NOTES

ANTICIPATED FISCAL POLICY AND REAL OUTPUT

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Abstract—The paper investigates empirically the effects of a measure of anticipated and unanticipated fiscal policy on real output. The fiscal measure employed is the change in real high-employment surplus scaled by real potential output.

The evidence indicates that both anticipated and unanticipated fiscal actions affect real output. The results do not provide any direct evidence on the appropriateness of the assumption of rational expectation formation; in fact, they are consistent with a rational expectations model with sticky wages or prices. They also cast doubt on the appropriateness of models that impose rationality and short-run neutrality.

I. Introduction

Although the effects of anticipated and unanticipated money growth on real variables have been subjected to extensive empirical examination (see Barro (1977), Mishkin (1982a, b), and Makin (1982)), the effects of anticipated and unanticipated measures of the stance of fiscal policy have, with the exception of McElhattan (1982), received little empirical attention. However, McCallum and Whitaker (1979) demonstrated theoretically that only the unanticipated component of systematic fiscal policy affects real variables in the context of a rational expectations macro model with perfectly flexible prices and wages, although built-in stabilizing aspects of fiscal policy can have significant effects upon real variables within the model. This result occurs because built-in stabilizers, unlike systematic counter-cyclical actions which require aggregate information that is available only with a lag, automatically provide reaction to current period shocks and thereby affect real output in the current period. Presumably, anticipated fiscal actions could affect real output in the type of rational expectations model employed by Fischer (1977) in which multi-period labor contracts exist. Given the strength of the McCallum-Whitaker results for the effectiveness of counter-cyclical fiscal policy, it is surprising that so little attention has been devoted to analyzing this proposition empirically.

The aim of this paper is to investigate empirically the effects of a measure of anticipated and unanticipated fiscal policy on real output. The fiscal measure examined is the change in the real high-employment surplus scaled by real potential output.[1] The high-employment surplus measure is chosen to avoid contaminating the fiscal measure with changes in expenditures or tax receipts due to the automatic stabilizing aspects of fiscal policy. This measure differs from those employed by McElhattan (1982) who examines only the effects of unanticipated fiscal actions on real output growth. McElhattan's unanticipated fiscal measures are defined as the current rates of change in real high-employment expenditures and tax receipts minus their respective average rates of change over the past two years. Thus, for example, according to McElhattan, the anticipated rate of change in real high-employment expenditures is assumed equal to its actual average rate of change over the previous two years; other macroeconomic variables such as the inflation rate or the unemployment rate are assumed to have no direct effect upon the anticipated growth in real high-employment expenditures. This assumption seems unduly restrictive and leads us to an alternative technique of specifying anticipated fiscal actions.

Following Mishkin's (1982a, b) advice about specifying anticipated money growth equations, an atheoretical statistical technique is used to specify the anticipated fiscal policy equation since it is difficult on theoretical grounds to exclude any information available to economic agents at time $t - 1$ and since the use of a statistical criterion prevents a search for a specification that yields particular results expected by the researcher. Mishkin employs multivariate Granger-causality tests that involve regressing money growth on four own lagged values as well as four lagged values of a set of macroeconomic variables. The other macro variables are retained only if they are jointly significant at the 5% level. The choice of four lags is arbitrary and the technique may lead to biased coefficient estimates in the anticipated fiscal policy equation if the true lag length for some variables is longer than four lags. Thus if one is employing a purely statistical technique to specify the anticipated fiscal policy equation it seems preferable to employ a technique that allows the data to determine the lag length rather than imposing an arbitrary lag

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[1] This is the type of variable employed by Dornbusch-Fischer (1981) in their popular macroeconomics text.

length. The technique used to specify the anticipated fiscal policy equation is described in section II and the empirical results are presented in section III. A brief summary and conclusion follows in section IV.

II. Specification of the Anticipated Fiscal Policy Equation

The technique employed here to specify the anticipated fiscal policy equation involves the use of the Granger-causality definition in conjunction with Theil's $\bar{R}^2$ (minimum standard error) criterion to specify the appropriate lag length for each variable considered. The macroeconomic variables considered for inclusion in the equation are the unemployment rate, the inflation rate, the rate of growth of real output, the balance-of-payments on current account, the rate of growth in the money supply (new Ml definition), the rate of change in the import price deflator, and the three-month Treasury bill rate. These variables are chosen because of their macroeconomic interest and because information about these variables is easily obtainable at low cost and thereby might be used by the public to predict the stance of fiscal policy.

