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FISCAL POLICY AND AGGREGATE DEMAND

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Fiscal Policy and Aggregate Demand

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This paper is an investigation of the effects of fiscal policy on private consumption and aggregate demand within an explicit intertemporal optimization framework. Empirical evidence is brought to bear on the following questions: (1) is consumption sensitive to the choice of tax versus debt financing of current government expenditure and (2) to what extent, if any, does government spending directly substitute for private consumer expenditure?

The former question has stimulated a considerable amount of research since the Barro (1974) revival of the "Ricardian equivalence" proposition. Kochin (1974), Barro (1978), Tanner (1979) and Kormendi (1983) obtain empirical results favorable to the proposition that, to a first approximation, the choice between current taxation and debt issuance to finance a given government expenditure stream is irrelevant to the determination of the level of aggregate demand. On the other hand, Feldstein (1982) rejects some of the assumptions adopted in the empirical specifications of Kochin, Barro and Tanner and comes to the conclusion that "...each of the basic implications of the so-called 'Ricardian equivalence theorem' is contradicted by the data."[1]

The latter question has also been touched upon in recent empirical studies. Feldstein's (1982) results detract from the proposition of "fiscal neutrality" whereby an increase in government spending induces an *ex ante* crowding out of an equal amount of private consumption expenditure. However, Kormendi (1983) obtains support for his "consolidated approach" to fiscal policy by finding a substantial degree of substitutability between government spending and private consumption.

The argument advanced in this paper is that probable misspecification bias in these previous studies renders the results suspect and may account for the fact that minor changes in the empirical models lead to radically different conclusions regarding the potency of fiscal policy. In place of the conventional methodology an alternative approach is presented which exploits restrictions placed on the data by the first order necessary conditions for intertemporal optimization in consumption. The empirical evidence is supportive of the joint hypothesis of rational expectations and Ricardian equivalence as well as of the proposition that government spending substitutes poorly for private consumption in utility.

I. Effective Consumption and Intertemporal Optimization

In this section we develop the model to be estimated later in the paper and point out some inherent difficulties in previous tests of fiscal neutrality. The theory applies to a representative individual who has time-separable preferences over private consumption, C, and the goods and services flowing from the government sector, G. Specifically, the agent's utility function is given by

$$V_t = \sum_{j=0}^{\infty} \left(\frac{1}{1+\delta} \right)^j u(C^*_{t+j}) \tag{1}$$

where δ is a constant rate of time preference and $u(\cdot)$ is a time-invariant, concave momentary utility function. Finally, $C^*_t = C_t + \theta G_t$ denotes the level of "effective" consumption in period t, a linear combination of private consumption and government goods and services. The constant marginal rate of substitution implies that a unit of government goods and services yields the same utility as θ units of private consumption.[2]

The representative agent is allowed unrestricted access to a capital market at which he may accumulate or decumulate assets at the assumed constant real rate of interest r. His period t flow budget constraint is given by

$$\frac{W_{t+1}}{1+r} - W_t + C_t = N_t - T_t \tag{2}$$

where: $W_t \equiv$ beginning of period holdings of one period bonds (which includes government debt), each unit of which is a claim to a unit of output, $N_t \equiv$ period t labor earnings and $T_t \equiv$ period t tax payments (net of transfers). Forward substitution in equation (2) yields

$$\sum_{j=0}^{\infty} \left(\frac{1}{1+r} \right)^j C_{t+j} = W_t + \sum_{j=0}^{\infty} \left(\frac{1}{1+r} \right)^j [N_{t+j} - T_{t+j}] \tag{3}$$

which equates the present discounted value of private consumption expenditure to initial asset holdings plus the present discounted value of net of tax labor earnings.[3]

The government sector has a flow budget constraint of the form

$$\frac{B_{t+1}}{1+r} - B_t + T_t = G_t \tag{4}$$

where $B_t \equiv$ government debt of one period maturity. Provided that the government debt grows at a rate less than the real rate of return,[4] equation (4) may be utilized to produce

$$\sum_{j=0}^{\infty} \left(\frac{1}{1+r} \right)^j T_{t+j} = B_t + \sum_{j=0}^{\infty} \left(\frac{1}{1+r} \right)^j G_{t+j} \tag{5}$$

which equates the present discounted value of tax receipts to the initial government debt plus the present discounted value of government purchases.

