The Dynamic Impacts of Government Expenditure and the Monetary Base on Aggregate Income: The West German Case, 1965 to 1974

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I. Introduction

There is a great deal of agreement nowadays that both the money stock and government expenditure influence the level of economic activity, measured by the level of aggregate income, in a major way. At the same time, however, very little is known about the dynamic paths through which these instruments of economic policy affect the economy in the short run. This gap is explained by the fact that practically all theoretical and empirical research on this topic has been undertaken within the context of static models[1]; it is obvious that within the context of these static models the time responses of aggregate income to changes in the money stock and government expenditure cannot be determined.

Our aim in this paper is to fill this gap in the case of the Federal Republic of Germany (F. R. G.). With this aim in mind, we estimate a simple dynamic macroeconomic model, and on the basis of the estimates of this model, 'dynamic multipliers' of the monetary base and government expenditure are derived and compared.

One important feature of this study is that the money supply is assumed to be endogenous[2]; and as such, it cannot be used as an instrument

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[1] There are, of course, some exceptions, e. g. the papers by *Andersen* and *Carlson* (1970), *Bergstrom* and *Wymer* (1976), *Chow* (1968), *Kmenta* and *Smith* (1973) and *Moroney* and *Mason* (1971).

[2] We note that the papers mentioned in footnote 1 employ an exogenous money supply, with the exception of the paper by *Moroney* and *Mason* (1971) where an endogenous money supply is postulated.

of stabilisation policy. What can be used as instruments are the partial determinants of the money supply. One important determinant of the money supply, we find, is the monetary base.

The model estimated in this paper is similar to the one developed by *Moroney* and *Mason* (1971), the main difference being that the latter paper is estimated using U. S. data, and that our model contains a greater number of equations.

II. The Model

The variables of the model are as follows:

Y_t = gross national product

Y_t^d = disposable income

C_t = consumption expenditure

I_t = gross private domestic investment

$(BS)_t$ = construction investment

G_t = government expenditure

X_t = exports

Q_t = imports

M_t = M_2-definition of money stock

R_{st} = short-term interest rate (average of the money market rate on three-months loans in Frankfurt and the net rate of three-months loans in the Euro-dollar market)

R_{Lt} = long-term interest rate (yield on fully-taxed fixed interest securities).

B_t = monetary base (currency in circulation plus minimum reserves on domestic liabilities).

R_{dt} = Lombard rate of the Deutsche Bundesbank

The equations are

(1) $$Y_t \equiv C_t + I_t + G_t + X_t - Q_t$$

(2) $$C_t = c_0 + c_1 Y_t^d + c_2 M_t + c_3 C_{t-1} + u_{1t}$$

(3) $$Y_t^d = h\, Y_t$$

(4) $$I_t = i_0 + i_1 Y_t + i_2 R_{Lt} + i_3 (C_{t-1} - C_{t-2}) + i_4 I_{t-1} + u_{2t}$$

(5) $$(BS)_t = s_0 + s_1 Y_t + s_2 R_{Lt} + s_3 (BS)_{t-1} + u_{3t}$$

(6) $$Q_t = q_0 + q_1 Y_t + u_{4t}$$

(7) $$R_{Lt} = r_0 + r_1 Y_t + r_2 R_{st} + u_{5t}$$

(8) $$M_t^d = d_0 + d_1 Y_t + d_2 R_{st} + d_3 M_{t-1} + u_{6t}$$

(9) $$M_t^s = m_0 + m_1 R_{st} + m_2 B_t + m_3 R_{dt} + u_{7t}$$

(10) $$M_t^d = M_t^s = M_t$$

where u_{it} = the disturbance errors.

The endogenous variables are: Y_t, Y_t^d, C_t, I_t, $(BS)_t$, Q_t, R_{Lt}, R_{st}, M_t^d, M_t^s; the predetermined variables are: C_{t-1}, C_{t-2}, I_{t-1}, $(BS)_{t-1}$, G_t, X_t, R_{dt}, and B_t, the last four being exogenous.

