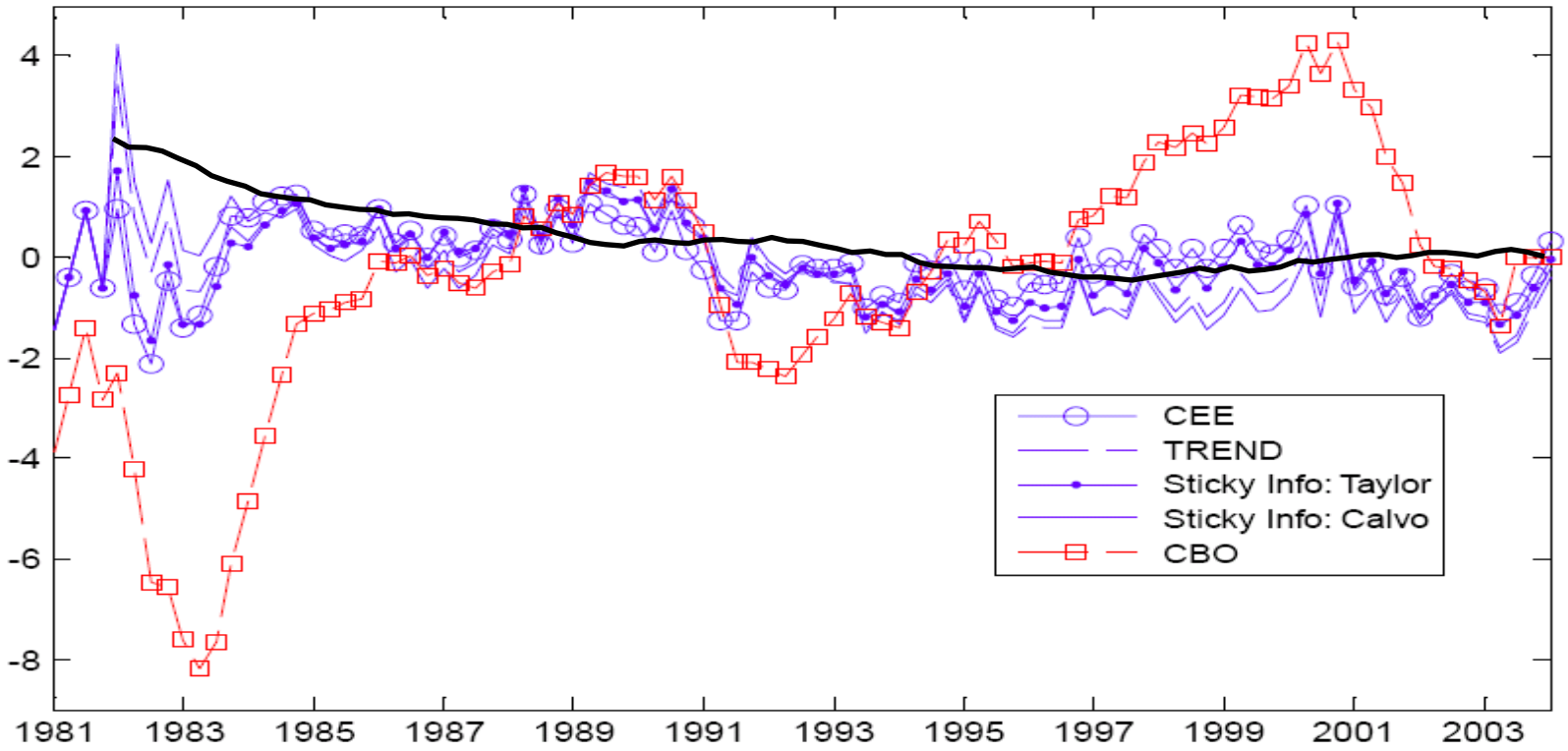


"Our" gap with LOWW dataset and policy rule

Andrés, López-Salido and Nelson (2005)



Andrés, López-Salido and Nelson (2005)



—— "Our" gap without *markup shocks*