The representative individual is assumed to be "forward looking" in regard to the fiscal affairs of the government. In particular, the agent recognizes the future tax obligations implicit in current debt issuance, which allows an equivalence between tax or debt finance of a given government expenditure stream. In addition, the individual takes into consideration the benefits to be derived from the future provision of goods and services by the government. Accordingly, the private and public sectors can be integrated by the substitution of the government budget constraint (5) into the representative agent's budget constraint (3) to obtain the following budget constraint in terms of effective consumption:

$$(6) \qquad \sum_{j=0}^{\infty} \left(\frac{1}{1+r}\right)^j C^*_{t+j} = (W_t - B_t) + \sum_{j=0}^{\infty} \left(\frac{1}{1+r}\right)^j [N_{t+j} + (\theta - 1)G_{t+j}].$$

Thus, the present discounted value of effective consumption is constrained by the level of net economy-wide wealth $(W_t - B_t)$, plus the present discounted value of labor earnings, plus $(\theta-1)$ times the present discounted value of government expenditure. The last term arises because a higher level of government spending imposes a negative (positive) wealth effect on the representative individual as long as $\theta < (>) 1$.

The maximization of the individual's objective function (1) subject to the effective intertemporal budget constraint (6) yields as first order necessary conditions

$$u'(C^*_{t+j}) = \lambda \cdot \left(\frac{1+\delta}{1+r}\right)^j \qquad j = 0,1,2,\ldots$$

along with the intertemporal budget constraint (6). Here, λ is a Lagrangian multiplier attached to (6) in the consumer's maximization problem. The consideration of the choice of consumption in the adjacent periods t, t+1 then leads to the Euler equation

$$(7) \qquad u'(C^*_{t+j}) = \left(\frac{1+\delta}{1+r}\right) u'(C^*_t).$$

Hence, in order for the individual to be choosing an optimal (interior) time path for effective consumption, it must be the case that he cannot improve his welfare standing by reducing effective consumption in one period, say t, and increasing effective consumption during another period, say t+1. The cost of reducing effective consumption during period t and purchasing a bond would be the reduction in utility such an action would entail, or $u'(C^*_t)/(1+r)$. The benefit of this action would be the (subjectively discounted) gain in utility during period t+1 to be obtained from the proceeds of the investment, which would be $u'(C^*_{t+1})/(1+\delta)$.

Note, in passing, the generality of condition (7). For instance, this condition should hold even if utility were also dependent upon leisure (in a manner separable from effective consumption) and there were quantity constraints in the labor market. As long as free access to the credit market is allowed, the agent would allocate resources so as to attain a smooth consumption profile even if during certain periods of his life he faced a situation of involuntary unemployment.

In order to obtain a closed-form solution for consumption, we restrict the form of preferences in the objective function (1). Assuming the monetary utility function is quadratic so

$$u(C^*_t) = -\frac{1}{2}(\overline{C}^* - C^*_t)^2$$

where $\overline{C}^*$ is the bliss level of effective consumption, the Euler equation is given by

$$C^*_{t+1} = \alpha + \beta C^*_t \tag{8}$$

where $\alpha \equiv [(r-\delta)/1+r]\overline{C}^*$ and $\beta \equiv (1+\delta)/(1+r)$. Using (8) to substitute out C^*_{t+j} $(j = 1,2,\ldots)$ in equation (6) allows us to write

$$C^*_t = [\frac{(\delta-r)}{r(1+r)^2}]\overline{C}^* + [\frac{r^2+2r-\delta}{(1+r)^2}]\{\sum_{j=0}^{\infty}(\frac{1}{1+r})^j[N_{t+j} + (\theta-1)G_{t+j}] + (W_t - B_t)\}. \tag{9}$$

Finally, the separation of the period t levels of income and government spending from the present value term in (9) yields the specification

$$(10) \qquad C_t = \beta_0 + \beta_1 N_t + \beta_2 W_t + \beta_3 G_t + \beta_4 T_t + \beta_5 B_t + \beta_6 \sum_{j=1}^{\infty} \left(\frac{1}{1+r}\right)^j N_{t+j} + \beta_7 \sum_{j=1}^{\infty} \left(\frac{1}{1+r}\right)^j G_{t+j}$$

where $\beta_0 = (\delta - r)\bar{C}^*/[r(1+r)^2]$, $\beta_1 = \beta_2 = -\beta_5 = \beta_6 = \beta_7/(\theta-1) \approx r/(1+r)$, $\beta_3 \approx -(r+\theta)/1+r$, where the approximations are for $\delta \approx r$, and $\beta_4 = 0$.

