ModYUKE Report: USLABOR

November 8, 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 utilization.
    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_
    DAPL_BAR_

!shocks:measurement

    RES_LLF_
    RES_DAPL_BAR_
```
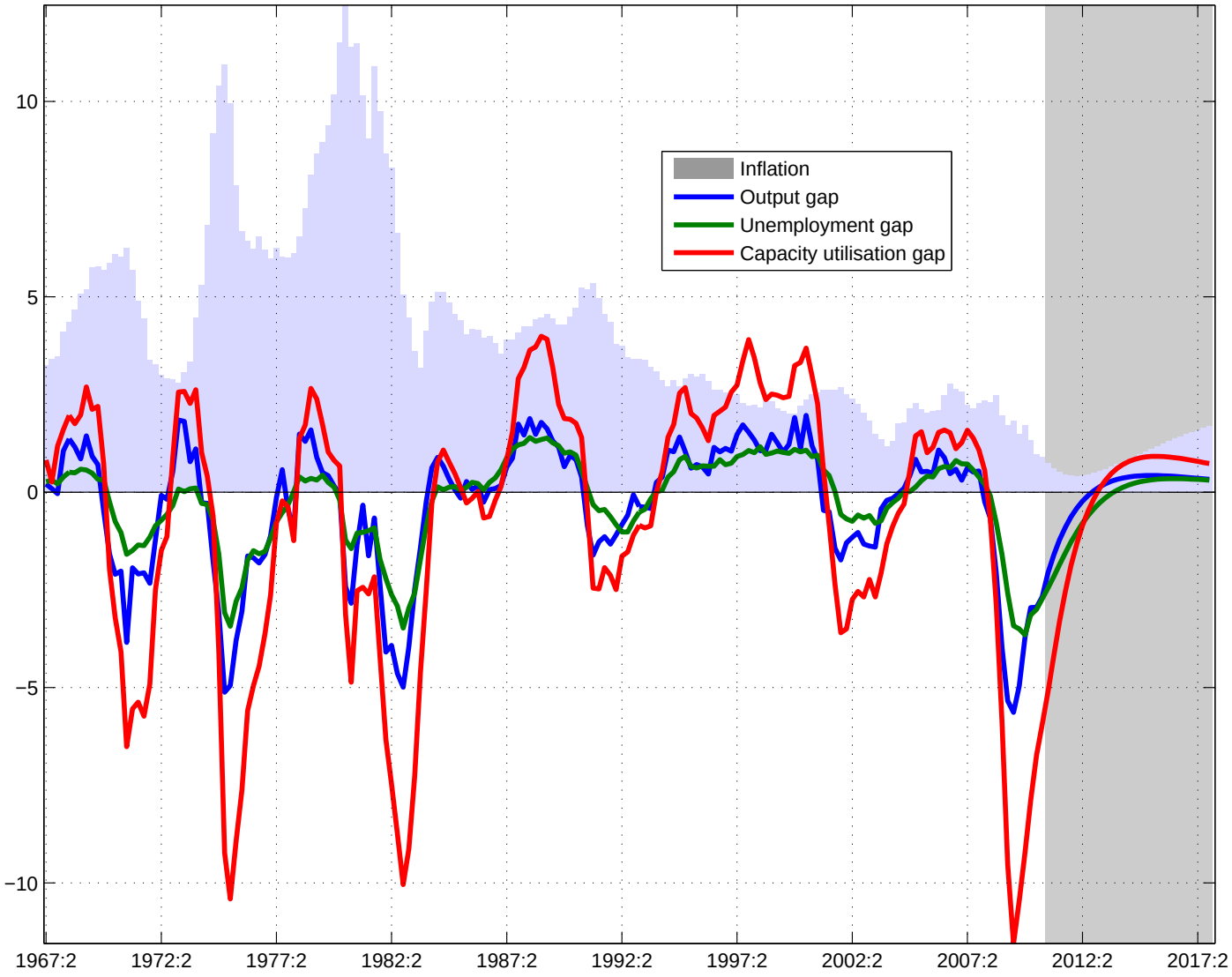
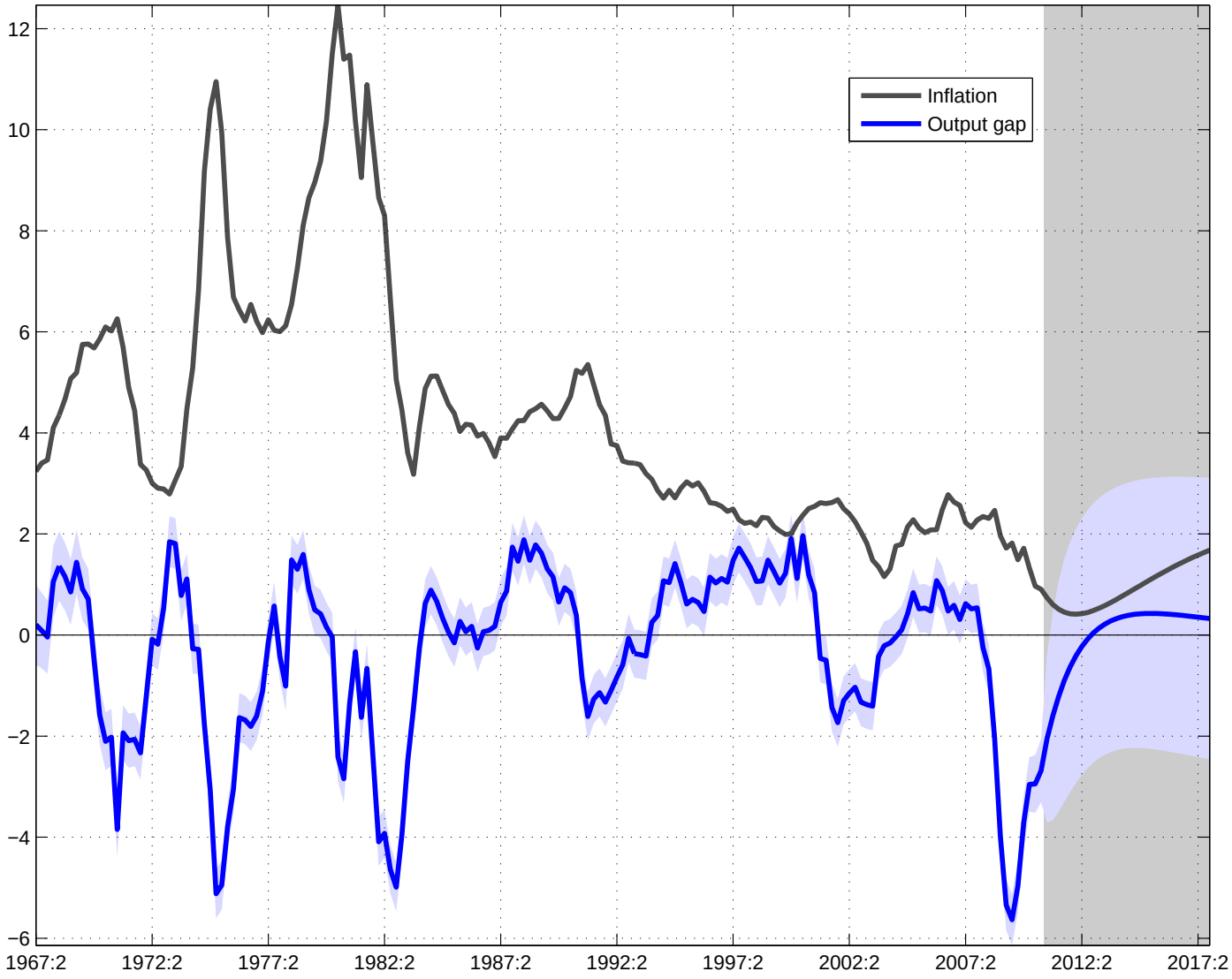

```
!equations:measurement

    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;
    DAPL_BAR_ = DAPL_BAR + RES_DAPL_BAR_;
