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The impact of anticipated and unanticipated policy actions on the stock market

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I. INTRODUCTION

Macroeconomic theory suggests that variations in stock prices have a potentially important effect upon the pace of macroeconomic activity. The life-cycle model of Ando and Modigliani (1963) suggests that changes in stock prices, by affecting consumer wealth, alter the consumption behaviour of households. In Tobin's (1969) general equilibrium model, variations in q – the ratio of the market value of the capital stock as determined in the stock and bond markets to the reproduction cost of the capital stock – affect private investment spending. Furthermore, Blanchard (1981) has recently developed a macroeconomic model in which the real value of the stock market plays a crucial role in determining aggregate demand and hence prices and output. The real value of the stock market is determined as the discounted value of real profits where the discount rate is the real interest rate. Changes in monetary and fiscal policy – both anticipated and unanticipated – affect the real value of the stock market by changing expectations about the future path of the real interest rate and real profits. The change in the real value of the stock market in turn alters both consumption and investment spending.

The aim of this paper is to analyse empirically the impact of both monetary and fiscal policy actions on the stock market. Since Blanchard (1981) shows that the time path of the real value of the stock market and hence output will vary depending upon whether policy actions are anticipated or unanticipated, the effects of both anticipated and unanticipated monetary and fiscal policy actions on the real vlaue of the stock market are estimated. The real value of the stock market is measured by Standard and Poor's 500 common stock price index divided by the implicit GNP deflator. The monetary variable used is the growth rate of M1 and the fiscal variable examined is the change in the real cyclically-adjusted surplus scaled by real middle-expansion trend GNP. The fiscal measure is chosen to avoid contaminating the fiscal policy variable with changes in expenditures or tax receipts due to the automatic stabilizing aspects of fiscal policy.[1]

[1]McCallum and Whitaker (1979) have shown that within the context of a flexible price rational expectations macro model built-in stabilizers automatically provide reaction to current period shocks and hence affect real output. Thus in selecting a fiscal policy measure one must avoid contaminating this measure with changes in expenditures or tax receipts due to the automatic stabilizing aspects of fiscal policy. For this reason and since in Blanchard's (1981) model the fiscal policy index he describes is clearly exogenous, the measure described in the text was chosen. We also note that this variable is similar to the one employed by Laumas and McMillin (1984).

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Following Mishkin's (1982) advice about specifying anticipated money growth equations, an atheoretical statistical technique is used to specify the anticipated monetary and fiscal policty equations. The major advantage of this technique over alternative procedures such as the one used by Barro (1977) is that an explicit statistical criterion prevents a search for a specification that yields particular results expected by the researcher. The technique used here allows the data to determine which variables are included in the anticipated policy equations and the lag length on these variables. The technique used to specify the anticipated policy equations is described in Section II and the empirical results are presented in Section III. A brief summary and conclusion follow in Section IV.

II. SPECIFICATION OF THE ANTICIPATED POLICY EQUATIONS

The technique employed here to specify the anticipated policy equations 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 use of the $\bar{R}^2$ criterion to specify lag lengths is chosen as a way of dealing with potential bias in coefficient estimates that may result from underspecifying the true lag length for one or more variables when a procedure like that of Mishkin (1982) which specifies an arbitrary common lag length for all variables is used. Since the same technique is employed in the specification of both the monetary and fiscal equations, to save space, the description of the technique will focus upon the monetary policy equation. The macroeconomic varibles considered for inclusion in this equation are the unemployment rate, the inflation rate, the growth rate of publically held federal debt, the rate of growth of nominal GNP, the fiscal policy variable, the rate of change in the import price deflator, the three-month Treasury bill rate, and the ratio of real net exports to real middle-expansion trend GNP. 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 monetary or 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 monetary policy equation is the determination of the own lag length for the monetary variable. This determination is made by varying the lag in the autoregression

$$M_t = a_0 + a_1(L)M_t + e_t$$

from 1 to m where M_t = rate of growth in M1 ($\log M1_t - \log M1_{t-1}$), $a_1(L)$ 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 $L^k M_t = M_{t-k}$, 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 monetary policy equation is made. The procedure begins with the estimation of the bivariate equation

$$M_t = a_0 + a_1(L)M_t + a_2(L)X_t + e_t$$

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 $n = 1, \ldots, m$. The lag length that yields the highest $\bar{R}^2$ is selected as the lag order for that macro varible. 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 M and this variable is retained for further consideration. If the coefficients are not significantly different from zero, the variable is not considered further.

