ModYUKE Report: USVER2

April 5, 2010

The Model

```
!variables:transition

    LGDP, LGDP_BAR, G, Y, GROWTH4, GROWTH, GROWTH4_BAR, GROWTH_BAR
    PIE4, PIELTE
    UNR, UNR_BAR, UNR_GAP, UNR_G
    CAPU, CAPU_BAR, CU_G, CAPU_GAP,
    'Population' LN, 'Population Growth' DLN,
    'Log Participation Rate' LP, 'Log Participation Rate Trend' LP_BAR,
    'Log Labor Force Trend' LLF_BAR, 'Log Labor Force' LLF,
    'Labor Force Trend Growth' DLLF_BAR, 'Labor Force Growth' DLLF,
    'Log Employment' LE, 'Employment Growth' DLE, 'Y/Y Employment Growth' DLE4,
    'Log Employment Trend' LE_BAR, 'Employment Trend Growth' DLE_BAR,
    'Y/Y Employment Trend Growth' DLE4_BAR,
    'Avg Labor Productivity' APL, 'Avg Labor Productivity Growth' DAPL,
    'Y/Y Avg Labor Productivity Growth' DAPL4,
    'Avg Labor Productivity Trend' APL_BAR, 'Avg Labor Productivity Trend Growth' DAPL_BAR,
    'Y/Y Avg Labor Productivity Trend Growth' DAPL4_BAR,
    'Participation gap' LP_GAP


!shocks:transition

    RES_APL_BAR, RES_G, RES_Y
    RES_PIE, RES_PIELTE
    RES_UNR_BAR, RES_UNR_G, RES_UNR_GAP
    RES_CAPU_BAR, RES_CU_G, RES_CAPU_GAP
    'Population Growth Shock' RES_DLN
    'Participation Rate Gap Shock' RES_LP
    'Participation Rate Trend Shock' RES_LP_BAR

!parameters

    lab_share, tau, growth_ss, rho1, rho2
    beta, omega
    parhist, lambda, unr_ss, alpha, phi1, phi2
    delta, kappa1, kappa2
    'Steady-State Population Growth' popgrowth_ss,
    'Steady-State Participation Rate' part_ss
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    'Population Growth Dynamics' zeta
    'Discouraging Effect on Participation' theta2
    'Participate Rate Dynamics' eta
    theta1

!equations:transition

    % Output.
    LGDP = LGDP_BAR + Y;
    Y = rho1*Y{-1} - rho2/100*(PIE4{-1} - PIELTE{-1}) + RES_Y;
    GROWTH4 = LGDP - LGDP{-4};
    GROWTH = 4*(LGDP - LGDP{-1});
    GROWTH4_BAR = LGDP_BAR - LGDP_BAR{-4};
    GROWTH_BAR = 4*(LGDP_BAR - LGDP_BAR{-1});

    % Inflation.
    PIE4 = PIE4{-1} + beta*Y + omega*(Y - Y{-1}) + RES_PIE;
    PIELTE = PIELTE{-1} + RES_PIELTE;

    % Unemployment.
    UNR = UNR_BAR - UNR_GAP;