We now turn to the discussion of the individual equations:

Consider first the consumption function: we begin by postulating a consumption function of the following form:

(2.1) $$C_t^* = a_0 + a_1 Y_t^d + a_2 M_t$$

where C_t^* = desired consumption expenditure. This form suggests that consumption is related to disposable income and to the money stock. The theoretical justification of this form is well known. This consumption function is similar to the standard Keynesian one, formulated in such a way that the impact of liquid assets on consumption can be taken into consideration; M_t, in this case, stands as a proxy for liquid assets.

Furthermore, we assume that in any period the difference between actual and desired consumption is not made up instantaneously, but only a portion b of the actual consumption is assumed to adjust to the desired level. We thus assume that:

(2.2) $$C_t - C_{t-1} = b\,(C_t^* - C_{t-1})$$

where b = the portion of adjustment achieved during one period. (Since the stock adjustment mechanism is applied to the dependent variable, an error term ought to have been included. However, for reasons of simplicity we ignore it in the case of our specification.) Substituting (2.1) in (2.2) and adding a disturbance term, we obtain (2) where:

$$c_0 = a_0 b\,, \quad c_1 = a_1 b\,, \quad c_2 = a_2 b\,, \quad c_3 = 1 - b$$

Next, the simplest possible relationship is postulated between gross national product and disposable income; we note that $(1 - b)$ in this case stands for the average tax rate among all taxpayers in the system.

The investment function is postulated along lines similar to the consumption function. We thus postulate, to begin with, the desired volume of investment (I_t^*) to be:

$$(4.1) \qquad I_t^* = e_0 + e_1 Y_t + e_2 R_{Lt} + e_3 (C_{t-1} - C_{t-2})$$

The theoretical arguments for the inclusion of Y_t and R_{Lt} are well known. We stress at this point, however, that although we do not allow for a lagged rate of interest, we recognise the importance of interest rate lags in the investment function, and the way we deal with this problem is to let the empirical evidence find the appropriate lag. The inclusion of $C_{t-1} - C_{t-2} = (\Delta C)_{t-1}$ is justified on the following grounds: some component of desired investment must be influenced by the recent direction and rate of change of sales[3]. Changes in consumption expenditure are used as a proxy; thus an accelerator type of variable is postulated at this point. Next we assume that:

$$(4.2) \qquad I_t - I_{t-1} = g (I_t^* - I_{t-1})$$

where g is the portion of adjustment achieved during one period. Substituting (4.1) in (4.2) and adding a disturbance term, we get equation (4), where:

$$i_0 = e_0 g\,, \quad i_1 = e_1 g\,, \quad i_2 = e_2 g\,, \quad i_3 = e_3 g\,, \quad \text{and} \quad i_4 = 1 - g$$

The construction investment function is postulated to be related to the level of income and the long-term rate of interest; this is assumed to be the desired form, thus:

$$(5.1) \qquad (BS)_t^* = l_0 + l_1 Y_t + l_2 R_{Lt}$$

and with the stock-adjustment hypothesis

$$(5.2) \qquad (BS)_t - (BS)_{t-1} = t\,[(BS)_t^* - (BS)_{t-1}]$$

we get equation (5) where:

$$s_0 = l_0\, t,\ s_1 = l_1\, t,\ s_2 = l_2\, t,\ s_3 = 1 - t\ .$$

Clearly, construction investment, due to its durability and lower degree of uncertainty, is bound to be more sensitive to changes in interest rates than other forms of investment. We therefore expect the R_{Lt}

[3] See *Moroney* and *Mason* (1971), page 798.

variable to be more important in this function and perhaps the lag involved should be shorter. The evidence we provide below shows quite clearly that this hypothesis is valid. The level of gross national product is included for the following reason: during periods of expansion, ceteris paribus, a higher demand for houses is observed and also a higher volume of mortgages is provided by relevant financial institutions. Consequently, the volume of mortgages should, logically, be included in the construction function. As data for this variable do not exist, we have decided to include the level of income instead which, as stated above, influences the demand for mortgages. To some extent, the banking sector would presumably satisfy this demand due to its higher liquidity associated with periods of expansion.

Imports are assumed to be related to the level of gross national product, whereas exports are assumed to be exogenously determined.

The long-term interest rate is assumed to be affected by the short-term rate via a stable term structure, and by the level of gross national product. The latter is included to capture the influence of the demand for loanable funds on R_{Lt}. In other words, as aggregate demand (whose proxy is Y_t) changes, the demand for loanable funds also changes, thus affecting the long-term interest rate.

