

TESTING RATIONAL EXPECTATIONS: COMMENT

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THE "NEW CLASSICAL" macroeconomics associated in particular with the work of R. E. Lucas,¹ T. J. Sargent and Neil Wallace² and Robert J. Barro³ has as one of its starting points the Friedman-Phelps⁴ natural rate hypothesis about unemployment. These macro models, assuming rational expectations, attempt to explain why actual output or employment may deviate from its natural level.

In a recent article Professor E. Shostak offered evidence for South Africa that led him to accept the natural rate hypothesis and "strongly reject[s] the rational expectations proposition."⁵

Given the equation

$$(1) \quad U_t = \bar{U}_t + \beta_1 (P_t - E_{t-1} P_t) + \beta_2 E_{t-1} P_t$$

where U_t is the Unemployment rate at time t , \bar{U}_t the Natural rate of Unemployment at time t , P_t the actual inflation rate at time t and $E_{t-1} P_t$ the Rational Expectation of the inflation rate at time t given all information available at time $t-1$.

Shostak suggests that,

- (i) an insignificant β_1 would comply with the Rational Expectations hypothesis where "even in the short run we cannot have a trade-off between inflation and unemployment",⁶ and
- (ii) an insignificant β_2 supports the natural rate hypothesis.

Having found that β_1 was significantly negative and that β_2 was not significantly different from zero, Shostak drew the conclusions quoted above.

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- 1 Lucas, R. E., "Expectations and the Neutrality of Money", *Journal of Economic Theory*, April 1972, 4(2) pp. 102-24; and "Some International Evidence on Output-Inflation Tradeoffs", *American Economic Review*, June 1973, 63(3), pp. 326-34; and "An Equilibrium Model of the Business Cycle", *Journal of Political Economy Review*, 1975, 83(6), pp. 1113-44.
- 2 Sargent, J., *Rational Expectations, the Real Rate of Interest and the Natural Rate of Unemployment*, Brookings Papers on Economic Activity 1973 (2), pp. 429-72; and "A Classical Macroeconomic Model for the United States", *Journal of Political Economy*, April 1976, 84(2), pp. 207-37; Sargent, T. J., and Wallace, N., "Rational' Expectations, the Optimal Monetary Instrument and the Optimal Money Supply Rule", *Journal of Political Economy*, April 1975, 83(2), pp. 241-55.
- 3 Barro, R. J., "Rational Expectations and the Role of Monetary Policy", *Journal of Monetary Economics*, Jan. 1976, 2(1), pp. 1-32.
- 4 Friedman, M., "The Role of Monetary Policy", *American Economic Review*, March 1968, 58(1), pp. 1-17; Phelps, E. S., "Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time", *Economica*, N.S., August 1967, 34 (135), pp. 254-81.
- 5 Shostak, E., "The Natural Rate Hypothesis: An Econometric Test for the South African Economy", *South African Journal of Economics*, March 1981, 49 (1), p. 9.
- 6 Shostak, *op. cit.*, p. 3.

This note will explain why condition (i) above does not provide a test of rational expectations or (ii) of the natural rate hypothesis. It will be explained why, on the contrary, if anything, Shostak's results provide support for the central propositions of macro models incorporating rational expectations.

It is quite incorrect of Shostak to assert that "the relatively new Rational Expectations movement in economics has questioned the existence of the short-term Phillips curve."⁷

In a previous discussion of this issue one of the authors argued: "It is incorrect to assume that rational expectations regards errors in forecasts as insignificant or absent. The implication of rational expectations is rather that the forecast errors are not correlated with anything that could profitably be known when the forecast is made..."⁸

The primary literature referred to by Shostak does not provide support for the idea that rational expectations implies that

$$(2) \quad P_t = E_{t-1} P_t$$

and therefore β_1 of (1) is assumed equal to zero.

It was Muth's original contention that "Expectations since they are confirmed predictions of future events are essentially the same as the predictors of the relevant Economic theory."⁹ Thus if it is assumed that the price level grows at the same rate as the growth in the money supply M_t , then, including a stochastic error term ϵ_t for random occurrences, distributed say, $\epsilon \sim N(0, \sigma^2)$, i.e.,

$$(3) \quad P_t = M_t + \epsilon_t$$

Rational price expectations $E_{t-1} P_t$ would then be

$$(4) \quad E_{t-1} P_t = E_{t-1} M_t \quad (\text{since } E_{t-1} \epsilon_t = 0)$$

and so

$$(5) \quad P_t - E_{t-1} P_t = (M_t - E_{t-1} M_t) + \epsilon_t$$

Thus, given rational expectations, there exist two major sources of prospective price-prediction errors, namely random stochastic shocks ϵ_t as well as unanticipated policies — in this case, money supply policies.