    UNR_BAR = UNR_BAR{-1} + UNR_G - parhist/100*Y{-1} - lambda/100*(UNR_BAR{-1} - unr_ss) + RES_UNR_BAR;
    UNR_G = (1-alpha)*UNR_G{-1} + RES_UNR_G;
    UNR_GAP = phi1*UNR_GAP{-1} + phi2*Y + RES_UNR_GAP;

    % Capacity untilization.
    CAPU = CAPU_BAR + CAPU_GAP;
    CAPU_BAR = CAPU_BAR{-1} + CU_G + RES_CAPU_BAR;
    CU_G = (1 - delta)*CU_G{-1} + RES_CU_G;
    CAPU_GAP = kappa1*CAPU_GAP{-1} + kappa2*Y + RES_CAPU_GAP;

    % Average productivity of labor.
    APL_BAR = APL_BAR{-1} + G/4 + RES_APL_BAR;
    G = (1-tau)*G{-1} + tau*growth_ss + RES_G;
    DAPL_BAR = 4*(APL_BAR - APL_BAR{-1});
    DAPL4_BAR = APL_BAR - APL_BAR{-4};
    DAPL = 4*(APL - APL{-1});
    DAPL4 = APL - APL{-4};

    % Potential output is residually determined from this equation.
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    APL_BAR = LGDP_BAR - LE_BAR;
    APL = LGDP - LE;

    % Population.
    DLN = (1-zeta)*DLN{-1} + zeta*popgrowth_ss + RES_DLN;
    DLN = 4*(LN - LN{-1});

    % Labor market participation.
    LP_GAP = theta1*LP_GAP{-1} -100/part_ss*theta2*(UNR - UNR_BAR) + RES_LP;
    LP_GAP = LP - LP_BAR;
    LP_BAR = (1-eta)*LP_BAR{-1} + eta*100*log(part_ss/100) + RES_LP_BAR;

    % Labor force trend.
    LLF_BAR = LN + LP_BAR;
    DLLF_BAR = 4*(LLF_BAR - LLF_BAR{-1});
    LLF = LN + LP;
    DLLF = 4*(LLF - LLF{-1});

    % Employment trend.
    % Mixed first-order expansion of UNR_BAR = 1 - E_BAR/LF_BAR;
    UNR_BAR - unr_ss = -(1-unr_ss/100)*(LE_BAR - LLF_BAR - 100*log(1-unr_ss/100));
    DLE_BAR = 4*(LE_BAR - LE_BAR{-1});
    DLE4_BAR = LE_BAR - LE_BAR{-4};
    UNR - unr_ss = -(1-unr_ss/100)*(LE - LLF - 100*log(1-unr_ss/100));
    DLE = 4*(LE - LE{-1});
    DLE4 = LE - LE{-4};

!variables:measurement

    GROWTH_, PIE4_, D_CAPU_, UNR_, PIE4_PIELTE_
    'Log Labour Force' LLF_, 'Log Participation Rate' LP_

    %These variables are added for tuning
    LP_BAR_

!shocks:measurement

    RES_LLF_

!equations:measurement
```
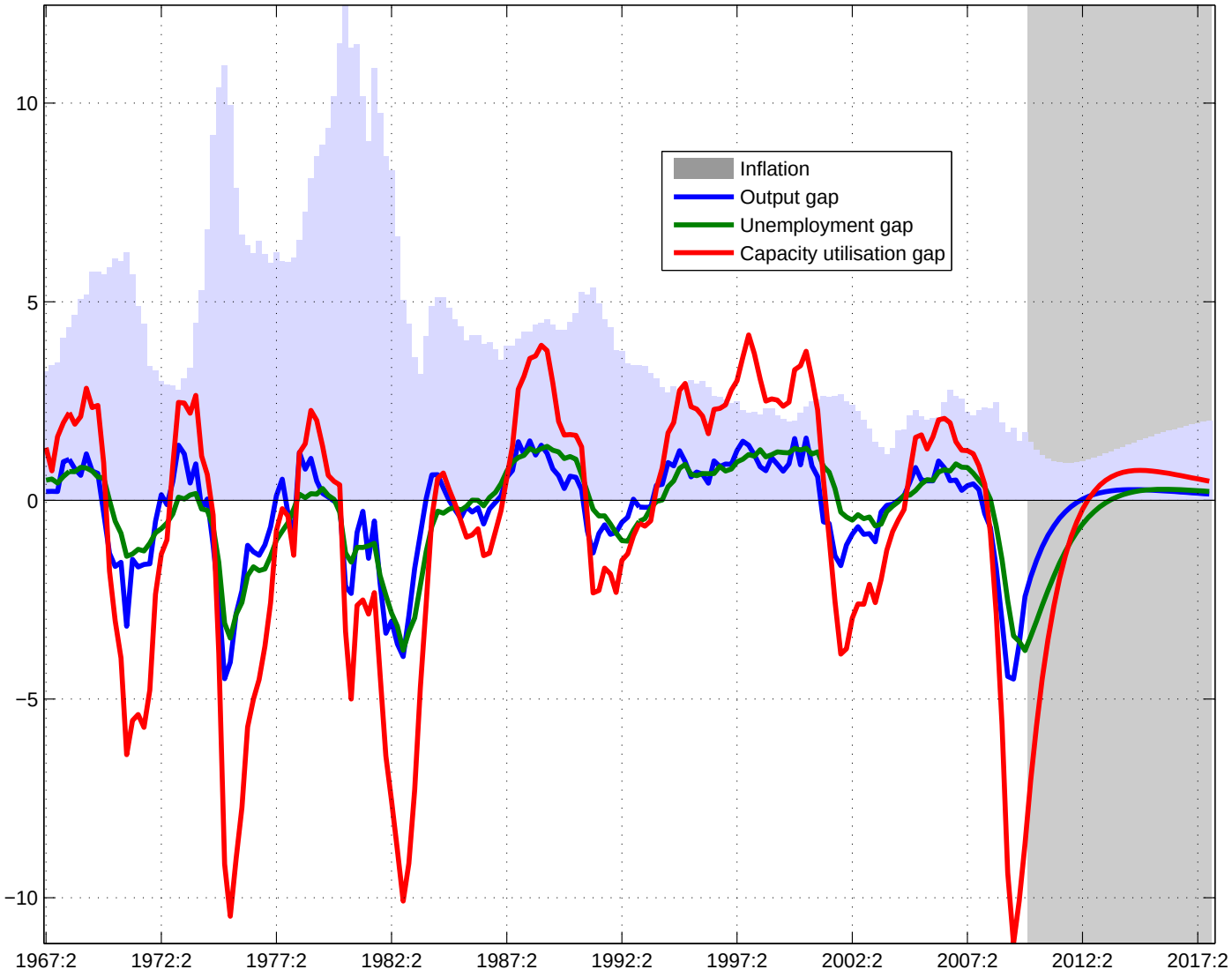
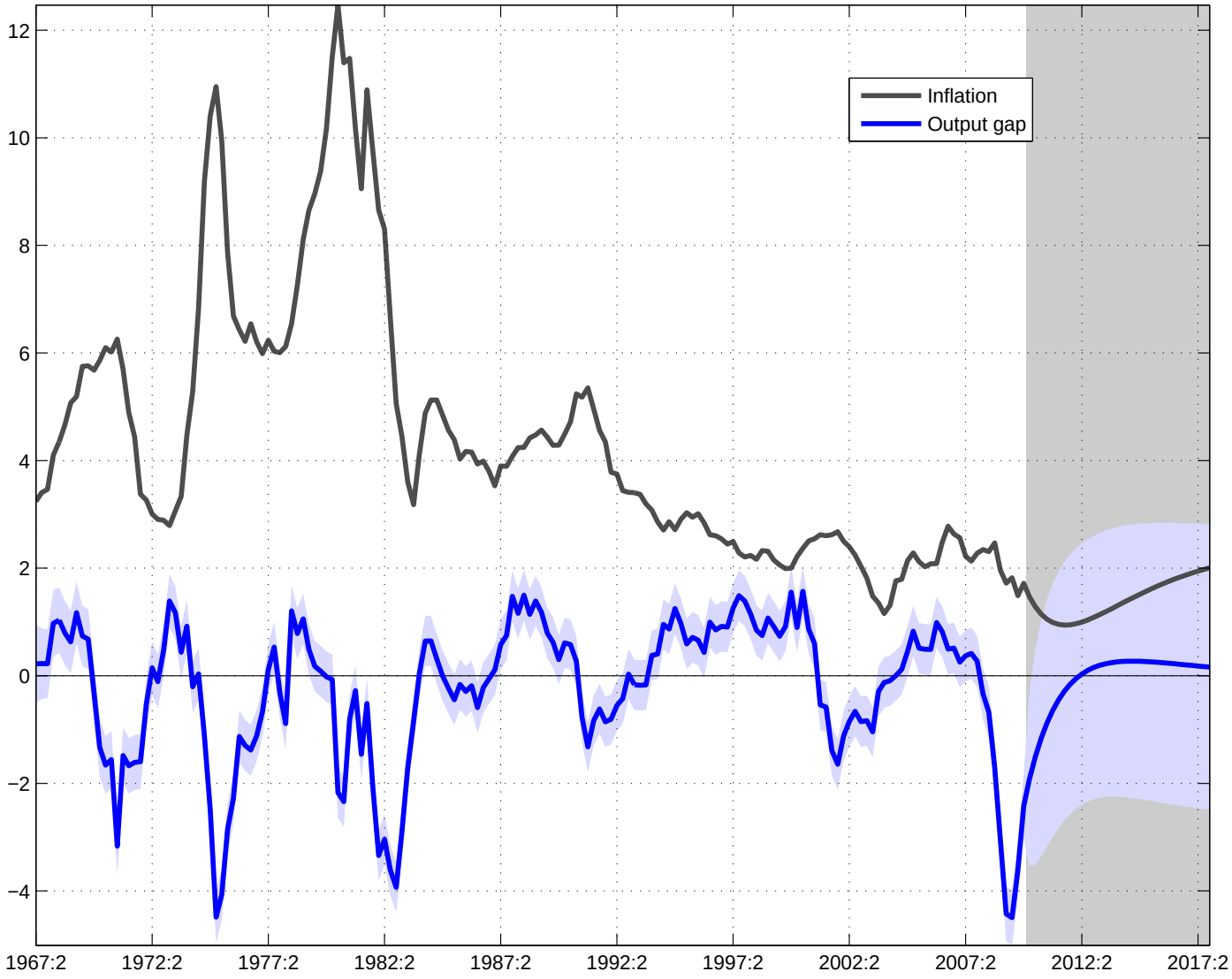

```
GROWTH_ = GROWTH;
PIE4_ = PIE4;
D_CAPU_ = CAPU - CAPU{-1};
UNR_ = UNR;
PIE4_PIELTE_ = PIE4 - PIELTE;
LLF_ = LLF + RES_LLF_;
LP_ = LP;

%These equations are added for tuning
LP_BAR_ = LP_BAR;
```

