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THE EFFECTS OF GOVERNMENT SPENDING ON PRIVATE CONSUMPTION: THEORY AND EVIDENCE

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The Effects of Government Spending on Private Consumption: Theory and Evidence

by

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I. INTRODUCTION

Consistent with the recent course of much of macroeconomics, the analysis of fiscal policy has undergone significant changes during the past decade or so. The Ricardian Equivalence Proposition (REP), for example, has become a benchmark for analysis of government debt, even for those who are skeptical of its empirical validity. Similarly, although perhaps less dramatically, a neoclassical benchmark has also been emerging in the analysis of the determinants and effects of government purchases. Like the REP, this new benchmark has its roots in the equilibrium approach to macroeconomics. The seminal effort is due to Bailey (1962, 1971). Among other contributors to the theory and its empirical basis have been Buiter (1977), Hall (1980), Barro (1981, 1984), Plosser (1982), Kormendi (1983), Benjamin and Kochin (1984), Aschauer (1985), Judd (1985), Ahmed (1986), and Aschauer and Greenwood (1986). Borrowing from the title of Aschauer's (1986) excellent survey, we call this new theoretical benchmark the "Equilibrium Approach" to the analysis of government spending.

The Equilibrium Approach combines several distinct elements. It 1) assumes that government purchases are exogeneous to consumption and output; 2) incorporates the direct substitutability of government purchases for private consumption and investment into the framework of the Permanent Income Hypothesis; and 3) allows government purchases to affect real output through the labor supply response to the wealth and intertemporal substitution effects of

government purchases, as well as through the provision of public inputs into private production processes. Although details of these elements can be altered without doing fundamental violence to the approach--in particular the exogeneity of government purchases--these three elements form the basis of the Equilibrium Approach benchmark in its current state.

This paper contains two main parts. First, we develop the theory of incorporating the consumption effects of government purchases into a three equation system for government purchases, output and consumption suitable for estimation. In doing so, we derive the cross-equation restrictions implied by the theory under standard but restrictive assumptions, such as constant real interest rates and ideal data. We will argue, however, that reasonable extensions of the theory would result in underidentification of certain key parameters, thus precluding standard tests of the theory using overidentifying restrictions. For this reason, we do not focus here on single country tests of the cross-equation restrictions. Instead, in the second part of the paper, we use 29 years of post-War time series data from a panel of 30 countries, and ask whether the estimated parameters for each country obey certain relations across the countries in the panel, relations predicted by the Equilibrium Approach. In this regard, we follow Lucas (1973), Kormendi and Meguire (1984), and Kormendi and LaHaye (1987).

The paper proceeds as follows. In Section II, we first review the consumption-income model of Kormendi and LaHaye, and then modify it to obtain the three-equation system mentioned previously. We present our estimates of this system and our examination of the cross-country relations in the parameters estimated from the time series for each country in Section III. We discuss our results and directions for further research in Section IV.

II. THE EQUILIBRIUM APPROACH TO GOVERNMENT SPENDING

II.1. Preliminaries

We begin by restating the two-equation model presented in Kormendi and LaHaye (1987), which draws on the work of Hall (1978) and Flavin (1981). We then introduce a series of modifications which results in the three-equation specification to be estimated in Section III.

The economy's oneperiod budget constraint is given by

$$(1) \quad w_t = (1+r)w_{t-1} + x_t - c_t - g_t ,$$

where w_t is the end-of-period capital stock (non-human wealth), r the constant real rate of interest, x labor income, c consumption expenditures, and g is government purchases.[2] Various concepts of permanent income can be obtained from the period t infinite horizon budget constraint

$$(2) \quad rw_{t-1} + (1-\alpha)\sum_j \alpha^j E_t x_{t+j} - (1-\alpha)\sum_j \alpha^j E_t g_{t+j} = (1-\alpha)\sum_j \alpha^j E\, c_{t+j}$$

where the summations range from 0 to infinity, $\alpha = 1/(1+r)$, and E_t is the expectations operator conditional on information available in period t. We assume full current information, i.e., $E_t V_t = V_t$, $\forall V$.

We use the following definitions:

$$(3) \quad x_t^p = (1-\alpha)\sum_j \alpha^j E_t x_{t+j} \qquad \theta_{x_t} = x_t^p - E_{t-1}x_t^p = (1-\alpha)\Sigma\alpha^j(E_t - E_{t-1})x_{t+j}.$$

$$g_t^p = (1-\alpha)\sum_j \alpha^j E_t g_{t+j} \qquad \theta_{g_t} = g_t^p - E_{t-1}g_t^p$$

$$y_t^p = rw_{t-1} + x_t^p \qquad \theta_{y_t} = y_t^p - E_{t-1}y_t^p = \theta_{x_t}$$

$$z_t^p = y_t^p - g_t^p \qquad \theta_{z_t} = \theta_{x_t} - \theta_{g_t}.$$

y_t^p, permanent total income, is a scalar measure of the economy's current and expected future resource constraints. z_t^p, permanent "disposable" income, is a a similar measure of the constraints on households, which by (2) equals the present discounted value of expected (infinite) lifetime consumption.[3] The θ's are innovations to permanent labor income (x), permanent government purchases (g) and permanent disposable income (z).