Finally, both equations 8 and 9 are borrowed from another paper by the authors (1976), which provides full justification and some empirical results on these two equations.

The definition of money used here is M_2, i. e. currency plus sight and time deposits of domestic non-banks. The reason we use M_2 is based on theoretical grounds. We believe that although the medium of exchange role of money is the predominant one, given the relative ease with which time deposits can be switched to sight deposits to finance transactions, time deposits should be included in the definition of money used in this paper.

III. Estimation of the Model

The model of section 2 has been tested using ordinary least squares (OLS) and two stage least squares (TSLS). The reason for providing estimates with these two methods is that we can detect whether there is any simultaneity bias in the model given the interdependence that prevails amongst the different equations.

We begin with the OLS-estimates ('t' values in brackets):

(1) $$Y_t \equiv C_t + I_t + (BS)_t + G_t + X_t - Q_t$$

(2) $$C_t = 4.97883 + 0.48579\, Y_t^d + 0.04933\, M_t + 0.30365\, C_{t-1}$$
$$(3.81846) \quad (6.56440) \qquad (2.30551) \qquad (2.83614)$$

[4]$D.W. = 2.03028$, [5]$S = 0.71866$, $R^2 = 0.99912$

(3) $$Y_t^d = 0.63046\, Y_t$$

(4) $$I_t = 2.53308 + 0.01956\, Y_t + 0.15897\, (C_{t-1} - C_{t-2})$$
$$(2.76503) \quad (2.09627) \qquad (1.43793)$$
$$+\, 0.87743\, I_{t-1} - 0.46909\, R_{Lt-2}$$
$$(12.11561) \qquad (2.45551)$$

$$D.W. = 1.95628, \quad S = 0.64153, \quad R^2 = 0.98500$$

(5) $$(BS)_t = 2.25063 + 0.04409\, Y_t - 0.46589\, R_{Lt} + 0.76207\, (BS)_{t-1}$$
$$(1.50418) \quad (2.51916) \qquad (1.41747) \qquad (6.57986)$$

$$D.W. = 1.94386, \quad S = 1.15180, \quad R^2 = 0.97188 .$$

(6) $$Q_t = -\, 10.62752 + 0.27662\, Y_t$$
$$(5.90959) \quad (27.29927)$$

$$D.W. = 0.38849, \quad S = 2.89227, \quad R^2 = 0.95270$$

(7) $$R_{Lt} = 3.73282 + 0.01816\, Y_t + 0.18724\, R_{st}$$
$$(13.61673) \quad (10.04684) \qquad (5.46654)$$

$$D.W. = 0.47591, \quad S = 0.43357, \quad R^2 = 0.88212$$

(8) $$M_t^d = -\, 4.78748 + 0.19482\, Y_t - 0.49969\, R_{st} + 0.86966\, M_{t-1}$$
$$(2.10602) \quad (3.15310) \qquad (2.79736) \qquad (15.94570)$$

$$D.W. = 1.33683, \quad S = 2.23389, \quad R^2 = 0.99845$$

(9) $$M_t^s = -\, 49.94388 + 1.95391\, R_{st} + 3.11660\, B_t - 1.67760\, R_{dt}$$
$$(22.31769) \quad (3.77208) \qquad (82.90306) \qquad (2.70019)$$

$$D.W. = 0.62055, \quad S = 3.29159, \quad R^2 = 0.99663$$

(10) $$M_t^d = M_t^s = M_t$$

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[4] D. W. = *Durbin-Watson* Statistic. (Strictly speaking one ought to use the asymptotic test proposed by *Durbin* [1970]. We quote the D. W. statistic for indicative purposes only, since in our analysis the criterion for autocorrelation is the t-test on the autocorrelation coefficient p.)

[5] S = standard error of estimate.

Next, the T.S.L.S.-estimates:

(1) $$Y_t \equiv C_t + I_t + (BS)_t + G_t + X_t - Q_t$$

(2) $$C_t = \underset{(3.95393)}{5.43539} + \underset{(6.25952)}{0.55757}\, Y_t^d + \underset{(2.24129)}{0.05050}\, M_t + \underset{(1.71580)}{0.21182}\, C_{t-1}$$

$$D.W. = 1.90057\,, \quad S = 0.72825\,, \quad x^2\,(9)^6 = 13.65880$$

The x^2 (9)-statistic is insignificant at the 5 % level implying adequate identification/specification.