The macro variables further considered for inclusion in the monetary policy equation are those found to Granger-cause M. 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

$$M_t = a_0 + a_1(L)M_t + a_2(L)X_{1,t} + a_3(L)X'_t + e_t$$

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 orders 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 M and is retained for further consideration. If the coefficients are not significantly different from zero, the variable is not considered further.

After the triviariate equations for all remaining macro variables are estimated, the variables found to Granger-cause M 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 monetary policy equation. The same process is applied to the fiscal policy variable.[2]

This procedure led to the following specifications for the monetary and fiscal policy equations:

$$M_t = a_0 + a_1^9(L)M_t + a_2^8(L)RTB_t + a_3^7(L)RNEXP_t + e_t, \quad (1)$$

$$F_t = b_0 + b_1^8(L)F_t + b_2^9(L)U_t + b_3^7IINF_t + e_t. \quad (2)$$

Data from 1955iii–1985iv were employed in the specification; data for the period 1955iii–1957iv were treated as presample values and provided the initial ten lags.[3] The superscript in the lag polynomial indicates the order of the lag; thus, the optimal lag on M is nine quarters. F = the change in the real cyclically-adjusted surplus scaled by real middle-expansion trend GNP. The explanatory variables are defined as RTB = three-month Treasury bill rate, $RNEXP$ = ratio of real net exports to real middle-expansion trend GNP,

[2]In addition to the variables listed in the text, the growth rate of M1 was considered for inclusion in the fiscal policy equation.

[3]Data for Standard and Poors' 500 stock price index, the cyclically-adjusted surplus, the rate of inflation (rate of change in the implicit GNP deflator), nominal GNP, the unemployment rate, the implicit deflator for imports, the three-month Treasury bill rate, M1 and real net exports are from the Citibank data tape. Data for real GNP were constructed from nominal GNP and the implicit GNP deflator. Data for middle-expansion trend GNP are from Holloway (1986). Publically held federal debt data were provided by the Federal Reserve Bank of St Louis.

U = unemployment rate for all workers, and $IINF$ = rate of change in the import price deflator. About 75% of the variation in money growth is explained by Equation 1 while about 43% of the variation in the fiscal variable is explained by Equation 2. In order to conserve space, the coefficient estimates are not reported here but are available upon request. Durbin–Watson and Q statistics indicated white-noise residuals. Following Mishkin (1982), we note that the observational equivalence problem described by Sargent (1976) is overcome since the anticipated policy equations contain lagged values of variables not directly included in the stock market equations. Because of this, it is possible to identify enough of the parameters of the stock market equations to determine the differential effects of anticipated and unanticipated policy actions on the stock market.

III. EMPIRICAL RESULTS

A variant of the two-step procedure outlined in Barro (1977) and Makin (1982) is used to estimate the effects of anticipated and unanticipated policy actions on the stock market. Tests of the type described by Nelson and Plosser (1982) and Stulz and Wasserfallen (1985) suggested that the hypothesis that the log of the real value of the Standard and Poors' common stock price index has a first-order unit root could not be rejected. As a consequence, the log difference of this variable is employed as the dependent variable.