```

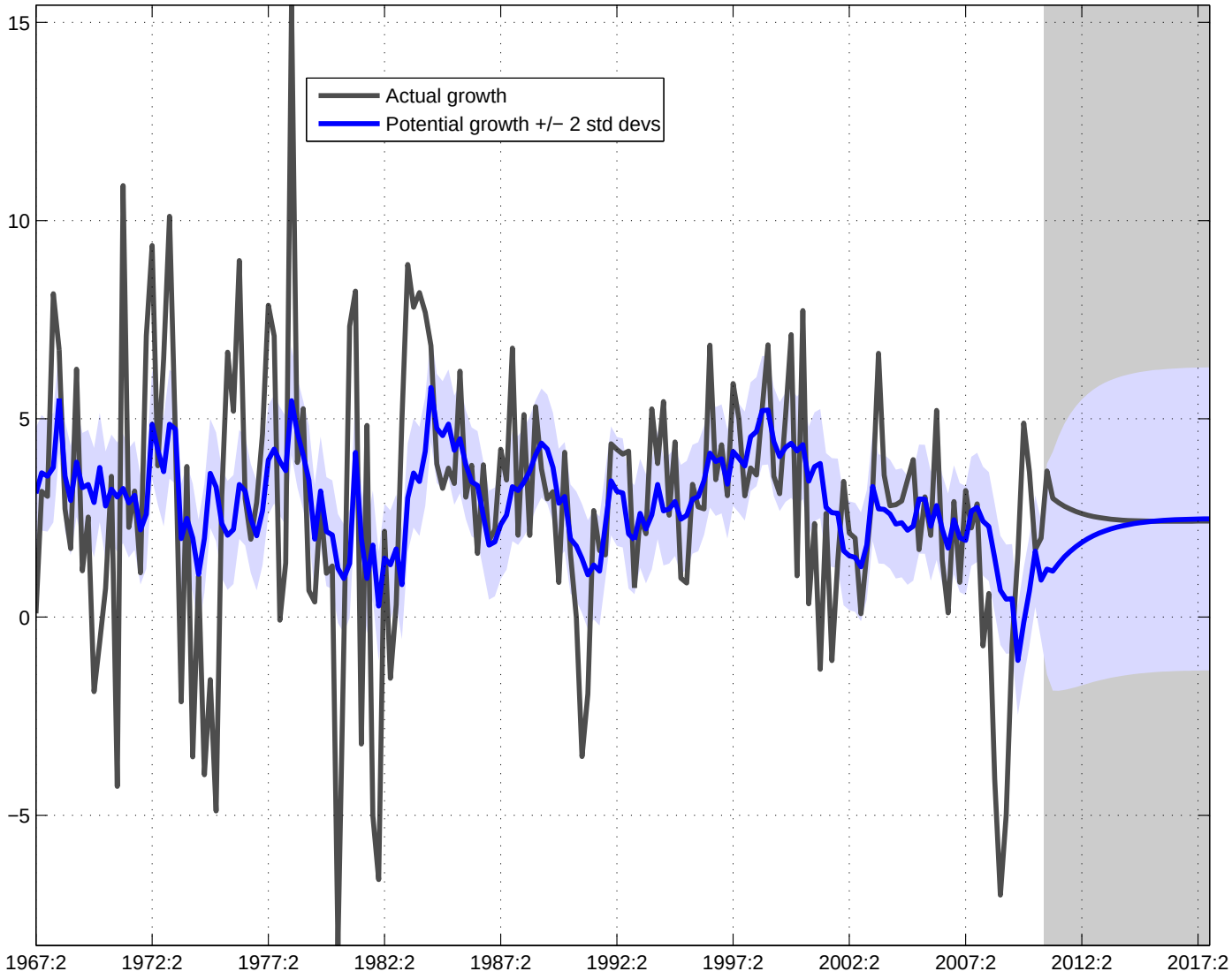
Economic activity gaps



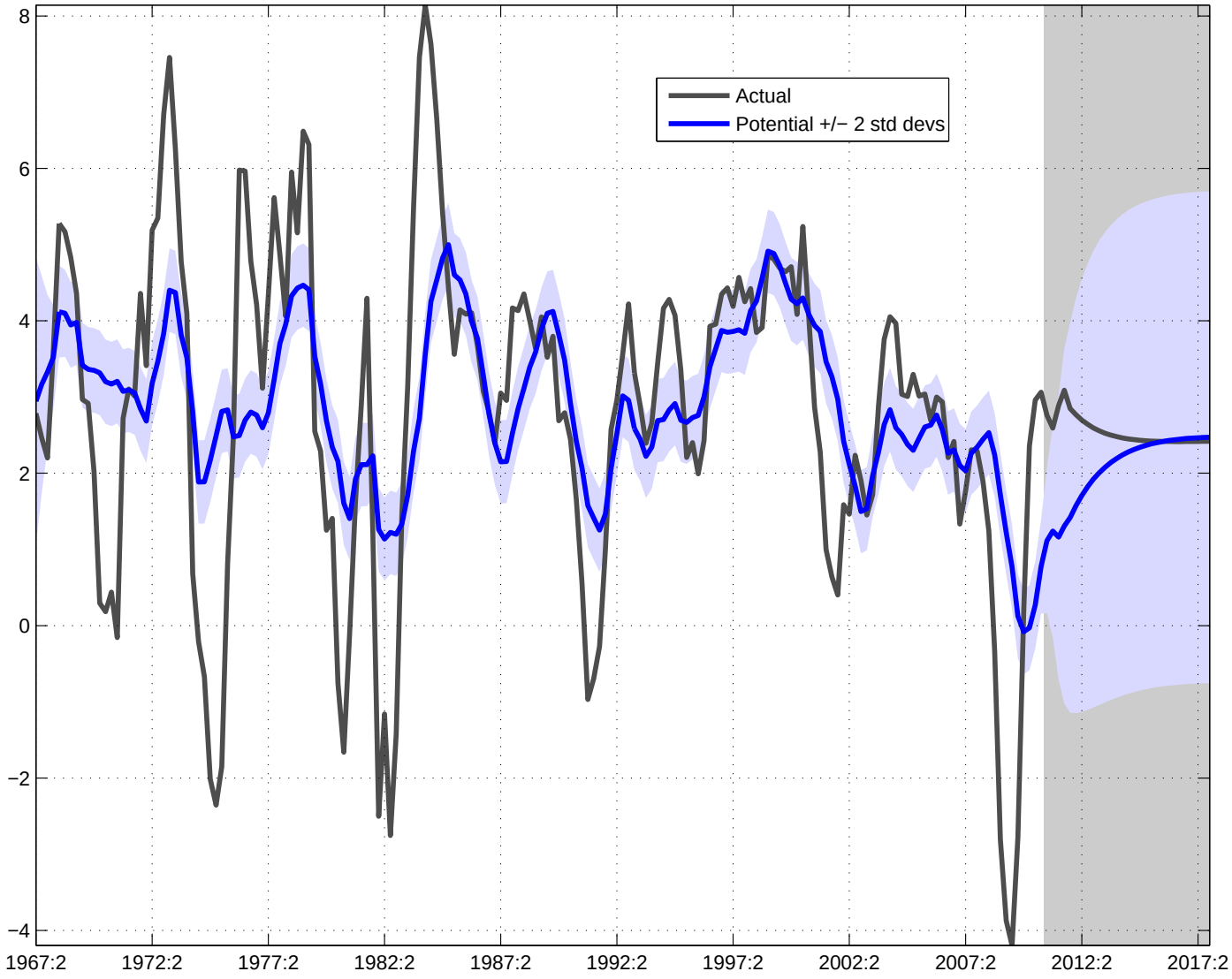
Output Gap +/- 2 std devs (w/o model or parameter uncertainty)

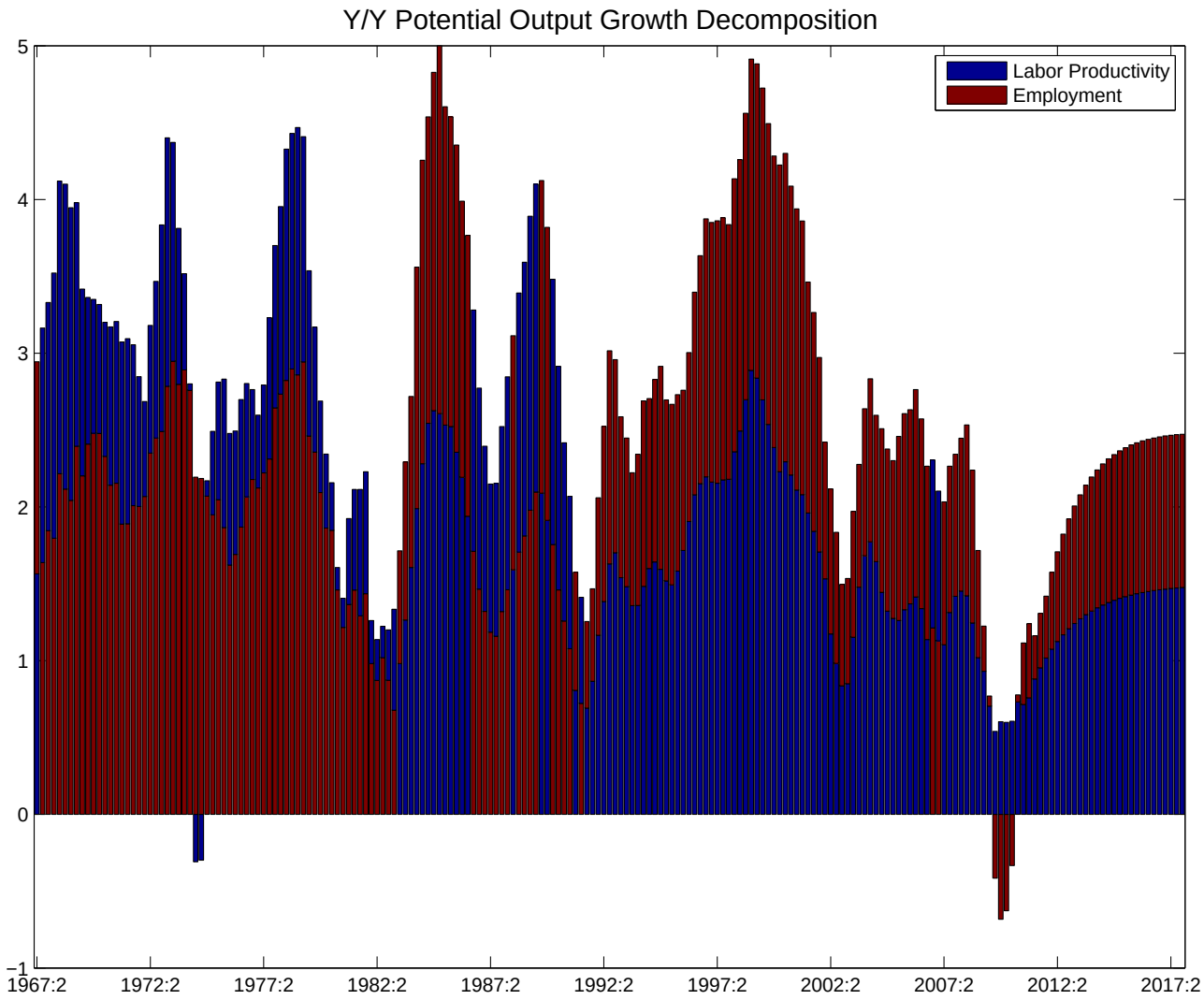


Output Growth (Q/Q Annualized) +/- 2 std devs (w/o model or parameter uncertainty)

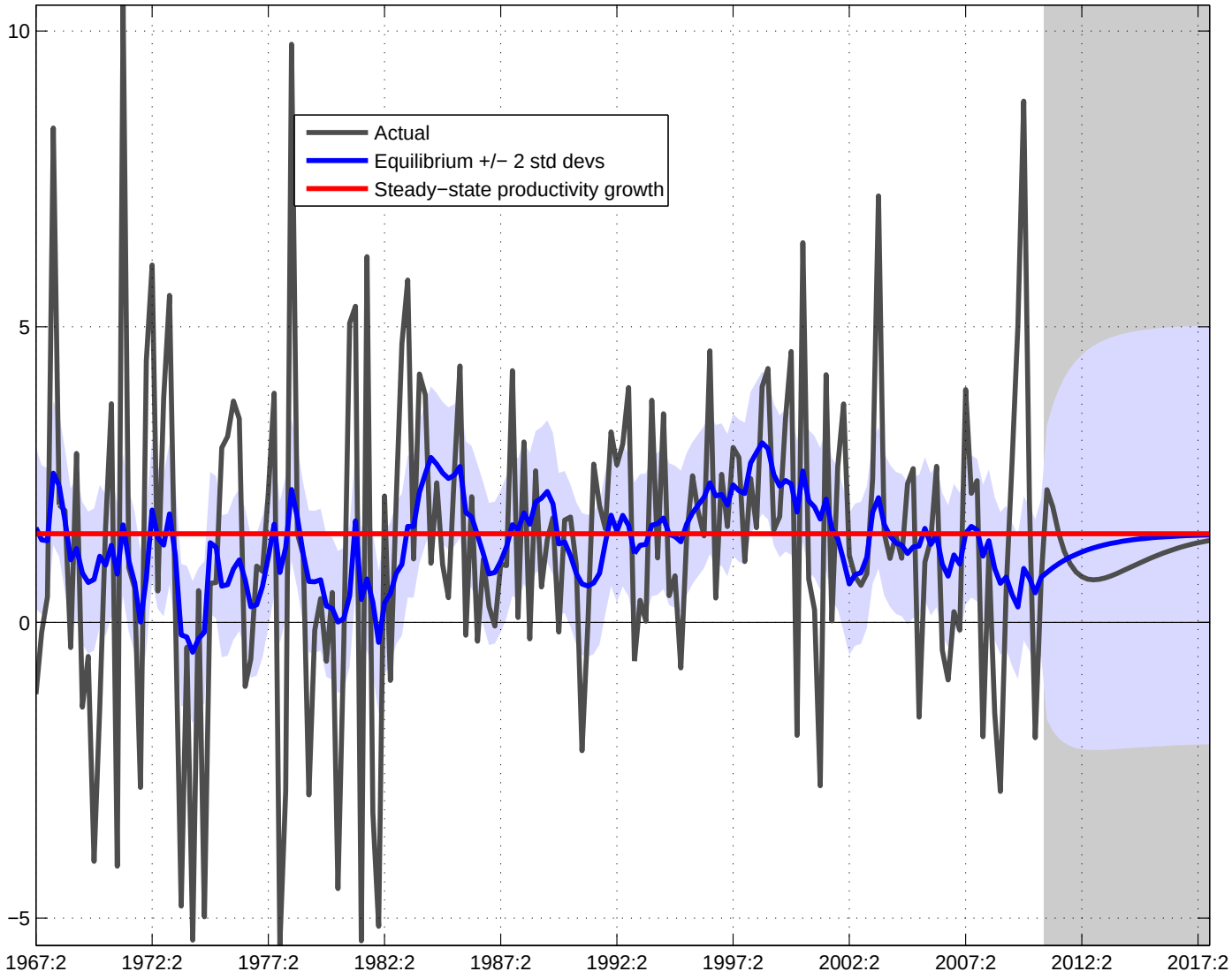


Output Growth (Y/Y) +/- 2 std devs (w/o model or parameter uncertainty)

