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The Relation Between Output, Anticipated and Unanticipated Monetary Policy in Iraq*

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This paper is a test of the policy ineffectiveness hypothesis using quarterly data from Iraq. This hypothesis claims that only unanticipated component of money growth affects the level of real output. The empirical results obtained indicate that both anticipated and unanticipated components of money growth significantly affect the level of real output. The empirical results further indicate that raw money growth has a significant and positive impact on real output. These empirical results are at odds with the essence of the policy ineffectiveness hypothesis.

I. Introduction

In recent years, the consolidation of the rational expectations hypothesis with the model of the natural rate of unemployment paved the way for some important evolutions in monetary theory and policy. Recent studies have emerged and old issues have been reexamined under a new paradigm. The policy ineffectiveness hypothesis associated with Lucas (1973) and Sargent and Wallace (1975) contends that only unexpected changes in the money supply affect real variables. Expected movements in the money supply are neutral both in the short and in the long run. This is due to the fact that economic agents with restricted information may interpret the price movements induced by the unexpected component of money growth as a relative price change, they will therefore increase their output.[1] In this regard, Barro (1977, 1978, 1981) and Barro and Rush

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1 Lucas (1973).

arranged as follows. Section 2 presents the methodology to be employed and discusses the empirical results. Section 3 comprises a summary and some concluding remarks.

II. Methodology and Empirical Results

Following Barro's (1977) approach, the basic format of test on the policy ineffectiveness hypothesis is to specify a model of real economic activity as a function of anticipated and unanticipated money growth, plus other factors proper to deciding the level of real output.[3] Since anticipated and unanticipated components of money growth are unobservable variables, in order to implement the test, I have to specify a money growth equation in order to decompose actual money growth into its anticipated and unanticipated parts. The monetary instrument explored here is the proportional growth in the money supply ln (M_t/M_{t-1}). The measure of money stock used in the present study is the narrow definition of money stock which consists of currency plus demand deposits.[4] The reason for using the narrow definition of money stock is that an organized market for bonds does not exist in Iraq. To initiate the sequence of anticipated money growth, I have to identify the macro variables that impact monetary policy. Unfortunately, I do not have a properly developed theory to predict money growth in Iraq, although the following intuitions

Bank of Iraq did not publish any data for money supply, prices, GNP, etc., for the period 1977: 4-1990:1. Iraq's Central Bank governer stated, "we don't issue any figures. The last time we issued quarterly figures was before 1979.... and up to now we have not published any because peace is not yet formalised." For more details, see The Middle East, April 1990, pp. 8-10.

3 This general estimation procedure has been mentioned to in the literature as a two-step procedure. However, it is important to note that some economists (i.e., Pagan (1984)) have suggested that this method may confer biased test statistics, though it yields consistent parameter estimates. An alternative method, namely, the joint estimation procedure, utilized by Mishkin (1982a, 1982b), Abel and Mishkin (1983), comprises estimating both the money growth forecasting equation and the out-put equation as a simultaneous system, which is hypothesized to generate more efficient parameter estimates. Nevertheless, in their 1982 study, Hoffman, Low and Schlagenhauf showed that the joint estimation procedure is not absolutely exceptional to the two-step procedure in deciding the infraction or existence of neutrality of expected money growth variables. It is also interesting to report that Barro estimated some of his preceding models utilizing the joint estimation method proposed by Abel and Mishkin. He noticed that expected money and output specifications were comparable to those in two-step estimation. His findings relating to the neutrality of expected money were not varied. For more information, see Barro and Rush (1980).

4 In a further effort, equation (1) has been estimated by replacing M1 with M2. The results obtained were similar to those reported in Table 1.

gest that the two periods lagged coefficient on unemployment (UN_{t-2}) turned out to be positive and statistically different from zero at the 5 percent level of significance. The coefficient of determination ($R^2 = 0.684$) indicates that the regressors of the money growth equation explain a sizable portion of the variation in money growth. The Durbin's h-statistic value of 0.2839 suggests the absence of first-order serial correlation in the residuals. The Chow (1960) stability test was employed to examine the structural stability of money growth forecasting equation. Utilizing the midpoint as the breaking date,[8] the computed F-value is 1.049. At the 5 percent level of significance, the critical F-value is 2.34. These results indicate that the money growth forecasting equation is structurally stable.

