On the Death of the Phillips Curve

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There is no evidence of a Phillips curve showing a tradeoff between unemployment and inflation. The function for estimating the nonaccelerating inflation rate of unemployment (NAIRU) has been incorrectly formulated. Indeed, the unemployment rate is a *positive* function of the inflation rate with a lag of a year or two. An alternative formulation of the relation between unemployment and inflation leads to an estimate that the NAIRU is about 3.7 percent and can only be achieved by a sustained inflation rate of *zero*. Moreover, this relation appears to have been stable for over four decades.

The Simple Relation between Unemployment and Inflation

For several decades now, macroeconomists have confused each other, generations of students, and too many policymakers by their search for the elusive Phillips curve, a presumed *negative* relation between unemployment and inflation (Phillips 1958). For a while, U.S. data beginning in the late 1950s seemed consistent with the hypothesis that there is an inherent tradeoff between the unemployment rate and the inflation rate. The Phillips curve became the critical link between the nominal (current dollar) variables and the real (inflation-adjusted) variables in the new macroeconomic models developed during this period and was the basis for recommendations that policymakers should choose that point on this relation that minimizes the sum of the costs of unemployment and inflation. And since the cost of unemployment always seemed larger and more urgent to reduce than the cost of inflation, this perspective contributed some part of the rationalization for the policies that led to the higher inflation rates of the 1970s.

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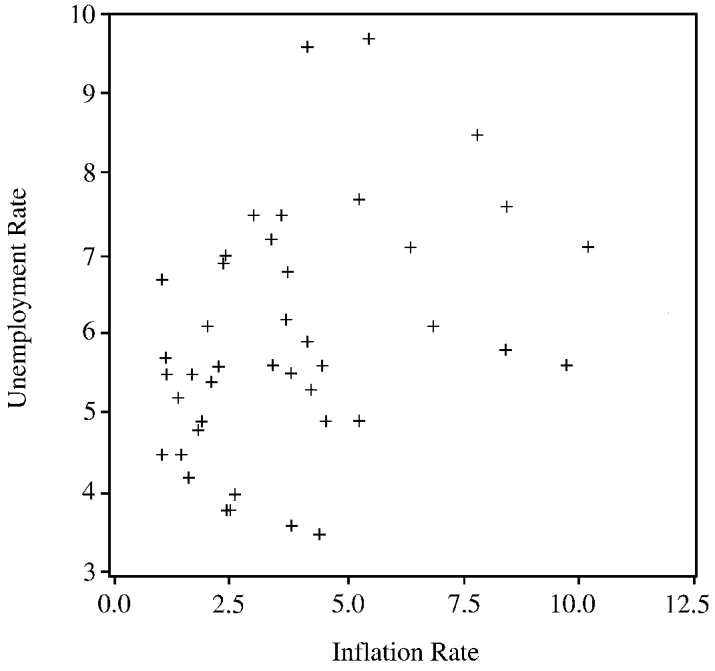
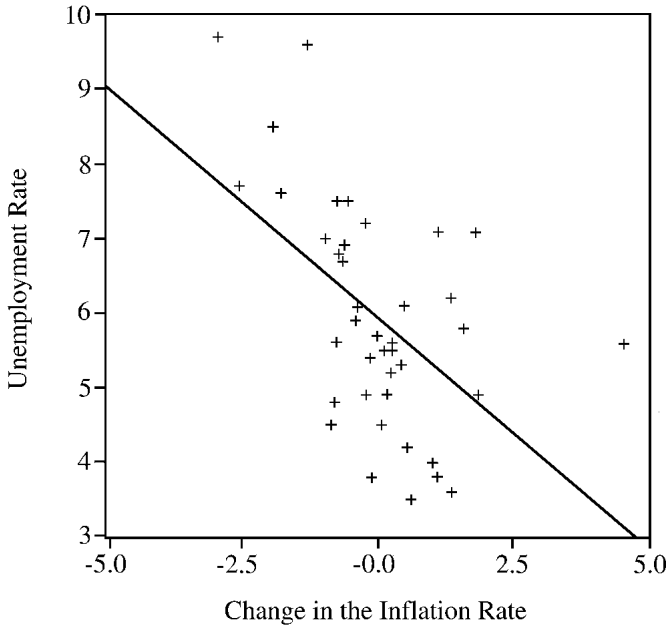
FIGURE 1
WHERE IS THE PHILLIPS CURVE?
1960–2001



But a strange thing happened on the road to this social engineering nirvana: Both inflation *and* unemployment increased in the 1970s, a condition that came to be described as "stagflation." This provoked an unproductive search for what might have caused the Phillips curve to shift; the favorite explanation at the time was the oil shock of the mid-1970s. But there was no obvious explanation consistent with a Phillips curve for the nearly continuous reduction of both unemployment and inflation after 1982. The futility of this search is illustrated by Figure 1, which presents the raw data on the unemployment rate and the inflation rate by year for the years 1960 through 2001, a relation that is close to white noise. The concept of a Phillips curve should be considered empty when most of the variation in the data must be explained by shifts in this presumed relation. In any case, the Phillips curve proved to be a poor basis for forecasting and a worse guide to policy.