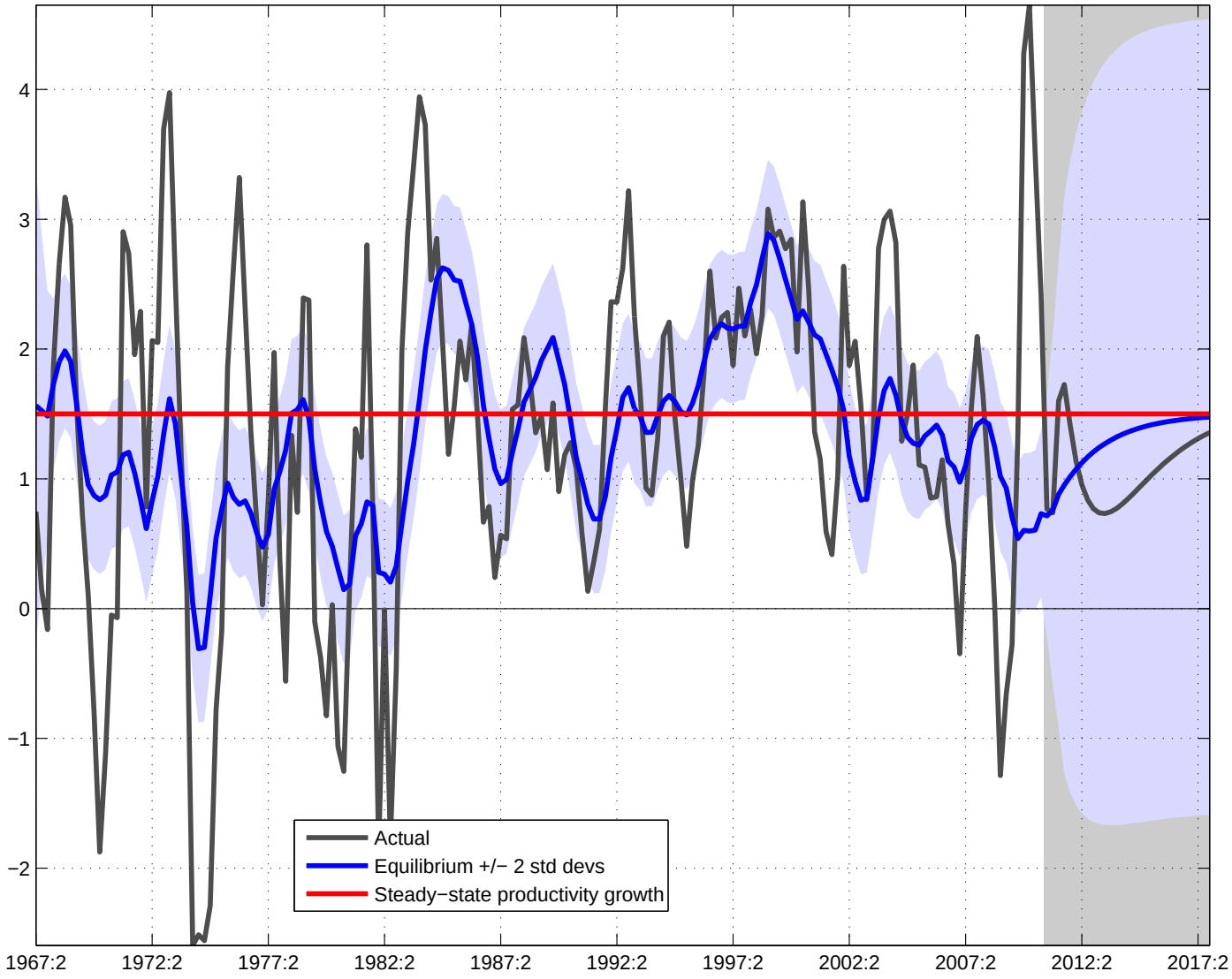



Y/Y Potential Output Growth Decomposition
Labor Productivity
Employment
5
4
3
2
1
0
−1
1967:2
1972:2
1977:2
1982:2
1987:2
1992:2
1997:2
2002:2
2007:2
2012:2
2017:2

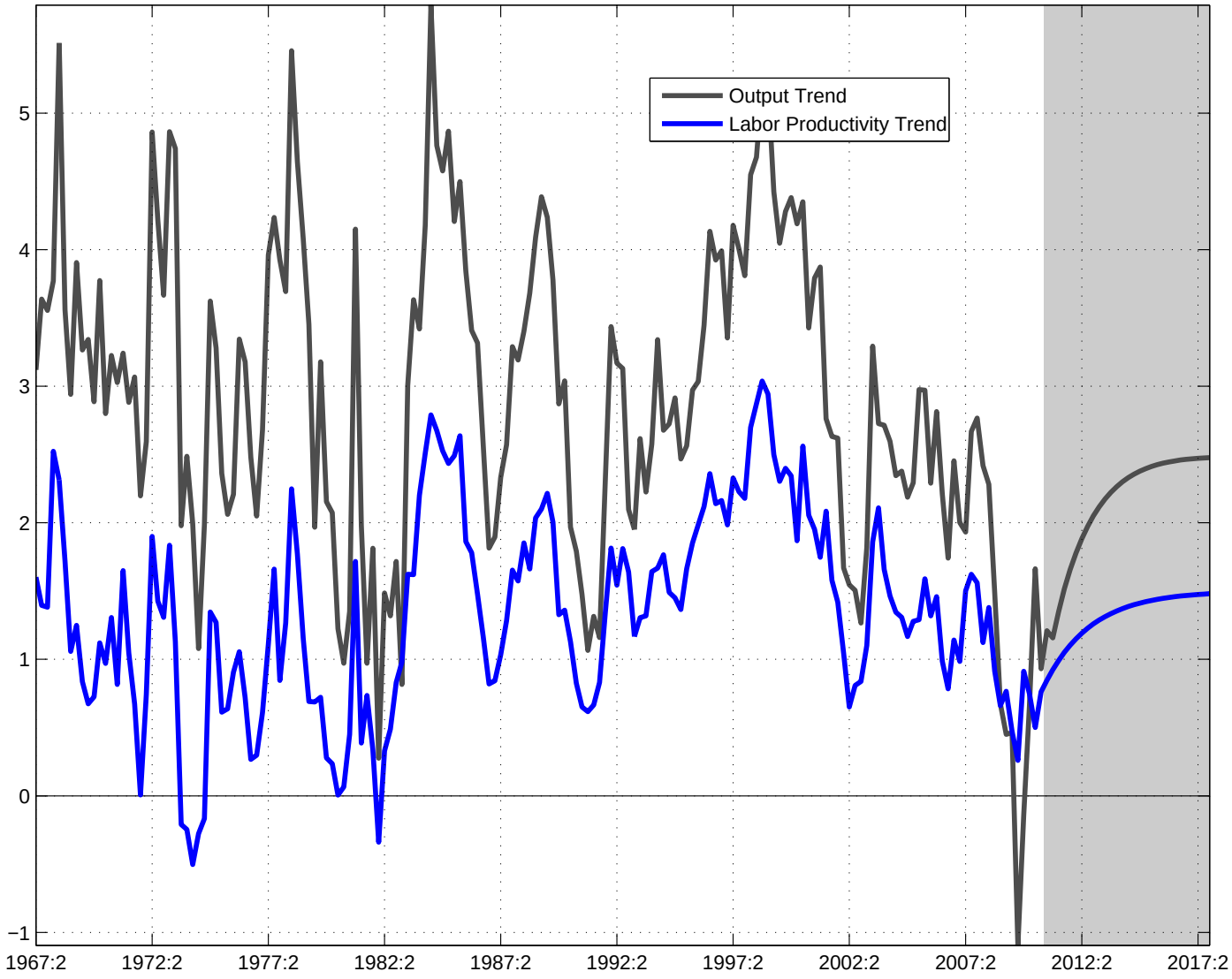
Growth of Labor Productivity (Q/Q Annualized)



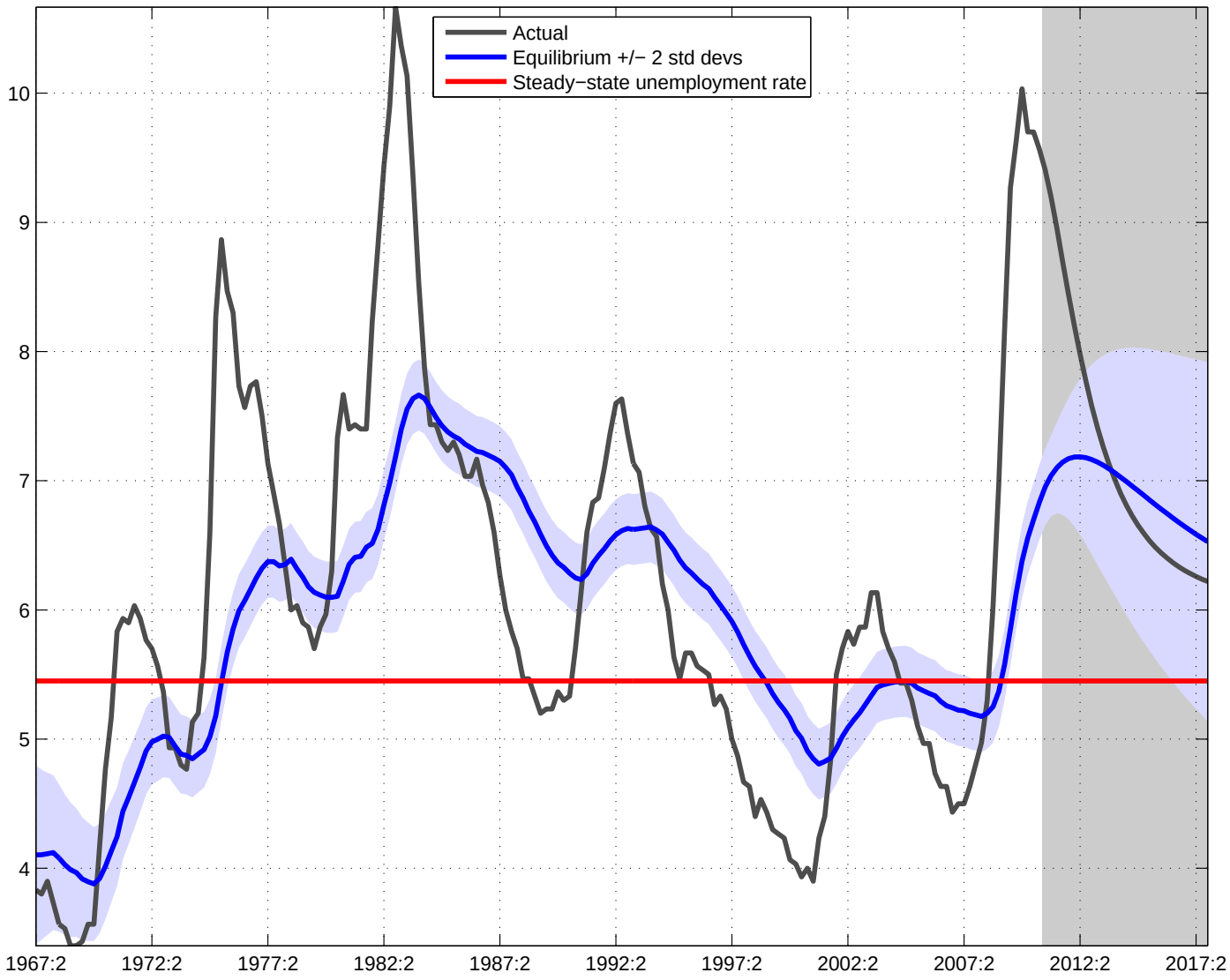
Growth of Labor Productivity (Y/Y)



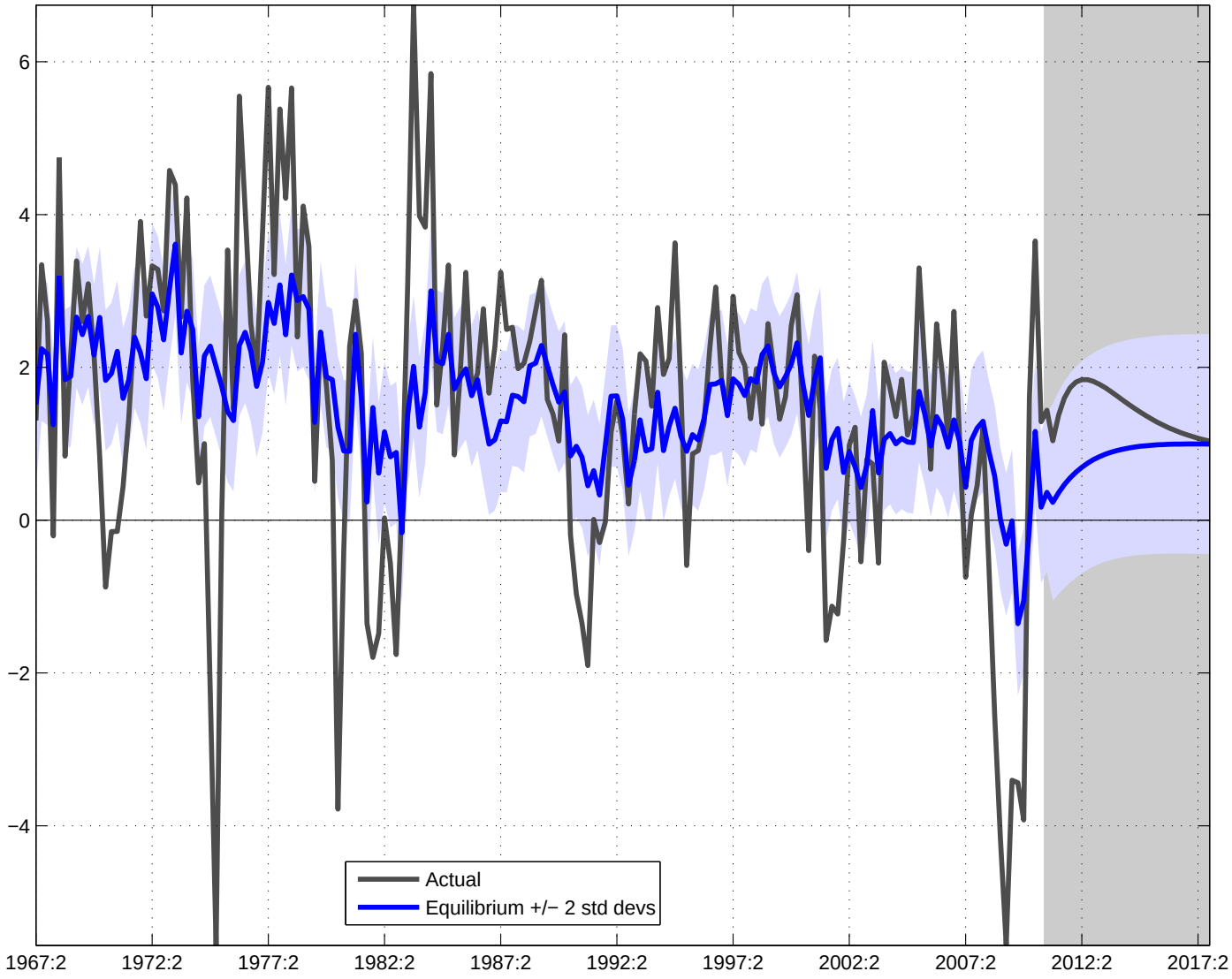