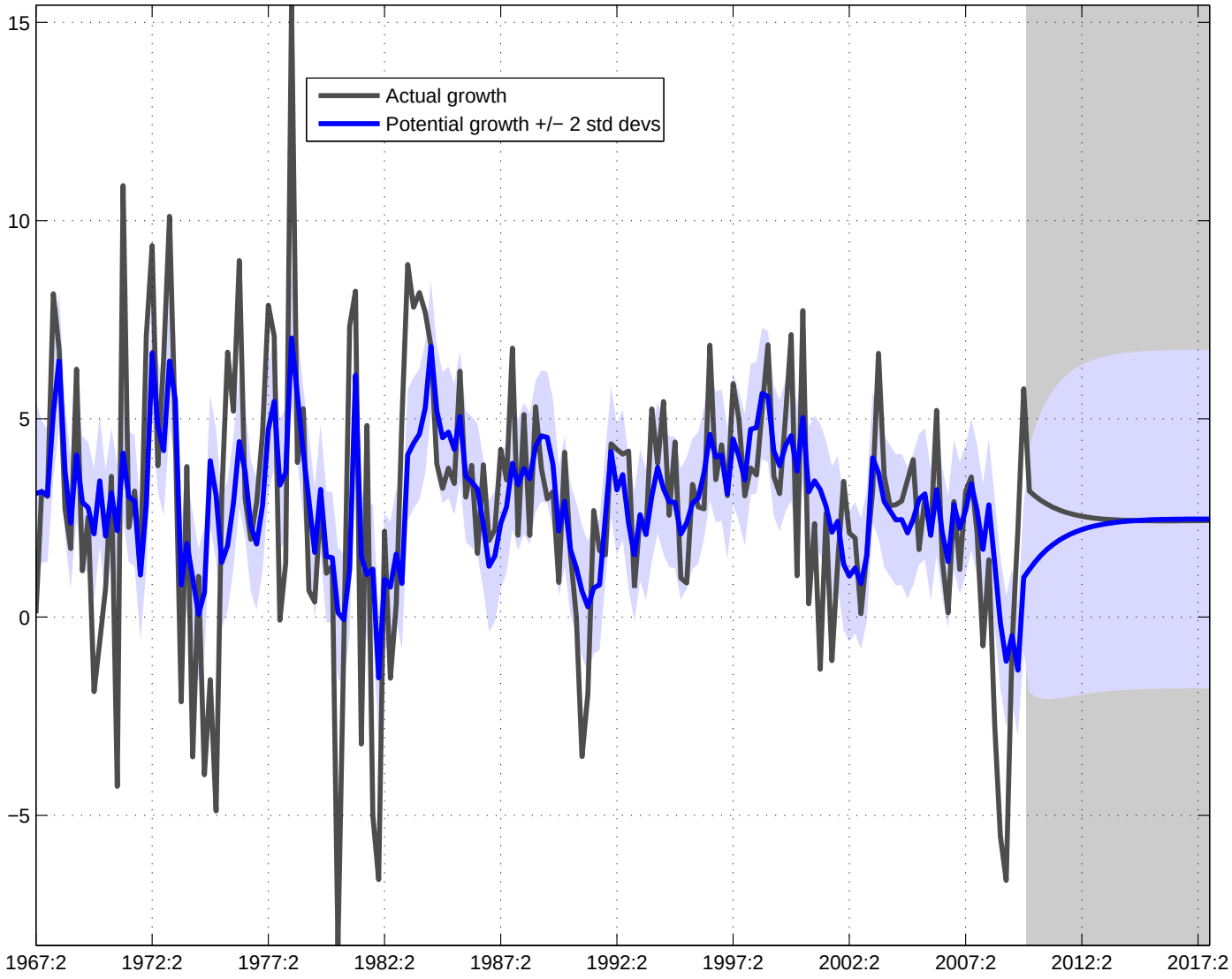
Economic activity gaps



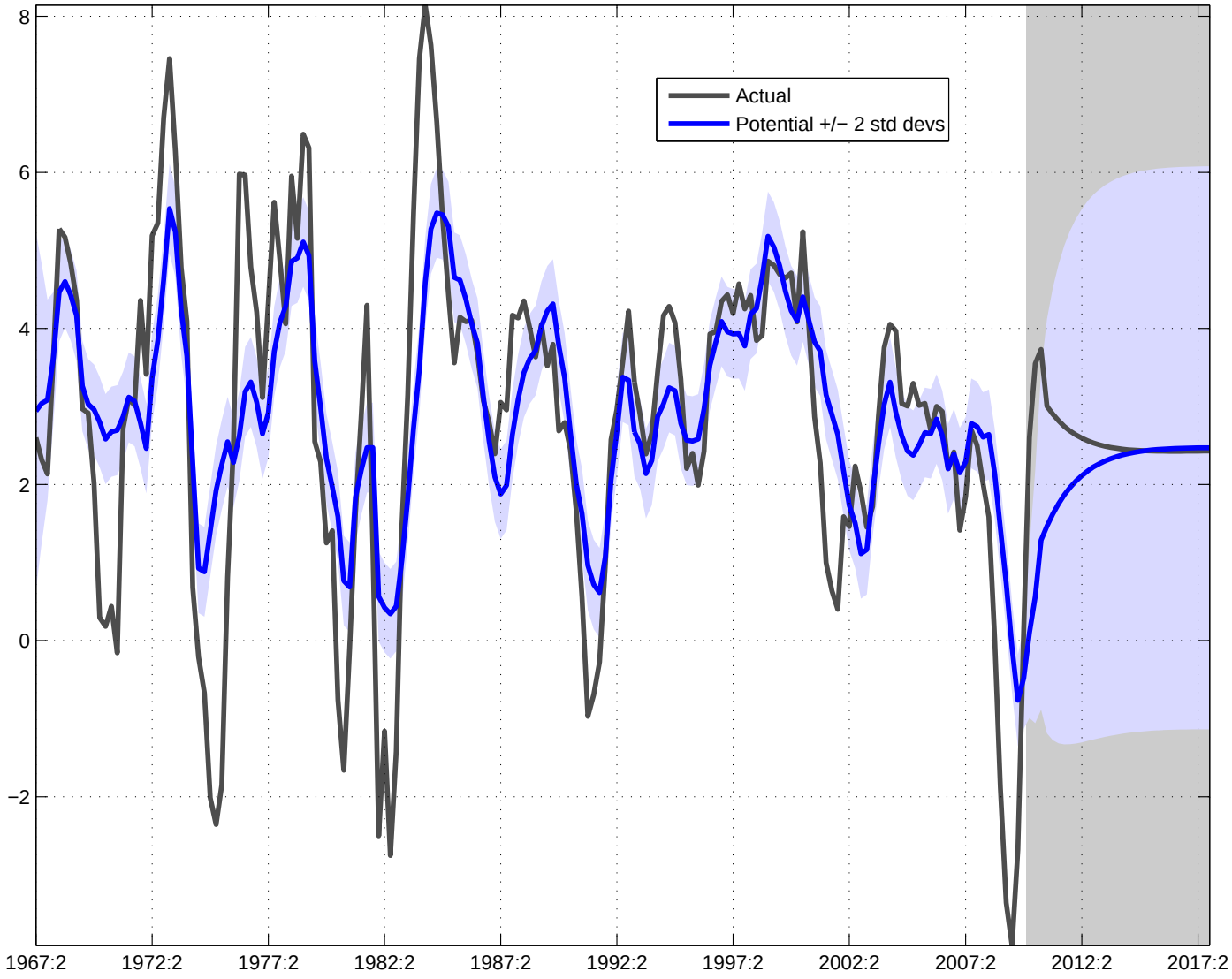
Output Gap +/- 2 std devs (w/o model or parameter uncertainty)



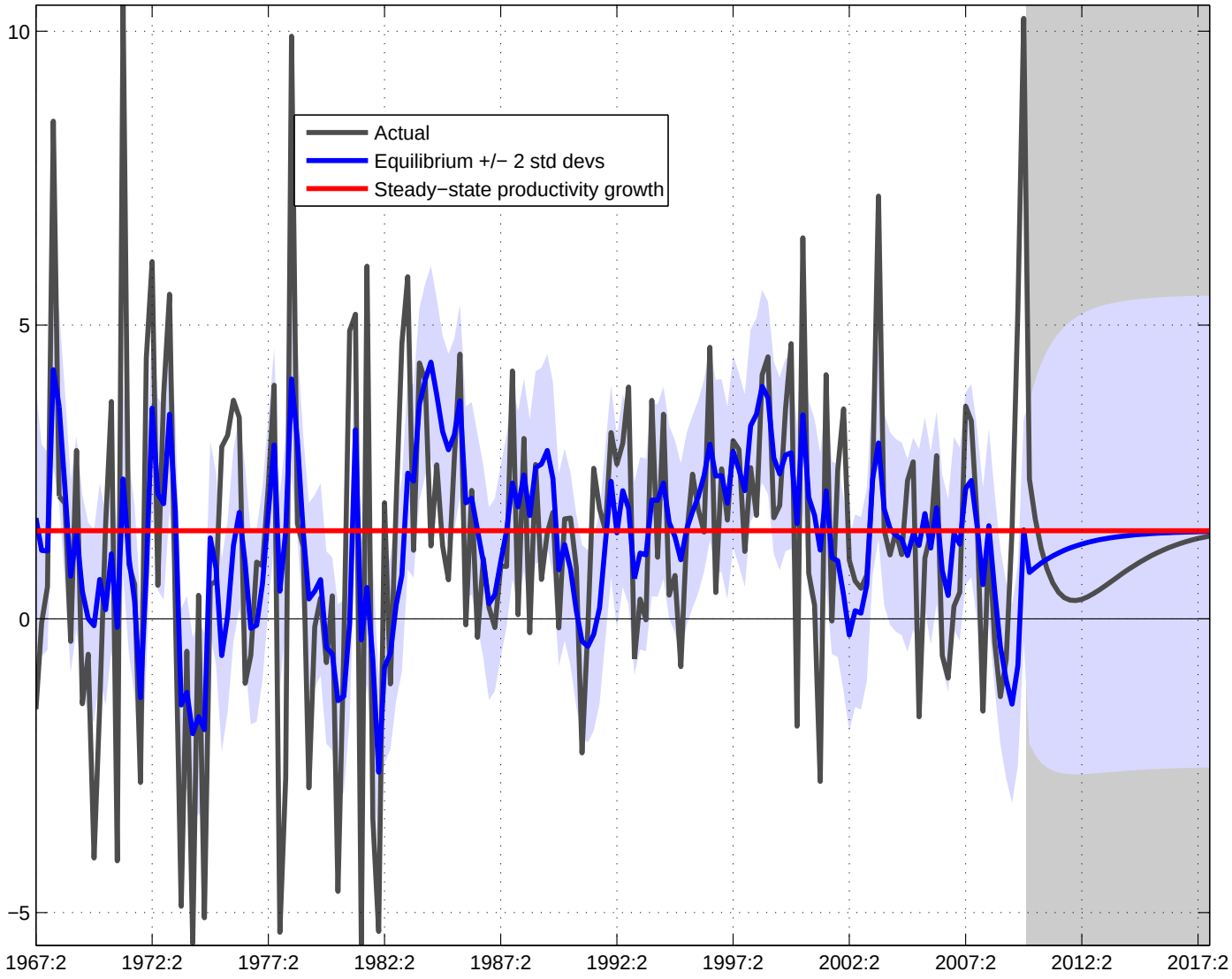
Output Growth (Q/Q Annualized) +/- 2 std devs (w/o model or parameter uncertainty)



