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STAFF MEMORANDA

IS GOVERNMENT SPENDING STIMULATIVE?

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In analyzing the effects of fiscal policy on the economy, traditional macroeconomic models stress that the choice between debt and tax financing of government spending may have distinctively different implications for consumption, investment, interest rates, and output. Bond financed expenditure typically is taken to be more stimulative than tax financed expenditure since individuals do not fully discount the future taxes implicit in bond issuance and as a consequence do not sufficiently reduce spending on consumer goods and services.

The newclassical approach to fiscal policy, on the other hand, emphasizes the role which operative intergenerational transfers may play in overturning this proposition. Barro (1974) establishes conditions under which the method by which government spending is financed is of no importance to the real economy. On this approach, altruistic individuals recognize that the taxes underlying any current public debt creation will be levied on subsequent members of their family line. Consequently, any shift from tax to bond financing of government spending is completely internalized by households, with the result of increased private savings and no additional effect on consumption expenditure or aggregate demand.

This "Ricardian" equivalence between bond and tax financing of a given public expenditure stream has been the subject of extensive empirical research. Boskin (1987), Feldstein (1982), Modigliani and Sterling (1986), and Poterba and Summers (1987), among others, offer evidence that consumption expenditure is affected by the method of government finance. However, Aschauer (1985), Barro (1978), Kochin (1974), Kormendi (1982), Seater (1982), Seater and Mariano (1985), and Tanner (1978, 1979) provide offsetting results. Other authors, such as Dwyer (1982), Evans (1985, 1986, 1987), and Plosser (1982, 1987) have found either no statistical association between public sector deficits and interest rates or a negative one, while Hoelscher (1987) captures a positive relationship between government bond issuance and long term interest rates. Aschauer (1988), Barro (1988), and Bernheim (1987) provide useful surveys of the empirical evidence. An objective reading of the research in this area would appear to yield the conclusion that the evidence is decidedly mixed on the basis of consumption studies, while in slight favor to the equivalence proposition on the basis of interest rate investigations.

Of course, granting the validity of the Ricardian theorem does not imply that fiscal policy has no impact on the economy. Clearly, taxes of the

non-lump sum variety generally will alter the incentives to consume and produce particular goods at particular points in time. Also, as emphasized earlier by Bailey (1971), the effects which government spending will have on macroeconomic variables depend upon the precise characteristics of the public expenditure being undertaken. Ahmed (1987) and Barro (1981, 1987), for instance, differentiate between transitory and permanent changes in goverment spending and trace out their effects on output, interest rates, and the trade balance.

Along this line of reasoning, temporary surges in goverment spending—typically associated with wartime—create an excess demand for goods and services, induce upward interest rate pressures, and result in either an increase in domestic production or a trade deficit. In contrast, a permanent rise in government expenditure promotes an equal degree of resource scarcity across time periods and has little or no effect on interest rates. Furthermore, as a permanent rise in government spending would be more likely to be associated with an increase in marginal tax rates—and greater disincentives to engage in the market activities of employment and production—output would be expected to rise by less than in the face of an equal sized transitory increase in public spending.

This paper takes a different tack and investigates the extent to which public consumption and investment spending have diffferential impacts on the level of gross national product. The empirical results indicate that distinguishing between government spending on current and capital accounts may be of fundamental importance to the proper assessment of the potency of government spending shocks to the economy. Specifically, public net investment in infrastructure capital—highways, port facilities, dams, sewers, etc.—turns out to have a dramatically larger impact on output than does military investment or public consumption expenditure.

I. Theoretical Concerns

The theoretical issues involved in differentiating between public consumption and investment expenditure and their consequent impact on output have been investigated elsewhere and are only discussed briefly here.[1] For detail, the reader is referred to Aschauer and Greenwood (1985). The government is assumed to spend on current and capital accounts in the amount gc and gi, respectively. Expenditures on current account provide consumption services (e.g. school lunches) as well as productive services (e.g. police and fire protection). Let the marginal rate of substitution between private consumption and public consumption services be denoted as u_{gc} and the marginal productivity of government services be given as f_{gc}. Government spending on capital account—additions to the public capital stock—similarly may provide a flow of consumption services and pro-

duction services. For instance, the stock of public highways may complement automobiles in producing vacations and simultaneously be functioning as an input in the production of private sector output. Define the marginal rate of substitution between private consumption and the service flow derived from public capital as u_{gi} and the marginal productivity of public capital as f_{gi}.

