ModYUKE Report: USVER3

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_
    DAPL_BAR_

!shocks:measurement

    RES_LLF_
    RES_DAPL_BAR_
```
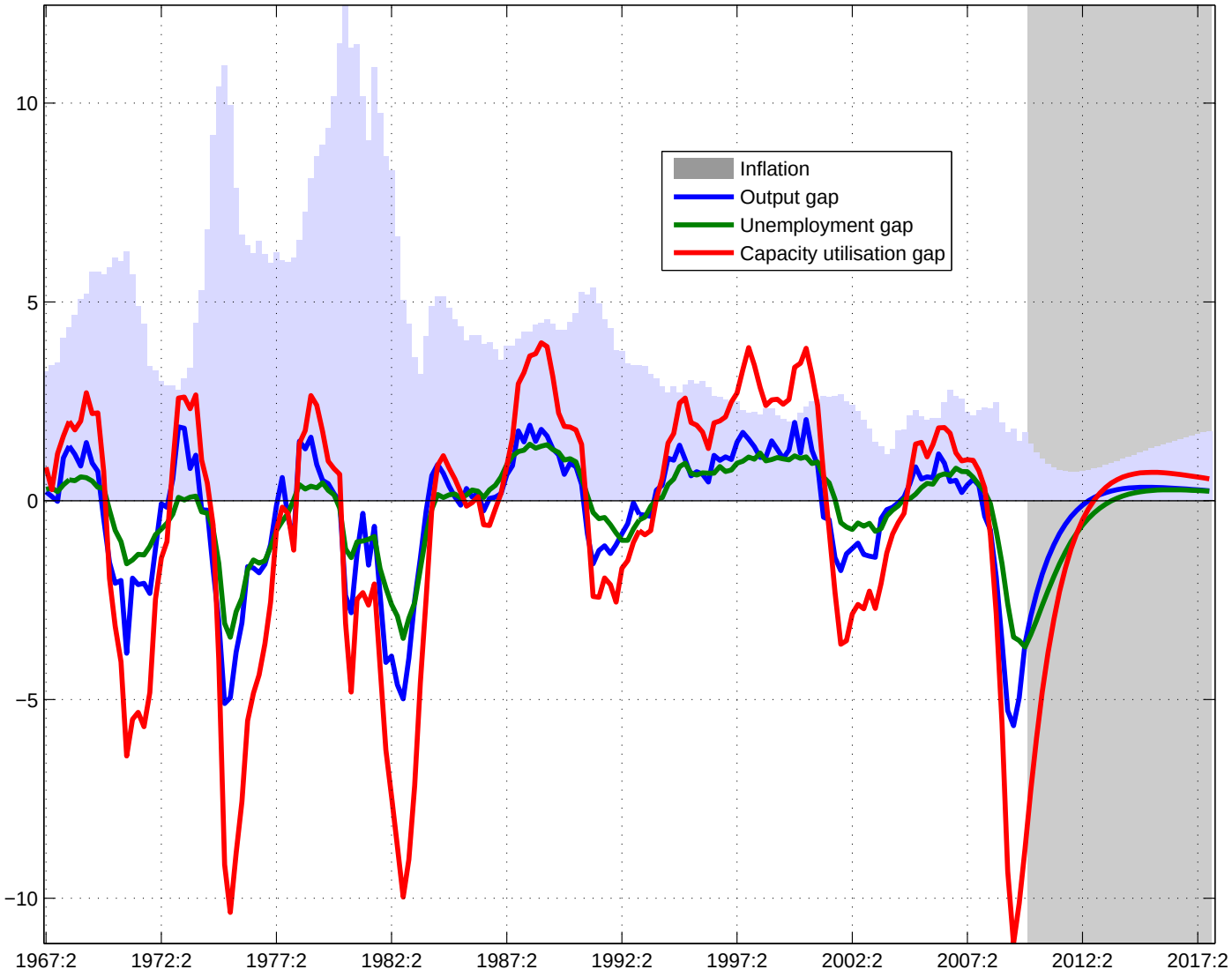
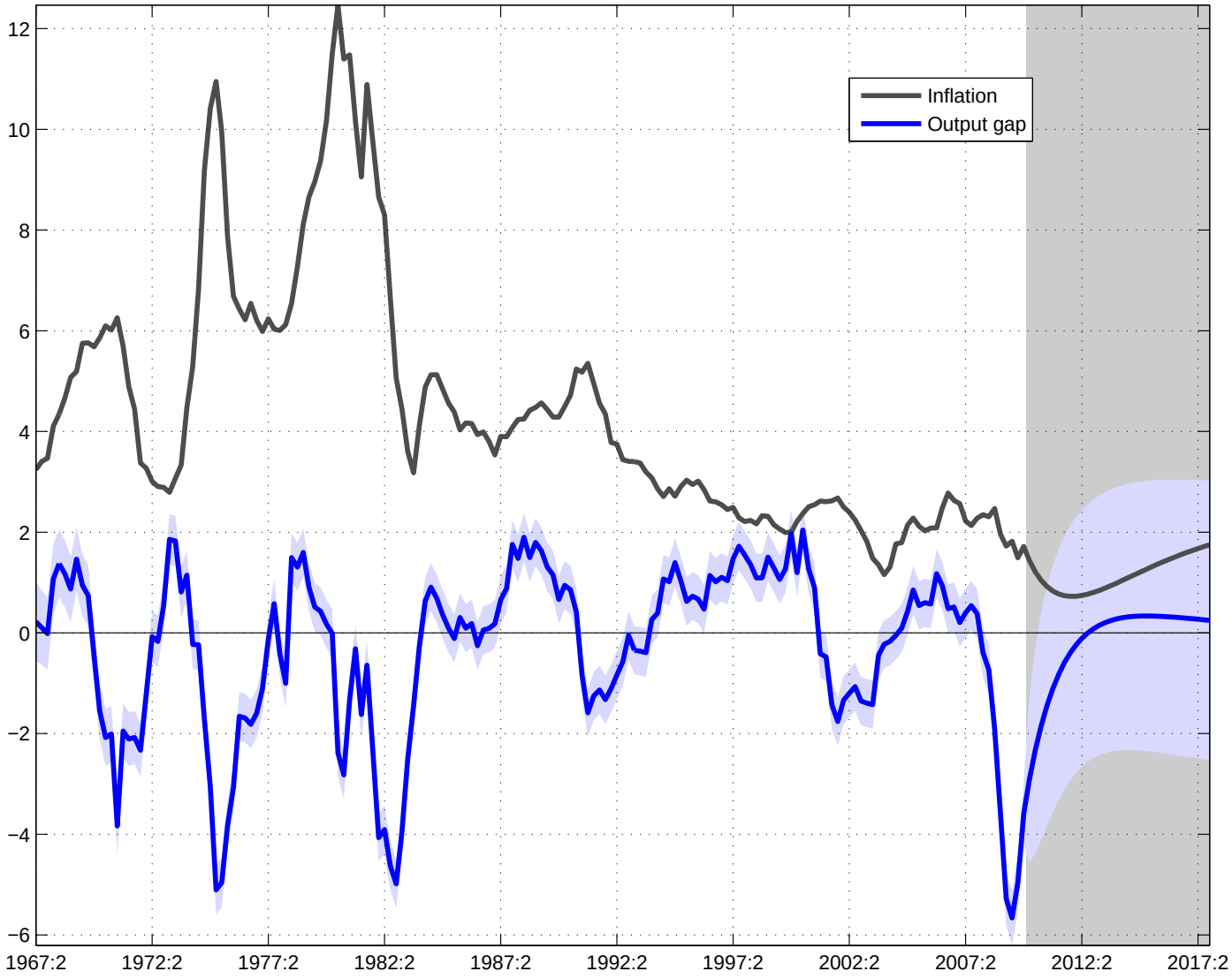

```
!equations:measurement

    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_;
```

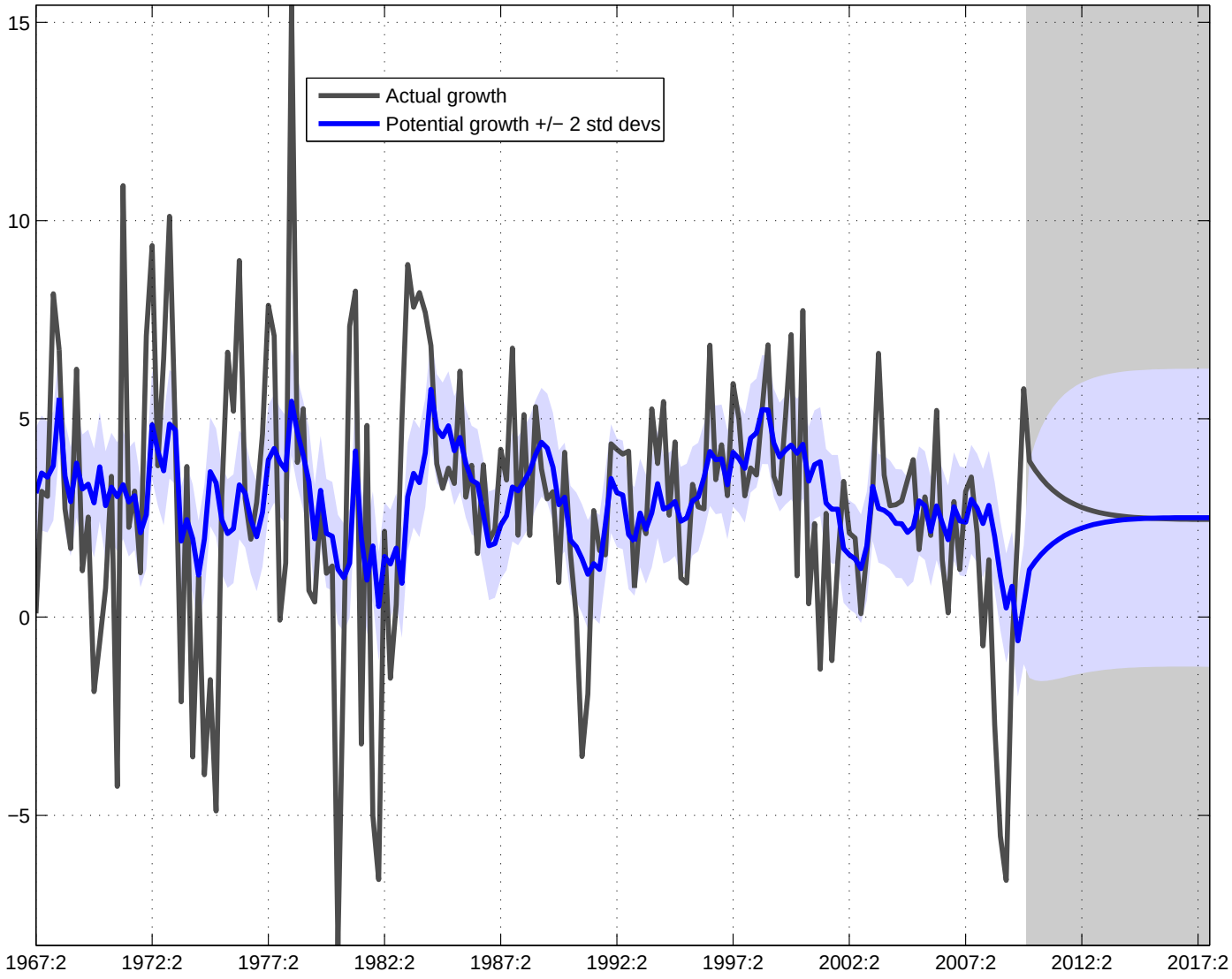
Economic activity gaps