Let the expected lifetime utility of households be an additively separable function of consumption, having the form

$$W = \sum_j \delta^j E_t[U(c_{t+j}) + V(l_{t+j}, g_{t+j})] ,$$

where $\delta = 1/(1+\rho)$ and ρ is the constant utility rate of time preference, U and V are time invariant functions, and l is leisure. Then the usual Euler equation linking the expected marginal utility of consumption across periods applies (Hall [1978]). The exact form of the consumption function and the time series behavior of c_t will naturally depend on the form of U. For the case of quadratic utility

$$(4) \quad c_t = k_o + kz_t^p,$$

where k_0 and k are related to ρ, r and the bliss level of consumption.[4] More generally, however, (4) can be interpreted as a linear approximation to the "true" relation between current consumption and the scalar measure of the economy's intertemporal budget constraint as embodied in z_t^p.

Using (1) and (3), it can be shown that

$$E_{t-1}z_t^p = (1+r)z_{t-1}^p - rc_{t-1}$$

so that if consumption is given by (4), the expected component of current consumption is

$$(5)\quad E_{t-1}c_t = (1+r(1-k))c_{t-1} - rk_0 ,$$

The unexpected component, resulting from new information on permanent labor income and government purchases, is

$$(6)\quad c_t - E_{t-1}c_t = k\,\theta_{z_t}$$

Combining (5) and (6), and adding a disturbance term ε_{ct} which is assumed orthogonal to the other rhs variables, we obtain

$$(7)\quad \Delta c_t = -rk_0 + r(1-k)c_{t-1} + k\,\theta_{z_t} + \varepsilon_{ct}.$$

Dividing by c_{t-1} to correct for heteroskedasticity yields (8), the consumption function estimated in Kormendi and LaHaye:

$$(8)\quad \frac{\Delta c_t}{c_{t-1}} = \frac{-rk_0}{c_{t-1}} + r(1-k) + k\,\theta'_{z_t} + \varepsilon'_{ct},$$

where the primes indicate innovations obtained from appropriately weighted regressions.

In order to complete the model we must relate the permanent income innovation, θ'_{z_t}, to observed data. With labor income and government purchases data we could simply estimate a disposable labor income process, using the same weighting as in the consumption equation,

$$\frac{\Delta(x-g)_t}{c_{t-1}} = \sum_{i=1}^{r} h_i \frac{\Delta(x-g)_{t-1}}{c_{t-1}} + \varepsilon'_{(x-g)_t} ,$$

to obtain

$$\theta'_{z_t} = \left(\frac{1}{1 - \sum_{i=1}^{r} \alpha^i h_i}\right) \varepsilon'_{(x-g)_t} \equiv V_z\, \varepsilon'_{(x-g)_t}.$$

Because we do not have labor income data for our panel of 30 countries, we estimate the time series process for "disposable total income" (y - g) where y is GNP (y = rw + x):

$$(9)\quad \frac{\Delta (y-g)}{c_{t-1}} = \sum_{i=1}^{r} f_i \frac{\Delta (y-g)}{c_{t-1}} + \varepsilon'_t$$

and define $\theta'_t \equiv V\varepsilon'_t$ where $V \equiv \dfrac{1}{1 - \sum_{i=1}^{r} a^i f_i}$. The term V, derived from the time series properties of disposable income, can be interpreted on the "persistence" of disposable income innovations.

Now, all that remains is to make some assumption about the relation between the observable θ'_t and the unobservable θ'_{z_t}. At this point assume that disposable labor income x-g is a constant fraction ϕ of disposable total income y-g. In this case, $\theta'_{zt} = \phi\theta_t$, and (8) becomes

$$(10)\quad \frac{\Delta c_t}{c_{t-1}} = \frac{-rk_0}{c_{t-1}} + r(1-k) + (k\phi V)\varepsilon'_t + \varepsilon'_{ct}$$

An unrestricted form of (10) suitable for estimation is

$$(11)\quad \frac{\Delta c_t}{c_{t-1}} = \beta_0 + \beta_1\left[\frac{1}{c_{t-1}}\right] + \beta\varepsilon'_t + \varepsilon'_{ct}$$

Even given some interest rate r (and hence α), the parameters V, k_0, k and ϕ are just identified within the context of the system (9) and (10), so that it is not possible to test $\beta = k\phi V$ directly. Moreover, if interest rates are endogeneous, in which case $\beta > k\phi V$ (as per Michener [1984]), or if variables have been excluded from (9) that are useful for predicting y, in which case $\beta < k\phi V$ is likely (see Kormendi and LaHaye [1986]) then tests of the relation between $\beta = k\phi V$ computed over a single country or regime are difficult to interpret.

For these reasons, Kormendi and LaHaye estimated (9) jointly with (11), and then asked whether there was evidence of a positive relation between the estimated values of β and V from each country. As long as observed parameters such as ϕ are not correlated with V across countries, variation in such parameters will reduce the measured correlation between β and V, biasing results away from the PIH. This cross-sectional procedure admits a positive relation more general than simple proportionality between the measured θ and "true" θ. It is also robust to any "excess sensitivity" of consumption to income innovations induced by endogeneous interest rate movements.[6]

II.2. Effects of Government Purchases on Consumption

Kormendi and LaHaye define private disposable income as GNP net of government purchases. This definition implicitly assumes that the persistence of innovations in GNP and government purchases are equal. It also assumes that such purchases do not substitute for, or interact in any other way with, private spending on consumption and investment. For these reasons, we now modify the preceding model by allowing the processes governing total income and government purchases to be estimated separately. This allows us to 1) estimate separate persistence parameters, V_y and V_g, for the two processes; 2) distinguish between the effects on consumption, β_y and β_g, of innovations in income (ε_y) and government purchases (ε_g); and 3) incorporate the substitutability of government purchases for private spending.