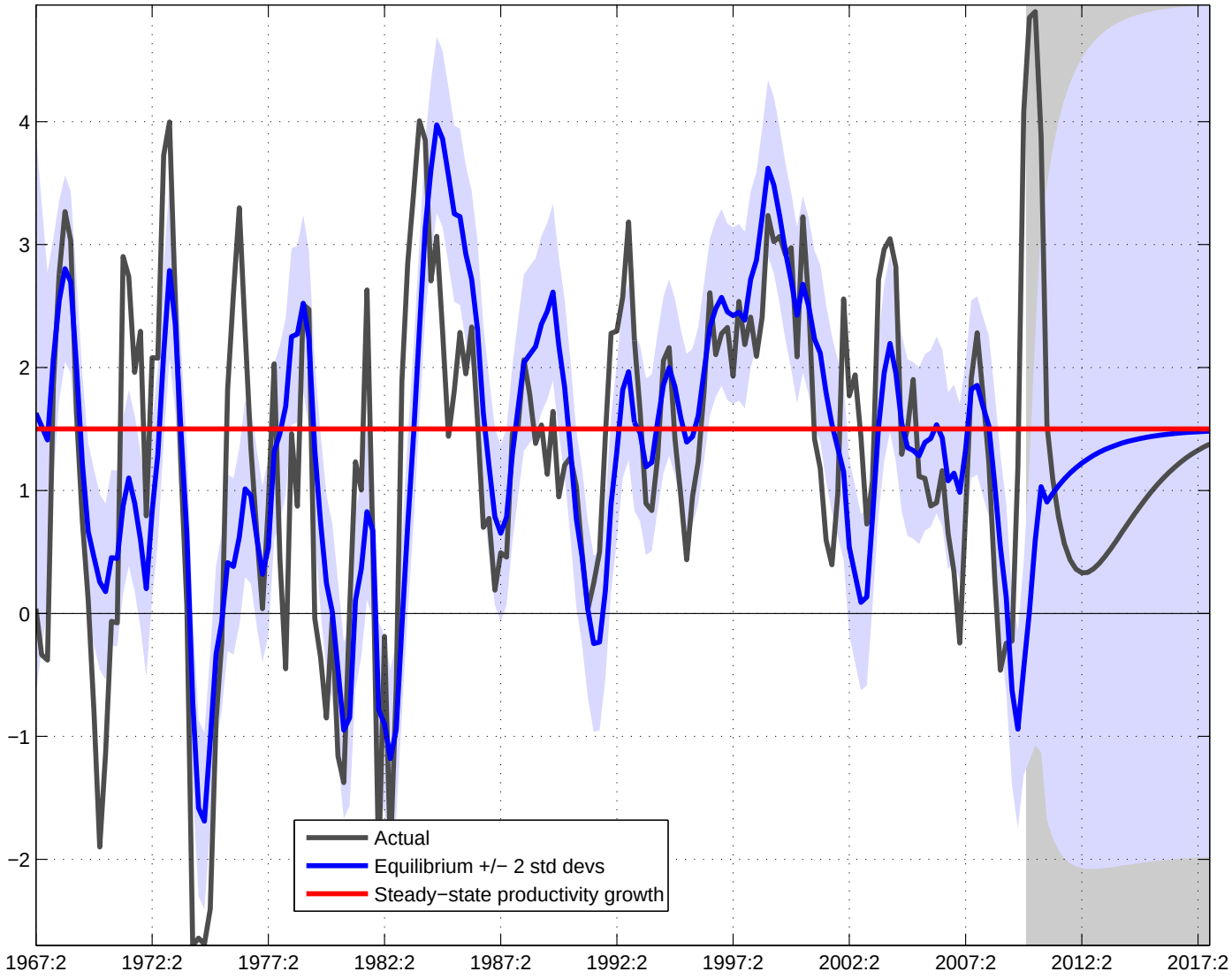
Output Growth (Y/Y) +/- 2 std devs (w/o model or parameter uncertainty)



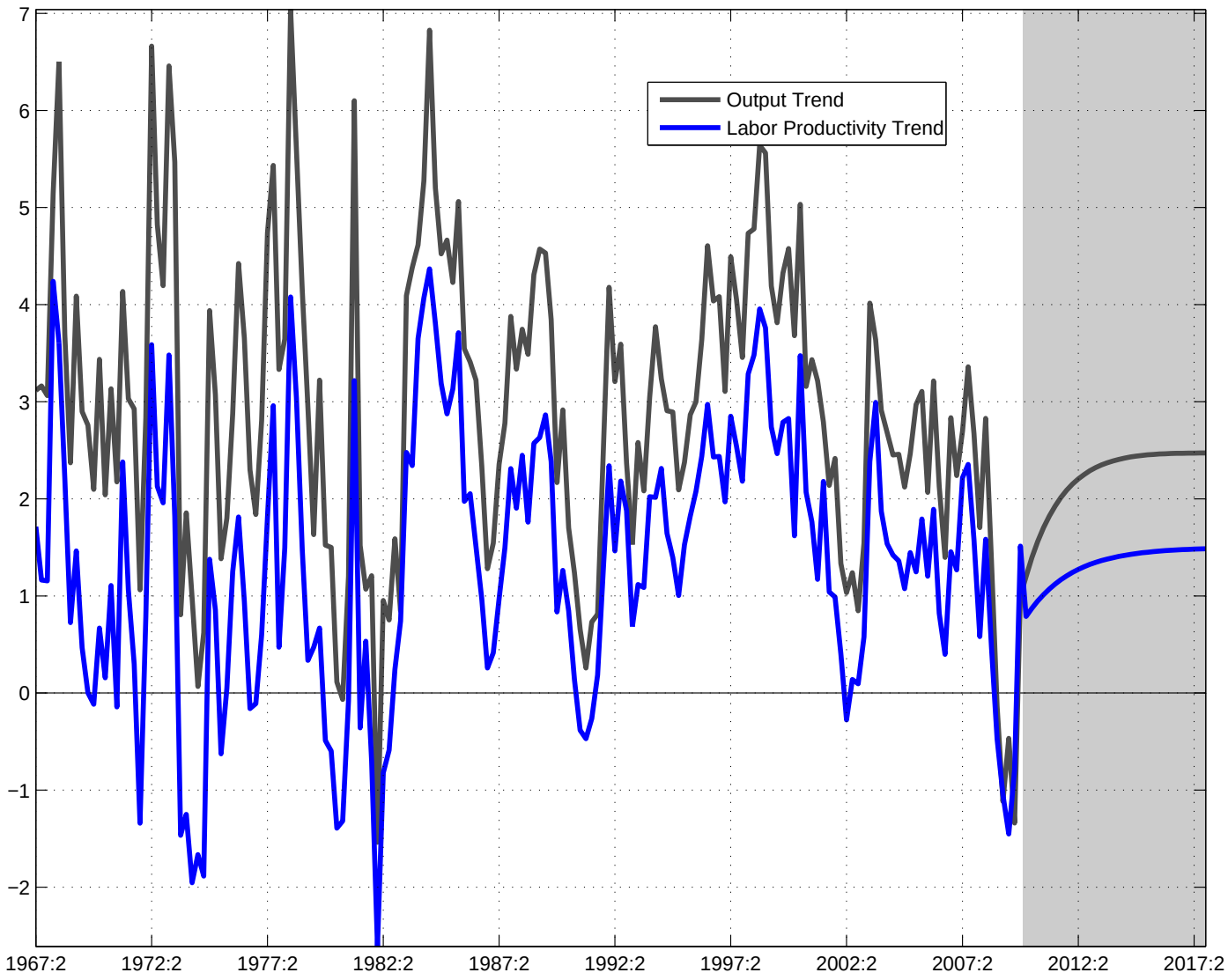
Growth of Labor Productivity (Q/Q Annualized)



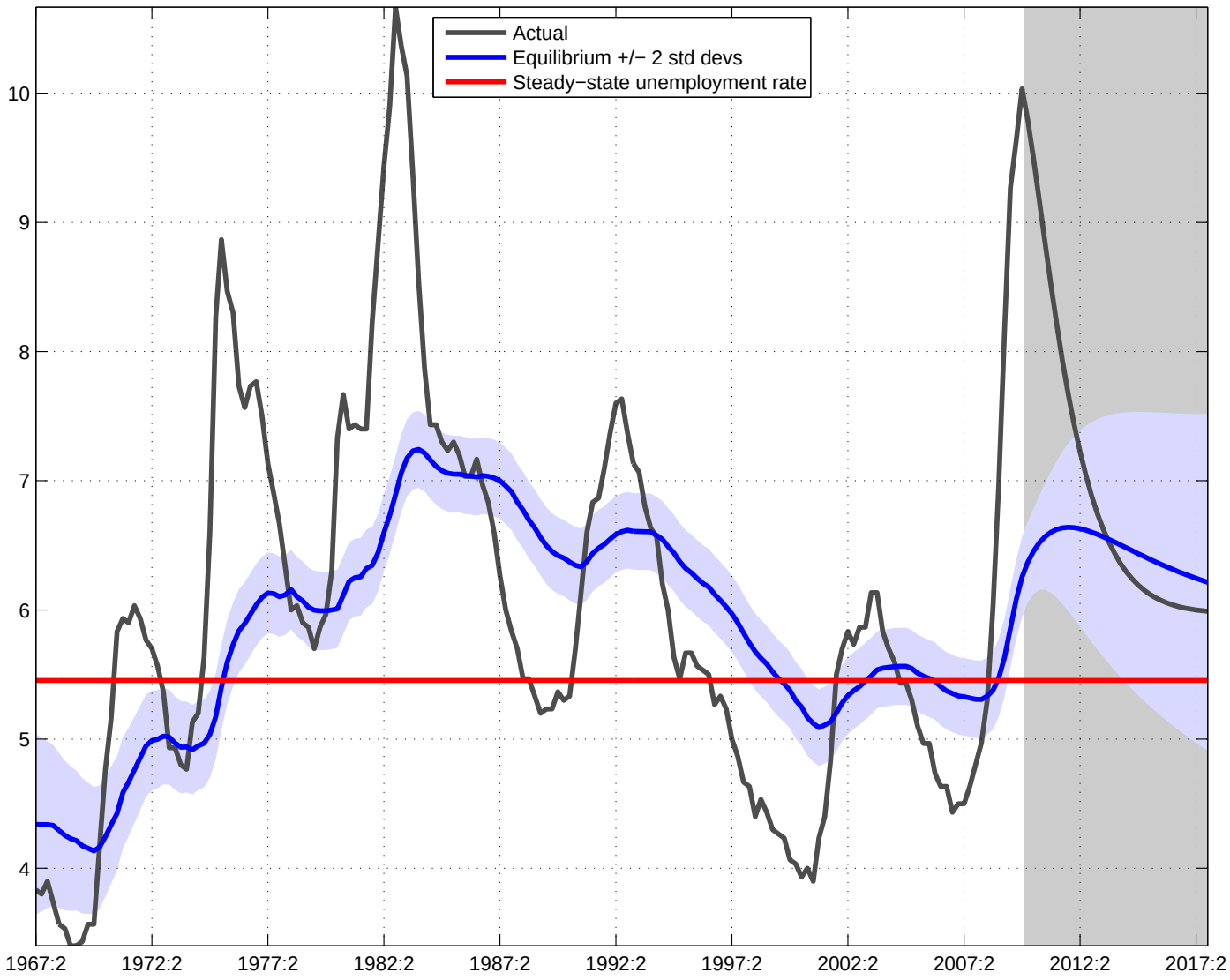
Growth of Labor Productivity (Y/Y)