Let us consider the relationship between the specification in equation (10) and that to be found in Feldstein's (1982) previous study of fiscal policy effectiveness[5]:

$$(10') \qquad C_t = b_0 + b_1 Y_t + b_2 W_t + b_3 G_t + b_4 T_t + b_5 B_t$$

where all variables are as measured before and Y_t is permanent income, measured by total national income. Feldstein argues, first, that the Ricardian equivalence theorem implies the restrictions $b_4 = 0$ and $b_2 + b_5 = 0$, which are in accord with the theoretical coefficients in equation (10). Second, he asserts correctly that a test of full fiscal neutrality, whereby current changes in government spending induce an equal, opposite shift in private consumption, would entail the additional restriction that $b_3 = -1$ in equation (10'). Despite the fact that the proposed restrictions are correct for the test of the null hypothesis, at least three criticisms can be pointed toward this formulation.

The first, obvious, criticism arises from the treatment of current income as exogenous for the purpose of estimation. As first pointed out by Haalvelmo (1943) since the disturbance term will not be orthogonal to current income, biased and inconsistent estimates will arise in ordinary least squares regression. Feldstein attempts to correct for this bias by employing instrumental variables for income and taxes in some of the reported regressions. Still, the chosen instruments--lagged income and taxes--may not be able to fully eliminate the bias due to serial correlation in the data series.[6]

Second, in his empirical work Feldstein enters a lagged value of total national income to capture any extra information it may contain as to permanent income. Implicit is the assertion that national income follows a second order autoregressive process. In this context, it would seem more appropriate to follow Sargent (1978) by postulating an auxiliary equation for income and computing estimates subject to the cross-equation restrictions between the stochastic processes governing consumption and income which would be imposed by the assumption of rational expectations. Further, the permanent income measure chosen by Feldstein--national income--is inappropriate since it includes future non-labor income as well as future labor income and the former is already accounted for in the wealth variable.[7] The appropriate income variable to be chosen is labor income as should be clear from inspection of the specification in (10).

Third, and most important to the issues of the present paper, the formulation in (10') omits any influence of future levels of government spending on current consumption decisions. Feldstein's own "fiscal expectations" view holds that a change in the current value of government spending or taxes signals future changes in one or both of these variables. This implies that the omitted government spending variables should be expected to be highly correlated with the fiscal policy variables which are included in (10'). Consequently, the coefficient estimates of the latter variables will be biased and will result in incorrect inferences regarding the ability of fiscal policy actions to alter aggregate demand.

For example, suppose that current tax revenues are positively correlated with future government spending. Then, since the theory predicts consumption to be negatively related to government spending (assuming $0 < \theta < 1$), the omission of future government spending from the regression equation (10') will tend to bias the estimated coefficient on the current tax variable below zero and provide an apparent refutation of the proposition of Ricardian equivalence. In this case, the current tax variable merely acts as a proxy for higher expected government spending. The general point is that since the current values of the fiscal policy variables carry information regarding future government spending, it is difficult to determine the extent to which the statistical significance of the fiscal policy variables in (10') uncovers a true structural relationship.

The approach of this paper is to abandon the methodology of earlier studies in this area of research and instead to utilize the restrictions which the Euler equation (7) places on the data as in Hall (1978), Flavin (1981), Mankiw, Rotenberg and Summers (1982), Hansen and Singleton (1983) and others.[8] This avoids the problems cited above and yields evidence on the substitutability of government spending for private consumption and on the joint hypothesis of rational expectations and Ricardian equivalence.