(3) $$Y_t^d = 0.63048\, Y_t$$

(4) $$I_t = \underset{(2.57027)}{2.36381} + \underset{(1.72536)}{0.01625}\, Y_t + \underset{(1.46144)}{0.16188}\,(C_{t-1} - C_{t-2}) + \underset{(12.32556)}{0.89902}\, I_{t-1}$$
$$- \underset{(2.21631)}{0.42549}\, R_{Lt-2}$$

$$D.W. = 1.99878\,, \quad S = 0.64272\,, \quad x^2\,(10) = 10.47502$$

Again, the x^2 (10)-statistic is insignificant at the 5 % level.

(5) $$(BS)_t = \underset{(1.91535)}{3.02580} + \underset{(2.41482)}{0.04335}\, Y_t - \underset{(1.84746)}{0.65072}\, R_{Lt} + \underset{(6.80007)}{0.79724}\,(BS)_{t-1}$$

$$D.W. = 2.00834\,, \quad S = 1.15811\,, \quad x^2\,(10) = 16.90511$$

The last statistic, too, is insignificant at the 5 % level.

(6) $$Q_t = -\underset{(5.93156)}{10.67156} + \underset{(27.31221)}{0.27687}\, Y_t$$

$$D.W. = 0.38854\,, \quad S = 2.89229\,, \quad x^2\,(11) = 35.12860$$

This time the $x^2\,(i)$-statistic is significant, which implies inadequate identification/specification of the import function. This expected result is due, of course, to the very simple form of the equation.

(7) $$R_{Lt} = \underset{(13.53316)}{3.71577} + \underset{(9.88273)}{0.01798}\, Y_t + \underset{(5.58172)}{0.19474}\, R_{st}$$

$$D.W. = 0.48035\,, \quad S = 0.43386\,, \quad x^2\,(11) = 29.03791$$

The last statistic is significant; again the very simple form of this equation must be responsible for the high x^2-statistic.

[6] This is a $x^2\,(i)$-test of identification/specification with i degress of freedom where $i = NI - NR - 4$ for NR regressors and NI instrumental variables used in estimation.

(8) $$M_t^d = -4.46645 + 0.18641\,Y_t - 0.52912\,R_{st} + 0.87771\,M_{t-1}$$
$$\quad(1.91824)\quad(2.92159)\qquad(2.90848)\qquad(15.59018)$$

$$D.W. = 1.34796\,,\quad S = 2.23525\,,\quad x^2\,(10) = 21.48359$$

The $x^2\,(i)$-statistic is significant at the 5 % level, but insignificant at the 1 % level.

(9) $$M_t^s = -49.91082 + 2.22624\,R_{st} + 3.11675\,B_t - 1.96203\,R_{dt}$$
$$\quad(22.21394)\quad(3.97104)\qquad(82.58130)\qquad(2.96838)$$

$$D.W. = 0.67953\,,\quad S = 3.30456\,,\quad x^2\,(10) = 28.12847$$

The $x^2\,(i)$-statistic is significant implying unacceptable identification/specification.

(10) $$M_t^d = M_t^s = M_t$$

We now provide T. S. L. S. - estimates but allow for a first-order autoregressive scheme.

(1) $$Y_t \equiv C_t + I_t + (BS)_t + G_t + X_t - Q_t$$

(2) $$C_t = 5.50489 + 0.56137\,Y_t^d + 0.05052\,M_t + 0.20666\,C_{t-1}$$
$$\quad(4.19937)\quad(6.62953)\qquad(62.31698)\qquad(1.78835)$$

$${}^{7}p = -0.03191\,,\quad S = 0.73702\,,\quad x^2\,(8) = 13.42138$$
$$(0.48522)$$