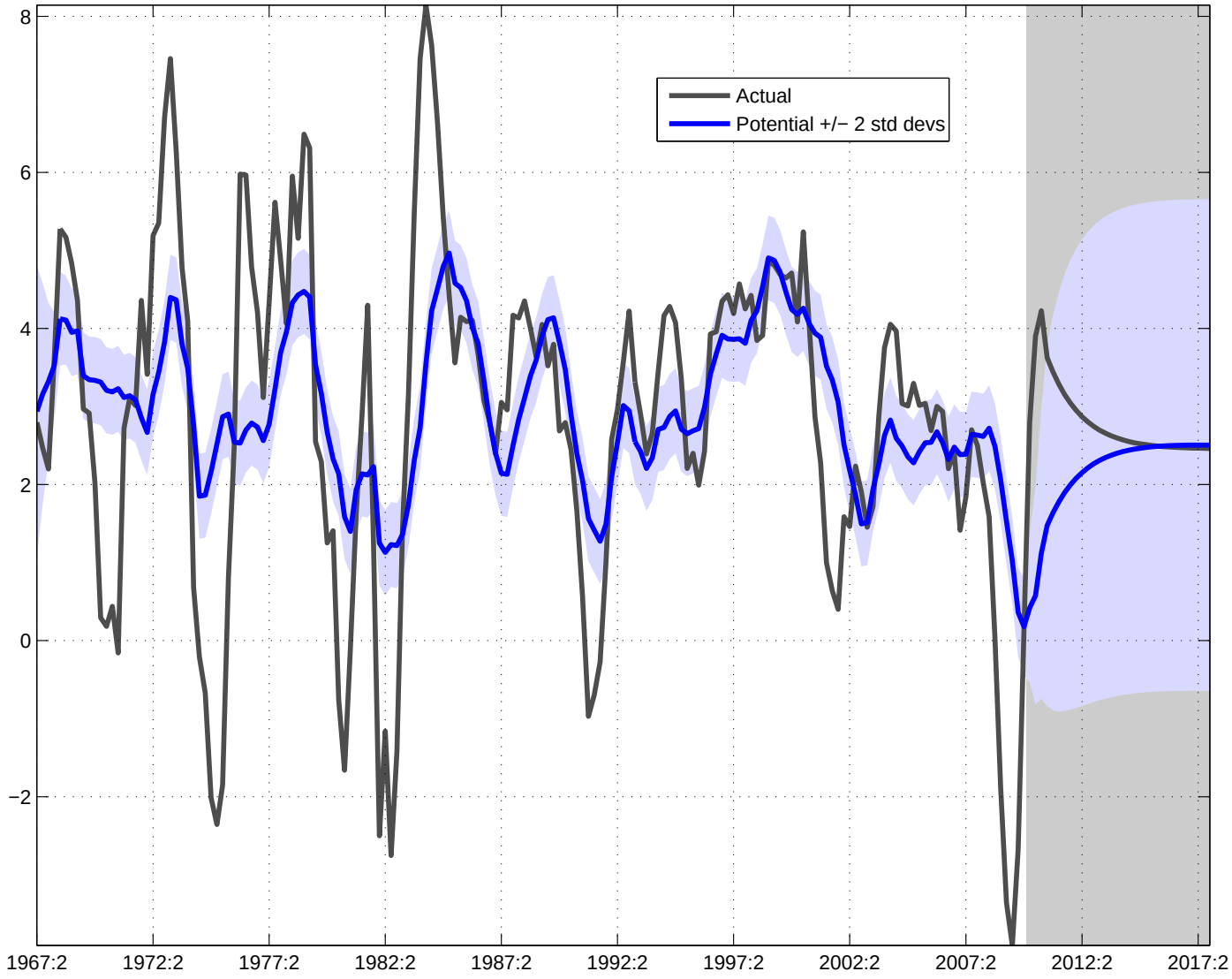
Output Gap +/- 2 std devs (w/o model or parameter uncertainty)



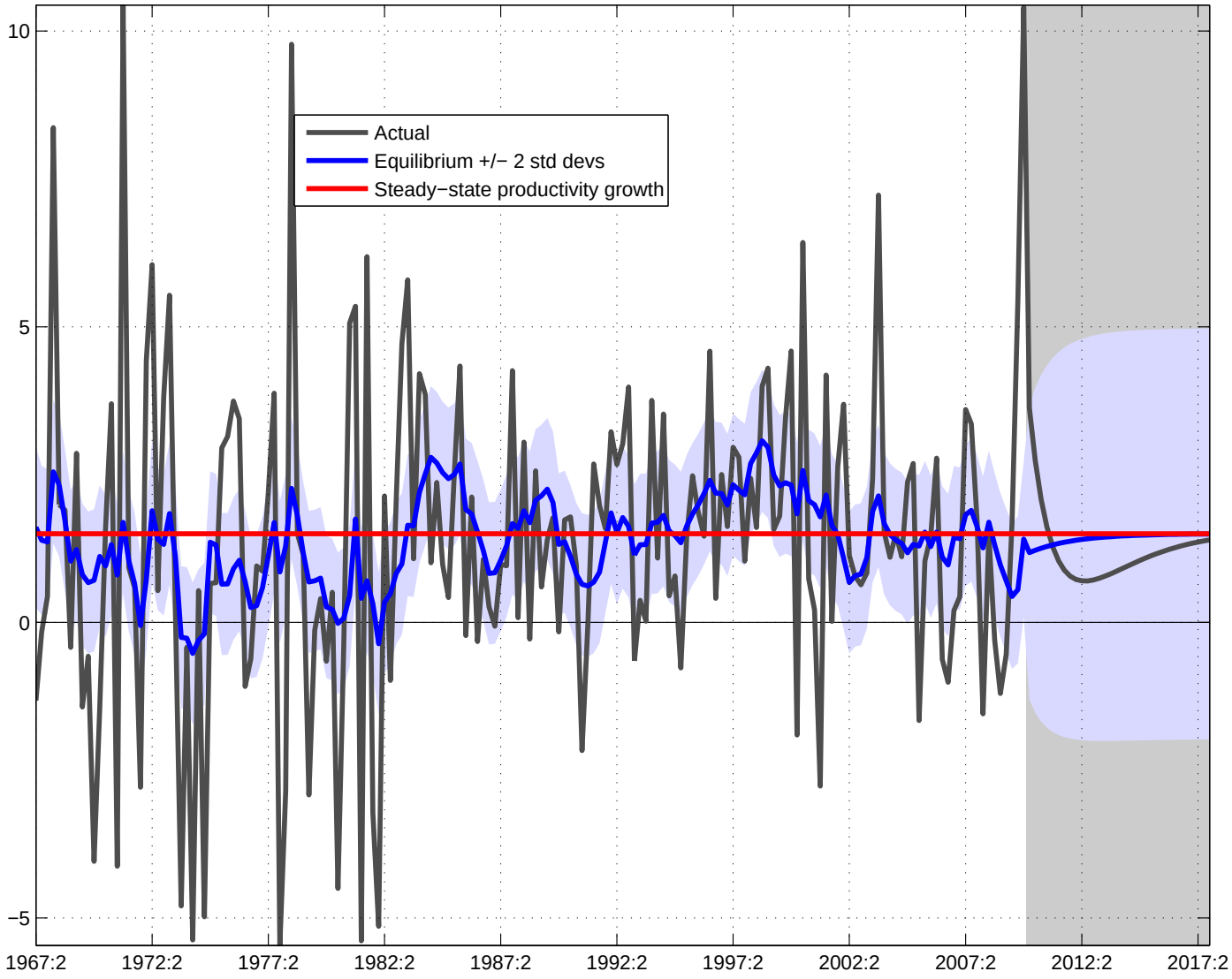
Output Growth (Q/Q Annualized) +/- 2 std devs (w/o model or parameter uncertainty)



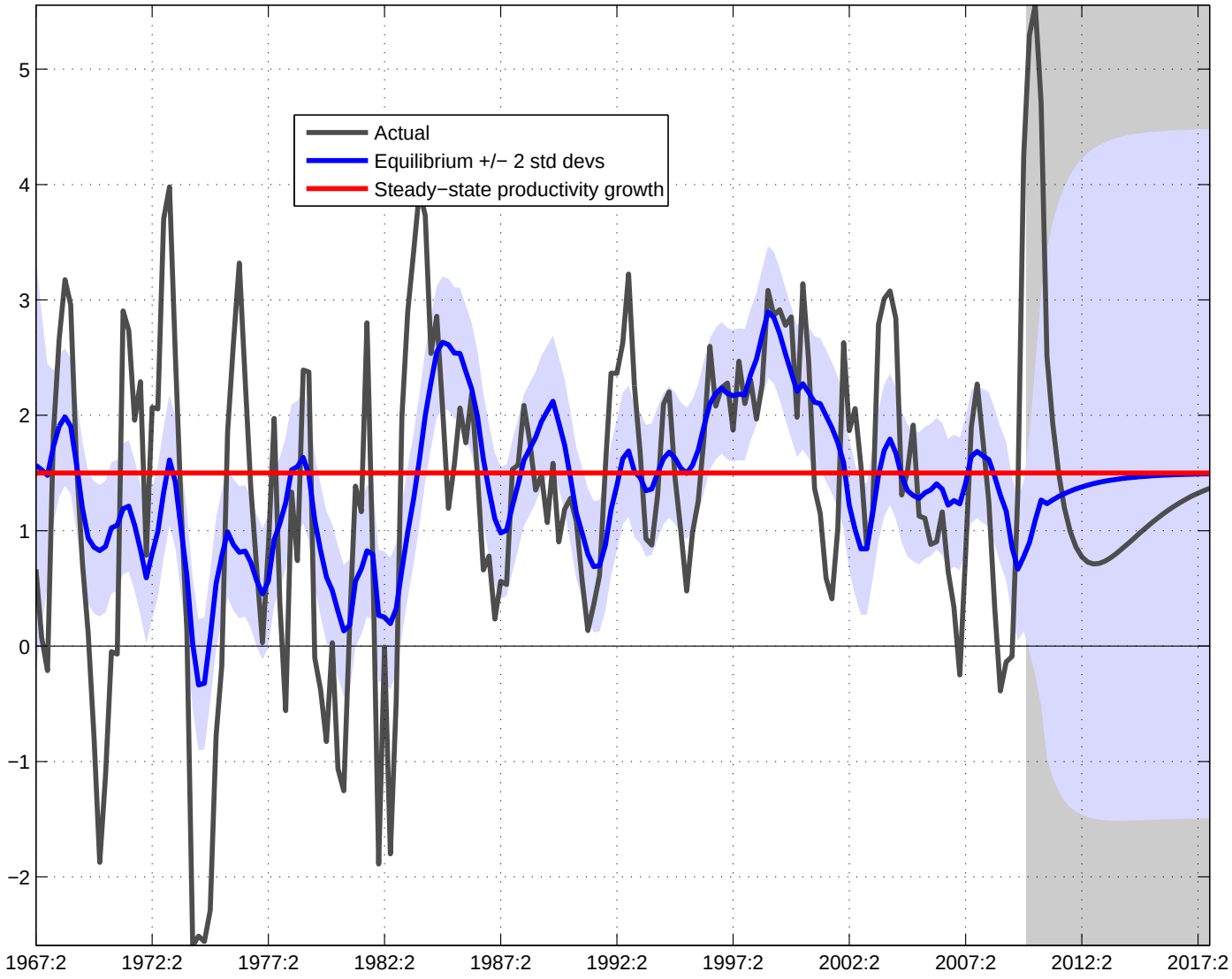
Output Growth (Y/Y) +/- 2 std devs (w/o model or parameter uncertainty)



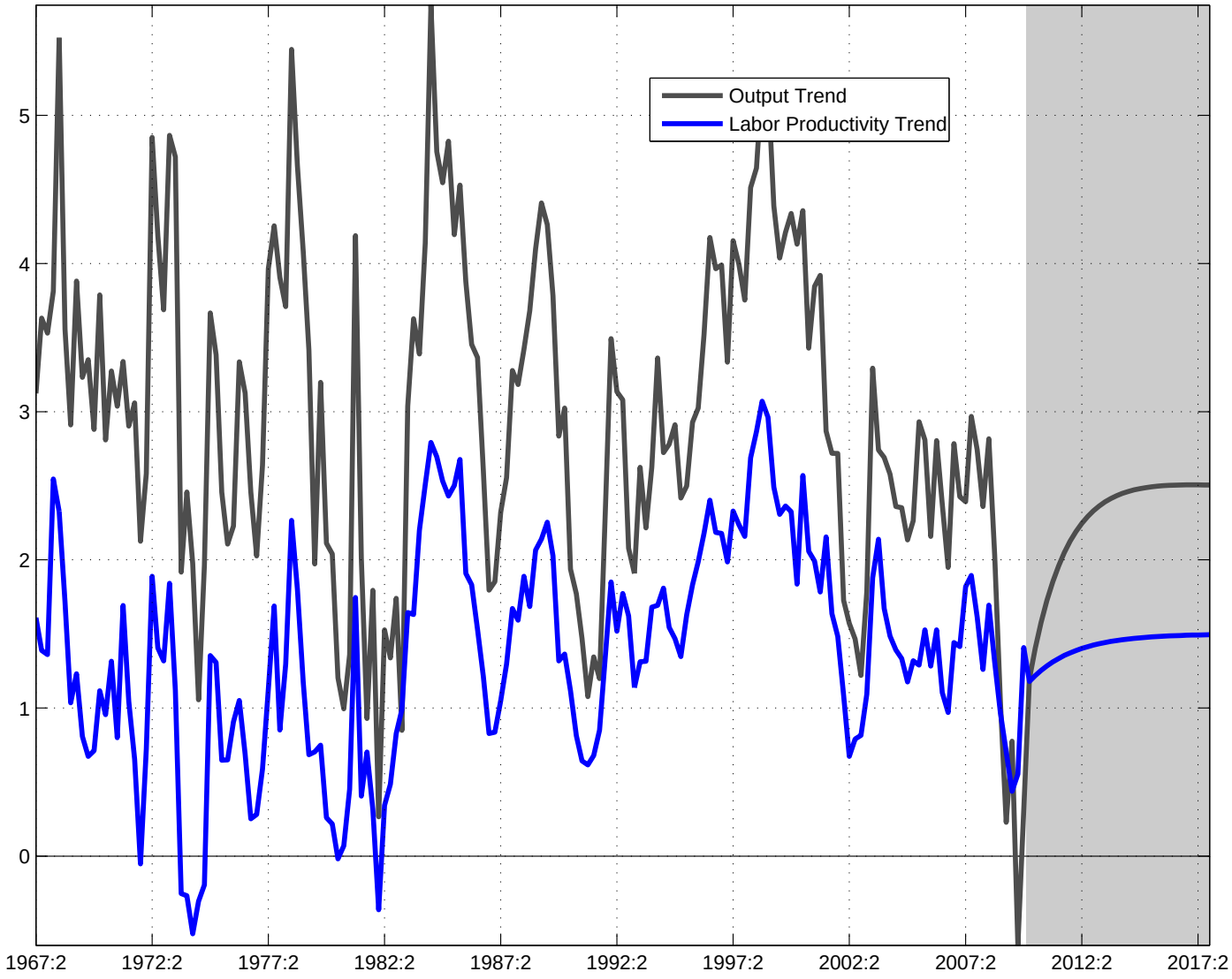