Specify the level of aggregate demand for goods and services as

$$y^d = c(r,gc,gi,...) + i(r,gi,...) + gc + gi \qquad (1)$$

where y^d = aggregate demand for goods and services, c = private consumption expenditure, i = private investment, gc = government spending on non-durable goods and services, gi = government investment, and r = real interest rate. In the neoclassical model, both private consumption and investment respond negatively to higher real interest rates. A permanent increase in government spending on consumption goods and services—holding fixed distortional taxes—will raise or lower private consumption expenditure depending upon the extent to which the goods provided by the public sector act as complements or substitutes to private consumption goods and they affect the level of effective wealth.[2] The impact on effective wealth, in turn, is proportional to the term $(u_{gc} + f_{gc} - 1)$; hence, effective wealth will fall with an increase in government spending on current services if, on the margin, the sum of the utility and production services is less than the private consumption opportunities foregone. For example, if private and public consumption goods were perfect substitutes and the goods played no role in private production ($u_{gc} = 1, f_{gc} = 0$) then a permanent rise in government spending on such goods would have no effect on the level of effective wealth and private consumption would fall one-to-one with the rise in government spending. Aggregate demand then would be left unaffected. In general, however, the effect on private consumption to a first approximation will be given by the term $(mpc/r)^*(u_{gc} + f_{gc} - 1) - u_{gc}$, where mpc = marginal propensity to consume out of wealth. Consequently, aggregate demand rises with an increase in government spending if the marginal value of government services in all uses is less than unity. A temporary increase in government spending on consumption goods—defined to be a rise inducing no change in the present value of government spending—will impact private consumption only to the extent that private and public goods are substitutes or complements. For example, in an intermediate case of less than perfect substitutability, private consumption would decline in an amount proportional to u_{gc}, less than in the instance of a permanent rise and its associated negative wealth effect operating on consumption, so that aggregate demand would rise by an amount directly related to $(1 - u_{gc})$. Aschauer (1985) and Kormendi (1983) contain results for the United States indicating that, indeed, public expenditure on goods and services is less than perfectly substitutable for pri-

vate sector spending. Ahmed (1986) finds similar effects of public consumption on private consumption in the United Kingdom and, in addition, that the marginal productivity of public services is sufficiently low as to yield the inequality $u_{gc} + f_{gc} < 1$.[3] We take these results as a maintained hypothesis in the subsequent discussion; consequently, the net effect on aggregate demand of a rise in government spending on consumption goods and services will not be as large as the rise in government spending itself, regardless of whether the change in public purchases is of a transitory or persistent character.

Public investment potentially can affect private consumption along various channels as well. In particular, net public investment will impinge on effective wealth to the extent that there has previously been an over or under-accumulation of public capital. Given that the marginal product of public capital plus the marginal rate of substitution between the flow of services from public capital lies above the marginal product of private capital, $f_{gi} + u_{gi} > f_i$, an increase in public net investment will raise effective wealth and thereby promote an increase in private consumption expenditure in an amount roughly equal to $(mpc/r)^*(f_{gi} + u_{gi} - f_i)$ per unit of net public investment.

A more central argument of this paper, however, is that public and private capital can be expected to be complementary inputs to the process governing the production of private goods and services. Specifically, a rise in government investment--given current capital stocks--may raise the marginal productivity of private capital and, in turn, stimulate higher private investment expenditure. This, coupled with the previously described effects on consumption and the likelihood that public capital spending will be transitory in nature, suggests that public investment expenditure may have significant positive effects on the level of aggregate demand.

The level of output supplied may be expressed as

$$y^s = y(r,gc,gi,...). \tag{2}$$

Here, higher real interest rates stimulate output along intertemporal substitution lines by raising the future value of current productive activity. Also, to the extent that government consumption expenditures lower effective wealth, higher government spending will raise the level of output in an amount equal to $(f_n^*mpcl/r)^*(u_{gc} + f_{gc} - 1)$ per unit of spending, where f_n = marginal product of labor and mpcl = marginal propensity to consume leisure out of wealth. Finally, higher govenment spending on current services will have a direct effect on output equal to f_{gc}, yielding a total effect on output of $(f_n^*mpcl/r)^*(u_{gc} + f_{gc} - 1) + f_{gc}$ per unit increase in such government spending.