In the first step of the procedure, the Kalman filter routine of the RATS statistical package is used to generate the anticipated and unanticipated policy measures. Since each policy equation contains 25 parameters, Equations 1 and 2 are initially estimated for the period 1958:1–1964:2. The fitted values from these regressions are the first observations for the anticipated policy measures while the residuals are the measures of unanticipated policy. The Kalman filter routine adds one observation to the initial sample and reestimates the parameters. The fitted values from this second regression are taken as the second observations of the anticipated policy measures and the residuals are the second observations of the unanticipated policy measures. Data are added one observation at a time, and the equations are reestimated. This procedure continues through 1985:4. Thus measures of the anticipated and unanticipated policy variables are available for the period 1964:2–1985:4. An alternative procedure that is often used to generate anticipated and unanticipated policy variables is the estimation of the policy equations over the full sample and the use of the fitted values from these full sample regressions as the anticipated policy measures and the use of the residuals as unanticipated policy actions. However, generation of the policy variables via the Kalman filter method avoids the assumption that economic agents have full sample estimates of the policy equations before the end of the sample.

The second step consists of estimating the following equation:

$$RSP_t = d_0 + \sum_{i=0}^{n_1} d_{1,i} AM_{t-i} + \sum_{i=0}^{n_1} d_{2,i} UM_{t-i} + \sum_{i=0}^{n_1} d_{3,i} AF_{t-i} + \sum_{i=0}^{n_1} d_{4,i} UF_{t-i} + e_{3,t} \tag{3}$$

where RSP = log difference of the real value of the Standard and Poors' 500 common stock price index, AM = anticipated money growth, UM = unanticipated money growth, AF = anticipated fiscal actions (i.e the anticipated change in the real cyclically-adjusted surplus scaled by real middle-expansion trend GNP), and UF = unanticipated fiscal actions. Equation 3 is estimated over the period 1967:1–1985:4. The beginning of the sample period was chosen so that a search of lag lengths up to ten quarters for the policy variables could be conducted.

Equation 3 was estimated using ordinary least squares and polynomial distributed lags. Following Schmidt and Waud (1973), Theil's $\bar{R}^2$ criterion was used to determine the length of the lag (n_1) and the degree of the polynomial. No end point constraints were employed. In Equation 3 the current value and eight lags of the policy variables were found to be optimal, and a fifth-degree polynomial was suggested by the $\bar{R}^2$ criterion.

Table 1 presents the estimates for Equation 3. About 45% of the variation in RSP is explained by the equation. The DW statistic is in the inconclusive range. As a result, the equation was reestimated with a first-order serial correlation correction using a maximum-likelihood iterative technique (the $AR1$ procedure in TSP 4.0). The estimated value of ρ (0.23) was not statistically significant, and the coefficient values are quite similar to those in Table 1. The discussion thus focuses upon the estimates in Table 1.

The hypotheses that the anticipated and unanticipated policy variables have no effect on RSP were tested using F-tests and are reported in Table 2. The hypothesis that the coefficients on the policy variable jointly equal zero can easily be rejected for AM, AF and

Table 1. *Effects of anticipated and unanticipated policy actions on RSP* (Sample: 1967:1–1985:4)*

