

WORKING PAPERS IN ECONOMICS

SOME FURTHER EVIDENCE ON THE POLICY
INEFFECTIVENESS PROPOSITION*

by

H. BHASKARA RAO

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ABSTRACT

In the empirical literature on the new classical model and its criticisms, the unemployment equation received much attention. In this paper we shall examine the validity of the new classical policy ineffectiveness proposition, using the output equation. Non-nested hypothesis tests are used to evaluate the Keynesian and new classical output equations. Our results, based on the U.S. data, show that the new classical model and the policy ineffectiveness proposition are conclusively rejected by the Keynesian model for the periods 1946-1985 and 1946-1989.

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SOME FURTHER EVIDENCE ON THE POLICY INEFFECTIVENESS PROPOSITION*

B.BHASKARA RAO

1. INTRODUCTION

The pioneering and influential papers by Barro (1977, 1978, 1981) have induced a number of empirical and theoretical investigations into the new classical model and the policy ineffectiveness proposition (PIP hereafter). While in several empirical works PIP was found to be valid, an equally large number of works raised doubts on the ability of the new classical model to explain the business cycle and the relevance of PIP; for a survey of this literature see Attfield, Demery and Duck (1985), Shaw (1987), Fischer (1988), Hoover (1988), McCallum (1989) and Mankiw (1990). The main thrust of the criticisms of the new classical model and PIP was directed at two of its key assumptions. Buiter (1981), for example, showed that if the price level does not fully adjust to clear the market within the unit time period, fully anticipated policies do affect

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the real variables. Various other critiques found it difficult to believe that a lack of information about current nominal variables, particularly the price level, can be the main source of the business cycle.

Empirical works, critical of the new classical model, have used various methodological approaches. In Carns and Lombra (1983) and Mishkin (1983) alternative sets of data and/or more general lag structures were used to show that unanticipated changes in money supply play only a small role in explaining deviations of output from its natural level. Gordon (1982) showed that price level adjustments in the U.S.A. are very sluggish. Alogoskoufis and Pissarides (1983), Horne and McDonald (1984) and Rao and Srivastava (1989) have developed variants of the Buiter model. In these models the new classical assumption that the price level is fully flexible and the alternative that price adjustment is sluggish are nested hypotheses. They have found that price adjustments are very sluggish in U.K. and Australia. Subsequently, Rao and Srivastava (1990) have developed a disequilibrium version of the goods market model for the U.K. and found that adjustment in the rate of inflation is sluggish for the period 1950–1989. An interesting aspect of this model is that it has estimated the structure of the underlying aggregate demand and supply model and found that it is reasonably well determined. In contrast, much of the empirical literature in this area is based on the reduced form estimation methods. Finally, Pesaran (1982, 1988) has used various non-nested hypothesis tests to reject the new classical model for the United States.

In this paper we shall extend Pesaran's non-nested hypothesis tests to evaluate the new classical and Keynesian models. Pesaran (1982) has used the Barro (1977) money forecasting and unemployment equations but the money forecasting equation was slightly modified. Subsequently Rush and Waldo (1988) have criticised Pesaran for ignoring the effects of the end of World War II in his money forecasting equation. When this effect was taken into account, the new classical model conclusively rejected the Keynesian model. In his reply Pesaran (1988) also took into account the effects of the end of the war in his Keynesian unemployment equation. With this modification he showed that the Keynesian model conclusively rejected the new classical model.

Even though the Pesaran–Rush–Waldo controversy is valuable, it has left an important gap. It is well-known that Barro (1978, 1981) has also estimated the new classical versions of the output and price equations to demonstrate the validity of PIP. But neither of these equations received attention in the aforesaid work based on the non-nested hypothesis tests. Therefore, in this paper, we shall examine the validity of PIP, utilising the new classical and Keynesian output equations. We have, however, ignored the price equation because it is hard to agree on what should be the specification of the Keynesian version. A variety of price determination processes can be added to the Keynesian IS–LM model. In contrast, the reduced form output equation of the IS–LM model is widely accepted as the Keynesian output equation.

It is worth anticipating the main conclusions of this

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paper. Our results show that the Keynesian output equation conclusively rejects the new classical equation for the period 1946–1985 as well as for the extended period of 1946–1989. Furthermore, these conclusions hold whether or not the Pesaran–Rush–Waldo modifications to the original Barro money forecasting equation are made.