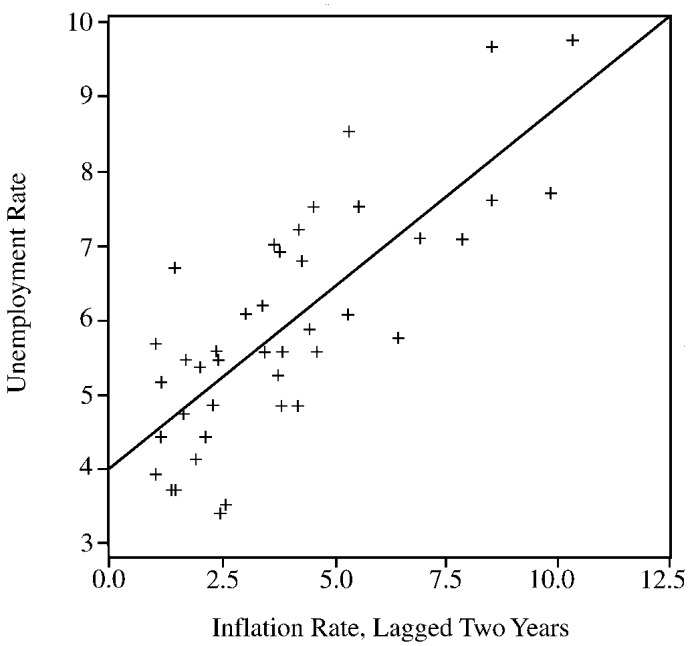
FIGURE 2
THE ELUSIVE NAIRU
1960–2001



The Elusive Search for the NAIRU

A more productive development was the reformulation of the Phillips curve by Ed Phelps (1967) and Milton Friedman (1968) as a negative relation between the unemployment rate and the *change* in the inflation rate. This formulation implies that the unemployment rate would decline in response to an *increase* in the inflation rate but would be invariant to any steady-state rate of inflation. As Figure 2 illustrates, there was at least a weak negative relation of the unemployment rate and the change in the inflation rate over the past four decades. This formulation led to a search for the lowest unemployment rate that could be maintained without an increase in the inflation rate, a number described by that dreadful acronym NAIRU. Figure 2 suggests that this rate is about 6 percent, but it also reveals that there has been a wide range of unemployment rates consistent with little change in the inflation rate. The U.S. unemployment rate, for example, ranged from 4 to 6 percent since 1994 with little variation in the inflation rate. The uncertainty about the NAIRU also led

FIGURE 3
THE LONG-TERM RELATION
1960–2001



to an unproductive search for what may have caused this relation to shift and reduced its value as a guide to policy.[1]

The Long-Term Relation between Unemployment and Inflation

The most important lesson from this examination is that there is a strong *positive* relation between the unemployment rate and the inflation rate lagged one or two years, as illustrated by Figure 3, a condition that Milton Friedman anticipated in his 1976 Nobel lecture (Friedman 1987). This finding is inconsistent with both the Phillips curve and the NAIRU reformulation of the relation between unemployment and inflation. There are at least several plausible reasons for a positive long-term relation between unemployment and inflation.

[1]For a summary of recent economic perspectives on this issue, see the 1997 Symposium in the *Journal of Economic Perspectives.*

First, since the tax code is not fully indexed, inflation increases effective tax rates, especially on the income from capital, and thus reduces output and employment. Second, inflation may confuse the relative price and wage signals on which an efficient labor market is dependent. Third, after a year or so, a high rate of inflation may trigger monetary restraint that temporarily increases the unemployment rate. The relative magnitude of these and other possible effects is not now known, but it is important not to dismiss this clear evidence of a positive long-term relation of unemployment and inflation.

A New Alternative Formulation

The relation between the unemployment rate and the inflation rate is better described by the following model:

$$(1)\ U^{*} = a - bI + cI_{-1} + u$$

$$(2)\ (U - U_{-1}) = d(U^{*} - U_{-1}) + v$$

$$(3)\ U = ad - bdI + cdI_{-1} + (1 - d)U_{-1} + (du + v).$$

Equation 1 expresses the equilibrium unemployment rate as a negative linear function of the current inflation rate and a positive linear function of the inflation rate lagged one year; this would be identical to the NAIRU relation if the coefficients *b* and *c* are equal. Equation 2 expresses the rate of change of the unemployment rate as a linear function of the difference between the equilibrium rate and the unemployment rate in the prior year; the actual rate converges on the equilibrium rate by the coefficient *d* per year. Equation 3, thus, is the result of inserting Equation 1 into Equation 2 and then solving for U.

An ordinary least squares regression on Equation 3 yields the following:

$$(4)\ U = 1.487 - .229I + .464I_{-1} + .594U_{-1} + (du + v)$$
$$\qquad\quad (.450)\ \ (.086)\ \ (.091)\ \ \ (.077)$$

Adjusted R-squared = .814
S.E.R = .642
Durbin-Watson = 1.955.

The sample is annual U.S. data from 1960 through 2001. The lessons from this regression are that there is a small negative relation between unemployment and inflation in the same year, a larger positive relation with the inflation rate in the prior year, and that the unemployment rate adjusts only slowly to the equilibrium rate. All of

the coefficient estimates are strongly significant, and this relation appears to have been stable over the whole sample.

An estimate of Equation 1 can then be derived from the above regression, yielding the following:

(5) $U^{*} = 3.672 - .564I + 1.144I_{-1} + u.$

The important lessons from this equation are that the level of the NAIRU has been stable over this period at about 3.7 percent, and that the only steady-state inflation rate consistent with this level of the unemployment rate is a *zero* rate.

Conclusion

The major lessons of this examination for macroeconomic policy are the following:

- There is *no* tradeoff of unemployment and inflation except in the same year.
- In the long term, the unemployment rate is a *positive* function of the inflation rate.
- The minimum sustainable unemployment rate is about *3.7* percent, and can be achieved only by a *zero* steady-state inflation rate.

In conclusion, a monetary policy targeted to achieve a steady growth of aggregate demand at a zero inflation rate is also consistent with the lowest possible sustainable unemployment rate.

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