(3) $$Y_t^d = 0.63100\,Y_t$$

(4) $$I_t = 2.37811 + 0.01612\,Y_t + 0.16115\,(C_{t-1} - C_{t-2})$$
$$\quad(2.53396)\quad(1.68069)\qquad(1.42246)$$

$$+\,0.90027\,I_{t-1} - 0.42711\,R_{Lt-2}$$
$$(12.01662)\qquad(2.19697)$$

$$p = -0.00668\,,\quad S = 0.65240\,,\quad x^2\,(9) = 10.46498$$
$$(0.09090)$$

(5) $$(BS)_t = 4.22278 + 0.14196\,Y_t - 0.74295\,R_{Lt} + 0.05323\,(BS)_{t-1}$$
$$\quad(0.96981)\quad(5.79719)\qquad(1.03665)\qquad(0.61984)$$

$$p = 0.78965\,,\quad S = 1.11489\,,\quad x^2\,(9) = 17.13413$$
$$(6.06880)$$

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[7] p stands for the autocorrelation parameter with its t-value in brackets. When this parameter is significant, autocorrelation of the first order prevails, and appropriate corrections have been introduced in that particular equation to cure autocorrelation (see *Sargan* [1964]).

(6)
$$Q_t = -\ 13.21679 + 0.29223\ Y_t$$
$$(2.15496)\quad(9.24819)$$

$$p = 0.81934\,,\quad S = 1.75563\,,\quad x^2\,(10) = 27.96909$$
$$(7.99230)$$

(7)
$$R_{Lt} = 3.57791 + 0.01958\ Y_t + 0.17806\ R_{st}$$
$$(4.63427)\quad(4.64096)\qquad(4.14092)$$

$$p = 0.76992\,,\quad S = 0.28544\,,\quad x^2\,(10) = 15.76001$$
$$(6.86344)$$

(8)
$$M_t^d = -\ 4.40189 + 0.18539\ Y_t - 0.52961\ R_{st} + 0.87845\ M_{t-1}$$
$$(1.82847)\quad(2.85309)\qquad(2.87773)\qquad(15.36063)$$

$$p = -\ 0.00327\,,\quad S = 2.26757\,,\quad x^2\,(9) = 21.47308$$
$$(0.11985)$$

(9)
$$M_t^s = -\ 53.20086 + 0.89333\ R_{st} + 3.16873\ B_t - 0.77472\ R_{dt}$$
$$(8.96296)\quad(1.82229)\qquad(37.99887)\qquad(1.32269)$$

$$p = 0.74522\,,\quad S = 2.14731\,,\quad x^2\,(9) = 17.29789$$
$$(7.34545)$$

(10)
$$M_t^d = M_t^s = M_t$$

The $x^2\,(i)$-statistic is comfortably insignificant in the case of the consumption investment and long-term rate of interest equations. It is only insignificant at the 1 % level in the case of the construction, demand for money, and the supply of money equations. In the case of the import function it is insignificant at the 0.1 % level. Thus we may conclude that the identification/specification of practically all equations in the model are acceptable at the 1 % level, with the exception of the import function. Its very simple specification is obviously a clear enough reason.

We note the difference in the two sets of estimates — O. L. S. and T. S. L. S. — which although small, is due to the simultaneity bias referred to above. The estimates on the whole are quite acceptable; in all cases the coefficients have the right sign, and in most cases the coefficients are significant, too. Let us consider those equations which clearly show the channels through which the money supply can influence the aggregrate level of income. In the consumption equation, the current money supply possesses a statistically very significant coefficient. Liquid assets, therefore, have a significant role to play in the consumption equation, although the impact of M_t on C_t can very well be capturing the stance of a change in the implicit rate of discount applied to consumer durables. Money also influences aggregate income through fixed investment and construction investment. This influence of money is registered via the lagged $(\Delta C)_t$-variable and the lagged rate of interest. In both cases the lag implies that money affects investment after a lag of about six months. In the case of construction investment, though, the impact of money is registered in the same period[8]. We note that in these three equations the corresponding lagged endogenous variables — i. e. C_{t-1}, I_{t-1}, $(BS)_{t-1}$ — are significant except in the case of construction investment where it has failed badly. This may well be due to the nature of this type of investment. The other two suggest that roughly 79 % of the adjustment to the desired consumption is achieved within one quarter. Similarly, the coefficient of I_{t-1} implies that only 10 % of the adjustment to the desired rate of investment is achieved within one quarter. We note, finally, the statistical significance of the demand for and supply of money, which confirms the results established by *Frowen* and *Arestis* elsewhere (1976).