2. OUTPUT EQUATIONS

Our specification of the new classical output equation is based on Barro (1981) which updated Barro (1977, 1978). Barro estimated this equation both in the level as well as in the first difference form. The specifications used by him are

$$\log(Y_t) = a_0 + a_1 DMR_t + a_2 DMR_{t-1} + a_3 \log(G_t) + a_4 t + e_{1t} \quad (1)$$

$$\Delta \log(Y_t) = b_0 + b_1 \Delta DMR_t + b_2 \Delta DMR_{t-1} + b_3 \Delta \log(G_t) + e_{2t} \quad (2)$$

where Y is real *GNP*, DMR are the residuals of the money forecasting equation, G is real government expenditure, t is time and e_1 and e_2 are disturbances with the usual classical properties. DMR are obtained by Barro as the residuals of the following first stage money forecasting equation

$$\Delta \log(M_t) = \alpha_0 + \alpha_1 \Delta \log(M_{t-1}) + \alpha_2 \Delta \log(M_{t-2}) + \alpha_3 FEDV_t + \alpha_4 UN_{t-1} + e_{3t} \quad (3)$$

In the above equation M_t is money supply (M_t), $FEDV$ is the deviation of the log of the real federal expenditure from the log of its trend value, UN is a measure of unemployment given by $\log[U/(1-U)]$ where U is the unemployment rate and e_3 is the disturbance term. The definitions of the variables and sources of data are as in Barro (1981) and Pesaran (1982).

Even though either of these output equations can be combined with the money forecasting equation to test PIP, it should be noted that Nelson and Plosser (1982) have shown that a wide range of historical time series for the U.S. economy can be characterised as random walks with drift. Therefore, to minimise the possibility of spurious correlations, as well as to conserve space, we shall report in the text only estimates based on the first difference of the output equation.¹ Barro (1981, p.145) has also given a similar justification for his first differences output equation,

¹ See Nelson and Kang (1984) and Dickey, Bell and Miller (1986) for a justification for estimation with the differenced variables. The latter point out that the consequences of unnecessary differencing are far less serious than doing nothing or removal of a linear trend. Estimates of parameters based on differencing are inefficient but unbiased and consistent.

Furthermore, we were unable to replicate Barro's estimates of the new classical level of output equation. When we estimated this equation, as in Barro (1981, pp.140-4), for 1946–1978 with the residuals from the money forecasting equation for the period 1941–1978, the coefficient of $\log(G_t)$ was insignificant. This might be partly due to subsequent revisions to the official U.S. data. However, our estimate in the first difference form was broadly in agreement with those

on the basis of the results in Plosser and Schwart (1978).

Barro (1981, p.140) also estimated an alternative non-new classical output equation in which the level of real output is assumed to depend on the current and four lagged changes in nominal money supply, real government expenditure and a trend variable. In comparison to his new classical output equations, the coefficients of this equation are poorly determined. As a first approximation this was interpreted by him as evidence in favour of his new classical approach. However, we are inclined to treat this equation as an *ad hoc* albeit a useful alternative output equation but not as the Keynesian output equation. As noted earlier, the Keynesian output equation should be derived as the reduced form output equation of the IS-LM model. Therefore, in its simplest form, real output should depend on the real and not nominal money supply, real government expenditure and other exogenous variables of the IS-LM model. Some experimentation with data for the period 1946-1985 showed that the following first differences version for this equation is satisfactory

$$\Delta \log(Y_t) = \beta_0 + \beta_1 \Delta \log(M_t/P_t) + \beta_2 \Delta \log(G_t) + \beta_3 \Delta UN_t + e_{4t} \quad (4)$$

where P_t is the price level and e_{4t} is the disturbance with the usual classical properties.

A variant of the above equation in which the lagged change in the rate of interest ΔR_{t-1} is used to replace ΔUN_t of Barro (1981, p.145) and we could easily replicate various results in Pesaran (1988).

is also well determined but it has a slightly inferior fit. When both variables are included, the coefficient of ΔR_{t-1} became insignificant.

The justification for the including ΔUN_t and/or ΔR_{t-1} in the output equation is as follows. The lagged interest rate variable becomes an exogenous variable in the IS-LM model, if interest sensitive expenditures respond with a lag to changes in the interest rate. The justification for the unemployment variable is less well-known. In the light of the developments in the disequilibrium economics, it can be argued that ΔUN_t may be serving as a simple proxy to capture the labour market spillover effects on the goods market. Therefore β_3 should be negative.