Growth of Labor Productivity (Q/Q Annualized)



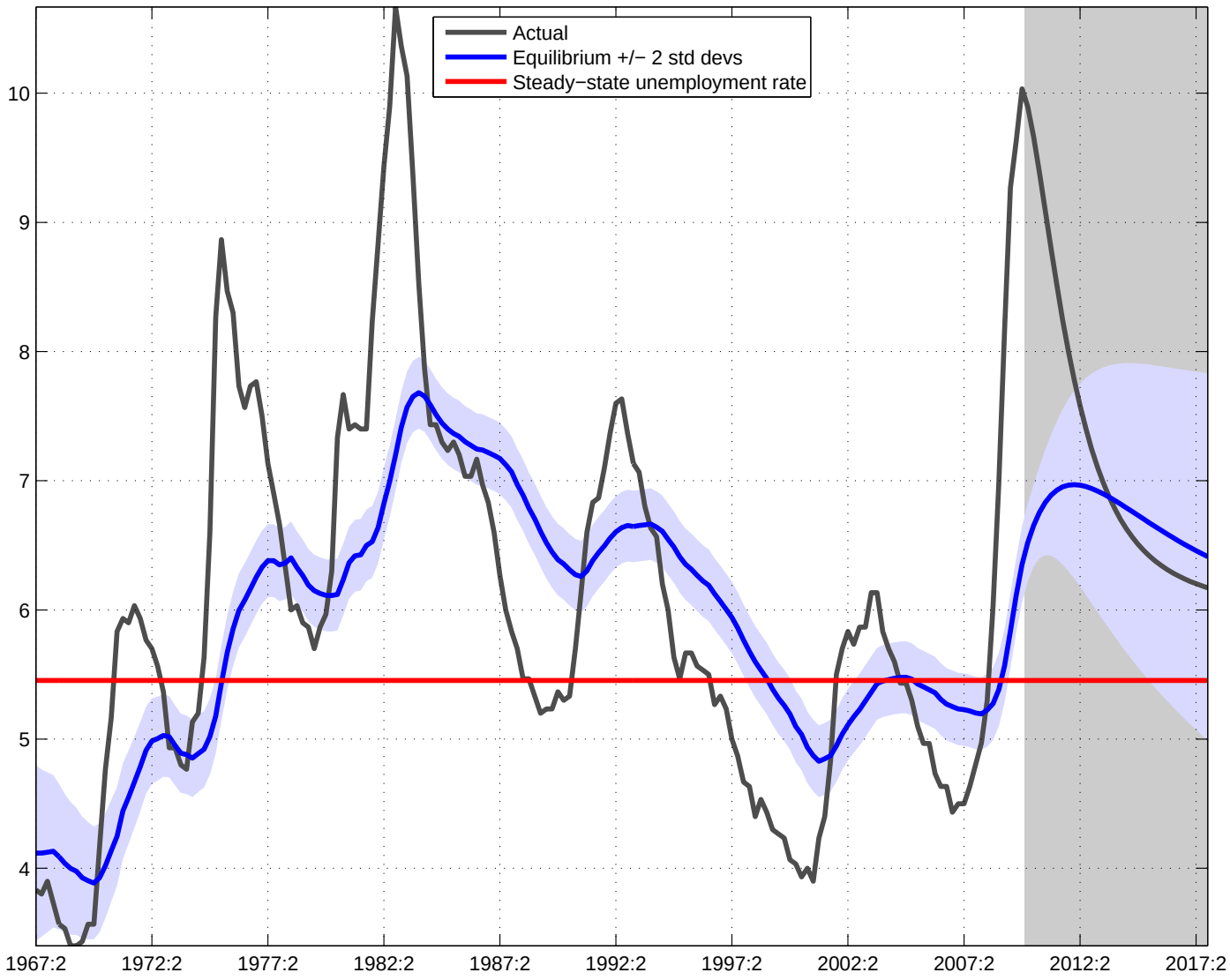
Growth of Labor Productivity (Y/Y)



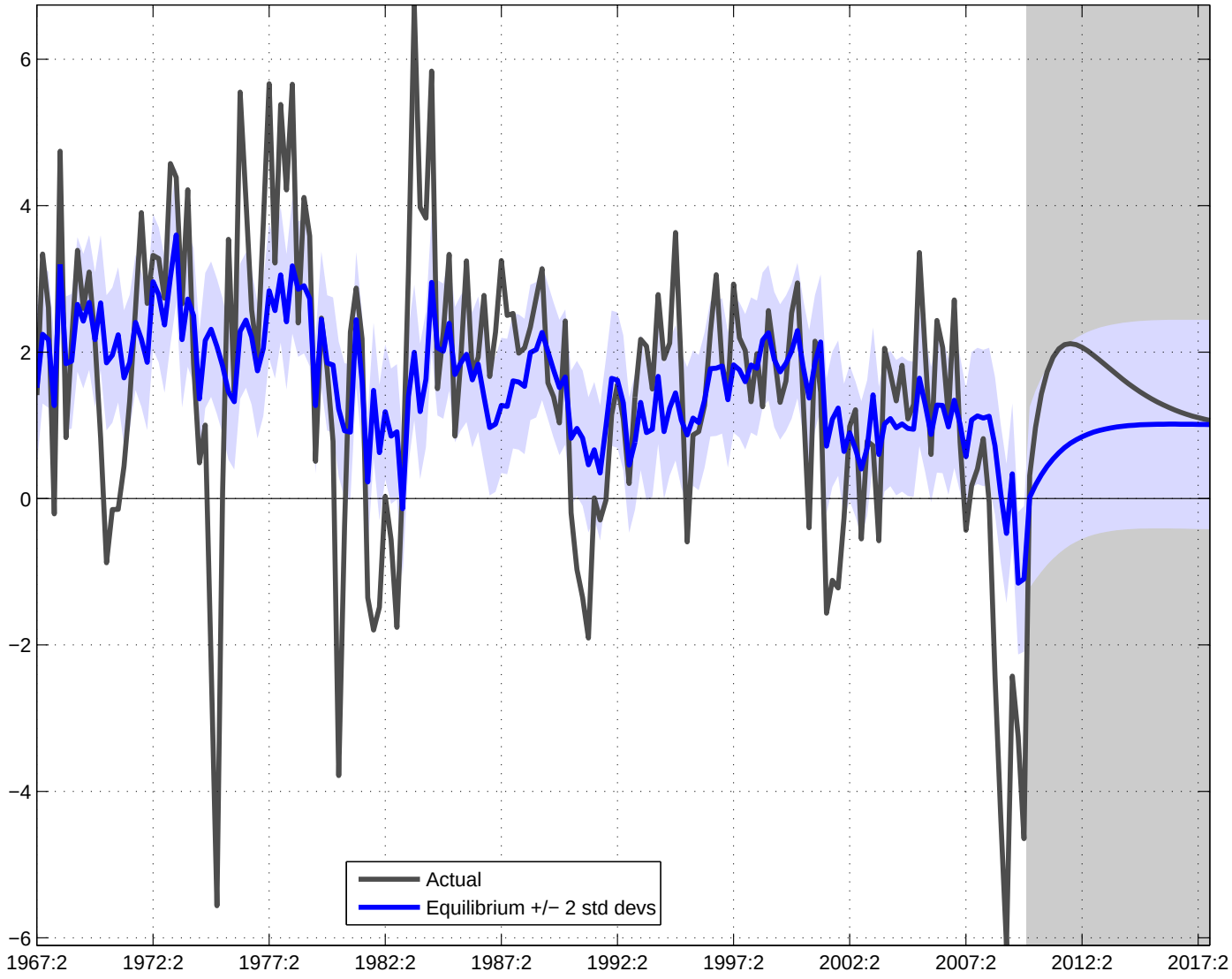
Labor Productivity and Output Trend Growth (Q/Q Annualized)



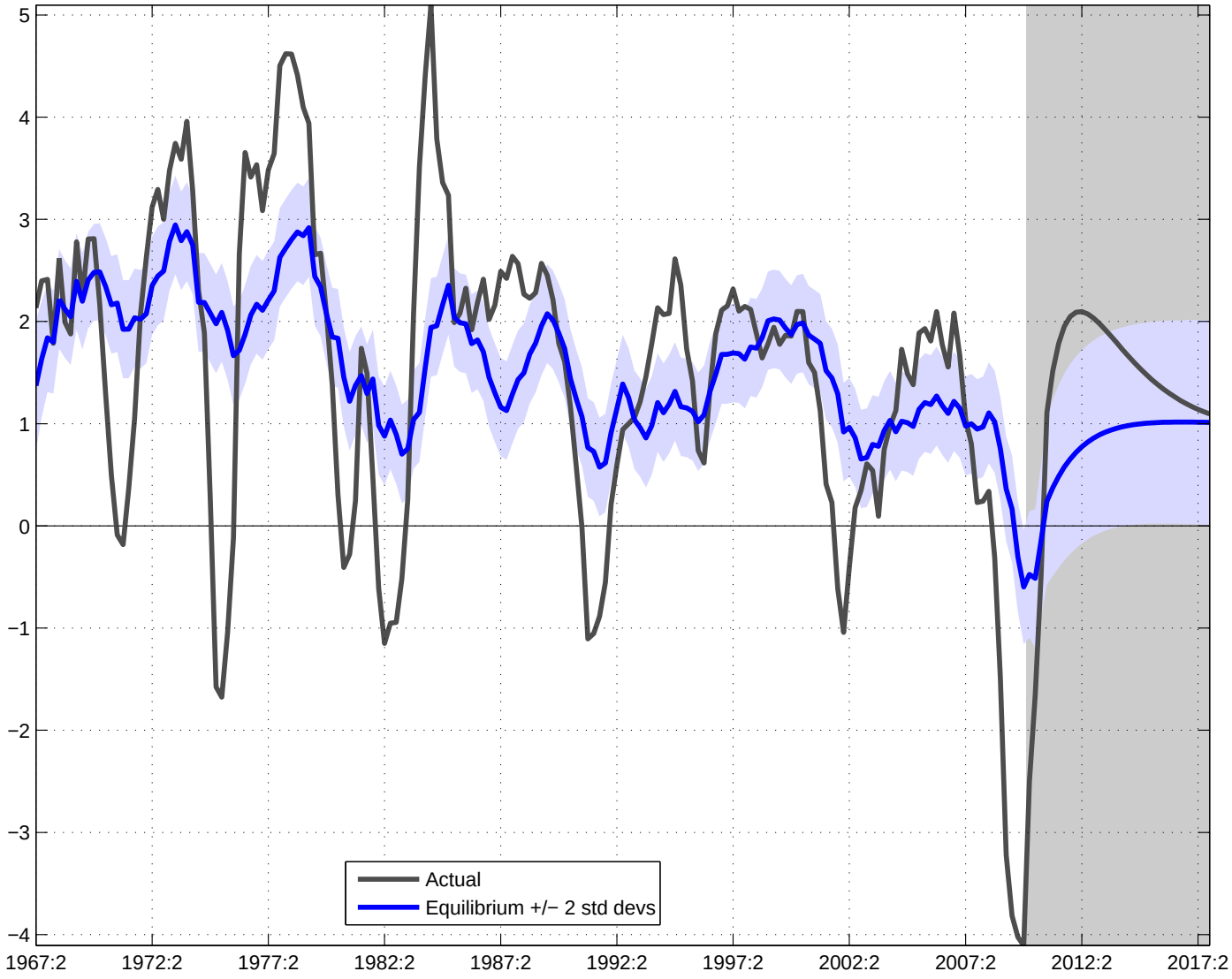
Unemployment Rate



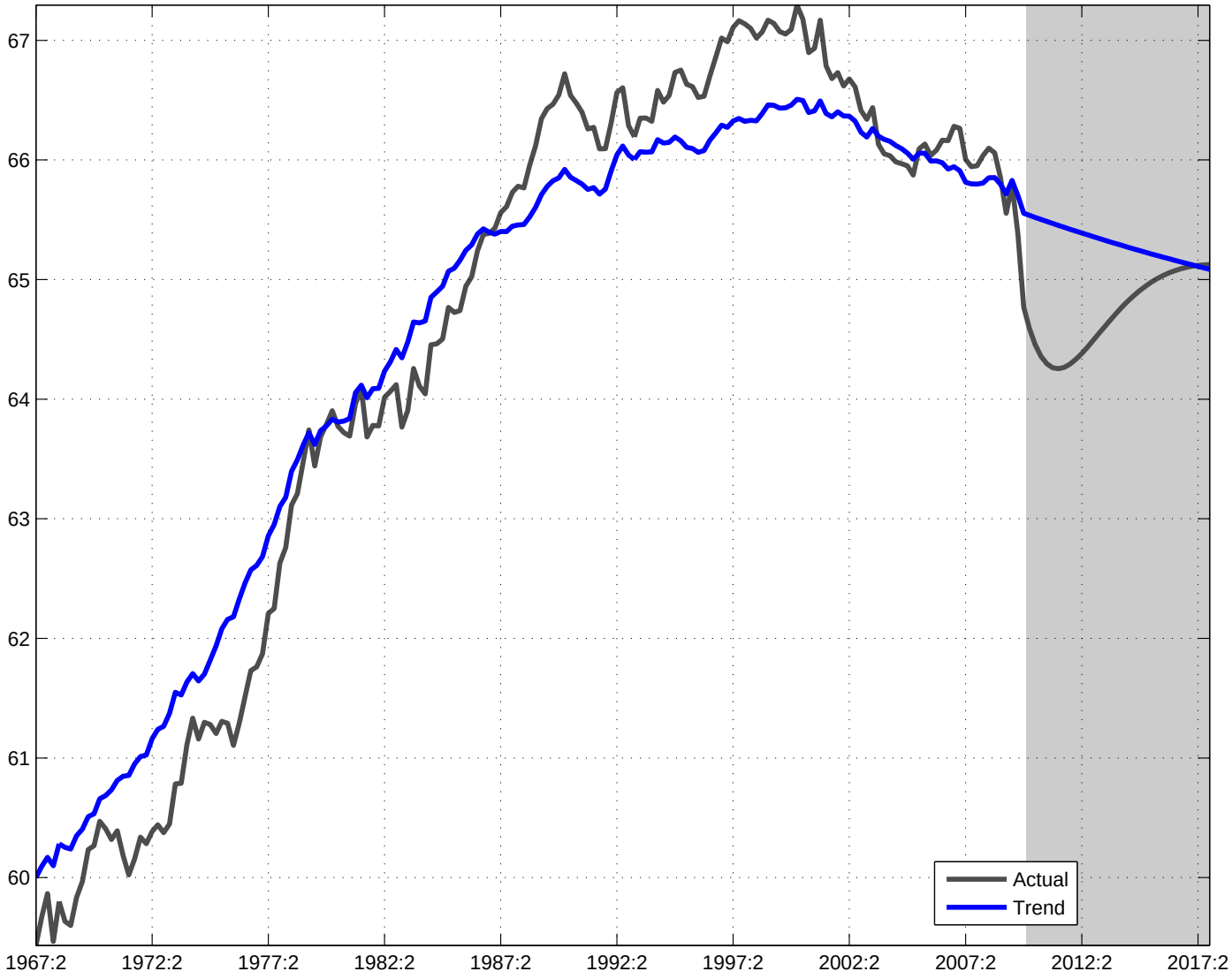
Growth of Employment (Q/Q Annualized)