The basic three equation model is[7]

$$(12)\quad \frac{\Delta g_t}{c_{t-1}} = \sum_i a_i \frac{\Delta g_{t-i}}{c_{t-1}} + \sum_i b_i \frac{\Delta y_{t-i}}{c_{t-1}} + \varepsilon'_{gt}$$

$$\frac{\Delta y_t}{c_{t-1}} = \sum_i c_i \frac{\Delta g_{t-i}}{c_{t-1}} + \sum_i d_i \frac{\Delta y_{t-i}}{c_{t-1}} + \varepsilon'_{yt}$$

$$\frac{\Delta c_t}{c_{t-1}} = \beta_y \varepsilon'_{yt} + \beta_g \varepsilon'_{gt} + \varepsilon'_{ct}.$$

Due to the presence of lagged income in government purchases equation, income innovations will result in revisions of expected permanent purchases, and vice versa. In the discussion that follows, it will be convenient to refer to (weighted) innovations in the present discounted value of future total income as

$$\theta'_{yt} \equiv (1-\alpha) \cdot \sum_j \alpha^j (E_t - E_{t-1}) \frac{y_{t+j}}{c_{t-1}},$$

keeping in mind that these are not the same as innovations in permanent labor income, either total (θ'_{xt}) or disposable θ'_{z_t}.

The innovations are given by

$$(13) \quad \theta'_{gt} = V_{gg}\varepsilon'_{gt} + V_{gy}\varepsilon'_{yt}$$

$$\theta'_{yt} = V_{yg}\varepsilon'_{gt} + V_{yy}\varepsilon'_{yt}$$

where

$$V_{gg} = \frac{1 - \Sigma\alpha^i d_i}{A} \qquad V_{yy} = \frac{1 - \Sigma\alpha^i a_i}{A}$$

$$V_{gy} = \frac{\Sigma\alpha^i b_i}{A} \qquad V_{yg} = \frac{\Sigma\alpha^i c_i}{A}$$

$$A = (1 - \Sigma\alpha^i a_i)(1 - \Sigma\alpha^i d_i) - (\Sigma\alpha^i b_i)(\Sigma\alpha_i c_i)$$

Assuming now that $x = \phi y$, yields

$$\theta'_{xt} = \phi\theta'_{yt} \qquad \text{which implies} \qquad \theta'_{z_t} = \phi\theta'_{y_t} - \theta'_{g_t}.$$

Hence, the theory which results in the consumption equation (8) yields the following restrictions on the model (12):[8]

$$(14)\quad \beta_y = k[\phi V_{yy} - V_{gy}]$$

$$\beta_g = -k[V_{gg} - \phi V_{yg}]$$

In the analysis so far, government purchases are simply acting as a direct drain on the intertemporal budget constraint facing households, "as if" they were waste. This could be due either to their separability from private consumption in utility functions, or to their having no inherent value. Now consider the possibility that government purchases substitute directly for private consumption or investment. Following the framework set out by Kormendi (1983), Barro (1984) and Aschauer (1985), we may think of households as choosing a level of effective consumption c* that maximizes expected utility, where $c^* = c + \omega_c g$ and ω_c is the measure of consumption substitutability. Under this concept of effective consumption, household expected utility functions take the form

$$W = \sum_j \delta^j E_t[U(c_{t+j} + \omega_c g_{t+j}) + V(l_{t+j}, g_{t+j})] .$$

Rearranging the budget constraint (1)

$$(1')\quad w_t = (1+r)w_{t-1} + x_t - c_t^* - (1-\omega_c)g_t$$

and repeating the development of the model through (4) yields the effective consumption function.

$$(4')\quad c_t^* = k_0 + k y_t^{p*}$$

where $y_t^{p*} = y_t^p - (1-\omega_c)g_t^p$. Following the development through (8) and substituting $\Delta c + \omega_c \cdot \Delta g$ for Δc_t^* yields the following modified version of our our basic consumption equation.

$$(8') \quad \frac{\Delta c_t}{c^*_{t-1}} = r(1-k) - \frac{rk_0}{c^*_{t-1}} - \omega_c \frac{\Delta g_t}{c^*_{t-1}} + k[\theta'_{xt} - (1-\omega_c)\theta'_{gt}] + \varepsilon'_{ct} .$$

If we consider the possibility that 1 unit of government purchases substitutes directly for ω_i units of private investment expenditures, the wealth effect $(1-\omega_c)\theta'_{gt}$ in (8') is replaced by $(1-\omega_c-\omega_i)\theta'_{gt}$, and the remainder of the analysis remains unchanged. Substituting for θ'_{xt} and θ'_{gt} and combining terms yields

$$(15) \quad \frac{\Delta c_t}{c^*_{t-1}} = \beta_0 + \frac{\beta_1}{c^*_{t-1}} + \beta_2 \frac{E_{t-1}\Delta g_t}{c^*_{t-1}} + \beta_y \varepsilon'_{yt} + \beta_g \varepsilon'_{gt} + \varepsilon'_{ct}$$

