

**Did the Phillips Curve
Survive the Boom of the 1990s?***

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**(based on joint research
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- Motivation
 - Fundamentals of U. S. miracle economy of late 1990s
 - Benign behavior of inflation, a new paradigm?
 - Made possible Fed's "benign neglect"
 - Productivity growth revival
 - Contributed to low inflation

- Phillips curve dead or alive?
 - Dead: either dead now or never existed
 - Group 1. New Economy rendered PC obsolete
 - Group 2. Never alive, always dead
 - Alive: Large and growing literature, with different emphases (esp. Gordon + Staiger-Stock-Watson). Low inflation explained by:
 - A declining TV-NAIRU (itself needing explanation)
 - Beneficial supply shocks

- More Challenging to Explain Low Inflation than in 1998?
 - Two years with actual $U <$ lowest NAIRU estimates
 - Some beneficial supply shocks went away
 - Productivity revival should eventually get into real wages
- This research approach
 - Keep revisiting a topic. Is the earlier work valid? If not, why not?
 - Keep original specification intact. If it is changed, explain it, record the effects
 - The importance of post-sample dynamic simulations
 - Is the question why inflation was so low or why unemployment was so low?

A general specification of the triangle framework is:

$$p_t = a(L)p_{t-1} + b(L)D_t + c(L)z_t + e_t. \quad (1)$$

NOTE! p is the rate of change of the price level

Lower-case letters designate first differences of logarithms, upper-case letters designate logarithms of levels, and L is a polynomial in the lag operator. The dependent variable p_t is the inflation rate. Inertia is conveyed by the lagged rate of inflation p_{t-1} . D_t is an index of excess demand (normalized so that $D_t=0$ indicates the absence of excess demand), z_t is a vector of supply shock variables (normalized so that $z_t=0$ indicates an absence of supply shocks), and e_t is a serially uncorrelated error term.

$$p_t = a(L)p_{t-1} + b(L)(U_t - U_t^N) + c(L)z_t + \varepsilon_t, \quad (2)$$

$$U_t^N = U_{t-1}^N + \eta_t, E\eta_t = 0, \text{var}(\eta_t) = \tau^2 \quad (3)$$

By definition, the change in labor's share (s_t):

$$s_t = w_t - \theta_t - p_t \quad (4)$$

The difference between the growth rates of wage rates and trend productivity is often called the growth rate of "trend unit labor cost" or TULC ($w-\theta^*$).

$$(w-\theta^*)_t = g(L)(w-\theta^*)_{t-1} + b(L)(U_t-U^N_t) + c(L)z_t + \varepsilon_t. \quad (5)$$

$$(w-\theta^*)_t = g(L)(w-\theta^*)_{t-1} + h(L)(p)_{t-1} + b(L)(U_t-U^N_t) + c(L)z_t + e_t. \quad (6)$$

$$(w-\theta^*)_t = [g(L)+h(L)](w-\theta^*)_{t-1} - h(L)(w-\theta^*-p)_{t-1} + b(L)(U_t-U^N_t) + c(L)z_t + e_t. \quad (7)$$

$$p_t = [g(L)+h(L)]p_{t-1} + h(L)(w-\theta^*-p)_{t-1} + b(L)(U_t-U^N_t) + c(L)z_t + e_t, \quad (8)$$

- Data: Puzzles to be Explained
 - Figure 1, 1960-2001, showing demand and supply
 - Note CPI-RS
 - Figure 2, 1987-2001, headline vs. CORE
 - Figure 3, 1960-2001, CORE only
 - Growing gap PCE vs. CPI-RS

- Specification Issues
 - Original Specification (1982)
 - Lagged dependent variable (1-24, six MA's)
 - Unemployment gap (0-4), NAIRU determined endogenously
 - Change in relative price of imports (1-4)
 - Change in relative price of food and energy (0-4)
 - Productivity deviation or acceleration (lag in real wage adaptation to productivity acceleration or deceleration)
 - Nixon controls "on" and "off"