Public investment spending similarly will impact on the level of output along a wealth channel. Specifically, a rise in public investment will induce an employment response depending on the sign of $f_i - f_{gi} - u_{gi}$; if the public capital stock is "too low"—so $f_i < f_{gi} + u_{gi}$ —the increase in the level of public capital accumulation will raise wealth and lower the supply of labor services in an amount equal to $(mpcl/r)^*(f_i - f_{gi} - u_{gi})$.

Equilibrium in the goods market results in the expression

$$y = f(gc,gi,...) \tag{3}$$

where the hypotheses of interest involve the magnitude of the response of output to a rise in public consumption and public investment spending, respectively. The framework of the neoclassical model implies that a rise in government spending on consumption goods and services will induce less than a unitary response of output. For example, in the case of a persistent rise in public consumption expenditure, the maximum impact on output will be given by $1 - u_{gc} < 1$; taking into account the effect the induced rise in interest rates has on aggregate demand as well as distortional taxation further attenuates the potency of such a rise in government spending. On the other hand, the impact on output of a rise in public investment spending is given by $a^*(f_i - u_{gi} + f_{gi}) + b^*(f_{i,gi} - f_{i,i})$, where $f_{i,gi}$ and $f_{i,i}$ represent the effect of higher public and private capital, respectively, on the marginal product of private capital. Here a and b represent positive constants. The first term in this expression relates output to any impact which higher public capital accumulation may have on wealth. If the public capital stock is at a deficient level, higher government capital formation will raise wealth and lower work effort while raising desired consumption. The induced excess demand for output raises interest rates and, in equilibrium, lowers the level of output. Aschauer (1987b) attempts to determine the extent to which the public capital stock has deviated from its optimal level. Although the point estimates therein suggest the possibility that the public capital stock may be too low, it is not possible to reject the hypothesis that a rise in public investment will not have any marginal effect on the level of wealth of the representative agent in the economy. The second term indicates the effect which public capital accumulation will have on output provided such capital is not a perfect substitute for its private sector counterpart. In the case of infrastructure capital we posit that $f_{i,gi} > 0$ while $f_{i,i} < 0$, so a rise in public investment potentially will have very strong positive effects on the evolution of private sector output.

II. Empirical Analysis

The empirical analysis centers on the period 1949 to 1985 and utilizes annual data. Aside from the data obtained from the *National Income and Product Accounts,* the paper also employs data on public net investment as published in *Fixed Reproducible Tangible Wealth in the United States.* The analysis relates gross national product to various public expenditure variables, the public sector deficit, and the growth rate of the monetary base.[4] [5] The government spending variable is composed of total expenditures on goods and services by all levels of government. The public net investment series is computed along perpetual inventory lines by subtracting cumulative depreciation from the gross capital stock—cumulative gross investment minus discards—so as to obtain the net capital stock. Depreciation of this form of capital to derive a net capital stock series is achieved by comparisons with similar types of private capital, data from governmental agencies on actual service lives, and on the assumptions made by Goldsmith in a background study on corporate stock ownership by institutional investors. The government capital accumulation series consists of federal, state, and local net expenditures on equipment and structures and includes spending on military items, highways, sewers, dams, educational structures, and other major public works projects. Government consumption is determined residually by subtracting public net investment from total expenditures on goods and services. As such, government consumption includes expenditures for the purpose of replacing depreciated or discarded public capital.

As discussed by Granger and Newbold (1974), Nelson and Kang (1984), and Nelson and Plosser (1981), in any study concerning the level of real output and associated time series it is necessary to take proper account of the likely nonstationarity of the data so as to avoid possible spurious correlations. The usual procedure is to first difference the data to achieve this end and thereby to focus on high frequency relationships in the sample. In the current study, a different procedure is followed to address the problem of nonstationarity. Specifically, the variables of particular interest are expressed relative to the private net capital stock. The rationale is that this specification will allow the analysis to pick up local trend relationships between public spending and output which the process of first differencing quite possibly would eliminate.