II. The Data and Empirical Results

In the study of intertemporal consumption behavior, it is of vital importance to distinguish between consumption and consumer expenditure. At any point in time, consumption might arise without any act of consumer spending (e.g., the enjoyment of programs from a previously acquired television set) as well as consumer expenditure without consumption (e.g., the purchase of a lawn mower at a winter sale). Ideally, then, one would like to add to current consumer expenditure a flow of services from previously acquired consumer durables and to subtract current expenditures on durable goods to obtain an adequate measure of consumption. In this paper, an attempt at the latter adjustment is made by defining consumption to be consumer expenditures on nondurables and services. Notice, however, that this adjustment is crude since many goods included in this category would still have durable characteristics. Further, no attempt at the former adjustment is made due to the arbitrariness and difficulties involved in the imputation of a service flow from the stock of consumer durables. Therefore, as the term is used in the empirical analysis below, consumption is per capita consumer expenditure on nondurables and services measured in constant (1972) dollars. Quarterly data are used throughout the study.

The empirical analysis assumes, again, quadratic utility but now in an explicitly stochastic environment so that the Euler equation may be written as

$$E_t C^*_{t+1} = \alpha + \beta C^*_t \tag{11}$$

where, as before, $\alpha \equiv [(r-\delta)/(1+r)]\bar{C}^*$, $\beta = (1+\delta)/(1+r)$ and E_t is the expectations operator conditional on information available up through period t.

We begin by neglecting the predicted theoretical effect of government spending on the time path of consumption so that equation (11) reduces to Hall's (1978) condition written here as

$$E_t C_{t+1} = \alpha + \beta C_t. \tag{11'}$$

Hall estimates (11') and finds that the data support the implication of the permanent income hypothesis that consumption follows a random walk with drift.[9] As a further check on the validity of the permanent income hypothesis, Hall in sequence introduces lagged values of consumption, disposable income and wealth to see if these variables have any predictive power for current consumption apart from that of one period lagged consumption. Although past values of wealth--as measured by stock prices--turn out to be statistically significant in predicting current consumption, Hall comes to the overall positive conclusion that "...there is little reason to doubt the life cycle-permanent income hypothesis."[10]

As the present paper is concerned with the impact fiscal policy actions have on the intertemporal path of consumption, consider the effect of past government deficits on current consumption as in the following regression equation

$$(12) \qquad C_t = \alpha + \beta C_{t-1} + \gamma_1 D_{t-1} + \gamma_2 D_{t-2} + \gamma_3 D_{t-3} + \gamma_4 D_{t-4} + u_t$$

where D_t is the per capita net deficit of the total government sector measured in constant (1972) dollars. The results from estimating this equation by ordinary least squares for the sample period 1948:I to 1981:IV are listed in Table 1.

The deficit variable makes a statistically important contribution to the predictive power of the equation, with primary influence arising from the first and second lagged values. The F-statistic for testing the null hypothesis that the coefficients on the deficit variable are all zero is equal to 4.17, substantially above the 5% critical value of 2.44 for (4,130) degrees of freedom. Thus, at least at first blush it appears that a damaging blow has been inflicted upon the Ricardian equivalence hypothesis and hence also upon the theoretical structure of this paper.

However, it may be argued that the influence of government financial variables on private consumption may be more apparent than real due to the fact that past taxes or deficits may help to predict current government spending. In this case, if government spending substitutes for private consumption in utility then the estimates of $\gamma_1,\ldots,\gamma_4$ would be expected to be significantly different than zero. Rather than providing a refutation of the joint hypothesis, the above results could be logically interpreted as evidence in favor of the joint hypothesis, provided that the cross-equation restrictions imposed by the theory cannot be rejected at conventional levels of significance.

So as to take consideration of this point, decompose effective consumption into its private and public components and write from equation (11) the following equation:

$$(13) \qquad C_t = \alpha + \beta C_{t-1} + \beta\theta G_{t-1} - \theta G_t^e + u_t.$$

Here, G_t^e is the expected level of government purchases for time t conditional upon all information available to the agent at time t-1. Government spending is measured empirically by per capita government expenditure on goods and services in constant (1972) dollars.[11]