IV. Dynamic Multipliers

The above estimates, in particular the T. S. L. S. estimates with first-order autocorrelation, are now used to derive the reduced form for Y_t:

$$\begin{aligned} Y_t = {} & 20.91307 + 1.23692\, G_t + 0.43814\, B_t - 0.066541\, M_{t-1} \\ & + 0.26201\, C_{t-1} + 0.20024\, (\Delta C)_{t-1} + 1.11203\, I_{t-1} \\ & + 0.06584\, (BS)_{t-1} - 0.52630\, R_{Lt-2} \end{aligned}$$

The coefficients of this equation are called 'impact' multipliers. Each one of them measures the immediate — i. e. first quarter — impact on gross national product of a change in the corresponding predetermined variable, with all other predetermined variables held constant. Thus an increase in the monetary base by DM 1,000 million would increase the gross national product by DM 438 million in the same quarter; and a DM 1,000 million increase in government expenditure would increase the gross national product by DM 1,237 million. One may therefore be tempted to conclude that since the government expenditure 'impact'

[8] We have tried several lag structures in both the fixed investment and construction investment functions. In all cases, except in the ones reported in the main text of the paper, the coefficients were insignificant and in most cases had the wrong sign, too.

multiplier is higher than that of the monetary base, the G_t-variable is the dominant policy variable in the economy. However, this conclusion would be incorrect. The reason is not difficult to find. Gross national product depends not only upon exogenous variables such as G_t and B_t, but also upon several lagged endogenous variables, which are themselves affected by the exogenous variables. The inevitable conclusion must therefore be that in a model where structural lags are important, the net impact of an individual policy cannot be determined in isolation and by reference to its reduced form coefficients. What is required in this case is to eliminate, first of all, the lagged endogenous variables, except the ones that refer to policy instruments and the policy target. Having done that we can then study the dynamic impact of alternative policies. In other words, we need 'dynamic multipliers' and not 'impact multipliers'.

In order to derive dynamic multipliers, we need the 'final form' for Y_t.[9] This can be attained by expressing the lagged endogenous variables as functions of predetermined variables only, and then substitute in the reduced form. We thus have:

$$\begin{aligned} Y_t = {} & 0.50388 + 1.89806\, Y_{t-1} - 1.18633\, Y_{t-2} + 0.26431\, Y_{t-3} \\ & - 0.01276\, Y_{t-4} + 0.00006\, Y_{t-5} + 0.43814\, B_t - 0.78305\, B_{t-1} \\ & + 0.62453\, B_{t-2} - 0.29880\, B_{t-3} + 0.05092\, B_{t-4} - 0.00207\, B_{t-5} \\ & + 1.23692\, G_t - 2.12169\, G_{t-1} + 1.10239\, G_{t-2} - 0.18270\, G_{t-3} \\ & + 0.00692\, G_{t-4} \end{aligned}$$

The stability of the system is examined by considering the auxiliary equation:

$$\begin{aligned} Y_t - 1.89806\, Y_{t-1} + 1.18633\, Y_{t-2} - 0.26431\, Y_{t-3} + 0.01276\, Y_{t-4} \\ - 0.00006\, Y_{t-5} = 0 \end{aligned}$$

Applying the *Schur* theorem[10] we find that the system is stable.

Dynamic multipliers can now be derived. This is achieved by using the final form to express gross national product in terms of initial conditions and the current values of the exogenous variables. For the first period we have:

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[9] 'Final form' for Y_t is that form where Y_t is a function of past levels, of itself exogenous and lagged exogenous variables only.

[10] See *Chiang*, A. C., Fundamental Methods of Mathematical Economics, pages 551 - 552.

$$Y_1 = A_1 + 0.43814\, B_1 + 1.23692\, G_1$$

where A_1 = all initial conditions that are given. The dynamic multipliers for period 1 are therefore: 0.43814 for the monetary base, and 1.23692 for government expenditure.