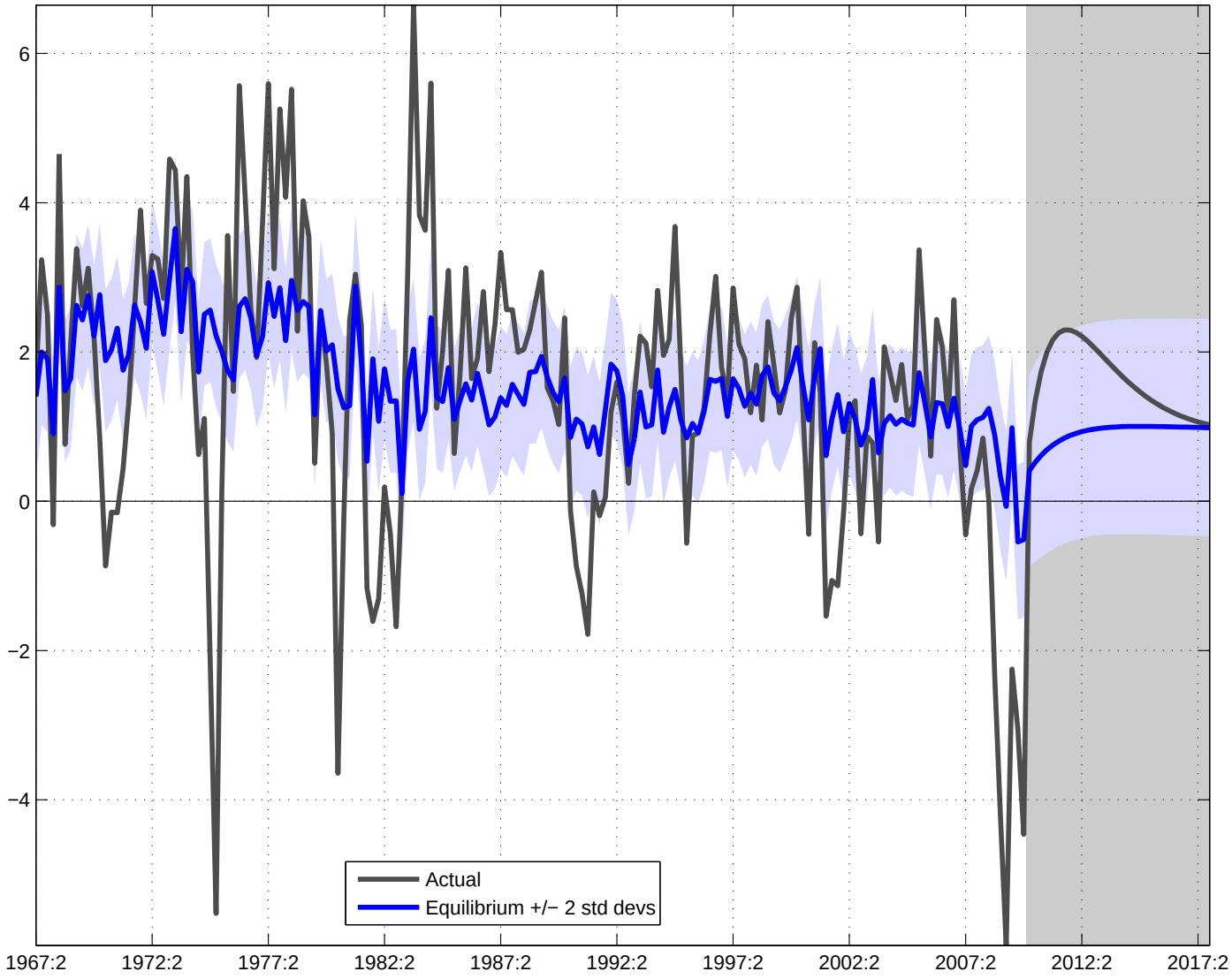
Labor Productivity and Output Trend Growth (Q/Q Annualized)