The auxiliary equation to be employed in the prediction of the current level of government spending is given by

$$(14) \qquad G_t = \gamma + \varepsilon(L)G_{t-1} + \omega(L)D_{t-1} + v_t$$

where $\varepsilon(L) = \sum_1^n \varepsilon_i L^{i-1}$ and $\omega(L) = \sum_1^n \omega_j L^{j-1}$, L being the lag operator $LX_t \equiv X_{t-1}$, and v_t satisfies the orthogonality condition $E(v_t|I_{t-1}) = 0$ (I_s being the information set available to the agent at time s) so that v_t is serially uncorrelated. Written in this form, it is postulated that apart from past values of government spending past values of government financial variables, summarized by past deficits, help to predict current government expenditure. The linear least squares predictor of G_t is then given by

$$E_{t-1}G_t \equiv G_t^e = \gamma + \varepsilon(L)G_{t-1} + \omega(L)D_{t-1}$$

which, upon substitution into equation (13), yields the two equation system below:

(15a) $$C_t = \delta + \beta C_{t-1} + \eta(L)G_{t-1} + \mu(L)D_{t-1} + u_t$$

(15b) $$G_t = \gamma + \varepsilon(L)G_{t-1} + \omega(L)D_{t-1} + v_t.$$

The "hallmark" of the rational expectations modelling approach is the existence of a set of cross-equation restrictions which is implied by the underlying theoretical structure. In the present case, we obtain

(16)
$$\delta = \alpha - \theta\gamma$$
$$\eta_i = \begin{cases} \theta(\beta - \varepsilon_i) & i = 1 \\ -\theta\varepsilon_i & i = 2,\dots,n \end{cases}$$
$$\mu_j = -\theta\omega_j \qquad j = 1,2,\dots,m.$$

Thus, the equation set (16) restricts the way in which past government expenditure and past government deficits may influence present consumption expenditure. In particular, if the Ricardian equivalence proposition does not hold, past values of the government deficit should have explanatory power for consumption expenditure apart from their role in forecasting government spending. Consequently, a finding that the data do not do violence to the restriction set (16) yields some ground on which to argue that, to a first approximation, the joint assumption of rational expectations and Ricardian equivalence provides a plausible description of reality.

The empirical procedure is to estimate the system (15) subject to the restrictions (16) by the method of full information maximum likelihood to acquire estimates of the free parameters of the system $(\alpha,\beta,\theta,\gamma,\varepsilon_1,\ldots,\varepsilon_n,\omega_1,\ldots,\omega_m)$, which are n + m + 4 in number. The method allows for nonlinear parameter restrictions within and across equations. The actual estimation was carried out in the TROLL computer package which utilizes the iterative hill-climbing technique developed by Davidon-Fletcher-Powell to maximize the likelihood function. The results of this estimation for the sample period extending from 1984 I to 1981 IV for the case of two lagged values of government spending and two lagged values of the government deficit are reported in Table 2.

Overall, the results appear to be encouraging for the joint hypothesis. Consider, first, the constrained estimates of the free parameters of the system. The estimated coefficient on the lagged value of consumption is highly significant and equal unity, with the implication that--holding fixed the level of government spending--private consumption expenditure follows a random walk process. The point estimate for the substitutability of public spending for private consumption equals .23 and is significantly different from zero at the 5% level. This result that government spending substitutes poorly for private spending implies that increases in government purchases of goods and services will have important expansionary effects on aggregate demand even in a setting where the government financing decision is irrelevant to the determination of real variables. In an expanded neoclassical model as in Hall (1980) or Barro (1981), to the extent that such increases in government spending are temporary in nature (e.g., wartime expenditure), there would also be a stimulative effect on real output as the induced rise in the real rate of return would call forth an intertemporal substitution of work effort from the future to the present. Note also that the point estimate of $\theta = .23$ is roughly in accord with Kormendi's (1983) results.

The results indicate that government spending reacts to a process innovation in a cumulative--and borderline unstable--manner. Further, the level of government purchases appears to be positively related to past government deficits, with principal predictive power being confined to the first lagged value of the deficit. Given that government spending and deficits are characterized by positive serial correlation, this latter result may be rationalized along the lines in Barro (1979) or Kydland and Prescott (1980) by the recognition that optimal public finance would require that temporary increases in government spending should be financed by debt creation in an attempt to smooth tax rates over time and, thereby, minimize the deadweight loss due to distortionary labor income taxation.