Next, by making successive unit increases in the time period, a series of dynamic multipliers can be derived. Thus, if $t = 2$ we have:

$$Y_2 = A_2 + 1.89806\, Y_1 - 0.78305\, B_1 - 2.12169\, G_1 \quad \text{or}$$
$$Y_2 = A_2 + 1.89806\, [0.43814\, B_1 + 1.23692\, G_1] - 0.78305\, B_1 - 2.12169\, G_1 \quad \text{or}$$
$$Y_2 = A_2 + [(1.89806)\,(0.43814) - 0.78305]\, B_1 +$$
$$[(1.89806)\,(1.23692) - 2.12169]\, G_1$$

Clearly, $[(1.89806)\,(0.43814) - 0.78305] = 0.04857$ is the dynamic multiplier in the second quarter for the monetary base in the first quarter; similarly,

$$[(1.89806)\,(1.23692) - 2.12169] = 0.22606$$

is the dynamic multiplier in the second quarter for government expenditure in the first quarter. Further substitutions of this kind generate a series of dynamic multipliers. We have calculated dynamic multipliers for lags up to 16 quarters; these appear in the following table.

Dynamic Multipliers

Lags, i	B_{t-i}	G_{t-i}
0	0.43814	1.23692
1	0.04857	0.22606
2	0.19694	0.06407
3	0.13318	− 0.00234
4	0.07731	− 0.02956
5	0.03813	− 0.03921
6	0.01334	− 0.04078
7	− 0.00080	− 0.03865
8	− 0.00825	− 0.03496
9	− 0.01166	− 0.03075
10	− 0.01251	− 0.02857
11	− 0.01012	− 0.02650
12	− 0.00734	− 0.02409
13	− 0.00508	− 0.02144
14	− 0.00344	− 0.01874
15	− 0.00131	− 0.01616
16	− 0.00001	− 0.00435

With the exception of the first two quarters, the dynamic multipliers for the monetary base are higher than those for government expenditure. We also note that, as expected, a change in the monetary base has its greatest impact after two quarters, given the lags of the estimated model.

V. Conclusions

The dynamic multipliers we have calculated clearly indicate that with the exception of the first two quarters, the impact of changes in the monetary base is stronger than that of government expenditure. In fact, the government expenditure multiplier becomes negative by the end of the first year. The reason is that after the initial increase in government expenditure and the consequent expansionary impact on the level of both consumption and investment, and therefore income, there is a tendency for interest rates to rise, which, ceteris paribus, causes a reduction in the level of investment and income. The impact, now, of a change in government spending exerts relatively minor effects beyond the initial period. By contrast, an equivalent change in the monetary base exerts a much stronger influence during subsequent periods. There is another important conclusion that our empirical results tend to verify. This conclusion turns out to impinge on the question of the so-called 'crowding-out' effect. In other words, "does government spending with a constant money supply displace a near-equal amount of private spending"?[11] If it does, then obviously government spending has no lasting effect on national income, and the value of the government spending multiplier is approximately zero. In our dynamic analysis the 'crowding-out' effect would imply a cumulative[12] multiplier whose value would be roughly equal to zero. Now, the cumulative multiplier is not equal to zero. In fact, it is comfortably different from zero, as the reader can easily verify. Thus, the 'crowding out effect' is not applicable in the case of the Federal Republic of Germany. Obviously, our conclusions are based on the estimated coefficients of the above small, linear macro-economic model. The degree of confidence one attaches to them would consequently depend upon one's faith in the theoretical and empirical specification of the model. But it is certainly an improvement over those studies that utilise single-equation models.

[11] See *Carlson* and *Spencer* (1975) for a full review of this discussion.

[12] That is to say, the sum of the dynamic multipliers in all 16 quarters.

VI. References

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Zusammenfassung

Die dynamische Einwirkung von Staatsausgaben und Geldbasis auf das Volkseinkommen: Der Fall Westdeutschland

Der Aufsatz beschäftigt sich mit der dynamischen Einwirkung von Staatsausgaben und der Geldbasis auf das Volkseinkommen; er gibt Einsicht in die dynamischen Prozesse, durch die diese wirtschaftspolitischen Instrumente auf kurze Sicht die Volkswirtschaft beeinflussen.