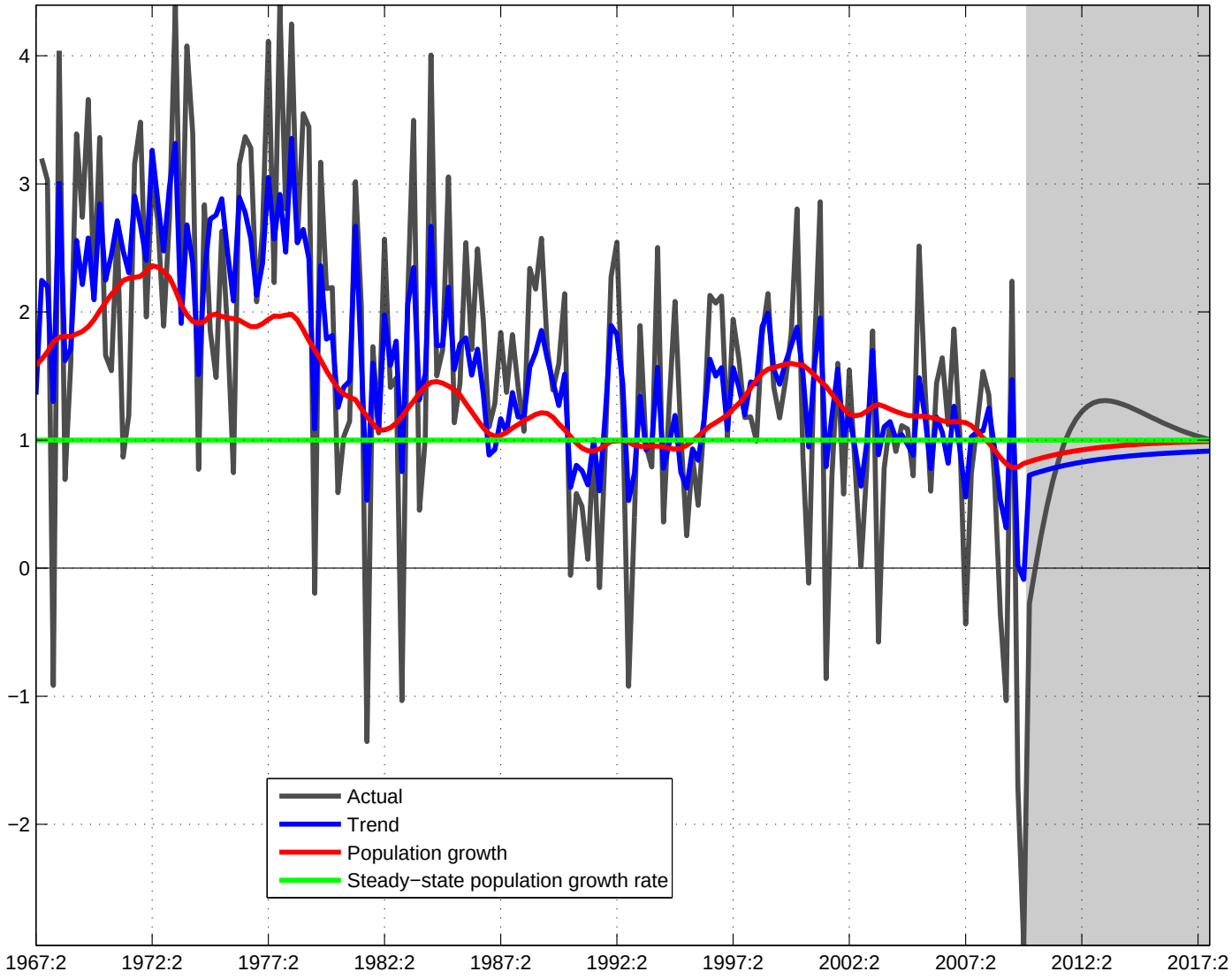
Growth of Employment (Y/Y Annualized)



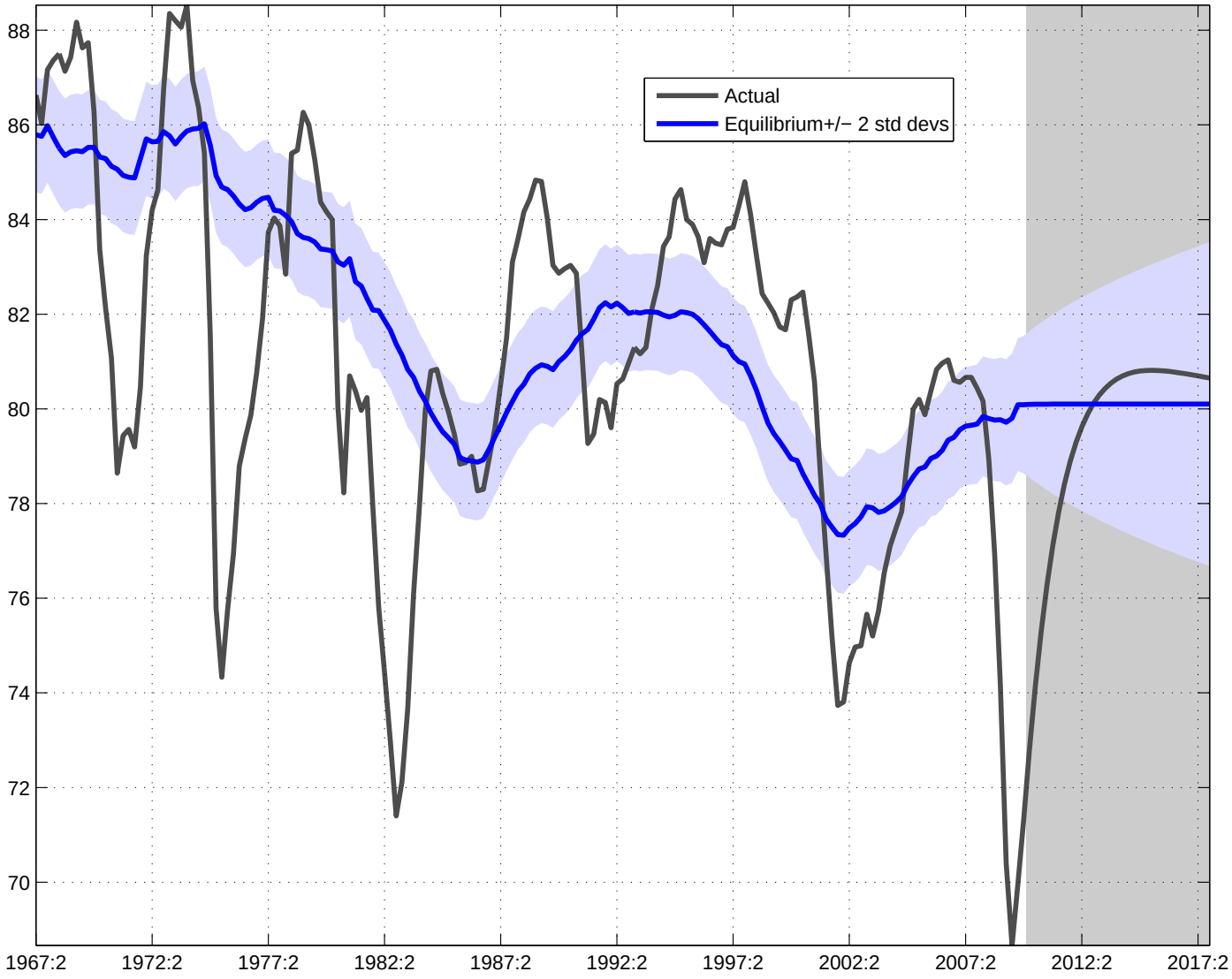
Participation Rate (in percent)



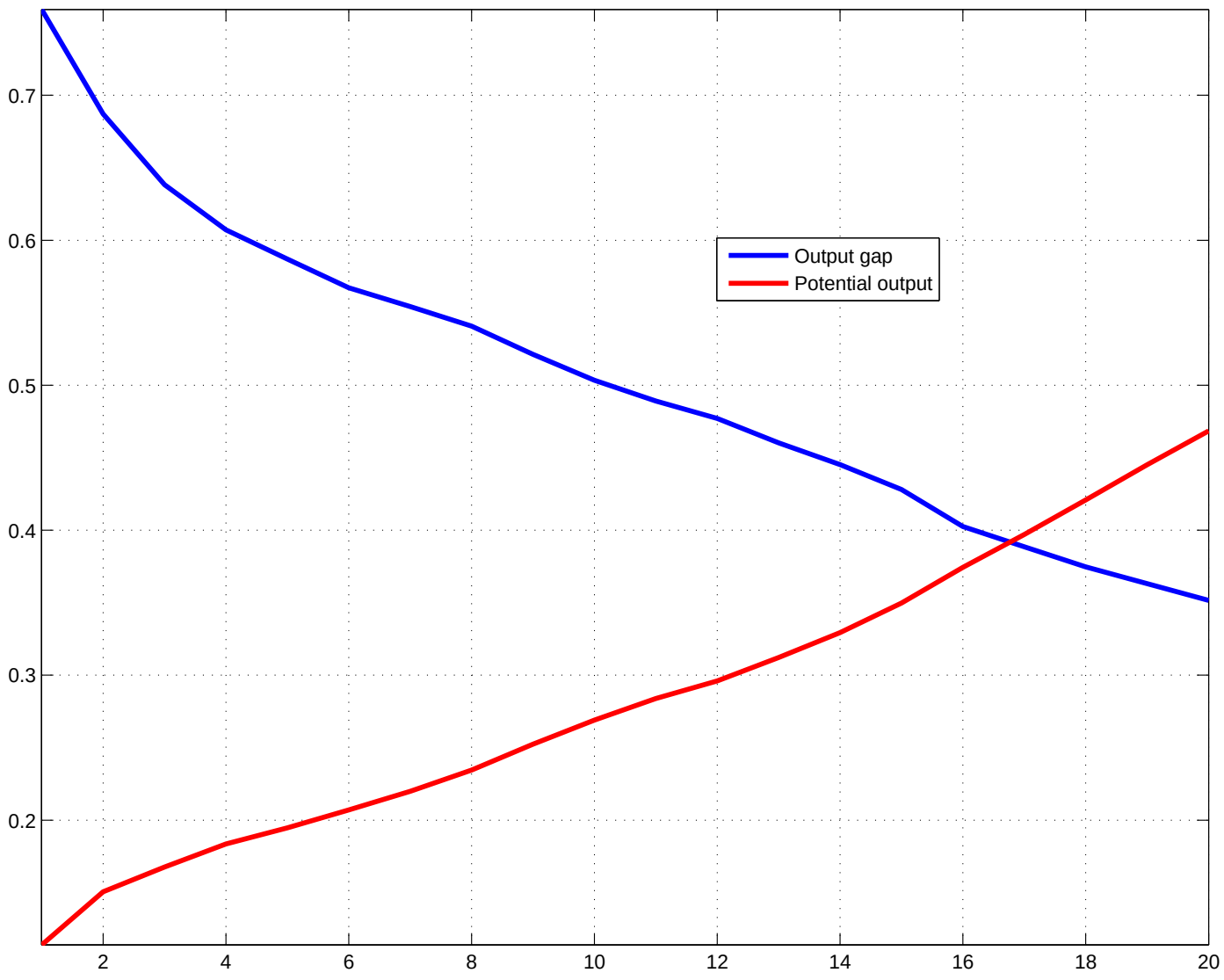
Labor Force And Population Growth (Q/Q Annualized)



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	0.326
beta	0.400	0.316	0.157	1.076
omega	0.500	0.316	0.252	0.576