Next, compare the unconstrained parameter estimates with the hypothesized values obtained by substituting the constrained estimates into the set of restrictions (16). We may argue in a heuristic manner that the data do not contain substantial evidence against the joint Ricardian equivalence - rational expectations hypothesis if the unconstrained parameter estimates and the hypothesized parameter values do not differ by a substantial amount from one another. Inspection of the latter two columns in Table 2 indicates that all parameters carry the same signs and are roughly of the same order of magnitude. We should expect, therefore, that a formal statistical test will not lead to a strong rejection of the (joint) null hypothesis.

Turning to this point, since the unconstrained version of the system (15) has $2(n+m)+3$ regressors and the number of free parameters in the system is equal to $n+m+4$, the log-likelihood ratio statistic

$$-2 \log_e (L_r/L_u)$$

is distributed in large samples as a $\chi^2(k)$ random variable with $k = [2(n+m)+3] - (n+m+4) = n+m-1$ degrees of freedom, where L_r is the value of the log-likelihood function under the constrained maximization and L_u is its value under the unconstrained maximization. A large discrepancy between the constrained and unconstrained values of the log-likelihood function results in a large value of the test statistic and evidence against the null hypothesis that the constrained model is true. For the case examined above where $n = m = 2$ the value of the log-likelihood ratio statistic is 4.281, substantially below the 10% critical value of the $\chi^2(3)$ distribution, 6.25 (the implied marginal confidence level is 76%, so that the null hypothesis cannot be rejected at a significance level lower than 24%). Therefore, in this case the data are incapable of rejecting the null hypothesis at conventional significance levels.

Notice that the least significant of the variables in the constrained estimation is the second lagged value of the deficit in the government purchases equation. A natural course would be to reestimate the model for the case of two lagged values of government spending and one lagged value of the government deficit. The results of this estimation over the sample period 1948 I to 1981 IV are listed in Table 3. The constrained coefficient estimates maintain the same, or nearly the same, values and levels of statistical significance. The only exception is the first lagged deficit variable, the coefficient of which experiences an increase in its value and a fall in its estimated standard error. Again, the unconstrained parameter estimates and the values implied by the constrained estimates and the restriction set (16) always have the same signs and are similar in magnitude. In this case, the log-likelihood ratio statistic is distributed asymptotically as $\chi^2(2)$ and takes on the value 4.280 which is still below the 10% critical value of the $\chi^2(2)$ distribution, 4.61 (the implied marginal confidence level is 87%). Although the elimination of the two period past deficit raises the confidence level at which the null hypothesis can be rejected, it remains impossible to argue that the data provides evidence against the joint proposition of Ricardian equivalence and rational expectations at conventional levels of significance.

The values of the Durbin h statistic in Tables 2 and 3 do not indicate the presence of a significant amount of autocorrelation in the estimated residuals of the consumption and government purchases equations. Nevertheless, a further check on the robustness of the results obtained above was implemented by expanding the lags of the government spending and deficit variables. Table 4 reports values of the associated log-likelihood ratio statistics as well as estimated values of the substitutability parameter, θ.[12] In all cases the null hypothesis under consideration cannot be rejected at the 10% level of significance. In one case, $n = m = 6$, it would be impossible to reject the null hypothesis at a significance level lower than 25%. The value of the substitutability parameter tends to rise with the number of included lags of government spending and deficits, to as much as .421 with the inclusion of two years of past spending and deficits. For the cases $n = m = 3$, $n = m = 4$ and $n = m = 6$, however, the substitutability parameter takes on the value $\theta = .33$, almost exactly the value found by Kormendi (1983) utilizing the conventional methodology. On the basis of these results we may come to the overall conclusions that the data do not appear capable of strongly rejecting the Ricardian equivalence theorem and that rises in government spending will only induce a partial ex ante crowding out of private consumption.

III. Conclusion

This paper has investigated the question of fiscal impotence within an explicit rational expectations optimizing framework. Two questions were posed: (1) to what extent does government spending induce an *ex ante* crowding out of private consumption expenditure and (2) to what degree do the data contain evidence against the tax discounting hypothesis associated with the theoretical analysis of Barro (1974)? Public expenditure was seen to reduce private consumper expenditure on non-durables and services in the range of 23 to 42%, a range which is compatible with Kormendi's (1983) results. The values of the log-likelihood ratio statistics are too low to reject the joint rational expectations-Ricardian equivalence hypothesis at the typical 5% or 10% levels, a finding which adds some support to the earlier empirical work of Barro (1978), Kochin (1979), Plosser (1982) and Kormendi (1983).