The second step of the testing procedure is the estimation of the output equation. The aim of this estimation is to assess the output responses to the anticipated and unanticipated money growth. Therefore, following

Table 1

MONEY GROWTH EQUATION FOR IRAQ
THE DEPENDENT VARIABLE IS $\ln(M_t / M_{t-1})$

Variables	Estimates
constant	−0.0358
	(−0.707)
$\ln(M_{t-1} / M_{t-2})$	0.0595
	(0.455)
$\ln GOV_{t-1}$	0.0151
	(2.037)*
$\ln UN_{t-1}$	−0.0136
	(−1.408)
$\ln UN_{t-2}$	0.0183
	(1.879)*
$R^2 = 0.684$, S.E. = 0.126845,	Durbin h = 0.2839

t-values are in parentheses.
* indicates significance at the 5% level.

8 The main justification for selection the midpoint as the spliting date was based on the finding by Farley, Hinich and McGuire (1975) who suggested that the Chow test was excellent at the midpoint.

Table 2

MAXIMUM LIKELIHOOD ESTIMATES OF EQUATION (2)
THE DEPENDENT VARIABLE IS $\ln Y_t$

	Anticipated Money Growth	Unanticipated Money Growth
$a = 6.71$	$c_0 = 2.98$ (3.96)*	$d_0 = 0.04$ (0.25)
(150.2)*	$c_1 = 5.52$ (8.11)*	$d_1 = 0.21$ (0.72)
$t = .0004$	$c_2 = 5.57$ (8.57)*	$d_2 = 0.66$ (1.74)*
(0.692)	$c_3 = 5.26$ (7.55)*	$d_3 = 1.07$ (2.54)*
$CHP = -.007$	$c_4 = 4.84$ (6.98)*	$d_4 = 0.97$ (2.68)*
(−.082)	$c_5 = 2.74$ (3.98)*	$d_5 = 0.48$ (2.18)*
	$\rho_1 = -1.71$ (−9.63)	
	$\rho_2 = 0.98$ (3.33)	
	$\rho_3 = -0.03$ (−.19)	
$R^2 = 0.996$, S.E. = 0.056351, D-W = 1.87.		

t-values are in parentheses.
* indicates significance at the 5% level.
ρ's represent autoregressive parameters.
t represents time trend variable.
CHP represents inflation rate.

lagged coefficients on the unanticipated component of money growth.

Table 4 comprises the ordinary least squares (OLS) estimates of equation (2) in which longer lags (20) of anticipated and unanticipated money growth are used as independent variables. The results indicate that some of the coefficients on both anticipated and unanticipated money growth are significantly different from zero at the 5 percent level of significance.

These empirical findings are inconsistent with the implication of the policy ineffectiveness hypothesis, which claims that the elementary impacts of anticipated money growth on the level of real output must be smaller than the elementary impacts of unanticipated money growth.[12] The empirical findings of the present study tend to deny the policy ineffectiveness hypothesis. The results show that the initial impacts of the anticipated money growth is statistically more significant than that of unanticipated money growth.

12 See Makin (1982), p. 129.

Table 4

ORDINARY LEAST SQUARES (OLS) ESTIMATES OF EQUATION (2)
THE DEPENDENT VARIABLE IS $\ln Y_t$

	Anticipated Money Growth	Unanticipated Money Growth
a = 6.47	c_0 = 10.6 (0.24)	d_0 = −0.69 (−0.95)
(15.9)*	c_1 = 19.7 (1.41)	d_1 = −2.83 (−1.24)
t = 0.039	c_2 = −13.9 (0.39)	d_2 = −2.94 (−1.02)
(1.287)	c_3 = −0.44 (−0.15)	d_3 = −0.72 (−0.18)
CHP = −.702	c_4 = 51.4 (4.13)*	d_4 = 1.87 (0.96)
(−.953)	c_5 = 1.22 (0.02)	d_5 = 5.81 (1.92)*
	c_6 = −23.32 (−1.2)	d_6 = −2.89 (−0.33)
	c_7 = 32.26 (1.38)	d_7 = −1.56 (−0.41)
	c_8 = 7.18 (0.144)	d_8 = −5.81 (−1.49)
	c_9 = −2.93 (−0.16)	d_9 = −2.88 (−0.31)
	c_{10} = 10.79 (3.12)*	d_{10} = −0.78 (−0.18)
	c_{11} = −1.88 (−0.13)	d_{11} = −3.75 (−0.91)
	c_{12} = −8.38 (−0.87)	d_{12} = 5.11 (0.84)
	c_{13} = 13.72 (1.39)	d_{13} = 4.22 (0.89)
	c_{14} = −0.17 (−0.09)	d_{14} = 5.78 (1.90)*
	c_{15} = −9.02 (−0.98)	d_{15} = 6.29 (0.93)
	c_{16} = 1.22 (0.10)	d_{16} = −3.49 (−0.45)
	c_{17} = 4.07 (0.71)	d_{17} = −3.92 (−0.65)
	c_{18} = −3.45 (−1.08)	d_{18} = −4.12 (−0.59)
	c_{19} = 2.05 (0.36)	d_{19} = 0.58 (0.11)
	c_{20} = −1.83 (−0.61)	d_{20} = 0.46 (0.34)