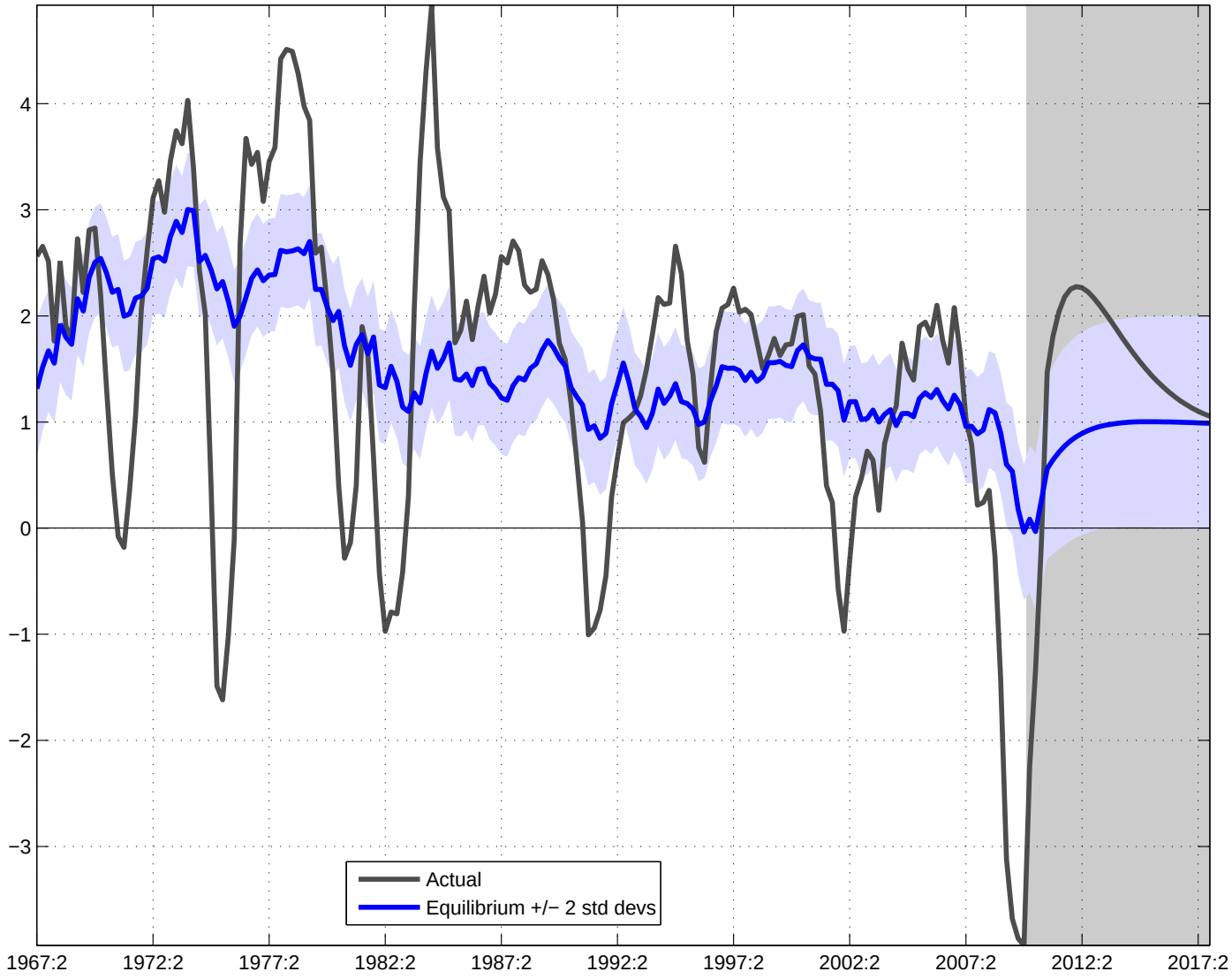
Unemployment Rate



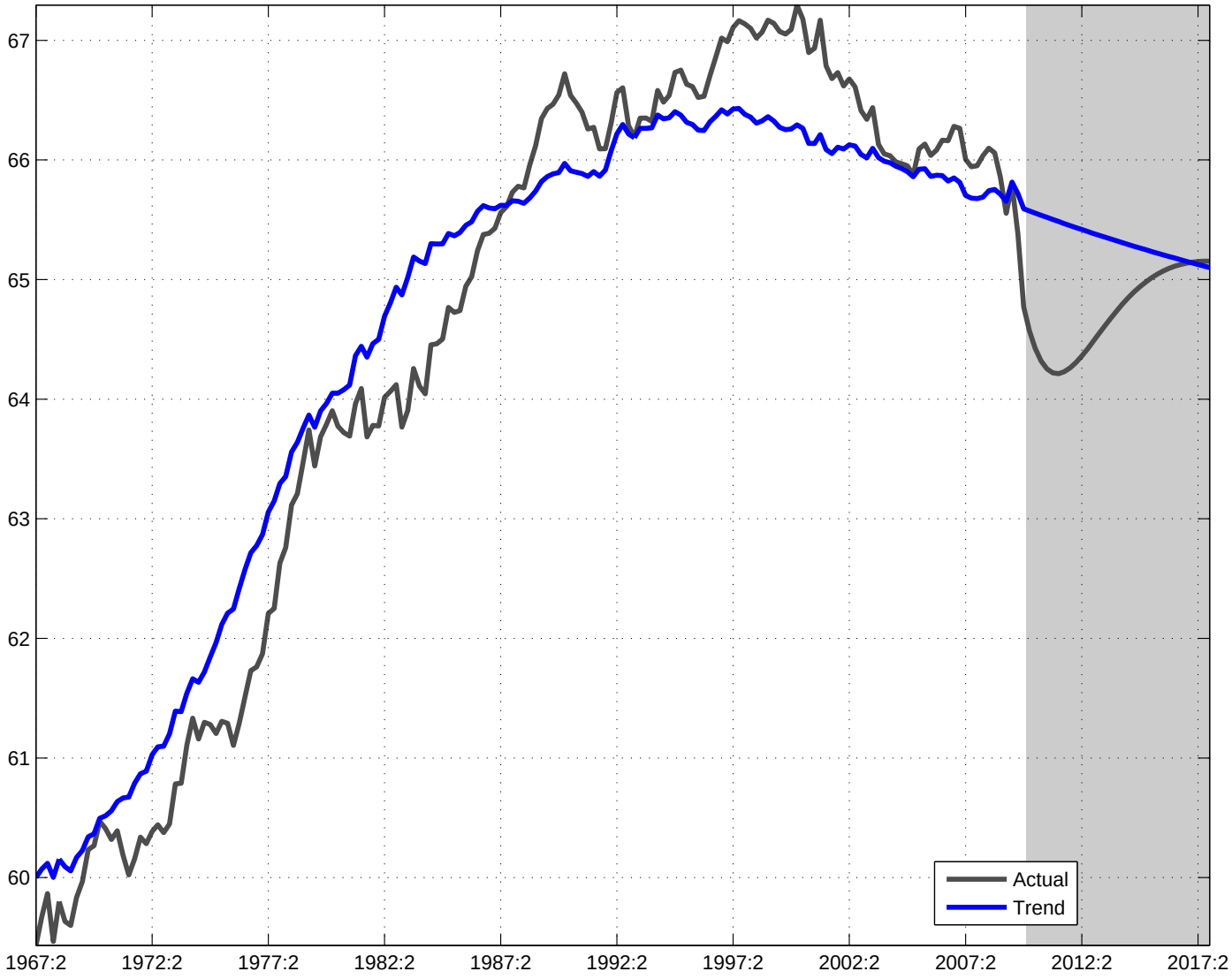
Growth of Employment (Q/Q Annualized)



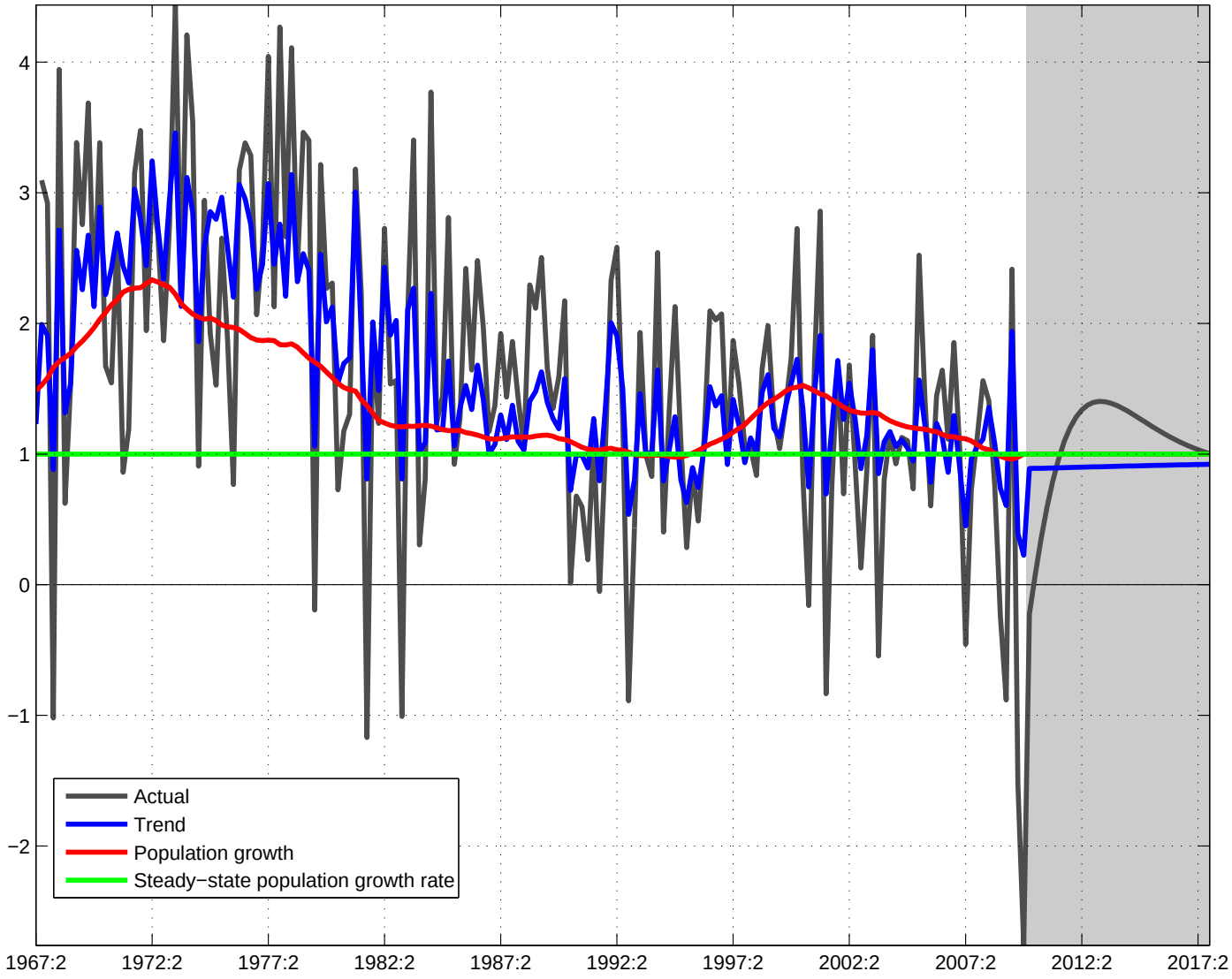
Growth of Employment (Y/Y Annualized)