Labor Productivity and Output Trend Growth (Q/Q Annualized)



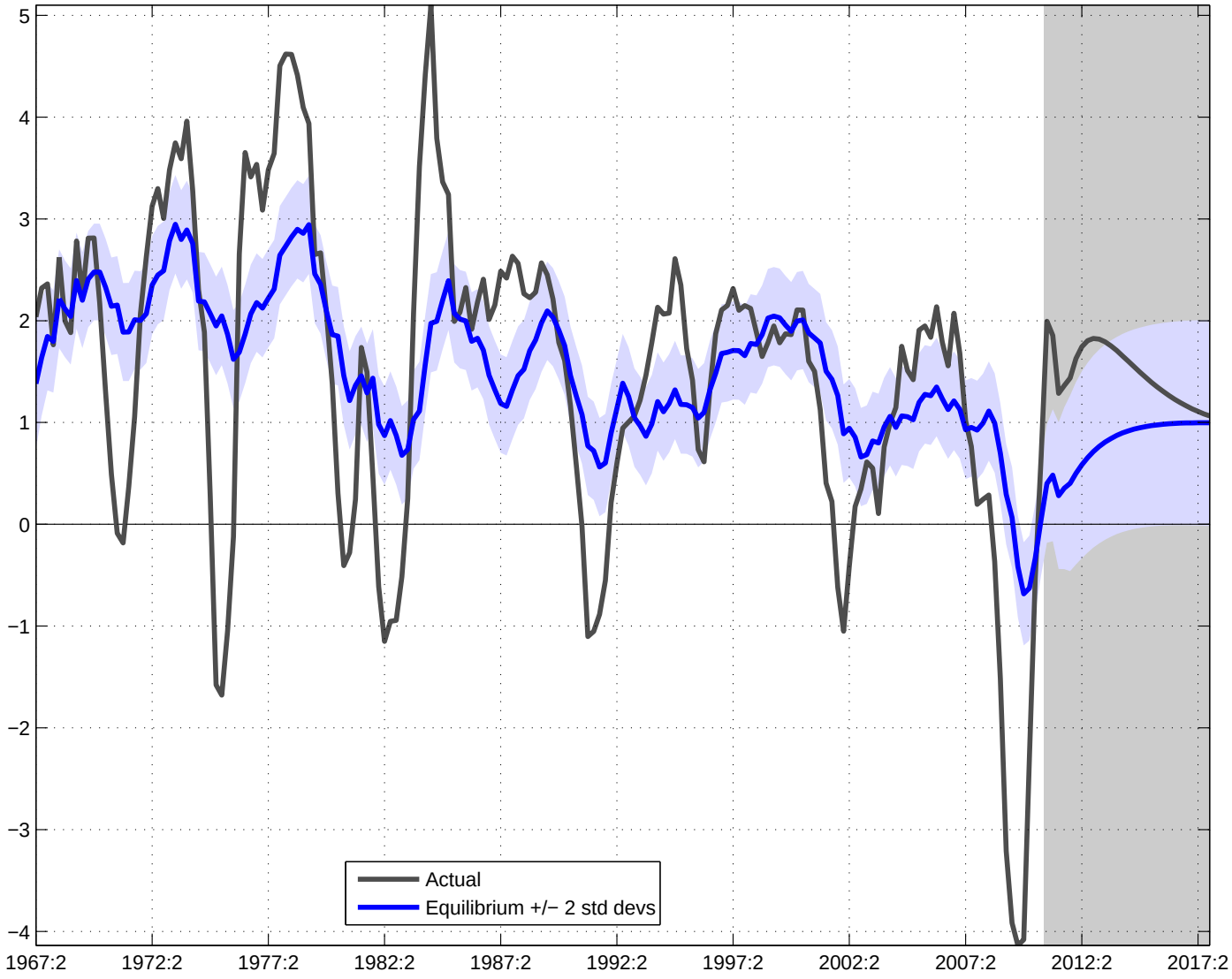
Unemployment Rate



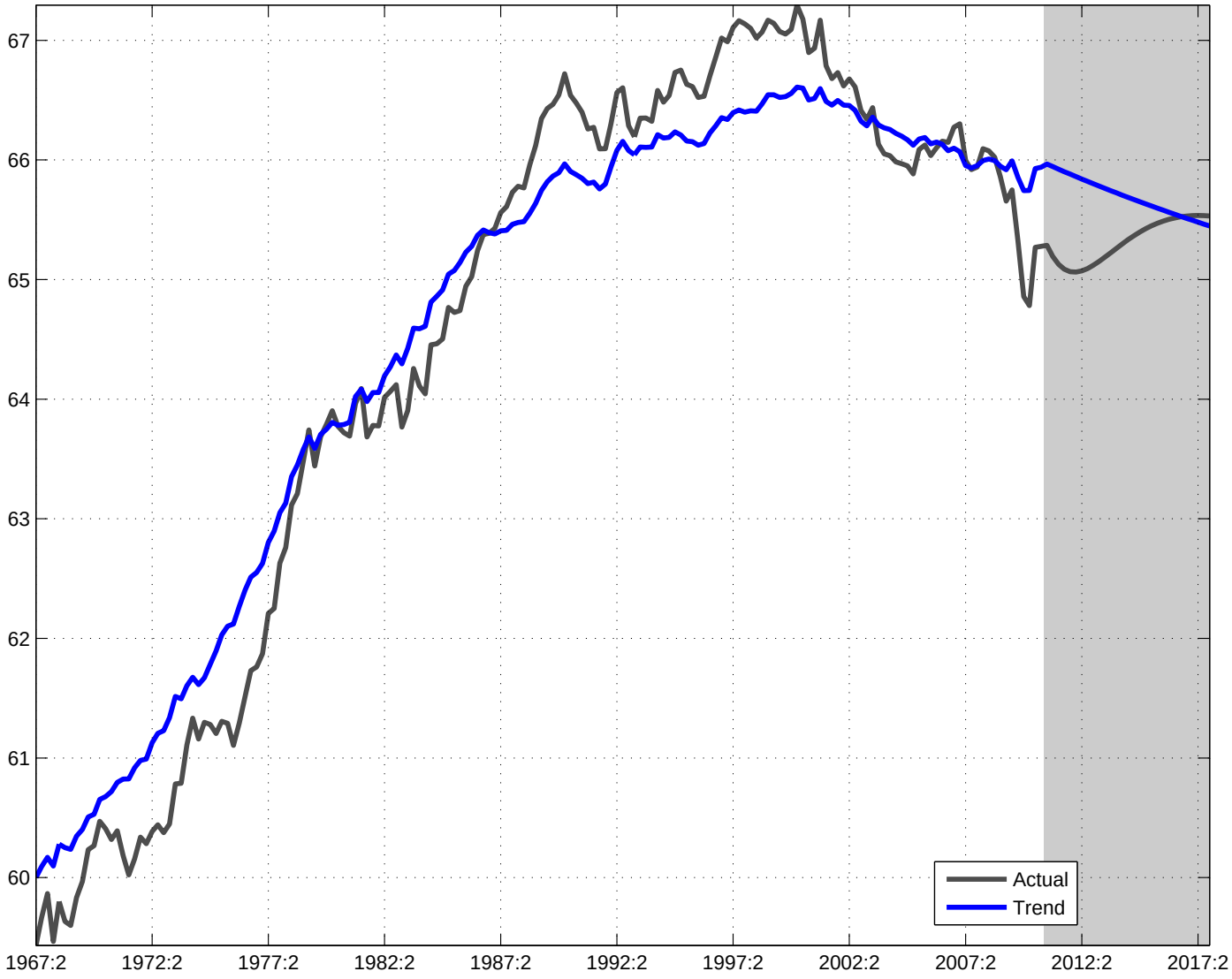
Growth of Employment (Q/Q Annualized)



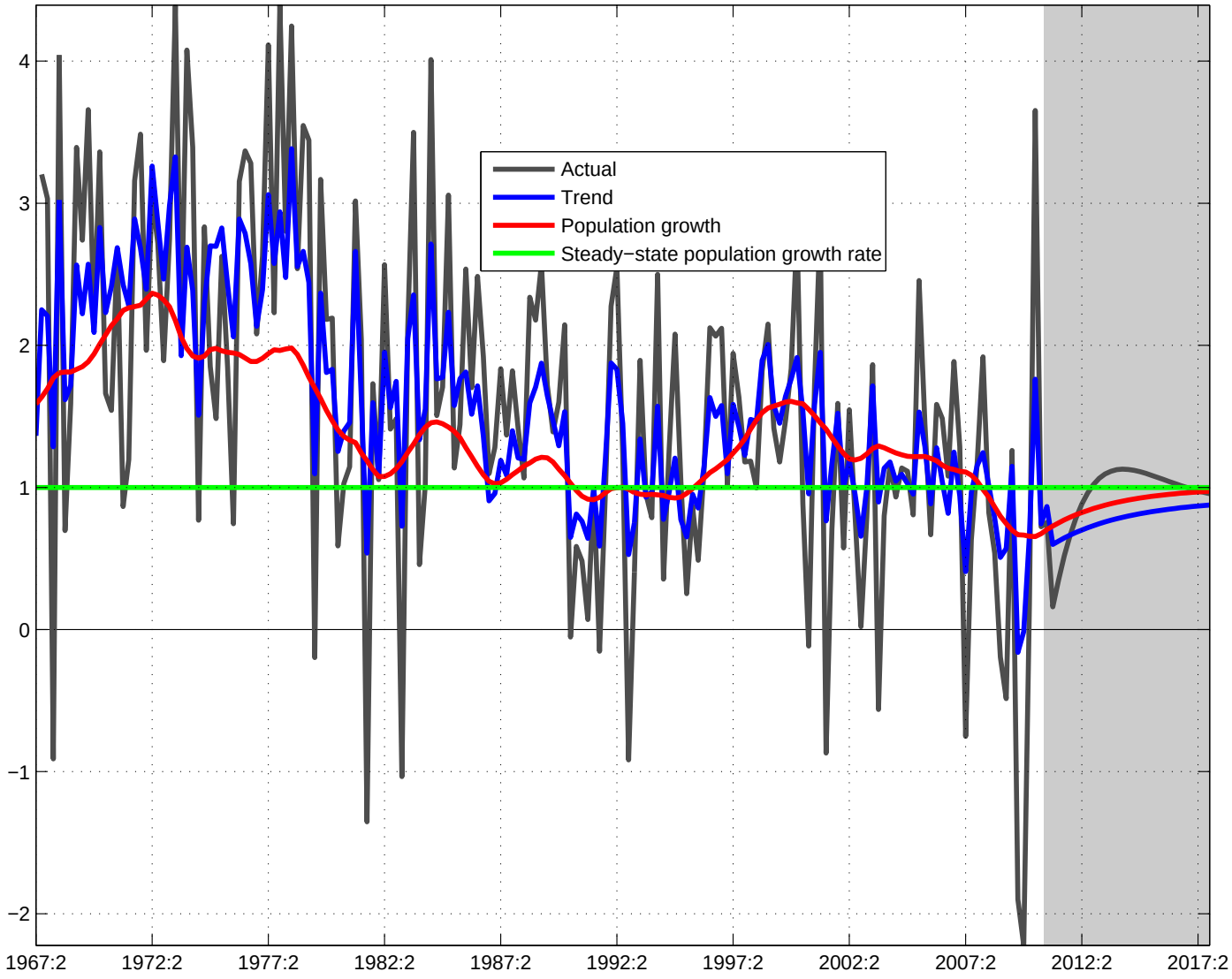
Growth of Employment (Y/Y Annualized)



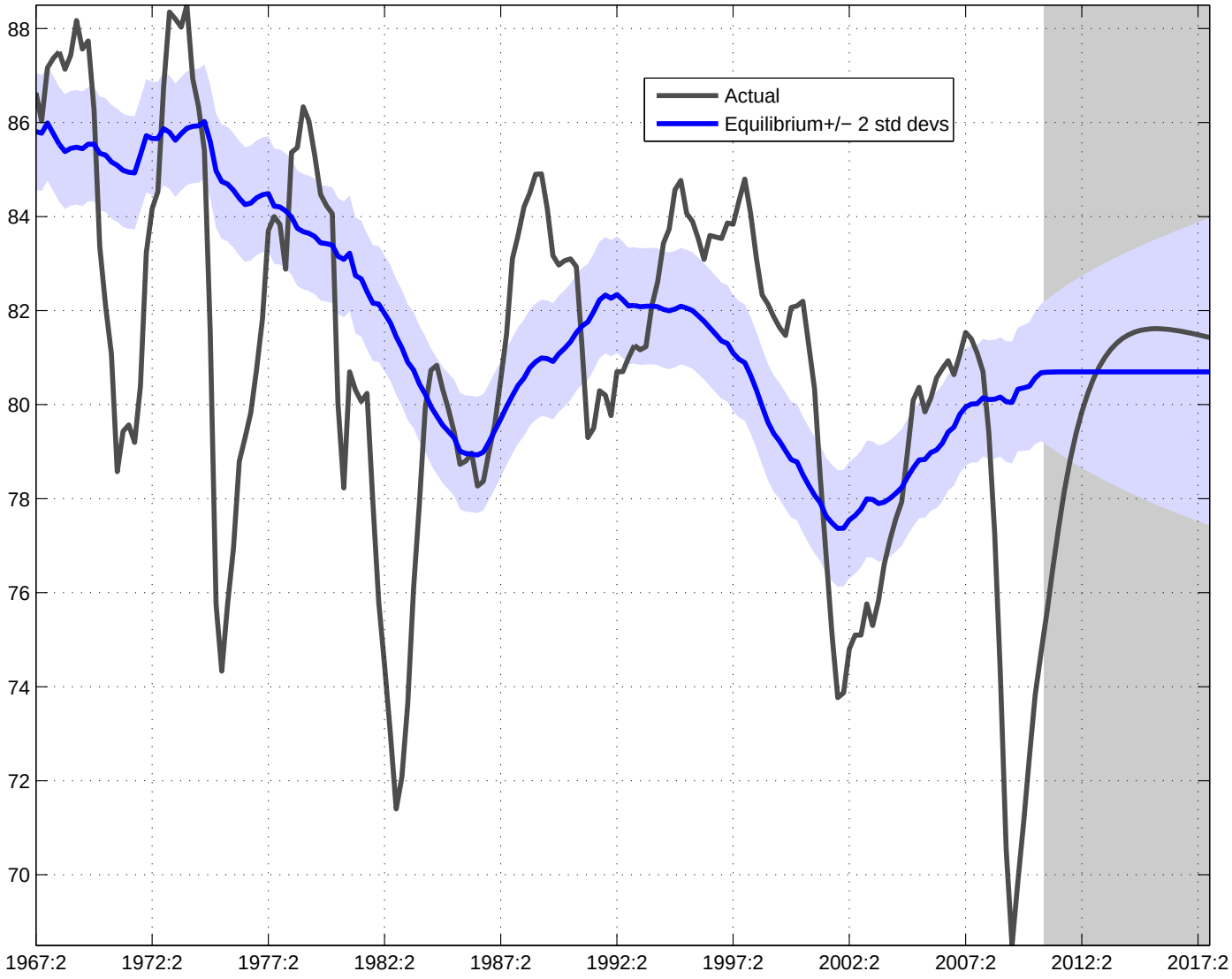
Participation Rate (in percent)



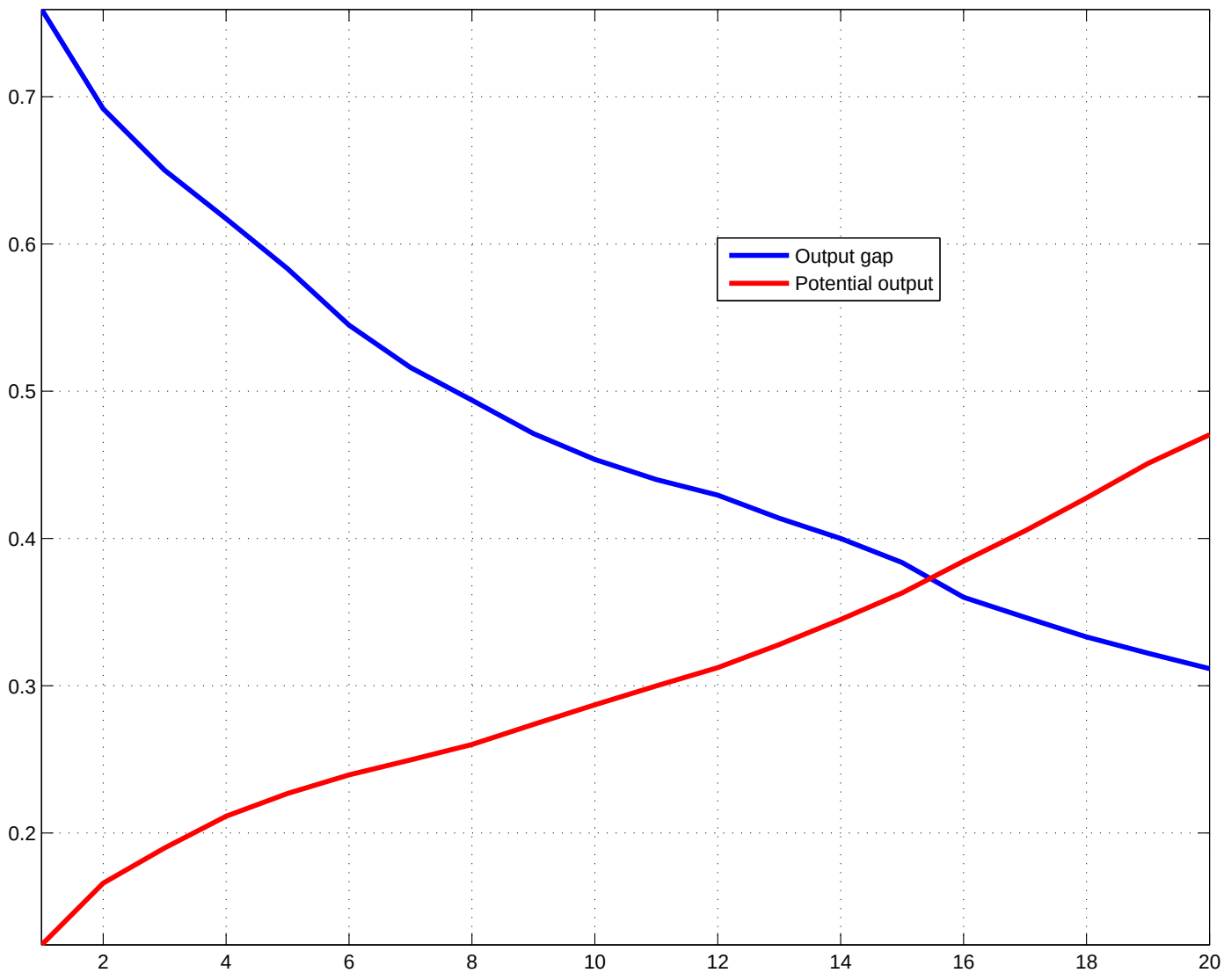
Labor Force And Population Growth (Q/Q Annualized)