The regression of the output-capital ratio on a constant, time, and a lagged value of itself yields the results

$$y = .41 - .002time + .71y(-1)$$
$$\quad (.16)\ (.001) \qquad (.11)$$

r-squared = .87
s.e.r. = .031
log-likelihood = 77.86
s.s.r. = .032

The output-capital ratio will be difference stationary if the coefficient on time is insignificantly different from zero and the coefficient on the lagged value of the output-capital ratio is insignificantly different from unity. If, instead, the coefficient value on the lagged value of the output-capital ratio is significantly less than unity, the output-capital ratio is trend stationary. The t-ratio for the purpose of testing the null hypothesis that the coefficient on y(-1) equals unity is computed as 2.64. For small samples, the least squares estimate of y(-1) is not distributed about unity but rather a smaller value. Dickey and Fuller (1979) present correct empirical distributions for the estimators of the above specification. For a sample size of 25, a t-ratio of 2.16 implies a 99 percent probability that the coefficient on y(-1) is less than unity. Thus, we may reject difference stationarity in favor of trend stationarity for the output-capital ratio.

Is Government Spending Expansionary?

Consider now the regression of the output ratio on the level of total government expenditures on goods and services, relative to the private net capital stock, and the rate of growth of the monetary base. We obtain

$$y = 1.09 - .005time + .87g + .54dm$$
$$\quad (.08)\ (.001) \qquad (.17) \quad (.18)$$

r-squared = .887
s.e.r. = .026
d-w = 1.24
log-likelihood = 81.68
s.s.r. = .026

Here, an increase in government spending has a significant, positive impact on the level of output, and the point estimate lies quantitatively, though not significantly, below unity. This result is in harmony with the neoclassical model and is consistent with the less than unitary response of output to temporary and permanent government spending results of Barro (1981).[6] An increase in the money base growth rate also induces a statistically important increase in the level of output. This, too, can be interpreted as being consistent with an equilibrium model due to either

informational discrepancies or deviations from superneutrality, at least on the transition path between steady-states.[7] Note, however, that the value of the Durbin-Watson statistic lies in the inconclusive range of the test for serial correlation in the residuals. Reestimating the equation with a first order autocorrelation correction allows the result

$$y = 1.25 - .006time + .51g + .55dm$$
$$\quad (.15)\ (.002) \qquad (.30) \quad (.18)$$

rho = .55 (.16)
r-squared = .911
s.e.r. = .025
log-likelihood = 83.86
s.s.r. = .020

Thus, we still find a significant relationship between the overall level of government expenditure on goods and services and the level of output, though only at the 10% level. Further, the 95% confidence interval for the coefficient on government spending allows for a multiplier as large as 1.1, somewhat larger than the value of unity as suggested by neoclassical theory.

However, the discussion above indicated that it may be inappropriate to assess the impact of government spending on the economy without taking consideration of the possible differential effects of government consumption and investment spending. Table I contains estimates of the effect of government consumption, military investment, and non-military investment on the output ratio. Here, government consumption is defined residually by subtracting from total government spending on goods and services public net investment, where the latter has been categorized into military and non-military components. The equations contained in Table I indicate that for the period 1949 to 1985 non-military public net investment—infrastructure investment—has had the most importance in influencing the level of output, while military investment and public consumption have had quantitatively minor and statistically insignificant effects on gross national product. Indeed, in all the equations, a rise in the level of public infrastructure investment of one dollar is associated with a rise in the level of output of approximately four dollars.

It might be claimed that a partial reason for this high positive association of output with productive public investment is due to the fact that both variables are expressed relative to a common variable, the private net capital stock. This argument may be addressed by estimation by two stage least squares, using the level of public net non-military investment relative to the public net capital stock as an instrument. This results in

Table I

Dependent variable is gross national product relative to the net private capital stock (both in 1982 dollars)