It should be noted, however, that ΔUN_t depends on $\Delta \log(Y_t)$ through the well-known Okun's law. To overcome the endogenous variable bias, the predicted values of ΔUN_t are used in our empirical work.²

3. EMPIRICAL ESTIMATES

The OLS estimate of the Keynesian and new classical output equations, given by (2) and (4), for the periods 1946-1985 and 1946-1989 are given below in Table 1. The original Barro (1981) specification of the money forecasting equation is used to obtain DMR for the new classical output equations.

The DW statistic of the Keynesian output equation for 1946-1985 fell into the inconclusive region. Therefore, this

² The exogenous variables $\Delta \log(G_t)$ and ΔR_{t-1} are used as instruments. $\Delta \log(M_t/P_t)$ was found to be insignificant.

equation has been reestimated, after allowing for the first order serial correlation process in its residuals and are given by (5) in Table 1. However, it should be pointed that the estimates without this adjustment, are virtually identical to those reported above. But the coefficient of the government expenditure was significant only at a slightly higher level than the 10% level. The *DW* statistics of equations (6) to (8) indicate absence of serial correlation in their residuals.

It can be seen from the estimates in Table 1 that the coefficients of both the Keynesian output equations are well determined and significant. While the coefficients of the new classical equation for 1946-85 are also well determined and significant, the coefficients of both money surprise variables are insignificant in the equation for 1946-1989. The only significant coefficients in this equation are the intercept and that of $\Delta \log(G_t)$.³

The usual comparison between the summary statistics of these alternative equations clearly favours the Keynesian equation for the longer sample period. For 1946-1985, however, both the Keynesian and new classical equations seem to be equally satisfactory. But, on the basis of the \bar{R}^2 , the Keynesian equation can be said to be marginally superior.

³ It should be noted that the *t* ratios of the coefficients of the new classical equations are subject to what is known as the 'generated regressor' problem. In general these *t* ratios are overestimates. Therefore, the significance of the new classical equations is somewhat overstated.

TABLE 1
ESTIMATES OF THE OUTPUT EQUATIONS

	KEYNESIAN		NEW CLASSICAL	
	1946-1985	1946-1989	1946-1985	1946-1989
	(5)	(6)	(7)	(8)
<i>Const.</i>	0.030 (10.67)*	0.029 (8.02)*	0.026 (6.47)*	0.027 (7.08)*
$\Delta \log(M/P)_t$	0.302 (2.81)*	0.190 (1.67)**		
ΔDMR_t			0.428 (2.00)*	0.189 (1.09)
ΔDMR_{t-1}			0.346 (1.68)**	0.200 (1.19)
$\Delta \log(G_t)$	0.039 (1.89)**	0.055 (2.16)*	0.126 (7.69)*	0.121 (7.46)*
ΔUN_t	-0.097 (3.35)*	-0.027 (2.13)*		
\bar{R}^2	0.74	0.67	0.62	0.59
<i>DW</i>	1.98	2.35	2.19	2.15
$\hat{\rho}_1$	-0.27 (1.78)**			
<i>SEE</i>	0.02	0.02	0.03	0.03

Notes

* significant at 5% level. ** significant at 10% level.

ated regressor' problem. In general these *t* ratios are overestimates. Therefore, the significance of the new classical equations is somewhat overstated.

Before we draw any firm conclusions, we shall subject these equations to the non-nested hypothesis tests. But prior to this, we should briefly explain the nature of the Pesaran-Rush-Waldo modifications to the money forecasting equation, because they seem to underlie the differences in the conclusions of Pesaran (1982, 1988) and Rush and Waldo (1988). Pesaran (1982) pointed out that the presence of $FEDV_t$ in the Barro money forecasting equation implies that information on $FEDV_t$ is available to the agents at the time they form an expectation about $\Delta \log(M_t)$. Thus the Barro equation has the somewhat unrealistic implication that agents correctly forecast $FEDV_t$. Pesaran (1982), therefore, replaced $FEDV_t$ with its expected value in his modified money forecasting equation. This would imply that the residuals in the new money forecasting equation DMR_t^P can be computed from the residuals of the Barro equation DMR_t^B as follows

$$DMR_t^P = DMR_t^B + \hat{\alpha}_3(0.8DGR_t). \quad (9)$$

In the above equation $\hat{\alpha}_3$ is the estimated coefficient of $FEDV_t$ in (2) and DGR_t are the residuals from the following government expenditure forecasting equation of Pesaran (1982, p.546)

$$\Delta \log(G_t) = \delta_0 + \delta_1 * \Delta \log(G_{t-1}) + \delta_2 UN_{t-1} + e_{5t}, \quad (10)$$

where e_5 is the disturbance term with the usual properties.