As is well known, one variable (X) is said to Granger-cause another (Y) if the past values of X in conjunction with past values of Y can be used to predict Y more accurately than just past values of Y. Thus, the first step in the specification of the anticipated fiscal policy equation is the determination of the own lag length for the fiscal variable. This determination is made by varying the lag in the autoregression $F_t = a_0 + a_1(L)F_t + e_t$ from 1 to m where F_t = change in the real high-employment surplus divided by real potential output, $a_1(L)$ is a distributed lag polynomial such that $a_1(L) = \sum_{k=1}^{m} a_{1k}L^k$, L is the lag operator so that $L^kF_t = F_{t-k}$, m = highest order lag (specified a priori to be 10), and e_t = zero mean white noise error term. The lag length that yields the highest $\bar{R}^2$ is selected as the order of $a_1(L)$.

Once the order of $a_1(L)$ is found, a determination of whether the other macro variables enter the anticipated fiscal policy equation is made. The procedure begins with the estimation of the bivariate equation $F_t = a_0 + a_1(L)F_t + a_2(L)X_t + e_t$ where X_t = relevant macro variables (considered one at a time) and $a_2(L)$ is a distributed lag polynomial defined in a manner similar to $a_1(L)$. $a_1(L)$ is fixed at its previously determined order and the lags in $a_2(L)$ are varied over $l = 1,\ldots, m$. The lag length that yields the highest $\bar{R}^2$ is selected as the lag order for that macro variable. An F-test of the joint significance of the coefficients on the macro variable is then performed. If the coefficients are significantly different from zero, the variable is said to Granger-cause F and this variable is retained for further consideration. If the coefficients are not significantly different from zero, the variable is said not to Granger-cause F and is not considered further.

The macro variables further considered for inclusion in the fiscal policy equation are those found to Granger-cause F. The order in which these variables are considered is determined by the $\bar{R}^2$ from the bivariate equations. The variables are ranked according to the $\bar{R}^2$ from the relevant bivariate equations with the variable with the highest $\bar{R}^2$ first, and so on. The trivariate equation $F_t = a_0 + a_1(L)F_t + a_2(L)X_{1,t} + a_3(L)X_t' + e_t$ is estimated where $X_{1,t}$ is the variable with the highest $\bar{R}^2$ in the bivariate equations, X_t' = remaining macro variables (considered one at a time), and $a_3(L)$ is defined analogously to $a_1(L)$ and $a_2(L)$. $a_1(L)$ and $a_2(L)$ are fixed at their previously determined order and the lags in $a_3(L)$ are varied over $p = 1,\ldots, m$. As before, the lag length that yields the highest $\bar{R}^2$ is selected as the lag order for that macro variable. An F-test of the joint significance of the coefficients on the macro variable is then performed. Again, if the coefficients are significantly different from zero, the variable is said to Granger-cause F and is retained for further consideration. If the coefficients are not significantly different from zero, the variable is not considered further.

After the trivariate equations for all remaining macro variables are estimated, the variables found to Granger-cause F are again ranked according to the $\bar{R}^2$, and the process continues in an analogous fashion until all variables are discarded or added to the fiscal policy equation.

Use of this procedure and data from 1959:1–1982:4[2] led to the following specification for the fiscal policy equation:

$$F_t = a_0 + a_1^8(L)F_t + a_2^3(L)U_t + a_3^{10}(L)RTB_t + e_{1,t}. \quad (1)$$

The superscript in the lag polynomial indicates the order of the lag; thus the optimal lag on the fiscal variable is eight periods. The other explanatory variables are defined as U = unemployment rate for all workers and RTB = three-month Treasury bill rate.

[2] Data for all variables are from the Citibank data tape and, in the case of the inflation rate, the growth rate of real output (measured by real GNP), and the rate of change in the import price deflator, the data reflect the July 1983 national income and product accounts revisions. A consistent series for the balance of payments on current account (excluding reinvested earnings) is available only through 1980:3. However, the same specification for equation (1) reported in the text was obtained when data for 1959:1–1980:3 were used. The coefficients on RTB were jointly significant at the 1% level while the coefficients on UN were jointly significant at approximately the 10% level.