	(1) OLS	(2) FOAC	(3) OLS	(4) FOAC	(5) OLS	(6) FOAC
const	1.22	.121	1.30	1.28	1.28	1.29
	(.14)	(.16)	(.04)	(.06)	(.03)	(.06)
time	−.005	−.005	−.006	−.005	−.006	−.006
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
ignm	3.80	3.72	4.10	4.20	4.37	4.11
	(.88)	(1.47)	(.70)	(1.13)	(.65)	(1.10)
igm	.34	.21	.48	.66	–	–
	(.53)	(1.30)	(.46)	(.98)		
gc	.22	.24	–	–		
	(.38)	(.49)				
dm	.58	.49	.62	.48	.63	.50
	(.17)	(.18)	(.15)	(.16)	(.15)	(.16)
rho	–	.35	–	.37	–	.35
		(.19)		(.19)		(.18)
const	1.22	.121	1.30	1.28	1.28	1.29
	(.14)	(.16)	(.04)	(.06)	(.03)	(.06)
time	−.005	−.005	−.006	−.005	−.006	−.006
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
ignm	3.80	3.72	4.10	4.20	4.37	4.11
	(.88)	(1.47)	(.70)	(1.13)	(.65)	(1.10)
igm	.34	.21	.48	.66	–	–
	(.53)	(1.30)	(.46)	(.98)		
gc	.22	.24	–	–	–	
	(.38)	(.49)				
dm	.58	.49	.62	.48	.63	.50
r-sq	.914	.919	.915	.921	.915	.923
s.e.r.	.025	.024	.024	.024	.024	.024
d-w	1.40	–	1.38	–	1.36	–
s.s.r.	.019	.017	.019	.017	.020	.017

standard errors in parentheses.

y = real gross national product

ignm = non-military net public investment in equipment and structures

igm = military net investment in equipment and structures

gc = public consumption expenditures; all relative to the private net capital stock.

dm = percentage growth rate of monetary base.

y = 1.28 - .006time + 4.43ignm + .63dm
(.03) (.001) (.65) (.15)

r-squared = .915
s.e.r. = .024
d-w = 1.36
log-likelihood = 87.04
s.s.r. = .020

and, with a first order autocorrelation correction,

y = 1.29 - .006time + 4.07ignm + .50dm
(.06) (.001) (1.12) (.16)

rho = .35 (.18)
r-squared = .923
s.e.r. = .024
log-likelihood = 86.48
s.s.r. = .017

Thus, the only change in the estimated equations is to be found in the coefficients of the public investment variable and such changes are statistically negligible.

Lucas (1976) called attention to the perils of assuming the coefficients of a reduced form expression to be invariant to changes in the underlying policy process. In the present case the forcefulness of this argument is diminished, at least relative to monetary applications, as the relationship between public capital accumulation and output depends upon channels which would be operative even if changes in government investment policy were preannounced. Still, it is of interest to determine whether or not the relationship between public investment spending and the level of output exhibits stability throughout the sample period. Estimating the last equation for the two subperiods from 1949 to 1967 and 1968 to 1985 leads to the results

1949-67:

y = 1.31 - .009time + 7.31ignm + .82dm
(.03) (.001) (1.64) (.16)

r-squared = .826
s.e.r. = .013
d-w = 1.87
s.s.r. = .006

1968-85:

$$y = 1.03 - .001time + 6.65igrm + .46dm$$
$$\quad (.20)\ (.003) \qquad (2.41) \qquad (.32)$$

r-squared = .826
s.e.r. = .016
d-w = 1.69
s.s.r = .009

The statistic relevant for testing the hypothesis of coefficient stability has an F-distribution with (4,28) degrees of freedom. The value of the statistic is 2.28, below the 95 percent critical point of the distribution, which is 2.71. Thus, we do not reject the hypothesis of stability, although it is informative to note that for both subsamples the estimated coefficient on the public net investment variable has increased by a large amount. However, given the size of the standard errors of the coefficient estimate, it is not possible to confidently reject the hypothesis that the coefficient equals the value obtained earlier from the full sample regressions.

As further evidence of the robustness of these results, consider the following regressions on subsamples obtained by deleting the first and last four years of the full sample period. This eliminates, in turn, the influence of both the immediate post-World War II period (1949-52) and of the most recent period of extremely low public investment (1982-85). We have

1953-85

$$y = 1.22 - .004time + 5.19ignm + .51dm$$
$$\quad (.06)\ (.001) \qquad (.97) \qquad (.20)$$

r-squared = .91
s.e.r = .024
d-w = 1.34
s.s.r. = .017

1949-81

$$y = 1.30 - .006time + 4.24ignm + .72dm$$
$$\quad (.03)\ (.001) \qquad (.63) \qquad (.15)$$

r-squared = .897
s.e.r. = .023
d-w = 1.43
s.s.r. = .015

The results thus do not appear to be dependent upon the particular sample chosen for the purpose of estimation, although there is some evidence of a larger effect of government net investment on the level of output for the period beginning in 1953.

Are Government Deficits Important?