The new-classical school of macroeconomic policy stresses the real effects of government spending rather than the method by which such spending is financed. The primary effect of temporary increases in government spending on output arise from the attempt by economic agents to smooth effective consumption levels over time. Hence, if $0 < \theta < 1$, this attempt will induce a reallocation of resources from other periods to the present which, in turn, will increase rates of return and cause an intertemporal substitution of work effort and a contemporaneous expansion of output. The empirical results of this paper suggest that this view of the effects of fiscal policy actions on the economy deserves at least some credibility, perhaps even the status of the working hypothesis.

Footnotes

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1. Feldstein (1982, p. 9).

2. See, for example, Barro (1981). We ignore other possible channels of influence of government spending on the economy such as providing infrastructure capital as an input to private production processes. On related matters see Aschauer (1983) and Buiter (1977).

3. The solvency condition $\lim_{k\to\infty}(\frac{1}{1+r})^k W_{t+k} = 0$ has been imposed to obtain equation (3).

4. To be exact, we impose $\lim_{k\to\infty}(\frac{1}{1+r})^k B_{t+k} = 0$. The conditions under which this is likely to hold are discussed by Barro (1974, 1976) and Feldstein (1976).

5. We abstract from social security wealth although it could be readily incorporated into the analysis. Also, it should be noted that similar criticisms could be made of other studies using the same methodology. Feldstein's was chosen at random.

6. See Feldstein (1982, p. 13).

7. As an illustration of this point, suppose wealth is kept fixed at the value W_t for $j = 0,1,\ldots,$ so

$$W_t = \sum_{j=0}^{\infty} (\frac{1}{1+r})^j RW_t$$

where $RW_t \equiv rW_t/1+r$ is the future nonlabor income the individual would receive in each period. Abstracting from governmental variables to center on the particular issue under consideration, we could write permanent income as

$$R[W_t + \sum_{j=0}^{\infty} (\frac{1}{1+r})^j N_{t+j}]$$

or, by substituting for W_t in this expression

$$R[\sum_{j=0}^{\infty} (\frac{1}{1+r})^j Y_{t+j}]$$

where $Y_{t+j} = [N_{t+j} + RW_t]$ may be taken to be national income. Thus, Feldstein is being redundant in defining permanent income in terms of national income and adding an independent wealth variable in (9').

8. Another interesting avenue would be to follow the instrumental variable approach as in Hayashi (1982).

9. The important implication of the Hall model is that $E(u_t X_{t-1}) = 0$ where X_{t-1} is any variable in the information set at time t-1 other than C_{t-1}. To see this, consider a simple Keynesian model with an investment accelerator as below:

$$C_t = cY_{t-1} + \varepsilon_t$$

$$I_t = v(Y_t - Y_{t-1}) + \eta_t$$

$$Y_t = C_t + I_t$$

where ε_t and η_t are both white noise processes. The reduced form equation for consumption is

$$c_t = \tilde{\beta} C_{t-1} + u'_t$$

where $\tilde{\beta} = (v-c)/(v-1)$ so for v large and $C \approx 1$, $\tilde{\beta} \approx 1$. However, in the Keynesian case we find that $E_t(u'_t X_{t-1}) \neq 0$. Crucial to this argument, of course, is the assumption of time separability in the specification of the consumer's preferences.

10. Hall (1978, p. 985).

11. The empirical analysis does not attempt to differentiate between government purchases which provide current utility and government purchases which provide future utility either directly or indirectly through private production processes. This distinction was made in the later sections of Kormendi (1983).

12. Complete results are available from the author by request.

Appendix: Variable Definitions and Statistical Sources

C_t ≡ real per capita consumer expenditure on nondurable goods and services

D_t ≡ net real per capita deficit of federal, state and local governments

G_t ≡ real per capita expenditures of federal, state and local governments

Deflation of nominal aggregates is by the implicit price deflator (1972=100) and total population of the United States. All variables are taken from the Citibank economic database, "Citibase".