rho1	0.800	0.158	0.820	0.138
kappa1	0.100	0.632	0.424	0.324
phi1	0.800	0.158	0.726	0.074
phi2	0.300	0.158	0.241	0.130
tau	0.100	0.158	0.123	0.098
delta	0.500	0.158	0.495	0.038
kappa2	1.500	1.581	1.234	0.481
parhist	5.000	3.162	4.877	2.319
rho2	5.000	3.162	5.134	4.619
lambda	1.000	3.162	1.034	13.229
zeta	0.100	0.079	0.083	0.040
eta	0.020	0.016	0.011	0.021
theta2	0.100	0.079	0.071	0.142
theta1	0.900	0.079	0.899	0.081
std_RES_Y	1.000	0.316	0.784	0.236
std_RES_G	1.000	0.316	0.751	0.248
std_RES_UNR_GAP	0.500	0.316	0.226	0.303
std_RES_UNR_BAR	0.020	0.016	0.017	0.007
std_RES_UNR_G	0.020	0.016	0.017	0.014
std_RES_CAPU_GAP	0.400	0.316	0.396	0.501
std_RES_CAPU_BAR	0.250	0.158	0.244	0.211
std_RES_CU_G	0.075	0.032	0.062	0.006
std_RES_PIE	0.500	0.316	0.517	0.081