In this particular example unexpected money supply developments can lead to unexpected price changes and so a deviation of actual real output or employment from its natural rate. The aggregate supply curves of the "New Classical" models take a form that conforms with the Phillips curve, i.e.,

$$(6) \quad Y - \bar{Y} = \beta_0 + \beta_1 (P_t - E_{t-1} P_t) + \epsilon_t$$

Y representing actual real output or employment and \bar{Y} the natural rate; β_1 of (6) is assumed to be positive,¹⁰ i.e. equivalent to a negative β_1 in (1). Equation (5) may be substituted into (6) to provide a reduced form with unexpected monetary policy as the driving force in the business cycle.

In his seminal work, Lucas (1973) provides an additional reason why Rational Expectations does not imply perfect information by postulating a model where "rational agents are placed in an economic setting in which they cannot distinguish relative from general price movements."¹¹ The important point demonstrated by this class of model is not that no (or "a minimal") short-run Phillips Curve exists, but rather that the short-run Phillips Curve that does exist cannot be exploited by policy-makers. An opponent of rational expectation, James Tobin, describes the theory as follows: "there is no [inflation-unemployment] tradeoff to systematic, anticipated macro policy. Policy surprises may confuse market participants, and distort their expectations, thus causing markets to clear at higher or lower employment rates. Such changes are short-lived; they last only until confusion dissipates."¹²

Thus it is contended that irrespective of the sample period rational expectations models do not imply that the β_1 's of (1) or (6) above be insignificantly different from zero. The β_1 's are assumed to respond to unexpected price developments ($P_t - E_{t-1} P_t$). The problem in undertaking tests of rational expectations lies in finding adequate proxies for the unobservable expected prices or expected policy variables. Robert J. Barro in perhaps the best known empirical test of rational expectations introduces his study in the following way: "The hypothesis that forms the basis of this empirical study is that only unanticipated movements in money supply affect real economic variables like the unemployment rate or the level of output."¹³

The test for β_2 in (1) is also flawed. Given the likelihood that expected inflation follows a similar trend to actual inflation (e.g. upward over the late 60s and 70s) it is not difficult to show that the natural rate hypothesis may well imply a positive and significant β_2 if \bar{U}_t , the natural rate of unemployment, is itself increasing. Such an increase is entirely consistent with Milton Friedman's Nobel lecture in which he explains the reasons for simultaneously higher inflation and lower growth rates in the 1970s.¹⁴ Higher inflation rates are thought of by Friedman to render market prices

10 See *inter alia* Lucas, R. E., Sargent, T. J., Barro, R. J., *op. cit.*

11 Lucas, R. E., (1973) *op. cit.*, p. 327.

12 Tobin, J., *Asset Accumulation and Economic Activity* (Chicago, Illinois: The University of Chicago Press: Oxford: Basil Blackwell, 1980). This particular reference is taken from a draft copy of the lectures. Lecture II, p. 15.

13 Barro, R. J., "Unanticipated Monetary Growth and Unemployment in the United States", *American Economic Review*, March 1977, 67 (2), p. 101.

14 Friedman, M., Nobel Lecture, "Inflation and Unemployment", *Journal of Political Economy*, June 1977, 85 (3), pp. 451-72.

7 Shostak, *op. cit.*, p. 1.

8 Kantor, B., "Rational Expectations and Economic Thought", *Journal of Economic Literature*, December 1979, 17 (4), p. 1430.

9 Muth, J. F., "Rational Expectations and the Theory of Price Movements", *Econometrica*, July 1961, 29

less efficient as a system for co-ordinating economic activity and thus higher rates of inflation are associated with a higher natural rate of unemployment.

Thus had β_2 (in (1)) been significant, this significance might have only reflected an increasing natural rate of unemployment, U_t (and therefore U_t), associated with a higher actual inflation rate P_t (and an increase in the expected rate of inflation $E_{t-1}P_t$).

Both the natural rate of unemployment and rational price expectations are not directly observable and hence have to be modelled and estimated. Shostak used two particular autoregressive models to estimate rational expectations. He did not explain why these two schemes should represent rational price expectations rather than some alternative formulation which may have provided superior "fits". Rational expectations should have certain properties; for one, they should use all relevant information available at time $t-1$. Should pure statistical forecasting procedures perform at least as well as predictions based on economic theory, then this could justify the use of time series models as representing the basis for rational expectations. Shostak could have used Box-Jenkins procedures so that all information in past prices — if nothing else — was used to establish expected prices. If however we accept Shostak's rational expectations proxies, it would have been helpful had Shostak re-estimated his proxies on lengthening the sample period. The R^2 value of these re-estimated autoregressive schemes might then have been used to determine how much additional information was given by increasing the sample period.

Obtaining suitable proxies for both the natural rate of unemployment and rational price expectations make it extremely difficult to test rational expectations conclusively. However, in our judgment Mr Shostak's methodology is not satisfactory both on theoretical and empirical grounds.

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