We now investigate the effect of public sector deficits, as measured by the National Income and Product Accounts, on the level of output. Table II contains the regressions relevant to the question of whether or not the method of financing public expenditure has any importance for output *given* the effects of public investment and money growth. Consider first the ordinary least squares results which indicate a statistically significant negative relationship between the level of output and the government deficit. While not consistent with standard analyses of the effects of public sector deficits, this result that deficits are contractionary has theoretical support in work by Aschauer (1987a), Blanchard (1984), Feldstein (1984), and Mankiw and Summers (1987).[8] Apparently, correcting for serial correlation in the residuals only strengthens this effect.

Of course, the deficit bears a countercyclical relationship to output, largely due to the procyclicality of tax revenues.[9] To take account of the implied simultaneity bias, equations (3) and (4) were run employing two stage least squares, with military net investment and government consumption relative to the private capital stock taken as instruments. While leaving the strong positive effect of public non-military investment virtually unaltered, the coefficient on the deficit variable changes sign but is statistically insignificant in both equations. Even taking the point estimates in the latter cases as valid, however, it is clear that public investment has the larger effect on the level of output.

We may also take account of the countercyclicality of the budget deficit by utilizing a series on the high-employment budget deficit. Such a series for the federal deficit is available for the period 1955 to 1985 and is to be found in Holloway (1986). Equations (5) through (8) contain estimates of the effects of public net investment and the cyclically-adjusted budget deficit on the output-capital ratio. The introduction of this variable, expressed relative to the net private capital stock, has two important effects on the fitted equations. First, the magnitude of the relationship between the public investment variable and output is enhanced, with the public capital accumulation multiplier now lying in the range of six to eight. However, this is to a large extent due to the elimination of the first seven sample points, as the coefficient on the public investment variable in a regression excluding the high employment budget deficit variable equals 5.87 (.96) and 6.41 (1.18) for the ordinary least squares and first-order autocorrelation correction es-

Table II

Dependent variable is gross national product relative to net private capital stock (in 1982 dollars)

	(1) OLS	(2) FOAC	(3) TSLS	(4) TSLS/FOAC	(5) OLS	(6) FOAC	(7) OLS	(8) FOAC
const	1.26	.124	1.29	1.27	1.11	1.03	1.00	1.00
	(.03)	(.07)	(.04)	(.07)	(.09)	(.10)	(.01)	(.02)
time	−.005	−.004	−.006	−.005	−.002	−.001	–	–
	(.001)	(.001)	(.001)	(.001)	(.002)	(.002)		
ignm	4.41	4.56	4.34	4.29	6.40	7.22	7.64	7.58
	(.61)	(1.34)	(.77)	(1.21)	(1.18)	(1.38)	(.54)	(.70)
def	−.63	−.85	.55	−.43	–	–	–	–
	(.27)	(.23)	(.62)	(.37)				
hdef	–	–	–	–	−.42	−.62	−.91	−.73
					(.53)	(.51)	(.34)	(.38)
dm	.52	.37	.73	.42	.37	.31	.21	.27
	(.15)	(.13)	(.21)	(.15)	(.21)	(.20)	(.16)	(.17)
rho	–	.55	–	.47	–	.32	–	.34
		(.17)		(.18)		(.19)		(.18)
r-sq	.925	.943	.881	.937	.914	.924	.912	.927
s.e.r.	.023	.020	.029	.021	.023	.021	.023	.021
d-w	1.02	–	1.60	–	1.29	–	1.19	–
s.s.r.	.017	.012	.027	.014	.014	.014	.015	.011

standard errors in parentheses.

def = National Income and Product Accounts total public sector deficit

hdef = cyclically-adjusted federal budget deficit; both deflated by the implicit deflator for gross national product and expressed relative to the net private capital stock.

timates, respectively (standard errors in parentheses). Second, the coefficient on the trend variable, although still negative, is not statistically different from zero. Elimination of the time variable from the regression then allows the coefficient on the high employment deficit to attain statistical importance in explaining the evolution of output, but the estimated relationship indicates a negative association between the deficit and output, just as in the ordinary least squares estimation employing the unadjusted total government budget deficit. Clearly, public net investment appears to have more importance in explaining output than does the size of the public sector deficit, whether the latter is or is not adjusted to take account of automatic effects associated with the business cycle.