- Specification Issues Discussed in Full Paper
 - Truncated specification — how it emerged, emphasis not on fit but on forecasting behavior in the 1990s
 - Treatment of productivity, how to capture acceleration and deceleration in a very noisy time series.
 - Smoothness issue, economic rather than statistical

- How Much of a Surprise was Inflation in the Late 1990s?
- Reminder: This question is answered in dynamic simulations
- When the NAIRU is forced to be constant, and estimation stops in 1995, a dynamic simulation has inflation from 1.2 to 1.5 percent too high by 2001
 - Errors for inflation variables do not extend to wage change variables, which are almost exactly on target in dynamic simulations
- When the NAIRU is allowed to vary, it declines from about 6.5 percent in the late 1980s to 5.0 to 5.5 percent in 2001, depending on the price index
 - Allowing NAIRU to vary reduces 2001 error in dynamic simulation from about 1.5 to 0.75.
 - Further reduction to 0.25 by using alternative smoothed productivity acceleration variable
 - Graph illustrating the NAIRU vs. actual unemployment

- Coefficients
 - Sum of coefficients on LDV almost exactly 1.0 without need for constraints
 - Sum of coefficients on unemployment gap ranges from -0.5 to -0.6, consistent with stylized fact ("rule-of-thumb") that the slope of Phillips curve is $-1/2$.
 - Highly significant effects of real import prices and real energy prices
 - Real import prices held down inflation in the late 1990s by about 0.9 percentage point per year (in dynamic simulations)
- Sample split (1962-80 vs. 1981-2001)
 - No significant structural shift
 - Long lags (24 quarters) on LDV significant in both sub-periods

- Is the Phillips Curve Dead?
 - Using interactive shift dummies, there is no significant shift in the slope of the Phillips curve after 1993 or after 1995.
- Wage-price feedback?
 - Mixed results, depending on price and wage data used
 - Dynamic simulation results better for single-equation than for multiple-equation versions.

- Future Outlook:
 - Ambiguity cap utiliz vs. unemployment, goods vs. services
 - Oil prices unpredictable, medical care prices adverse, computer prices will continue to decline but will have smaller weight in total spending than in 1995-2000

- The New-Keynesian Phillips Curve

- The New Keynesian Phillips Curve
 - Based on forward-looking expectations
 - Standard specification

$$p_t = E_t p_{t+1} + b(U_t - U^N_t) + \varepsilon_t \quad \textbf{(A)}$$

- Mankiw has called the NKPC a "failure":

"It is not at all consistent with the standard stylized facts about the dynamic effects of monetary policy, according to which monetary shocks have a delayed and gradual effect on inflation"
- Mankiw implies that the problem is the unresolved conflict between empirically valid backward-looking expectations and theoretically appealing forward-looking rational expectations

· But Mankiw's diagnosis is wrong, because backward-looking expectations are not the issue. Compare the NKPC as actually estimated by Gali-Gertler (2000) with (2):

$$p_t = p_{t-1} + b(U_t - U^N_t) + \varepsilon_t \quad (\text{B})$$

$$p_t = a(L)p_{t-1} + b(L)(U_t - U^N_t) + c(L)z_t + \varepsilon_t, \quad (2)$$

· As estimated in the NKPC, the forward looking expectations term is almost always replaced by the backward-looking lagged inflation term.

- Unlike (2), there are no further lags on the LDV
- Unlike (2), the NAIRU is not allowed to vary
- Most important, all supply shock variables are omitted

· This literature is remarkable because it represents an isolated cell in the macroeconomic literature, with cross-citations only to itself and no citations to three decades in which a coherent empirical model of U. S. inflation dynamics has been developed and repeatedly challenged through adoption by the best time-series econometricians (Stock-Watson) and by the self-imposed technique of post-sample dynamic simulations.