where $\beta_2 = -\omega_c$ and

$$(16) \quad \beta_y = k[\phi V_{yy} - (1-\omega_c-\omega_i)V_{gy}]$$

$$\beta_g = -\omega_c - k[(1-\omega_c-\omega_i)V_{gg} - \phi V_{yg}]$$

The main difference between the consumption relation in (12) and (15) is that the latter contains lags of government purchases and income through the appearance of $E_{t-1}\Delta g_t$, subject to the relevant cross-equation restrictions. In comparing (16) and (14), the V_{gy} term in β_y and the V_{gg} in β_g are now multiplied by $1-\omega_c-\omega_i$ to reflect the fact that wealth effects are mitigated to the extent that government purchases are substitutable for consumption and investment. Although the presence of ω_c and $1-\omega_c-\omega_i$ alters somewhat the interpretation of the β_y-V_{gy} and β_g-V_{gg} cross-country relations, the basic strategy of investigating such relations is unaffected. In particular, both β_y and V_{yy} and β_g and V_{yg} should be positively related; and, conditional upon $\omega_c + \omega_i < 1$, both β_y and V_{gy} and β_g and V_{gg} should be negatively related. Note that $\omega_c + \omega_i < 1$ is the condition for government spending to have a negative wealth

effect. In section III we will develop the cross-country hypotheses in more detail in conjunction with the empirical results.

III. EMPIRICAL RESULTS

III.1. The Data.

Data by country for the period 1951 to 1979 were taken from the International Financial Statistics (IFS) computer tape. We used national accounts data on private consumption expenditures (IFS series 96f) to measure consumption, on government purchases (91f) to measure government consumption, and on GDP (99b) to measure aggregate output. Each of these series was divided by the CPI (series 64; 1975=1.0) and population (99z) in order to restate it in real per capita terms. Thirty countries were found with continuous data over the designated sample period.

IFS data do not treat purchases of durable goods by the government and private sectors identically. With the exception of the U.S., government purchases do not include government expenditures on structures and non-military durable equipment; instead these are included in gross fixed capital formation (93e). On the other hand, private consumption does include expenditures on consumer durables.[9] Government consumption excludes the purchases of government enterprises, which are either treated as intermediate inputs or are included in gross fixed capital formation. The output of nonfinancial government enterprises is treated identically to that of private enterprises (IMF [1986]). Therefore our analysis cannot address any substitution in consumption between the output of public and private enterprises.

III.2. The Relation Between Consumption and Disposable Income.

As a point of reference, we first present some results similar to those found in Kormendi and LaHaye (1986). The estimates of β_j and V_j, $j=1,\ldots,30$,

underlying Table 1 were derived from estimates of equations (9) and (11) for each of the 30 countries. We used the sample average propensity to consume as a measure of k_j.[10] The notation $\rho(z_1, z_2|z_3)$ denotes the partial correlation across countries between z_1 and z_2, controlling for z_3. Of special interest is the strong positive value of $\rho(\beta, V|k)$, which accords with the implication of the PIH that the propensity to consume out of innovations in disposable income (β) should be greater when the effect of such innovations on permanent disposable income is greater.[11] The partial correlation between β and k is likewise large.[12]

III.3. The Effects of Income and Government Spending on Consumption: Descriptive Results.

We now turn to estimates of (12) for our panel of 30 countries.[13] The parameters of interest are the four persistence measures V_{yy}, V_{gg}, V_{yg}, V_{gy}, and the propensities to consume out of innovations β_y and β_g. These are shown in Table 2 along with their (approximate) standard errors. An examination of these estimates reveals some interesting regularities. β_y is positive, usually several standard errors from zero, and varies significantly from country to country. Moreover the β_y and V_{yy} in Table 2 and the β and V underlying Table 1 are roughly similar across countries. Thus the β_y and V_{yy} do not appear highly sensitive to the choice of specification. The values for β_g and V_{gg}, on the other hand, reveal that the restrictions implied by the 2 equation model of Kormendi-LaHaye are not robust. In particular, the relations $\beta_g = -\beta_y$ and $V_{gg} = V_{yy}$ do not appear to hold, although there does seem to be an apparent negative correlation between β_y and β_g. We will return to this observation shortly.[14]

Unlike β_y, β_g has a mean that is essentially zero, but takes on both positive and negative values, often more than two standard errors from zero,

suggesting that the dispersion about the zero mean is not simply the result of estimation error.[15] This may be important for the interpretation of the effects of government purchases. To see why, refer to (14) where β_g is expressed in terms of V_{gg} and V_{yg}. There we see that $\beta_g > 0$ would require $V_{yg} > V_{gg}$. That is, the negative direct effect of an innovation in government purchases (V_{gg}) would have to be more than offset by a positive indirect wealth effect of such innovations on expected future income through the coefficients of lagged g (c_i) in the income equation. Examination of the relative magnitudes of V_{gg} and V_{yg}, however, suggests that this is improbable for all but a very few countries.

A positive β_g could also be the result of "super-efficient" substitutability of government purchases for private spending. As shown in (16), if government spending substitutes for both private consumption and investment, then V_{gg} is multiplied by $(1-\omega_c-\omega_i)$. If $\omega_i > 1$, then $\beta_g > 0$ could obtain, i.e., government spending could have a positive direct wealth effect which exceeds the negative direct substitution effect. If such a positive wealth effect were a significant characteristic of the bulk of the countries in our panel, it would betray itself through a positive relation across countries between β_g and V_{gg}, even absent direct measures of ω_c and ω_i. If, on the other hand, this direct wealth effect were positive for some countries and negative for others, the observed pattern of the β_g's could be explained thereby, but the relation between β_g and V_{gg} across countries would be difficult to interpret unless direct measures of ω_c and ω_i were obtainable.