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	0.496	0.021
beta	0.400	0.316	0.156	0.026
omega	0.500	0.316	0.251	0.036
rho1	0.800	0.158	0.822	0.018
kappa1	0.100	0.632	0.435	0.033
phi1	0.800	0.158	0.723	0.018
phi2	0.300	0.158	0.240	0.014
tau	0.100	0.158	0.117	0.020
delta	0.500	0.158	0.495	0.021
kappa2	1.500	1.581	1.222	0.060
parhist	5.000	3.162	4.898	0.375
rho2	5.000	3.162	5.082	0.417
lambda	1.000	3.162	1.045	0.226
zeta	0.100	0.079	0.082	0.010
eta	0.020	0.016	0.011	0.002
theta2	0.100	0.079	0.064	0.008
theta1	0.900	0.079	0.898	0.010
std_RES_Y	1.000	0.316	0.788	0.037
std_RES_G	1.000	0.316	0.753	0.043
std_RES_UNR_GAP	0.500	0.316	0.221	0.023
std_RES_UNR_BAR	0.020	0.016	0.017	0.002
std_RES_UNR_G	0.020	0.016	0.017	0.002
std_RES_CAPU_GAP	0.400	0.316	0.407	0.033
std_RES_CAPU_BAR	0.250	0.158	0.241	0.020
std_RES_CU_G	0.075	0.032	0.063	0.004
std_RES_PIE	0.500	0.316	0.516	0.029