III. Conclusion

This paper has investigated the implication of distinguishing between public consumption and public net investment—on non-military and military equipment and structures, respectively—for a proper assessment of the importance of fiscal policy to the level of output. Briefly, while military investment and public consumption are of little statistical importance to gross national product, net public investment in infrastructure capital has a strong positive effect on the level of output. The channel by which public net investment on non-military items is expected to have such an expansionary effect on output is through a structural complementary relationship between private and public net capital stocks in the private production process. Specifically, a rise in public capital accumulation enhances the productivity of private capital which, in turn, stimulates additional private capital investment. Aschauer (1987c) offers supporting evidence by isolating a strong positive association between the public non-military capital stock and the rate of return to non-financial corporate capital, the latter being measured as the ratio of corporate profits plus net interest (as a return to debt holders) to the replacement value of fixed nonresidential capital, land, and inventories.

Further, given the level of public investment, neither the National Income and Product Accounts budget deficit nor a version adjusted for cyclical effects exhibits the positive association with output claimed by conventional macroeconomic models. Thus, in determining the effects of fiscal spending and revenue plans on the economy, the results of this paper suggest that more attention should be focused on the type of expenditure being advocated and less on the method by which such spending is to be financed, whether by debt or taxes.

[1] The underlying model assumes an infinite planning horizon, a constant returns to scale production technology, and competitive conditions in factor and product markets.

[2] Effective wealth is defined as the economy-wide level of wealth, obtained by consolidating private and public sector budget constraints. In the present context it may be written as

$$k_0 + \sum_t R_t(w_t + (u_{gc} + f_{gc} - 1)gc_t + (f_{gi} + u_{gi} - r_t)gk_{t-1})$$

where k_t = national (private plus public) capital stock during period $t+1$, $R_t = ((1+r_1)(1+r_2)...(1+r_t))^{-1}$, w_t = real wage in period t, and gk_t = public capital stock during period t + 1.

[3] More exactly, Ahmed (1986), Aschauer (1985), and Kormendi (1983) obtain point estimates for u_{gc} in the range (.2, .4) while Ahmed (1986) finds a value of f_{gc} of .39.

[4] Results involving net as opposed to gross national product were insufficiently distinguishable from those of the paper to warrant reporting.

[5] This paper does not differentiate between expected and unexpected money growth but rather focuses on the effects of various fiscal policies. Mishkin (1983) contains results which indicate a significant expansionary role for expected money, although less than that of unexpected money. Blanchard (1987) is a thoughtful survey of these and related issues.

[6] Barro (1981) isolated a greater expansionary effect of temporary than of permanent changes in military spending. Permanent changes in non-military purchases were found to be insignificantly different than zero. Note that Barro's empirical specification involved regressing the natural logarithm of real output on various government spending variables exressed relative to gross output.

[7] See, for example, Fischer (1979), where higher money growth is associated with faster rates of capital accumulation in the optimizing model of Sidrauski (1967), at least for preferences in the constant relative risk aversion class.

[8] Aschauer (1987a) argues in an optimizing framework with time separable preferences that to the extent government debt issuance increases perceived wealth, desired work effort will decrease, reducing the level of output in equilibrium. Blanchard (1984) provides a model such that in an environment of slowly increasing deficits over time, real interest rates on long bonds rise, thereby depressing investment and output. Feldstein presents a two sector model in which a negative fiscal deficit multiplier becomes possible through induced changes in the sectoral balance of demand. Mankiw and Summers (1987) offer the idea that an appropriate scale variable in money demand is aggregate consumption and not real output; consequently, it becomes possible for a tax cut to be contractionary if the effect on output due to the excess demand for goods is dominated by the effect due to an increased demand for money.

[9] See, for example, Firestone (1960).

Data Sources

The private and public capital stock series are mid-year arithmetic averages of the end-of-year net stocks published in Fixed Reproducible Tangible Wealth in the United States 1925-85. The private net stock is composed of fixed nonresidential capital in billions of 1982 dollars (Table 8, column 1). The public net stocks are of non-military and military capital, also in billions of 1982 dollars (Table 16, columns 1 and 4). The public investment flows are the changes in the end-of-year stocks. Government consumption expenditure is derived by subtracting public net investment from total government expenditure on goods and services, the latter being obtained from the Economic Report of the President. The monetary base is from the Federal Reserve Bulletin. The NIPA deficit is converted to a real magnitude using the deflator for gross national product, both obtained from the Economic Report of the President. The cyclically adjusted deficit is from Holloway (1986).

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