III.4. The Effects of Government Spending and Income on Consumption: Cross-Country Results.

We now turn to Table 3 which contains our findings on the relations across countries among the estimated parameters. The number of hypothesized relations

increases considerably when we pass from a two-equation to a three-equation system. As in Table 1, we summarize these hypotheses in column 4 in the form of expected signs of partial correlation coefficients. We focus on the partial correlation of β_y or β_g with the parameter in column 3, holding constant the parameters in the appropriate list at the foot of the Table. A brief keyword summary of the theoretical motivation for each hypothesis is included in column 5.

Two of the hypotheses merit additional discussion. First, the correlation between β_y and β_g should be negative (H1). This emerges from a theory of consumption based on private disposable income (y-g), in which case $\beta_y = -\beta_g$ obtains. Even if factors not modelled, such as joint endogeneity of consumption and government purchases, break this mirror-equality, a general negative relation between β_y and β_g could still obtain. Second, the wealth effect of government purchases on consumption (β_g) would be negatively related to the mean "size" of the government sector relative to income (H9), given diminishing marginal substitution of public for private spending. To this end we introduce the parameter k_g, the share of government purchases in income, a quantity analogous in construction to k_c, the average propensity to consume.

Column 6 of Table 3 presents the sample partial correlations conditioned on a fuller set of parameters described at the foot of the Table. Column 7 gives the partial correlations conditioned on a reduced set of parameters (also detailed at the foot of the Table) from which were excluded those parameters whose partial correlations with β_y and β_g were small and insignificant. All correlations were computed with the omission of Canada, because both its its V_{gg} and standard error were clear outliers.[16]

The correlation between β_y and β_g is indeed large and negative, as hypothesized.[17] The correlations of β_y with k_c and V_{yy} are large, positive and

significant, which is consistent with Kormendi and LaHaye's findings. The β_y-V_{gy} correlation (H4) sheds light on the wealth (resource constraint) effects of government purchases. V_{gy} is the effect of an innovation in current income on the permanent flow of government spending. If such purchases absorb future resources on net so that $\omega_c + \omega_i < 1$, this correlation should be negative, which we observe. The theory is mute on the signs of the β_y-V_{gg} and β_y-V_{gg} correlations, and these turn out to be effectively zero.

The results for H1 through H6 are in accord with the predictions of our simple version of the Equilibrium Approach to government spending, once we make the ancillary assumption that permanent government purchases have negative wealth effects. However, if these negative wealth effects were the major part of the story, the many positive and significant estimates of β_g in Table 2 would be difficult to explain, as discussed earlier. This should be kept in mind as we turn to the correlations involving β_g in H7 through H12.

Note immediately that the correlation between β_g and k_c is large and positive (especially when conditioned on the reduced parameter set of column 7), which is at odds with the assumption that government purchases have negative wealth effects. This correlation suggests that $[(1-\omega_c-\omega_i)V_{gg} - V_{yg}] < 0$ holds. This, in combination with the strength of the correlation and the magnitudes of V_{gg} and V_{yg}, implies that $\omega_c + \omega_i$ may indeed exceed 1. The β_g-V_{gg} correlation, while not very significant, is still positive, again suggesting that $\omega_c + \omega_i > 1$. There is little evidence that β_g reflects sizeable cross-effects of shocks to government purchases on permanent income, as H9 would suggest. The correlation between β_g and V_{yg} is small. The theory does not address either the β_g-V_{yy} correlation (H10), or the β_g-V_{gy} correlation (H11). While the latter is small, the former is positive and rather significant. We offer no explanation for this unexpected result.

The last hypothesis (H12) involves the effect of k_g, our measure of the "size" of government, on β_g. If the substitutability of public for private spending declines as public spending increases, then β_g should be negatively correlated with k_g, which seems to be the case, especially for the correlations in column 7 computed with a reduced set of control parameters.

The results for β_y are virtually all consistent with the theoretical predictions, and strongly so at that. On the other hand, the results for β_g are mixed and do not fully square with those for β_y. The difficulty seems to be that β_g is often large and positive, which is consistent with a large substitutability of government purchases for private spending inducing a positive wealth effect. However, such a large substitution effect is not consistent with the observed negative $\beta_y - V_{gy}$ correlation. A possible explanation could be that $\omega_c + \omega_i$ is distributed across countries symmetrically about 1. We suspect, however, that the explanation is more likely to lie in the joint endogeneity of consumption and government purchases to resource shocks.

IV. Conclusion

This paper has presented some results from an empirical investigation of the effects of government spending on consumption and real output. The focus has been on the effects of innovations in spending and income. The theoretical framework underlying this investigation is the newly emerging equilibrium Approach to the analysis of government spending. Our strategy has been as follows. First, we specify a three-equation system for consumption, output and government spending derived from a simple stylized version of the Equilibrium Approach. Second, we estimate this system using post-war time series data from a panel of the 30 countries. Third, we focus on parameters associated with the effects of spending and income shocks and investigate whether these

parameters conform cross-sectionally to the predictions of the Equilibrium Approach.