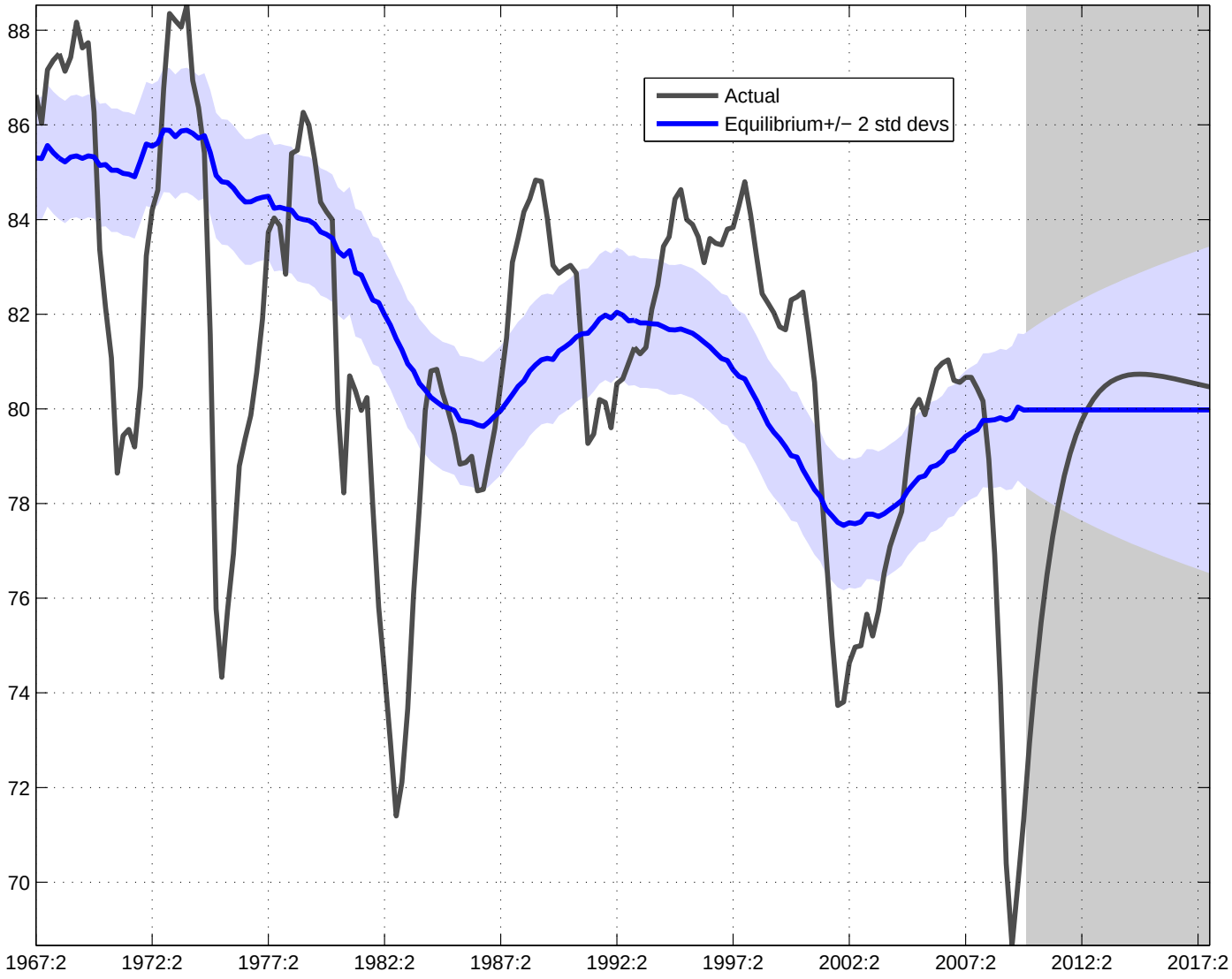
Participation Rate (in percent)



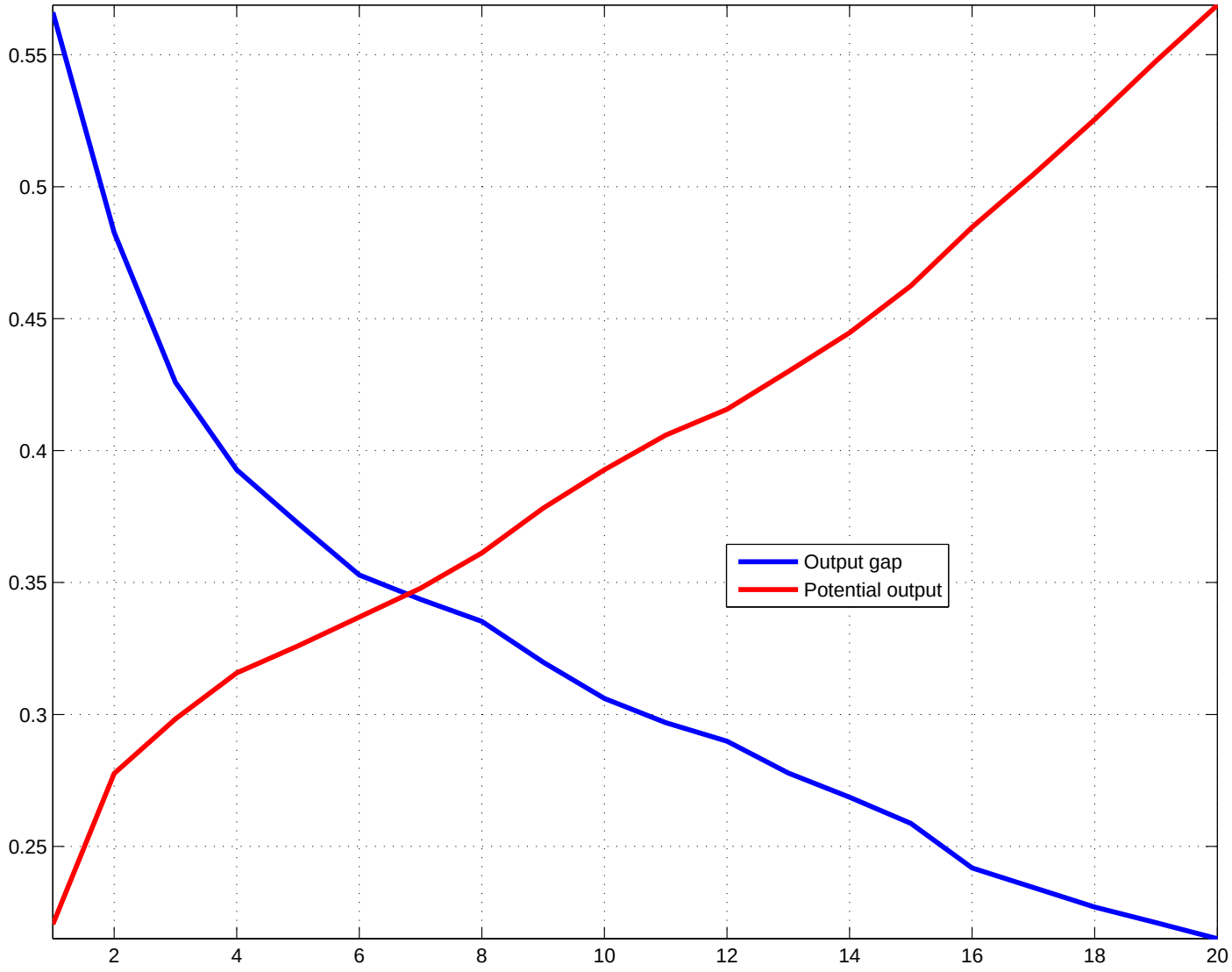
Labor Force And Population Growth (Q/Q Annualized)



Equilibrium Capacity Utilization +/- 2 std devs (w/o model or parameter uncertainty)



Relative Variances of Potential Growth and Changes in the Output Gap at Different Horizons



Regularized Maximum Likelihood

Parameter	Prior		Posterior	
	Mode	Dispersion	Mode	Dispersion
alpha	0.500	0.158	0.498	0.021
beta	0.400	0.316	0.202	0.028
omega	0.500	0.316	0.286	0.038
rho1	0.800	0.158	0.811	0.019
kappa1	0.100	0.632	0.502	0.038
phi1	0.800	0.158	0.762	0.018
phi2	0.300	0.158	0.284	0.016
tau	0.100	0.158	0.119	0.019
delta	0.500	0.158	0.496	0.021
kappa2	1.500	1.581	1.410	0.078
parhist	5.000	3.162	4.888	0.406
rho2	5.000	3.162	5.122	0.441
lambda	1.000	3.162	0.870	0.226
zeta	0.100	0.079	0.083	0.010
eta	0.020	0.016	0.011	0.002
theta2	0.100	0.079	0.077	0.008
theta1	0.900	0.079	0.896	0.010
std_RES_Y	1.000	0.316	0.769	0.039
std_RES_G	1.000	0.316	0.856	0.041
std_RES_UNR_GAP	0.500	0.316	0.211	0.024
std_RES_UNR_BAR	0.020	0.016	0.017	0.002
std_RES_UNR_G	0.020	0.016	0.018	0.002
std_RES_CAPU_GAP	0.400	0.316	0.377	0.035
std_RES_CAPU_BAR	0.250	0.158	0.237	0.020
std_RES_CU_G	0.075	0.032	0.065	0.005
std_RES_PIE	0.500	0.316	0.529	0.029
std_RES_PIELTE	0.300	0.316	0.082	0.010
std_RES_APL_BAR	0.250	0.079	0.218	0.011
std_RES_DLN	0.150	0.119	0.142	0.013
std_RES_LP	0.150	0.119	0.166	0.012
std_RES_LP_BAR	0.100	0.079	0.140	0.008