Es wird ein einfaches makroökonomisches Modell entwickelt, bei dem das Geldangebot endogen durch den kurzfristigen Zins, den Diskontsatz und die Geldbasis bestimmt wird. Der kurzfristige Zins wird bestimmt durch Geldangebot und -nachfrage, wobei die Geldnachfrage eine Funktion der Einkommenshöhe, des kurzfristigen Zinses und des Geldvolumens früherer Perioden ist. Es wird angenommen, daß der kurzfristige Zinssatz den langfristigen über eine stabile Zeit-Struktur der Zinssätze beeinflußt. Im Modell wird ferner an-

genommen, daß sowohl Bauinvestitionen als auch die Bildung von Anlagevermögen vom langfristigen Zinssatz beeinflußt werden, während Verbrauchsausgaben eine Funktion des Geldvolumens sind.

Die empirischen Ergebnisse dieses Modells sind hinreichend zufriedenstellend, um eine grundlegende dynamische Gleichung zu gewinnen, die sich als stabil erweist, von der die zeitlichen Pfade der Auswirkungen von Veränderungen bei den Staatsausgaben und bei der Geldbasis auf das Bruttosozialprodukt abgeleitet werden. Mit Ausnahme der ersten beiden Vierteljahre ist die Wirkung von Änderungen der Geldbasis auf das Bruttosozialprodukt stärker als die von Änderungen der Staatsausgaben. Die letzteren haben allerdings eine unmittelbarere Wirkung, die jedoch viel schneller versickert als die durch eine Änderung der monetären Basis hervorgerufene Wirkung.

Summary

The Dynamic Impacts of Government Expenditure and the Monetary Base on Aggregate Income: The West German Case

This paper deals with the dynamic impacts of government expenditure and the monetary base on aggregate income; thus some light is thrown on the dynamic paths through which these instruments of economic policy affect the economy in the short run.

A simple dynamic macroeconomic model is developed with the money supply being endogenously determined by a short-term rate of interest, the discount rate and the monetary base. The short-term rate of interest is determined by the supply of and demand for money, the latter being a function of the level of income, short-term interest rates and the lagged money stock. The short-term interest rate is assumed to influence the long-term rate via a stable term structure of interest rates. The model further assumes that the level of both construction investment and fixed capital formation is influenced by the long-term interest rate, whereas consumption expenditure is a function of the money stock.

The empirical performance of this model is sufficiently satisfactory to obtain a fundamental dynamic equation — which is found to be stable — from which the time paths of the effects of changes in government expenditure and the monetary base on the gross national product are derived. With the exception of the first two quarters, the effect of changes in the monetary base on the gross national product is stronger than that of changes in government expenditure. The latter, though, has a more immediate impact which, however, is dispersed with far greater speed than that of the monetary base.

Résumé

L'influence dynamique des dépenses de l'état et de la base monétaire sur le revenu national: Le cas de l'Allemagne de l'ouest

Les auteurs s'intéressent à l'influence dynamique des dépenses publiques et de la base monétaire sur le revenu national; ils pénètrent dans les processus dynamiques par lesquels ces instruments de politique économique influent à court terme sur l'économie.

Ils développent un modèle macroéconomique simple dans lequel l'offre de monaie est déterminée endogénement par le taux d'intérêt à court terme, le taux d'escompte et la base monétaire. Le taux d'intérêt à court terme est défini par l'offre et la demande de monnaie, la seconde étant fonction de l'importance des revenus, du taux à court terme et du volume monétaire de périodes antérieures. Il est admis que le taux à court terme influence le taux à long terme via une structure stable dans le temps des taux d'intérêt. Le modèle admet également que les investissements en constructions et la formation de patrimoines sont influencés par le taux à long terme, tandis que les dépenses de consommation constituent une fonction du volume monétaire.

Les résultats empiriques du modèle sont suffisamment satisfaisants pour obtenir une équation dynamique fondamentale qui s'avère stable et dont dérivent les voies temporelles des influences sur le produit national brut des modifications survenant dans les dépenses de l'Etat et dans la base monétaire. A l'exception des deux premiers trimestres, l'effet de changements de la base monétaire sur le produit national brut est plus important que celui de modifications de dépenses de l'Etat. Ces dernières ont toutefois une influence plus immédiate, mais aussi plus éphémère que l'effet produit par la mutation de la base monétaire.