Table 1. Ordinary Least Squares Estimate of Equation (12)

1948:I to 1981:IV

Constant	C_{t-1}	D_{t-1}	D_{t-2}	D_{t-3}	D_{t-4}	SER = 2.09 $\bar{R}^2$ = .998
1.522	.999	−.054	.066	−.042	−.026	h = .875
(.754)	(.003)	(.025)	(.036)	(.036)	(.025)	F = 4.17

Notes: Estimated standard errors in parentheses. h is Durbin's test statistic for serial correlation in the residuals in the presence of lagged dependent variables. F is the value of the statistic appropriate for testing the null hypothesis that the coefficients on the lagged values of the government deficit are all zero. $C_t \equiv$ per capita consumer expenditure on nondurables and services in constant (1972) dollars. $D_t \equiv$ per capita net deficit of federal, state and local governments in constant (1972) dollars.

Source: Citibank economic database.

Table 2. FIML Estimation of Equation System (15):

1948:I to 1981:IV

$n = m = 2$

constrained	unconstrained	hypothesized
α = 1.360 (.117)	δ = 1.922 (1.238)	δ = .920
β = 1.002 (.001)	β = .990 (.015)	β = 1.002
θ = .229 (.111)	η_1 = -.024 (.061)	η_1 = -.088
γ = 1.293 (.659)	η_2 = .035 (.060)	η_2 = .088
ε_1 = 1.385 (.077)	μ_1 = -.028 (.026)	μ_1 = -.010
ε_2 = -.384 (.077)	μ_2 = -.002 (.025)	μ_2 = -.010
ω_1 = .041 (.030)	γ = 1.267 (.749)	γ = 1.293
ω_2 = .025 (.030)	ε_1 = 1.421 (.080)	ε_1 = 1.385
$\bar{R}^2_C$ = .998	ε_2 = -.420 (.080)	ε_2 = -.384
$\bar{R}^2_G$ = .998	ω_1 = .027 (.033)	ω_1 = .041
h_C = 1.17	ω_2 = .026 (.034)	ω_2 = .025
h_G = .44	$\bar{R}^2_C$ = .999	
	$\bar{R}^2_G$ = .998	

$-2 \log_e(L_r/L_u) = 4.281$

Notes: Estimated standard errors in parentheses. See Table 1 for definition of h. The coefficients in the column headed "hypothesized" are obtained by substitution of the constrained coefficient estimates into the set of restrictions (16).

Source: Citibank economic database.

Table 3. FIML Estimation of Equation System (15):

1948:I to 1981:IV

$n = 2,\ m = 1$

constrained	unconstrained	hypothesized
α = 1.370 (.121)	δ = 1.930 (1.239)	δ = 1.068
β = 1.002 (.001)	β = .990 (.002)	β = 1.002
θ = .231 (.113)	η_1 = −.026 (.057)	η_1 = −.093
γ = 1.308 (.654)	η_2 = .037 (.056)	η_2 = .090
ε_1 = 1.404 (.075)	μ_1 = −.029 (.015)	μ_1 = −.014
ε_2 = −.403 (.075)	γ = 1.278 (.150)	γ = 1.308
ω_1 = .061 (.016)	ε_1 = 1.442 (.075)	ε_1 = 1.404
$\bar{R}^2_C$ = .998	ε_2 = −.441 (.075)	ε_2 = −.403
$\bar{R}^2_G$ = .998	ω_1 = .049 (.018)	ω_1 = .061
h_C = 1.340	$\bar{R}^2_C$ = .999	
h_G = .010	$\bar{R}^2_G$ = .998	

$$-2 \log_e (L_r / L_u) = 4.280$$

Notes: See Table 2.

Table 4. Values of the Log-likelihood ratio

Statistic and θ estimates

n = m =	N	θ	$-2 \log_e L_r/L_u$	k	$\chi^2_{.75}$	$\chi^2_{.90}$	$\chi^2_{.95}$
3	136	.331	8.710	5	6.63	9.24	11.07
4	136	.332	11.481	7	9.04	12.02	14.07
6	134	.332	13.561	11	13.70	17.28	19.68
8	132	.421	21.568	15	18.20	22.31	25.00

Notes: N ≡ sample size. k ≡ degrees of freedom for likelihood ratio test.

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