Calibrated Parameters

Parameter	Value
lab_share	0.700
growth_ss	1.500
unr_ss	5.454
popgrowth_ss	1.000
part_ss	64.000
std_RES_LLF_	0.853

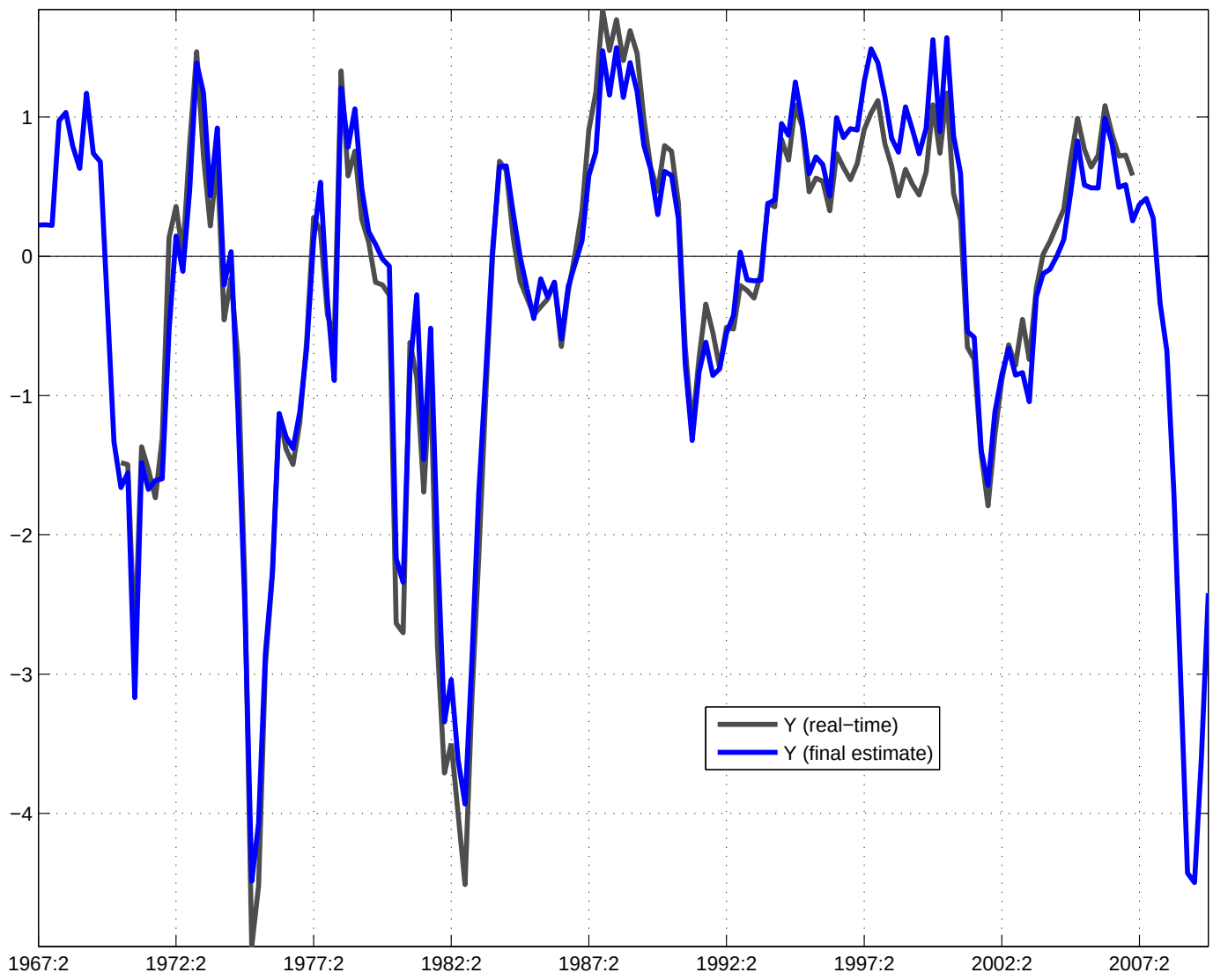
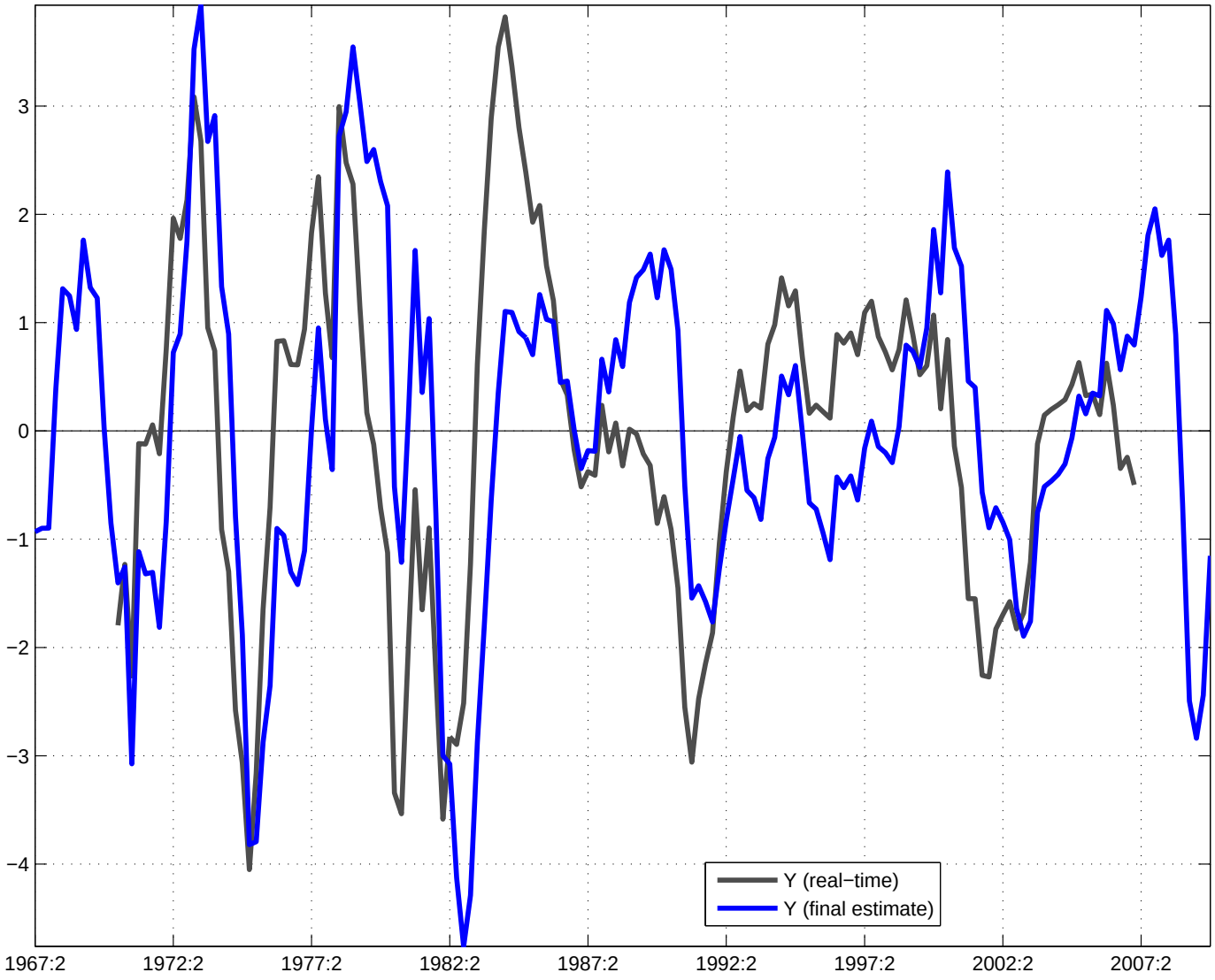
RMSEs

Parameter	1Q Ahead	4Q Ahead	8Q Ahead	12Q Ahead
GROWTH_	3.365	3.427	3.433	3.453
PIE4_	0.514	1.387	1.935	2.220
UNR_	0.298	1.002	1.438	1.575

Mean absolute revisions (according to most recent estimates)

quarter	$t-12$	$t-8$	$t-4$	t (nowcast)
Y	0.044	0.075	0.132	0.212
Y (HP)	0.169	0.333	0.745	1.227
UNR_GAP	0.033	0.033	0.044	0.066
UNR_GAP (HP)	0.084	0.176	0.387	0.625

Real-time output gap (MV)



Real-time output gap (HP)