Subsequently, Rush and Waldo (1988) argued that Pesaran (1982) has ignored the effects of the end of World

War II in the above equation. Therefore, they included a $WANI$ dummy variable into equation (10). Since these modifications have significantly affected the relative merits of the new classical and Keynesian approaches, we shall use all the three variants of the money forecasting equation in our non-nested hypothesis tests. The new classical model with the Barro money forecasting equation is denoted as NC1. The models based on the Pesaran and the Rush and Waldo modifications are denoted as NC2 and NC3 respectively. Estimates of α_3 are obtained from our estimates of the Barro money forecasting equation for the two sample periods. Data-FIT of Pesaran and Pesaran (1987) has been used to compute the test statistics and these are given in Tables 2 and 3 below.⁴

The first three test statistics are distributed as $N \sim (0,1)$ in the large samples and the fourth one has a F distribution, with the degrees of freedom in the parentheses. AIC and $SBIC$ are the Akaike information criterion and the Schwarz Bayesian information criterion respectively. When these statistics are positive, the model assumed to be true under the null hypothesis should be accepted.

⁴ For 1946-1985, estimates of the Keynesian equation without the serial correlation transformation has been used. As pointed out, these are virtually identical to those in equation (5). Furthermore, test procedures with the serial correlation transformation are not available in Data-FIT.

TABLE 2*
Sample Period 1946-1985

	K/NC1	NC1/K	K/NC2	NC2/K	K/NC3	NC3/K
\bar{N} - test	-1.16	-6.47	-0.65	-7.00	0.10	-6.94
W - test	-1.12	-5.38	-0.64	-5.82	0.10	-5.76
JA - test	1.38	3.84	-0.25	4.10	0.99	4.35
F - test	0.94	7.25	1.82	10.25	0.94	7.25
	(2, 34)	(2, 34)	(2, 34)	(2, 34)	(2, 34)	(2, 34)
K vs NC1 $AIC = 6.03$ and $SBIC = 6.03$						
K vs NC2 $AIC = 7.40$ and $SBIC = 7.40$						
K vs NC3 $AIC = 7.84$ and $SBIC = 7.84$						

Notes

* K/NC1 means that the Keynesian model is tested against the new classical model NC1. NC1/K to NC3/K should be interpreted in a similar manner.

TABLE 3*
Sample Period 1946-1989

	K/NC1	NC1/K	K/NC2	NC2/K	K/NC3	NC3/K
\bar{N} - test	0.33	-4.02	0.48	-4.41	0.79	-4.37
W - test	0.33	-3.61	0.49	-3.96	0.81	-3.92
JA - test	0.15	3.08	-0.48	2.96	-0.85	1.85
F - test	0.07	4.68	0.73	6.05	0.75	6.42
	(2, 38)	(2, 38)	(2, 38)	(2, 38)	(2, 38)	(2, 38)
K vs NC1 $AIC = 4.77$ and $SBIC = 4.77$						
K vs NC2 $AIC = 5.26$ and $SBIC = 5.26$						
K vs NC3 $AIC = 5.56$ and $SBIC = 5.56$						

* See notes for Table 2

It can be seen from the estimated values of these statistics, in Tables 2 and 3, that all of them unequivocally reject at the 5% level the three versions of the new classical output equation in favour of the Keynesian alternative. Only the JA statistic for 1946-1989 failed to reject, at the 5% level but not at the 10% level, the Rush-Waldo version of the new classical model against the Keynesian model. Our results thus provide strong support to the Keynesian output equation. None of the Pesaran-Rush-Waldo modifications could alter our conclusion.

4. CONCLUSIONS

In this paper we have used a widely accepted version of the Keynesian output equation and evaluated its relative merits with respect to the Barro new classical output equation. All the non-nested hypothesis tests unequivocally rejected the new classical approach against our Keynesian alternative. Our findings thus lend strong support to Pesaran's (1982, 1988) findings based on an analysis of the unemployment equations. Together they imply that fully anticipated changes in money do effect the real variables in the U.S. economy and therefore the policy ineffectiveness proposition is invalid.

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