TABLE 1.—ANTICIPATED FISCAL POLICY EQUATION[a]
Dependent Variable:
F_t = (*Change in Real High-Employment Surplus*) /*Real Potential Output*

Constant	−.001	(−0.42)	R^2 = .46
F_{t-1}	−.181	(−1.57)	SE = .0054
F_{t-2}	−.087	(−0.75)	DW = 1.98
F_{t-3}	−.301	(−2.73)	
F_{t-4}	−.288	(−2.43)	
F_{t-5}	−.275	(−2.37)	
F_{t-6}	.103	(0.01)	
F_{t-7}	−.215	(−1.90)	
F_{t-8}	−.277	(−2.45)	
RTB_{t-1}	.001	(1.31)	
RTB_{t-2}	.001	(0.53)	
RTB_{t-3}	−.003	(−1.48)	
RTB_{t-4}	.003	(1.46)	
RTB_{t-5}	−.003	(−1.55)	
RTB_{t-6}	.004	(1.78)	
RTB_{t-7}	−.008	(−3.48)	
RTB_{t-8}	.007	(3.13)	
RTB_{t-9}	−.004	(−2.23)	
RTB_{t-10}	.003	(2.12)	
UN_{t-1}	−.005	(−1.65)	
UN_{t-2}	.012	(2.33)	
UN_{t-3}	−.007	(−2.20)	

[a] t-statistics are in parentheses after the coefficient estimates.

The coefficient estimates are presented in table 1. Following Mishkin (1982a), we note that the observational equivalence problem described by Sargent (1976) is overcome since the anticipated fiscal policy equation contains lagged values of the unemployment rate and the Treasury bill rate. Since these variables are not directly included in the real output equation, it is possible to identify enough parameters of the real output equation to test the hypothesis that only unanticipated fiscal actions affect real output. The temporal stability of the equation was checked by means of the Chow (1960) test. The sample was split into two equal parts and the Chow test indicated that the hypothesis of stability of the coefficients could not be rejected at the 5% level.[3] Autoregressions of the residuals from this equation indicated the absence of serial correlation in (1).[4]

III. Empirical Results

The proposition that only unanticipated fiscal actions affect real output is tested using the two-step procedure outlined in Barro (1977) and Makin (1982). Following Makin, a difference stationary series for real output—i.e., the growth rate of real output—is employed. In the first step of the two-step procedure the fiscal policy equation is estimated and the predicted values from this equation are defined as anticipated fiscal actions while the residuals are used as unanticipated fiscal actions. The second step consists of estimating the following equation and examining the coefficients on anticipated and unanticipated fiscal actions:

$$RY_t = b_0 + \sum_{i=0}^{16} b_{1,i} AF_{t-i} + \sum_{i=0}^{16} b_{2,i} UF_{t-i} + e_{2,t} \quad (2)$$

where RY = rate of growth in real output (measured as log real GNP in t minus log real GNP in $t-1$), AF = anticipated fiscal actions, and UF = unanticipated fiscal actions.

Equation (2) is estimated following Mishkin (1982a, b) using polynomial distributed lags with a correction for first-order serial correlation. A fifth degree polynomial with only a far end-point constraint is used. Following Schmidt and Waud (1973), Theil's $\bar{R}^2$ (minimum standard error) criterion was used to determine the degree of polynomial, length of lag, and appropriateness of end-point constraints. The estimated equation is reported in table 2. The DW statistic suggests that the residuals are free of first-order serial correlation, and about 53% of the variation in real output growth is explained.

We see from this table that many of the coefficients for both unanticipated and anticipated fiscal policy are significant. In fact, the absolute value of most of the coefficients on the anticipated fiscal variable are greater than the coefficients on the unanticipated fiscal variable. The sum of the coefficients for both fiscal variables is significantly negative with the absolute value of the sum of the coefficients for the anticipated fiscal variable substantially greater than the absolute value of the sum for the unanticipated fiscal variable. These results thus suggest that both an anticipated and an unanticipated increase (decrease) in the high-employment deficit (surplus) relative to potential output raises actual real output.[5] To the extent that the fiscal measures used here are purged of the influence of the automatic stabilizing aspects of fiscal policy, these results are not consistent with models that impose rationality of expectations and short-run neutrality. However, they are consistent with models in which expectations are formed rationally but prices and wages are sticky.