We find that estimates of the parameters pertaining to income innovations conform fairly well as a whole to the predictions of the theory. The analogous parameters for innovations in government spending, on the other hand, although interpretable under the theory, yield mixed results. In particular, some of our findings are consistent with a positive wealth effect of government spending, while others suggest the contrary.

Two directions for further research bear some discussion at this point. First, some of our findings might more easilv be explained if government spending were endogeneous to income, or jointly endogeneous with private consumption (e.g., in response to latent shocks such as to future productivity). Although such shocks are difficult to identify using time series data from a single country, it may be possible to test for the presence of such shocks using extensions of the cross-country methodology set out here. Second, we have not attempted here to estimate directly the substitutability parameter for government spending, as Aschauer (1985) has shown to be possible. Preliminary results using data on tax revenues to help identify this parameter have shown some promise. Unfortunately such data are as yet available only for a subset of the countries in our panel. We are currently attempting to augment our data base in order to pursue these inquiries.

Table 1

Partial Correlations Relevant to the PIH

	Hypothesized Sign	Value (Standard Error)
$\rho(\beta,k\|V_y)$	+	.72 (.14)
$\rho(\beta_y,V_y\|k)$	+	.59 (.16)

Table 2A

Estimates and Approximate Standard Errors for the Consumption Equation Coefficients of the Innovations in Income and Government Purchases

Country	β_y	$S\beta_y$	β_g	$S\beta_g$
Australia	0.44	0.04	0.62	0.29
Austria	0.38	0.08	- 0.86	0.52
Bolivia	0.70	0.03	0.52	0.39
Canada	0.34	0.05	- 0.52	0.21
Colombia	0.22	0.11	2.77	0.76
Costa Rica	0.81	0.11	- 1.43	0.72
Denmark	0.53	0.07	- 0.03	0.08
Dominican Republic	0.73	0.11	- 0.39	0.33
Fed. Rep. of Germany	0.16	0.04	1.08	0.43
Finland	0.62	0.09	- 0.90	0.75
France	0.67	0.07	- 1.39	0.48
Greece	0.40	0.09	1.36	0.34
Guatemala	0.62	0.11	0.12	0.58
Iceland	0.43	0.09	1.80	1.05
Ireland	0.54	0.08	- 2.00	0.72
Israel	0.41	0.07	0.00	0.07
Netherlands	0.16	0.07	1.64	0.43
New Zealand	0.68	0.13	0.51	0.91
Norway	0.14	0.09	- 0.03	0.54
Panama	0.99	0.32	- 0.96	1.22
Paraguay	0.92	0.13	- 0.45	0.62
Peru	0.55	0.06	- 0.73	0.30
Philippines	0.37	0.10	1.29	0.47
South Africa	0.40	0.05	0.70	0.42
Sri Lanka	0.56	0.17	0.68	1.01
Sweden	0.39	0.06	0.58	0.42
Switzerland	0.35	0.03	0.20	0.20
United Kingdom	0.59	0.11	- 0.88	0.45
United States	0.43	0.02	0.13	0.12
Venezuela	0.30	0.07	- 1.13	0.82
MEAN	0.49	0.09	0.08	0.52
STD. DEV.	0.21	0.06	1.08	0.29

Note: $S\beta_x$ is the asymptotic standard error of β_x.

Table 2B

Persistence Measures and Their Approximate Standard Errors

Country	V_{yy}	SV_{yy}	V_{gg}	SV_{gg}	V_{gy}	SV_{gy}	V_{yg}	SV_{yg}
Australia	0.87	0.17	1.02	0.30	0.12	0.05	-1.92	1.11
Austria	0.90	0.20	1.03	0.37	0.08	0.05	0.35	1.39
Bolivia	1.30	0.04	0.89	0.21	0.01	0.01	-1.16	0.80
Canada	0.80	0.20	2.68	2.13	0.32	0.26	0.04	1.59
Colombia	0.69	0.15	0.76	0.15	0.01	0.02	0.49	1.05
Costa Rica	0.76	0.14	0.75	0.16	-0.03	0.03	-0.17	0.64
Denmark	1.07	0.21	0.57	0.14	-0.05	0.15	0.22	0.20
Dominican Republic	1.01	0.19	0.54	0.12	0.06	0.05	-0.20	0.43
Fed. Rep. of Germany	0.84	0.20	1.56	0.52	0.02	0.04	1.03	2.38
Finland	0.86	0.11	0.70	0.22	0.04	0.02	-1.97	1.08
France	0.78	0.15	0.46	0.04	-0.03	0.02	0.85	0.35
Greece	0.86	0.12	0.77	0.22	-0.02	0.02	0.34	1.08
Guatemala	0.42	0.05	0.70	0.17	0.02	0.02	-0.46	0.36
Iceland	0.67	0.11	0.88	0.20	0.01	0.01	1.48	1.47
Ireland	0.75	0.13	0.47	0.09	0.04	0.02	0.37	0.71
Israel	1.21	0.23	0.96	0.33	0.62	0.29	0.17	0.26
Netherlands	0.91	0.22	1.20	0.29	0.09	0.05	1.33	1.29
New Zealand	1.00	0.17	0.41	0.06	-0.01	0.01	1.13	0.73
Norway	0.69	0.16	0.64	0.17	0.02	0.02	0.98	1.10
Panama	1.11	0.27	0.64	0.17	0.11	0.06	0.79	0.80
Paraguay	1.26	0.33	0.81	0.18	-0.13	0.08	0.39	0.76
Peru	0.37	0.05	0.56	0.24	0.09	0.03	-1.00	0.37
Philippines	0.67	0.14	0.39	0.08	0.04	0.02	-0.12	0.56
South Africa	0.89	0.15	0.76	0.13	0.07	0.03	0.42	0.67
Sri Lanka	0.97	0.29	0.75	0.24	0.07	0.05	0.50	1.33
Sweden	1.07	0.25	0.83	0.17	0.09	0.04	-0.99	1.02
Switzerland	1.09	0.08	0.79	0.16	0.05	0.02	0.74	0.61
United Kingdom	0.73	0.20	0.76	0.15	0.09	0.08	0.27	0.40
United States	1.06	0.08	1.13	0.24	0.16	0.06	-0.11	0.31
Venezuela	0.66	0.13	0.37	0.14	0.05	0.02	-0.69	1.06
MEAN	0.87	0.16	0.83	0.26	0.07	0.05	0.10	0.86
STD. DEV.	0.21	0.07	0.43	0.37	0.13	0.07	0.87	0.48