d_0	−0.04	$d_{1,0}$	3.95	$d_{2,0}$	3.26	$d_{3,0}$	−3.48	$d_{4,0}$	−1.52
	(−1.48)		(3.82)		(2.31)		(−2.59)		(−1.19)
		$d_{1,1}$	−0.66	$d_{2,1}$	1.51	$d_{3,1}$	−0.22	$d_{4,1}$	1.86
			(−0.72)		(1.06)		(−0.13)		(1.23)
		$d_{1,2}$	−0.48	$d_{2,2}$	−0.75	$d_{2,2}$	−1.10	$d_{4,2}$	−1.24
			(−0.76)		(−0.63)		(−0.77)		(−0.83)
		$d_{1,3}$	0.17	$d_{2,3}$	−2.10	$d_{3,2}$	−2.49	$d_{4,3}$	−2.99
			(0.24)		(−1.66)		(−1.85)		(−1.96)
		$d_{1,4}$	−0.07	$d_{2,4}$	−2.09	$d_{3,4}$	−3.00	$d_{4,4}$	−1.86
			(−0.11)		(−1.98)		(−2.33)		(−1.36)
		$d_{1,5}$	−0.74	$d_{2,5}$	−1.01	$d_{3,5}$	−2.67	$d_{4,5}$	−0.24
			(−1.06)		(−0.88)		(−1.94)		(0.18)
		$d_{1,6}$	−0.87	$d_{2,6}$	0.27	$d_{3,6}$	−2.12	$d_{4,6}$	0.91
			(−1.37)		(0.24)		(−1.65)		(0.78)
		$d_{1,7}$	−0.09	$d_{2,7}$	0.48	$d_{3,7}$	−1.67	$d_{4,7}$	0.14
			(−0.11)		(0.30)		(−1.21)		(0.11)
		$d_{1,8}$	0.14	$d_{2,8}$	−1.89	$d_{3,8}$	−0.51	$d_{4,8}$	3.19
			(0.15)		(−1.24)		(−0.40)		(2.43)
		$\Sigma d_{1,i}$	1.35	$\Sigma d_{2,i}$	−2.33	$\Sigma d_{3,i}$	−17.3	$\Sigma d_{4,i}$	−1.26
			(0.75)		(−0.38)		(−3.18)		(−0.17)

$\bar{R}^2 = 0.452$
S.E = 0.047
DW = 1.57

*t-statiatics are in parentheses below the coefficient estimates.

Table 2. *F-tests for the significance of the policy effects*

Hypothesis	F-statistic*
1. H_0: the coefficients on AM jointly equal 0	2.88 [6, 51] (0.02)
2. H_0: the coefficients on UM jointly equal 0	1.82 [6, 51] (0.11)
3. H_0: the coefficients on AF jointly equal 0	3.03 [6, 51] (0.01)
4. H_0: the coefficients on UF jointly equal 0	2.98 [6, 51] (0.01)

*The terms in brackets are the degrees of freedom for the F-test. The numerator degrees of freedom is 6 since a fifth-degree polynomial is used in estimating Equation 3.

The term in parentheses is the marginal significance level of the F-statistic.

UF. However, a similar hypothesis for *UM* can be rejected only at the 11% level. It thus appears that both anticipated and unanticipated policy actions – with the possible exception of unanticipated money growth – significantly affect real stock prices.[4]

Both anticipated and unanticipated money growth have a significant, positive contemporaneous effect upon *RSP*. However, the contemporaneous effect is the only significant effect for both variables, and the sum of the coefficients for both variables is not significantly different from zero. Over time the initial positive impact is washed out so that, in the longer run, monetary actions, whether anticipated or unanticipated, have no effect on *RSP*. Anticipated fiscal actions have a significant contemporaneous effect, and there are significant lagged effects as well. Since the numerator of the fiscal variables is the change in the real cyclically-adjusted *surplus*, the negative coefficients indicate that an increase in the *deficit* raises *RSP*. The sum of the coefficients for anticipated fiscal actions is significantly negative. This significant sum does not suggest that a one-time increase in the real cyclically-adjusted deficit has a permanent effect upon *RSP*. The significant sum of the coefficients suggests that a sustained increase in the fiscal measure has a lasting effect upon *RSP*. But, since trend GNP grows over time, a sustained increase in this variable requires continuing increases in the real cyclically-adjusted deficit. Unanticipated fiscal actions have little initial impact, and the peak expansionary effect occurs with a lag of three quarters. The sum of the coefficients is negative, but is not significantly different from zero.[5]

[4]Since variations in the stock market also affect Tobin's q, the effects of the policy variables on q were also briefly examined. An equation like Equation 3 with the log difference of q as the dependent variable was specified; the $\bar{R}^2$ criterion suggested an optimal lag of ten quarters and a fifth-degree polynomial. Because of the lack of reliable data on q, the equation was estimated over 1967:1–1979:4, a much shorter time period than for *RSP*. F-tests suggested that the null hypothesis that the coefficients on anticipated (unanticipated) money growth jointly equalled zero could be rejected at the 7% (8%) level. The null hypothesis that the coefficients on the anticipated (unanticipated) fiscal policy measure jointly equalled zero was rejected at the 4% (2%) level. As in the case of *RSP*, anticipated and unanticipated fiscal actions significantly affect q. However, neither anticipated nor unanticipated money growth affect q at the 5% level, but both do at slightly higher levels of significance. Data for q were kindly provided by J. H. Ciccolo.