Finally, we note that the results do not suggest that a one time increase in the high-employment deficit has a permanent effect upon real output growth. A one shot increase in the high-employment deficit will only temporarily raise real output growth. The variable employed here is the ratio of the change in the high-

[3] The F-statistic for the Chow test is 1.61. At the 5% level the critical F is approximately equal to 1.80.

[4] The autoregressions tested for first through fourth order serial correlation. None of the coefficients on the lagged residuals were significant.

[5] Since the fiscal measure employed here was frequently in deficit over the sample period, the negative coefficients indicate that an increase in the high-employment deficit raises real output.

TABLE 2.—EFFECTS OF ANTICIPATED AND UNANTICIPATED FISCAL POLICY ON REAL OUTPUT GROWTH[a]
SAMPLE: 1961:3–1982:4

			Equation (2)					
b_0	0.0037	(3.96)	$b_{1,0}$	0.334	(1.44)	$b_{2,0}$	−0.232	(−1.14)
			$b_{1,1}$	−0.726	(−4.01)	$b_{2,1}$	0.123	(1.16)
			$b_{1,2}$	−1.191	(−6.28)	$b_{2,2}$	0.078	(0.68)
			$b_{1,3}$	−1.295	(−7.24)	$b_{2,3}$	−0.161	(−1.45)
			$b_{1,4}$	−1.213	(−7.03)	$b_{2,4}$	−0.446	(−3.88)
			$b_{1,5}$	−1.065	(−6.04)	$b_{2,5}$	−0.684	(−5.31)
			$b_{1,6}$	−0.924	(−5.22)	$b_{2,6}$	−0.826	(−5.91)
			$b_{1,7}$	−0.829	(−4.95)	$b_{2,7}$	−0.858	(−6.08)
			$b_{1,8}$	−0.787	(−5.13)	$b_{2,8}$	−0.794	(−5.78)
			$b_{1,9}$	−0.785	(−5.35)	$b_{2,9}$	−0.666	(−4.90)
			$b_{1,10}$	−0.796	(−5.28)	$b_{2,10}$	−0.512	(−3.72)
			$b_{1,11}$	−0.790	(−5.06)	$b_{2,11}$	−0.375	(−2.73)
			$b_{1,12}$	−0.736	(−4.82)	$b_{2,12}$	−0.286	(−2.19)
			$b_{1,13}$	−0.619	(−4.33)	$b_{2,13}$	−0.261	(−2.10)
			$b_{1,14}$	−0.439	(−3.09)	$b_{2,14}$	−0.288	(−2.18)
			$b_{1,15}$	−0.226	(−1.50)	$b_{2,15}$	−0.322	(−2.21)
			$b_{1,16}$	−0.044	(−0.35)	$b_{2,16}$	−0.274	(−2.24)
			$\sum_{i=0}^{16} b_{1,i}$	−12.13	(−5.95)	$\sum_{i=0}^{16} b_{2,i}$	−6.78	(−5.08)
	$R^2 = .53$							
	SE = .0079							
	DW = 2.11							
	$\rho = -.23$							

[a] t-statistics are in parentheses after the coefficient estimates.

employment deficit to real potential output (F). The significant sum of the coefficients suggests that a sustained increase in F has a lasting effect on real output growth. Since real potential output grows over time, a sustained increase in the fiscal variable requires continuing increases in the real high-employment deficit.

IV. Conclusion

This paper has investigated empirically the effects of a measure of anticipated and unanticipated fiscal policy on real output. The measure employed is the change in the real high-employment surplus scaled by real potential GNP. To the extent that the measure employed here is purged of the effects of the automatic stabilizing aspects of fiscal policy, the results do not suggest that only unanticipated fiscal actions affect real output. This result is contrary to the rational expectations-flexible wage and price model of McCallum-Whitaker (1979). Anticipated fiscal actions do affect real output, although the effects of a one-shot increase in the real high-employment deficit on real output appear to be short-lived. The results, of course, do not provide any direct evidence on the appropriateness of the assumption of rational expectation formation; in fact, they are consistent with a rational expectations model with sticky wages or prices of the Fischer (1977) type. The results do cast doubt on the appropriateness of models that impose rationality and short-run neutrality.

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