std_RES_PIELTE	0.300	0.316	0.076	0.009
std_RES_APL_BAR	0.250	0.079	0.189	0.010
std_RES_DLN	0.150	0.119	0.143	0.013
std_RES_LP	0.150	0.119	0.171	0.012
std_RES_LP_BAR	0.100	0.079	0.136	0.008

Calibrated Parameters

Parameter	Value
lab_share	0.700
growth_ss	1.500
unr_ss	5.450
popgrowth_ss	1.000
part_ss	64.000
std_RES_LLF_	0.821
std_RES_DAPL_BAR_	0.930

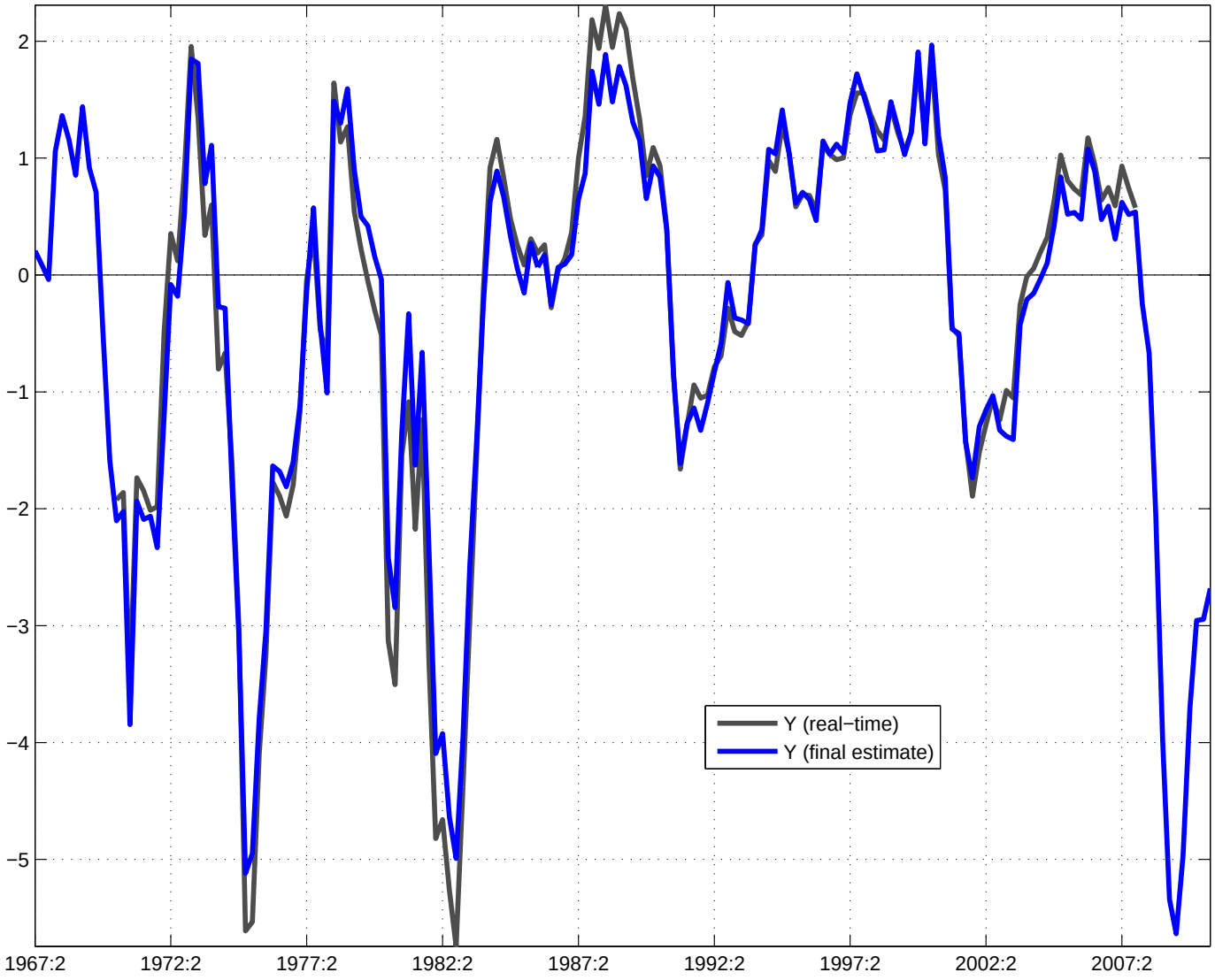
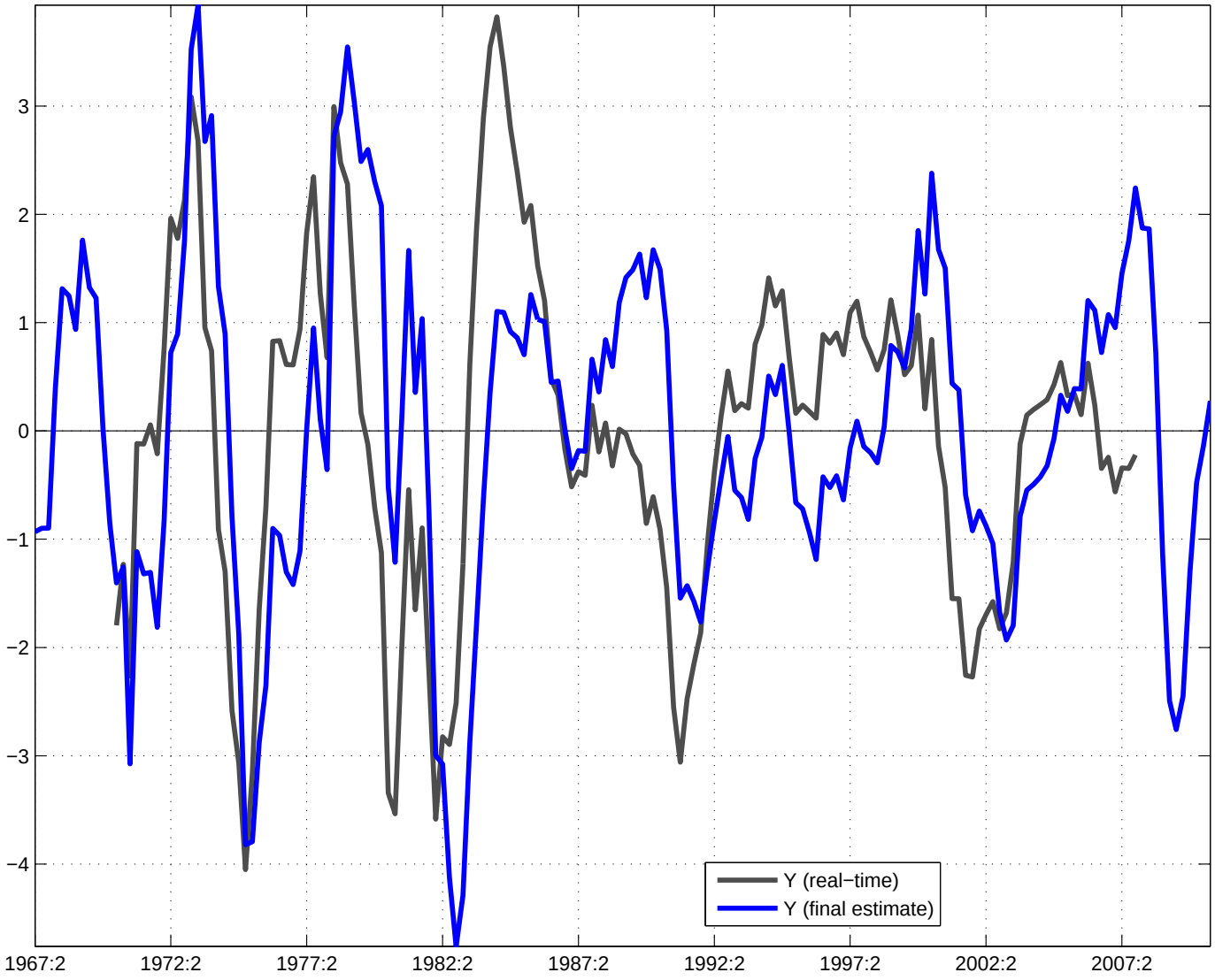
RMSEs

Parameter	1Q Ahead	4Q Ahead	8Q Ahead	12Q Ahead
GROWTH_	3.412	3.363	3.370	3.414
PIE4_	0.515	1.404	1.998	2.369
UNR_	0.300	1.020	1.607	1.779

Mean absolute revisions (according to most recent estimates)

quarter	$t-12$	$t-8$	$t-4$	t (nowcast)
`Y`	0.051	0.090	0.156	0.231
`Y (HP)`	0.172	0.333	0.754	1.250
`UNR_GAP`	0.051	0.047	0.050	0.067
`UNR_GAP (HP)`	0.086	0.176	0.393	0.640

Real-time output gap (MV)



Real-time output gap (HP)