Note: SV_{xy} is the asymptotic standard error of V_{xy}.

Table 3

Partial Correlations Relevant to the Equilibrium Approach to Government Spending

Hypothesis (1)	Correlation Between (2)	(3)	Hypothesized Sign (4)	Theoretical Basis (5)	Partial Correlation (Standard Error) (6)	(7)
H1	β_y	β_g	-	Information on private disposable income $\tilde{y}$.	-.68 (.15)	-.75 (.14)
H2	β_y	k_c	+	Propensity to consume out of permanent income.	.75 (.14)	.78 (.13)
H3	β_y	V_{yy}	+	Role of "persistence" of income shocks.	.62 (.17)	.61 (.17)
H4	β_y	V_{gy}	$\frac{-}{+}$	Cross-effect of current income shock on future government purchases. < 0 if such purchases have negative wealth effects, i.e., if $\omega_c + \omega_i < 1$, and vice versa.	-.39 (.19)	-.40 (.19)
H5	β_y	V_{gg}	0	None	-.09 (.18)	-----
H6	β_y	V_{yg}	0	None	-.06 (.20)	-----
H7	β_g	k_c	$\frac{-}{+}$	Propensity to consume out of the permanent resource effect of government spending shocks. < 0 if $[(1-\omega_c-\omega_i)V_{gg} - V_{yg}] > 0$.	.40 (.21)	.47 (.18)
H8	β_g	V_{gg}	$\frac{-}{+}$	Wealth effect of government purchases. < 0 if $\omega_c + \omega_i < 1$.	.23 (.21)	.21 (.19)
H9	β_g	V_{yg}	+	Cross-effect of government spending shocks on future income.	.14 (.23)	-----
H10	β_g	V_{yy}	0	None	.42 (.20)	.44 (.19)
H11	β_g	V_{gy}	0	None	.02 (.19)	-----
H12	β_g	k_g	-	Effect of size of government on wealth effect of government spending shocks.	-.29 (.22)	-.42 (.19)

Note: The partial correlations are computed between β_y or β_g (column 2) and the parameter given in column (3), controlling for other parameters as described below.

Column #	Value of Col. (2)	Parameters Controlled for in Computing Partial Correlations.
6	β_y	β_g, k_c, V_{yy}, V_{gg}, V_{gy}.
6	β_g	β_y, k_c, V_{yy}, V_{gg}, V_{gy}, k_g.
7	β_y	β_g, k_c, V_{yy}, V_{gy}.
7	β_g	β_y, k_c, V_{yy}, V_{gg}, k_g.

Table 4

Estimated Contemporaneous Effects of Government Purchases on Output (β_{yg}) and Vice Versa (β_{gy}), with Approximate Standard Errors

Country	β_{yg}	$S\beta_{yg}$	β_{gy}	$S\beta_{gy}$
Australia	2.84	1.32	0.06	0.03
Austria	1.17	1.28	0.03	0.03
Bolivia	3.21	3.00	0.01	0.01
Canada	-0.35	1.05	-0.01	0.03
Colombia	2.39	1.30	0.05	0.03
Costa Rica	1.45	1.33	0.03	0.03
Denmark	0.70	0.27	0.30	0.12
Dominican Republic	-0.82	0.67	-0.07	0.06
Fed. Rep. of Germany	2.33	1.81	0.03	0.02
Finland	3.99	1.72	0.04	0.02
France	2.55	1.67	0.03	0.02
Greece	1.46	1.89	0.02	0.03
Guatemala	1.30	1.11	0.04	0.03
Iceland	10.29	1.43	0.07	0.01
Ireland	6.10	1.65	0.06	0.02
Israel	-0.10	0.21	-0.09	0.19
Netherlands	3.95	0.90	0.12	0.03
New Zealand	0.59	1.53	0.01	0.03
Norway	0.27	1.23	0.01	0.05
Panama	1.34	0.73	0.09	0.05
Paraguay	-0.24	1.00	-0.01	0.04
Peru	0.64	1.18	0.02	0.04
Philippines	1.76	0.96	0.08	0.04
South Africa	3.97	1.48	0.06	0.02
Sri Lanka	2.31	1.13	0.06	0.03
Sweden	1.23	1.56	0.02	0.03
Switzerland	3.32	1.60	0.04	0.02
United Kingdom	1.34	0.84	0.07	0.04
United States	2.43	1.13	0.06	0.03
Venezuela	6.19	2.08	0.04	0.01
MEAN	2.25	1.30	0.04	0.04
STD. DEV.	2.29	0.54	0.06	0.03