[5]In the case of Tobin's q, the sums of coefficients on anticipated and unanticipated money growth are not significantly different from zero. The sum of the coefficients for anticipated fiscal policy is again singificantly different from zero, but the sum of the coefficients for unanticipated fiscal policy, while negative, is not significantly different from zero. The pattern of coefficients differs somewhat from that for *RSP*.

The initial positive impact of the monetary variables on the stock market is not unexpected in a world in which contracts are written in nominal terms. As Blanchard (1981) notes, the increase in nominal money balances when prices do not adjust instantaneously implies that real balances have risen. This increase in real balances in conjunction with an anticipation of higher inflation in the future due to higher money growth initially reduces real rates, and the real value of the stock market rises. As output rises in response to the higher stock values, the real rate begins to rise, and real stock prices move towards their original level. The results in Table 1 suggest that any impact of higher money growth fades quickly. This may be due to weak effects of higher money growth on real rates. This possibility is suggested by the recent interest rate studies of Makin (1983) and Peek and Wilcox (1984); these studies suggest a short-lived, small, negative impact of changes in money growth on interest rates.

As noted earlier, the evidence presented here suggests that expansionary fiscal actions raise the real value of stock prices. This result can be explained within the context of Blanchard's (1981) model. Since the real value of the stock market is determined as the discounted value of real profits where the discount rate is the real interest rate, fiscal actions affect the stock market by altering the time path of output and hence real profits and the real interest rate. In his analysis of anticipated fiscal actions, Blanchard distinguishes between two cases – the 'bad news' and the 'good news' cases. Anticipated fiscal actions are viewed by the public as raising both output and the interest rate. If the effects of higher future real rates are expected to outweigh the effects of higher output levels on real profits, then the stock market falls. However, if the higher real profits generated by the higher level of real output are expected to more than offset the higher real interest rate, then the stock market rises when an expansionary fiscal action is anticipated. The results presented in this paper appear to be consistent with the good news' case. Anticipated expansionary fiscal actions have a contemporaneous positive effect upon the stock market, and as output actually rises with a lag, the value of the stock market rises further. In the case of unanticipated expansionary fiscal actions, there is no immediate impact upon the stock market. However, as output, real profits and the real interest rate rise over time in response to the unanticipated action, the real value of the stock market also rises.

We note that the expansionary effects of both monetary and fiscal actions on the stock market are broadly consistent with previous studies that have estimated the effects of anticipated and unanticipated policy actions on real variables. McMillin and Laumas (1987) found that anticipated and unanticipated fiscal actions have significant effects on real consumption and investment expenditure and that anticipated and unanticipated money growth have significant, short-run effects on these variables. Furthermore, Laumas and McMillin (1984) found that both anticipated and unanticipated fiscal actions have expansionary effects upon real output while Mishkin (1982) found that both anticipated and unanticipated money growth have positive short-run effects upon real output. Makin (1982), however, found a significant effect of anticipated monetary growth on real output but little evidence of significant effects of unanticipated money growth on real output.

IV. CONCLUSION

This paper has analysed empirically the effects of anticipated and unanticipated monetary and fiscal policy actions on the stock market. The results suggest that anticipated as well as unanticipated expansionary fiscal actions raise real stock prices; anticipated increases in money growth have similar effects, but the evidence is somewhat weaker in the case of unanticipated money growth. These results are broadly consistent with the 'good news' version of the model developed by Blanchard (1981) in which monetary and fiscal actions affect the stock market by altering the time paths of real profits and the real interest rate. The results are also generally consistent with recent studies of the effects of anticipated and unanticipated policy actions on real variables.

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