- But (B) is nested in (2), so its restrictions can be tested. They are ALL rejected emphatically. The SSR of (B) is more than five times that of (2).
 - Because the estimated value of " b " is relatively low, the fitted value from (B) is indistinguishable from a random walk
 - By omitting supply shocks that create a positive correlation between p and U , the error term is biased toward zero
- Conclusion: relying on the NKPC for understanding inflation, forecasting inflation, or carrying out policy analysis with macroeconomic models is hazardous to your health

Figure 1. Four Quarter Moving average in GDP, PCE, and CPI-RS

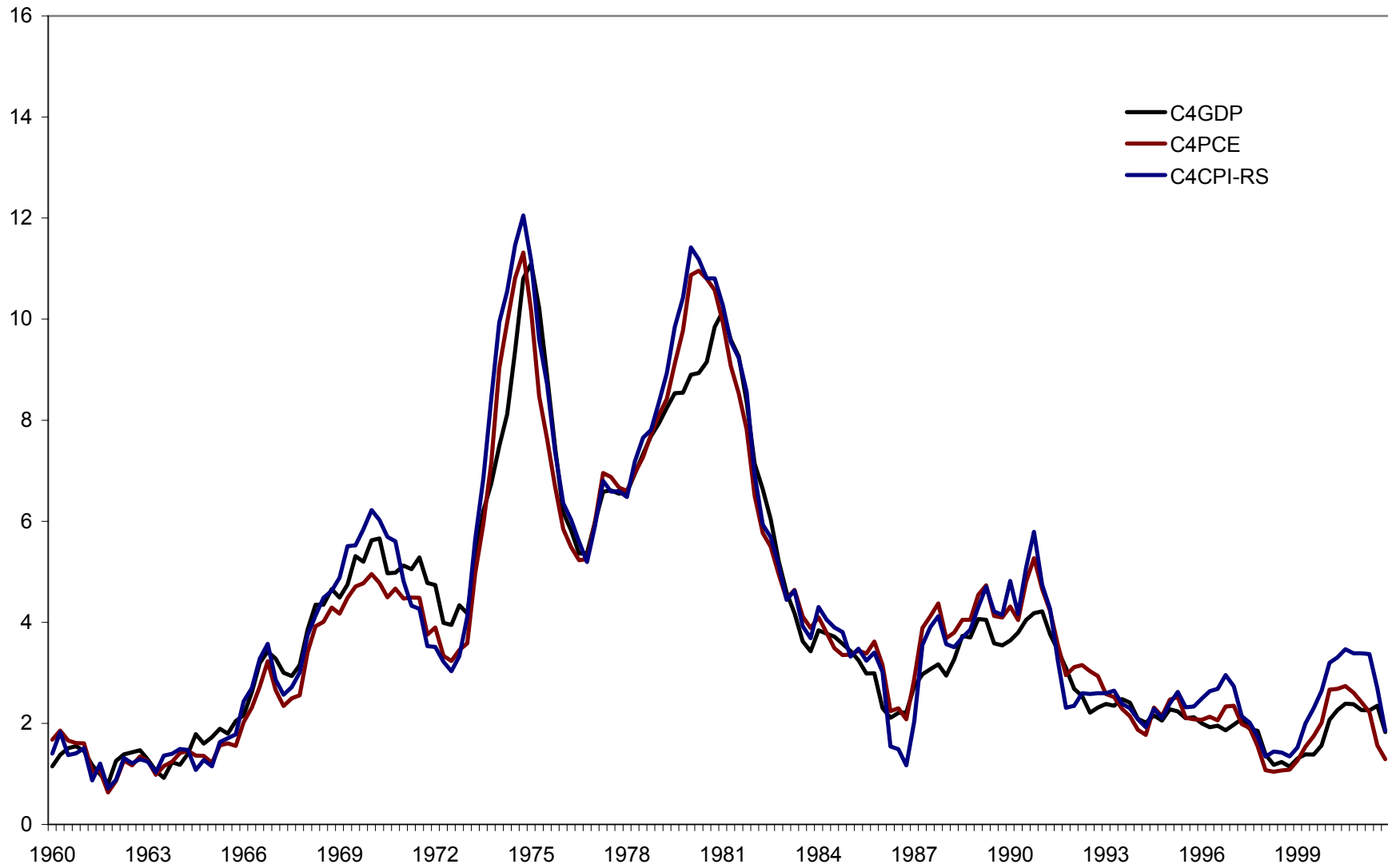