Note: $S\beta_{xy}$ is the asymptotic standard error of β_{xy}. β_{yg} was estimated by adding to the income (second) equation of system (12) the term $\beta_{yg}\varepsilon'_{gt}$, and reestimating the system subject to the additional nonlinear cross-equation restrictions. β_{gy} was estimated as the least squares projection coefficient of the residuals from the government purchases (first) equation in (12) on those from the income equation (without $\beta_{yg}\varepsilon_{gt}$). $S\beta_{gy}$ was computed from the formula $(\beta_{gy} \div \beta_{yg})S\beta_{yg}$, derived from the fact that the t-statistics for β_{gy} and β_{yg} are equal.

FOOTNOTES

1. The relation between a firm's earnings and the rational valuation of its stock is similar to the relation between income and consumption under the PIH. Kormendi and Lipe (1986) examine the relation between the effect of an earnings innovation on stock returns and the persistence of the earnings process across a panel of 145 firms, and find evidence that these are positively related across firms as predicted by classical models of firm valuation.
2. In the context of a small open economy for which an exogeneous interest rate may be a tenable assumption, the capital stock w_t includes net foreign assets.
3. This definition of disposable income implicitly assumes the "Ricardian Equivalence" of tax and debt finance.
4. The exclusion of additional influences, including current leisure (or equivalently work effort) and government purchases reflects the separability of U and V, not the form of U.
5. Mankiw and Shapiro (1985) have shown that the excess sensitivity of consumption to income can be spurious when income and consumption are detrended rather than differenced. This, among other reasons, is why the dependent variables in (7) (and ultimately (17)) and (9) are in differenced form.
6. The more "persistent" the y process, the smaller will be the extent of "excess sensitivity" and hence measured β. This would also bias results away from the PIH.
7. Each equation in (12) also includes a constant term and the variable $1/c_{t-1}$, which have been omitted for simplicity.

8. Alternatively, assuming that $x - g = \phi(y-g)$ yields

$$\beta_y = k\phi[V_{yy} - V_{gy}]$$

$$\beta_g = k\phi[V_{yg} - V_{gg}] .$$

9. Since private consumption expenditures include consumer durables, modifying our model along the lines of Mankiw (1982) and Bernanke (1985) would be of interest.

10. k_j is the mean of $c_{jt}(y-g)_{jt}$, t=1954,...,1979.

11. As discussed in Kormendi and LaHaye (1986), measurement error in y may bias estimates of β towards 0. Likewise, if the measurement error were more transitory than the true (y-g), V may also be biased towards 0. Thus the measured correlation between β and V is potentially biased upwards. If this were the case, any positive correlation between β and V observed over the entire sample would be attenuated when computed over subsamples stratified by an ordinal measure of data quality. Summers and Heston (1984) group countries into four categories based on the quality of their national accounts data. We repeated the cross-sectional estimates reported in Tables 1 and 3, controlling for data quality using the taxonomy of Summers and Heston, and found the correlations to be unaffected. Also, if the results in Table 1 were due to measurement error varying systematically across countries, one would expect the correlations to decline upon controlling for the standard error of the income equation. Again, this did not occur.

12. These partial correlations can be computed over <u>ranks</u> instead of the raw data. The resulting non-parametric rank partial correlations are only slightly smaller than those in Table 1.

13. We estimated the 3 equations in (12) over the time series for each country by nonlinear multivariate regression, subject to the cross-equation restrictions implied by the presence of innovations in g and y in the consumption equation. We included 3 lags of (changes in) consumption and income in the consumption and income equations, so that i=1 to 3 for each of ai, bi, ci and di.

The system (12) was estimated using two passes of TSP's LSQ command, with the reported results taken from the second pass. The first pass estimated the system with an unrestricted cross equation residual covariance matrix but with β_y and β_g constrained. The coefficients to be estimated were assigned starting values of zero (0.1 when assigning a 0 would result in a degenerate model) and the identity matrix was used to initialize the residual covariance matrix. The estimated covariance matrix from the first pass was then diagonalized and held fixed during the second pass. Starting values of coefficients for the second pass were the estimated values from the first pass.

14. Although our main concern is not Hall-Flavin tests of the consumption equation, the outcomes of such tests are quite similar to those reported in Kormendi and LaHaye. Slightly more than the expected number of countries reject the Hall-Flavin restrictions at low marginal significance levels. Relaxing these restrictions for those countries does not materially affect any of the crosscountry results below.

15. For 15 out of the 30 countries, the implied t statistic for β_g exceeds 1.65 in absolute value, when under a null of $\beta_g = 0$, only about 3 countries would be expected to do so.

16. The deletion of Canada does not materially affect any of the correlations that do not involve V_{gg}.

17. The mean across countries of the estimation error correlation between β_y and β_g is -.30. This contributes to, but does not dominate, the total measured correlation of -.69, leaving room for theoretical determinants. No other pairs of parameters exhibited an estimation error correlation that could contribute materially to the total correlations in Table 3.

18. The sample mean of V_{gg} is .83, that of V_{yg} is .11; see Table 2.

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