R^2 = 0.999, S.E. = 0.000708, D–W = 2.01

t-values are in parentheses.
* indicates significance at the 5% level.
t represents time trend variable.
CHP represents inflation rate.

Table 5

CALCULATED F-STATISTICS FOR STRUCTURAL
STABLITY FOR THE OUTPUT EQUATION (2)

No. of Lags	Calculated F-Value	Critical F-Value
5	1.42	1.98
7	1.63	2.07
20	1.81	1.94

Table 6

THE YULE-WALKER NONITERATIVE PROCEDURE
ESTIMATES OF EQUATION (3). THE DEPENDENT IS ln Y_t

Variables	Estimates
Intercept	6.6761 (132.19)*
time	0.0134 (7.04)*
CHP	–0.1761 (–0.64)
ln MG_t	0.399 (1.27)
ln MG_{t-1}	0.851 (2.48)*
ln MG_{t-2}	1.196 (3.22)*
ln MG_{t-3}	1.653 (4.36)*
ln MG_{t-4}	0.989 (2.63)*
ln MG_{t-5}	0.806 (2.26)*
ln MG_{t-6}	0.543 (1.47)
ln MG_{t-7}	1.359 (3.76)*
ln MG_{t-8}	1.446 (4.04)*
ln MG_{t-9}	1.552 (4.31)*
ln MG_{t-10}	1.593 (4.16)*
ρ_1	–0.619 (–3.87)
ρ_2	0.087 (0.461)
ρ_3	0.019 (0.119)
$R^2 = 0.985$, S.E. = 0.180952	

t-values are in parentheses.
* indicates significance at the 5% level.
ρ's represent autoregressive parameters.
CHP represents inflation rate.

money supply (MG) exert a significant and positive effect on the level of real output.

The results from the Chow (1960) test, taking the mid-point as the breaking date, suggest that the hypothesis of structural stability cannot be rejected at the 5 percent level of significance (calculated F-value = 1.2, and the critical F-value = 1.93).

I further estimated equation (3), following Nelson and Plosser (1982), by replacing the natural level of real output (Y_t^*) with the lagged value of the dependent variable which is used to represent the nonstationary in output. Nelson and Plosser (1982) call this the difference stationary (DS) method of detrending.

It is clear from the empirical results shown in Tables 6 and 7 that raw money growth exerts a significant and positive effect on the level of real output in the short run.

III. Summary and Some Concluding Remarks

This study has examined empirically the validity of the policy ineffectiveness hypothesis in Iraq over the quarterly period 1961:1 to 1977:3. I specified an equation to predict money growth. With a different lag length, the anticipated and unanticipated components of money growth were then used in the output equation (2). The empirical results indicate that both anticipated and unanticipated components of money growth exert a significant and positive effect on the level of real output. The results further suggest that the anticipated component of money growth has a stronger impact on the level of real output than the unanticipated component of money growth. The results also indicate that both anticipated and unanticipated components of money growth stimulate a positive deviation of real output from the natural rate. These empirical findings were discovered to be inconsistent with the tenor of the policy ineffectiveness hypothesis, which contends that only the unanticipated money growth matters. This suggests that anticipated monetary policy could play a significant role in affecting the level of real output.

Furthermore, the empirical findings suggest that raw money growth has a significant and positive impact on the level of real output. This implies that (anticipated) monetary policy is not neutral.

Appendix

Definition of the Variables and Sources of Data

ln $(M_t/M_{t-1}$ = The proportional growth in the money supply. M represents the M1 concept of the money stock.

GOV = The real expenditure of federal government (I used government consumption as a proxy for this variable).

RES = The value of international reserves.

Y = Real gross national product.

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