std_RES_PIELTE	0.300	0.316	0.083	0.067
std_RES_APL_BAR	0.250	0.079	0.191	0.018
std_RES_DLN	0.150	0.119	0.142	0.086
std_RES_LP	0.150	0.119	0.171	0.040
std_RES_LP_BAR	0.100	0.079	0.135	0.180

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_	0.818
std_RES_DAPL_BAR_	0.930

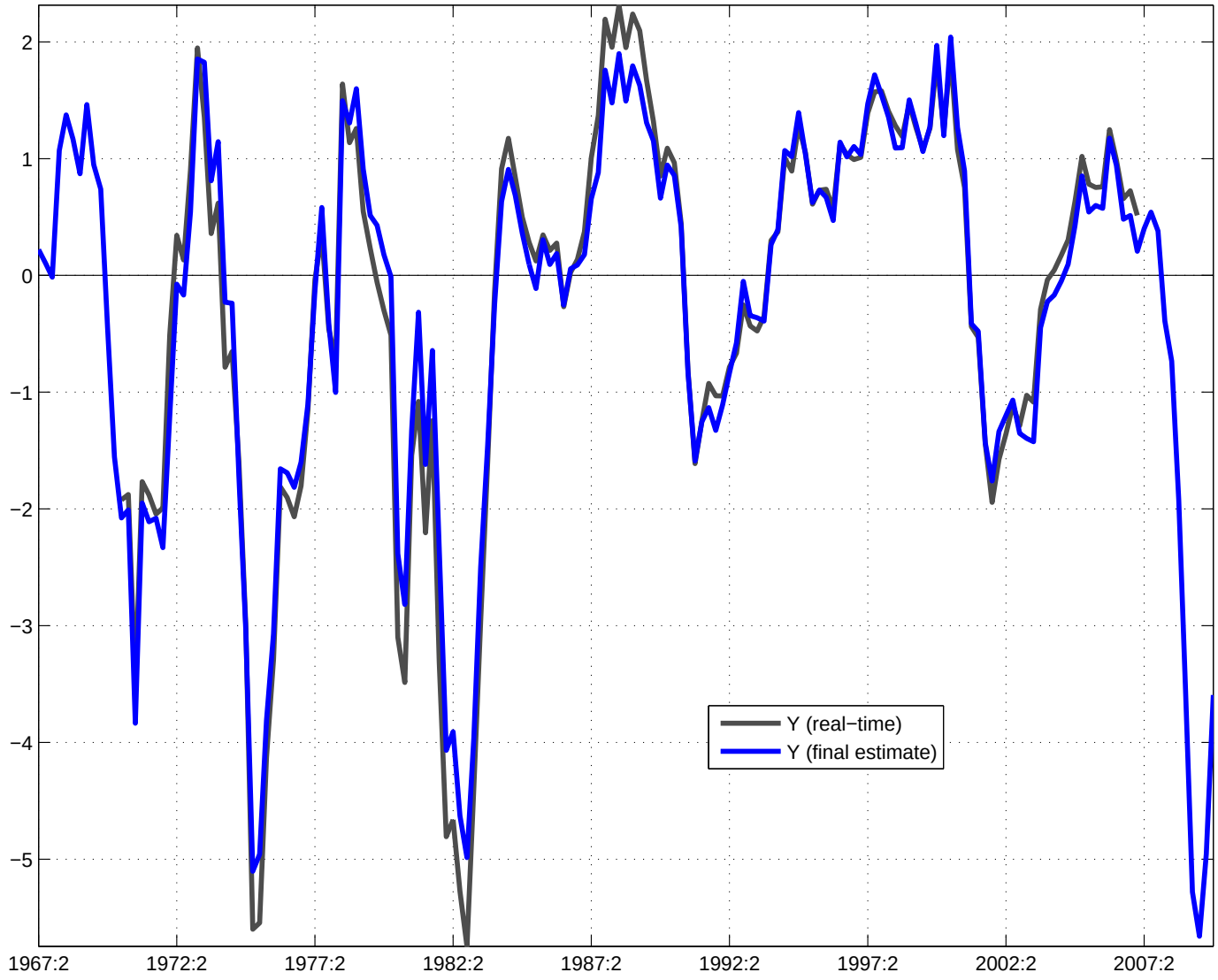
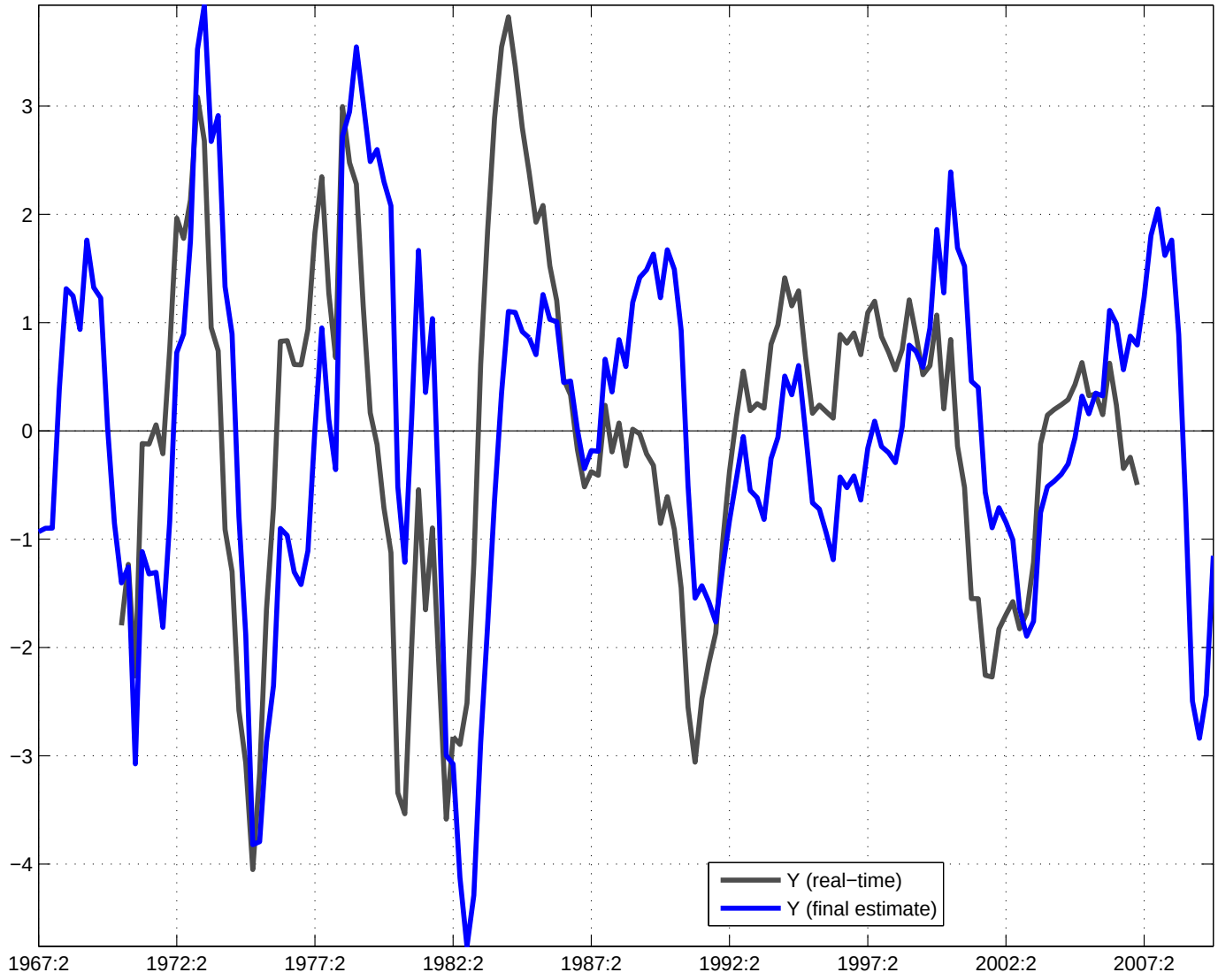
RMSEs

Parameter	1Q Ahead	4Q Ahead	8Q Ahead	12Q Ahead
GROWTH_	3.414	3.362	3.381	3.427
PIE4_	0.517	1.397	1.954	2.266
UNR_	0.303	1.018	1.486	1.626

Mean absolute revisions (according to most recent estimates)

quarter	$t-12$	$t-8$	$t-4$	t (nowcast)
Y	0.049	0.088	0.155	0.231
Y (HP)	0.169	0.333	0.745	1.227
UNR_GAP	0.046	0.043	0.048	0.065
UNR_GAP (HP)	0.084	0.176	0.387	0.625

Real-time output gap (MV)



Real-time output gap (HP)