Figure 2. Four Quarter Moving average in PCE, CPI-RS, Core PCE and Core CPI-RS

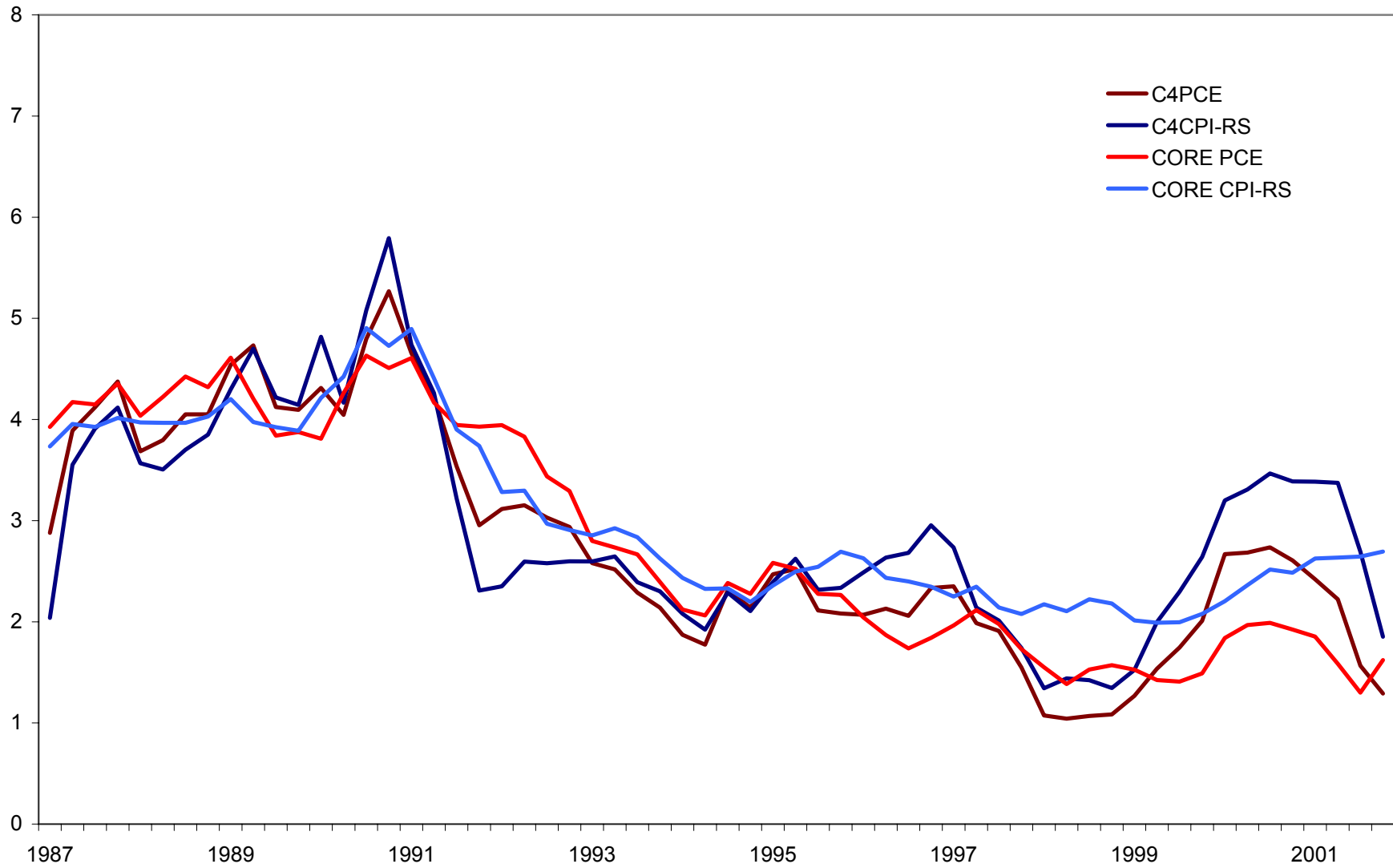


Figure 3. Four Quarter Moving average in Core PCE, Core CPI-RS, and Core CPI

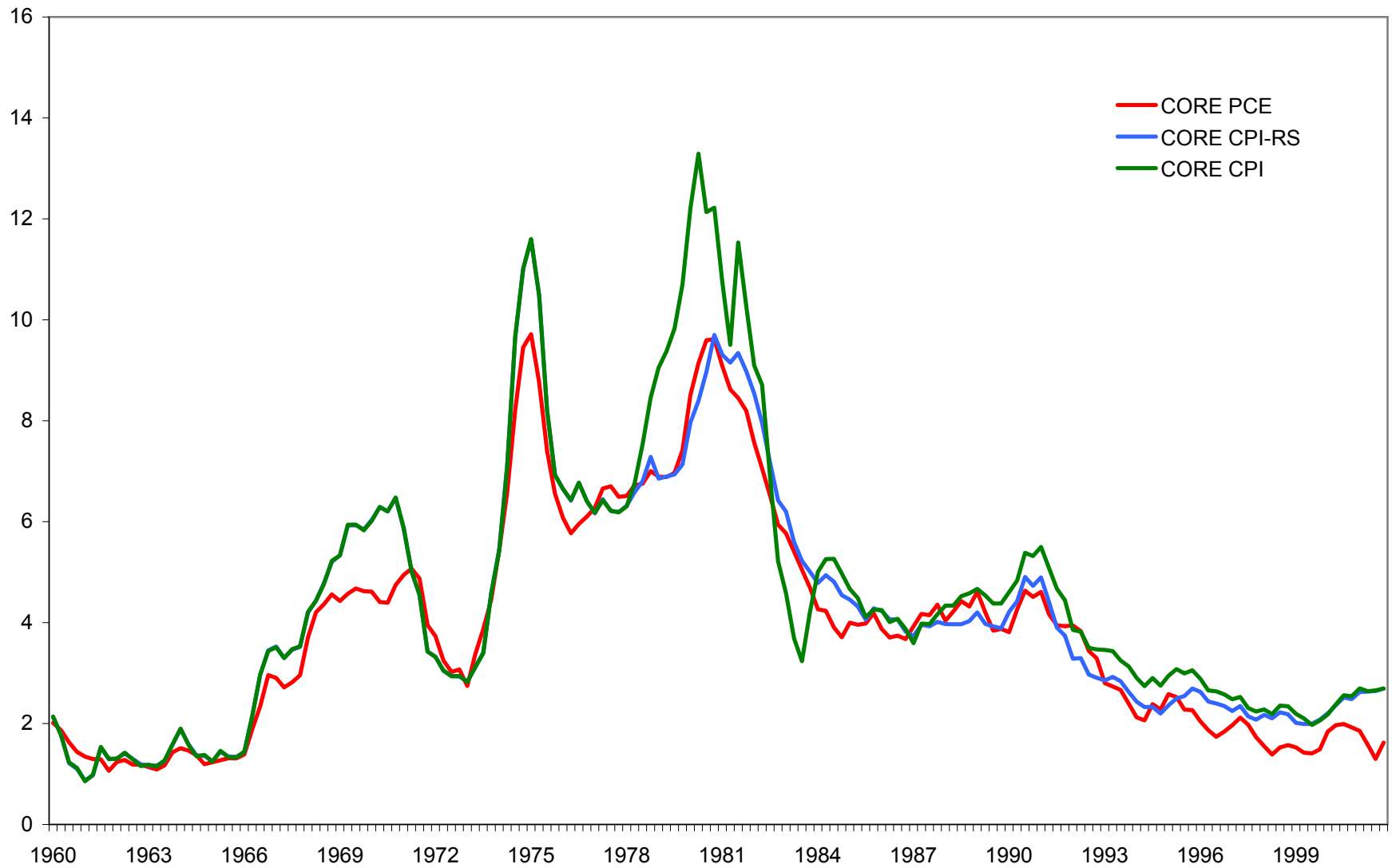


Figure 4
Actual Unemployment and
TV-NAIRUs for PCE and GDP Price Indexes, 1961-2000

