GENERAL EQUILIBRIUM APPROACH TO GOVERNMENT SPENDING EFFECT

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This paper is intended to focus on the direct effect of government expenditures on private activities in the framework of a dynamic optimizing general equilibrium model. The results show that, in the steady state, government consumption expenditures crowd out private consumption fully, on the other hand, government investment expenditures raise private investment and so real output, producing a positive multiplier. The solution also shows that the larger the share of consumption components in total government spending, the more the government spending crowds out the private spending.

I. INTRODUCTION

The impacts of fiscal policy on the economy have been extensively considered in the macroeconomic literature.

Keynesian analysis has focused on studying the effect of fiscal policy through its influence on the aggregate demand. Given an increase in government purchases or fiscal deficits, output expands by an amount larger than the original expenditure change. But it also produces higher interest rates, which depress private investment and so output. This is the mechanism of the indirect crowding out effect. The effectiveness of fiscal policy as a stabilization instrument hinges on the degree of crowding out caused by fiscal expansion.

According to standard macro models, government purchases have a multiplier effect on output no matter what the composition of the expenditure is. Along with this theoretical analysis, there exist several large scale econometric models that provide estimates for the multiplier of government purchases. The estimates vary depending on the model used, but they are in all cases significantly bigger than one (see de Leeuw and Gramlich (1968)). But this line of logic has been questioned by neoclassical economists lately. If goods and services provided by government are regarded as close substitutes for private consumption goods, then, as Bailey (1971) has pointed out, the multiplier effect vanishes. Barro (1981), focus-

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ing on the distinction between temporary versus permanent changes in government purchases, provides empirical evidence that the effect on real output of temporary changes (defense purchases related to war) is bigger than that of permanent changes (military as well as non-military, and state and local purchases). Seung-soo Han (1984) estimates the fiscal deficit multiplier as 2.31 using annual data for Korea during 1970-82. Kye-sik Lee (1988) gets the result that fiscal policy in Korea has been a powerfully effective instrument for economic stabilization, to the extent that government spending in Korea, whether debt- or tax-financed, has crowded in rather than crowded out household consumption. Aschauer (1985) investigates the effects of fiscal policy on private consumption and aggregate demand within an explicit intertemporal optimization framework. Aschauer (1988) has surveyed the various elements of fiscal policy from the perspective of a model with competitive equilibrium approach. Aschauer and Greenwood (1985) construct a neoclassical general equilibrium model elaborately over two periods to investigate the macroeconomic effects of fiscal policy with the policy variables being government consumption, government production service, public investment goods, transfer payments, labor income tax, corporate income tax. Government services would yield consumption benefits for individuals and production benefits for firms. Government consumption expenditures are allowed to influence utility directly by providing a current substitute for private consumption goods with no interaction with leisure. Government investments in public capital, on the other hand, have the potential of enlarging society’s future production possibilities and of augmenting the rate of return on private capital. This is the direct crowding-out or-in effect caused by fiscal expansion.¹

This paper is intended to focus on the latter issue and elaborate upon it in the framework of a dynamic optimizing general equilibrium model.

II. THEORETICAL MODEL

‘Crowding out’, in a broad sense, refers to the displacement of private economic activity by public economic activity. More specifically, crowding out refers to the phenomena of government consumption, investment, borrowing, and saving displacing their private counterparts. Crowding out is shown to be a multidimensional concept. The degree of crowding out, the time horizon considered, direct and indirect crowding out constitute the four main categories.²

Each of the latter two has many subcategories. With direct or ‘ex ante’ crowding out governmental economic activity directly enters as an argument into structural private behavioral relationships without affecting the price level and the interest rate. Indirect or ‘ex post’ crowding out refers to crowding out in the reduced from

²See Buiting (1977) for the details.
of the model without there being any direct crowding out at the level of the structural private behavioral relationships: rather than that, it has an indirect effect through price levels and the interest rates. The short run-long run dichotomy in the time horizon contrasts the impact effect of changes in government activity - for given values of the short-run exogenous but long-run endogenous (or predetermined) variables such as asset stocks and expectations about the future - with the long-run, steady-state effect of such changes when stocks and expectations have fully to the change in government policy. So the degree of crowding out with this multidimensional concept would be reflected in the measure of effectiveness of fiscal policy.

The analysis of fiscal policy in conventional macroeconomic models typically has stressed the first order importance of the financial aspects of public sector budgetary policy. Deficits - whether driven by a tax reduction or an increase in public expenditure - create excess supply in the bond market, upward pressure on interest rates, an ex post crowding out of expenditure on durable goods and/or an expansion of output and employment.

Recently, some macroeconomists have reconsidered the impact which the public sector's spending and tax decisions may have on macroeconomic variables. A variety of models have been constructed on the basis of optimizing agents making consumption and production decision on the basis of available information in a competitive equilibrium setting. A logical outcome of this modelling strategy being near equivalence of debt and taxes in the financing of public expenditure, Aschauer (1985, 1988, 1989), Aschauer & Greenwood (1985) and others instead emphasize the real aspects of fiscal policies, placing considerable weight on the time profile and composition of public expenditure on goods and services and on the role of distortional taxation in affecting the decisions to consume and produce at the margin.

The general equilibrium model that they use is based upon the microfoundation of macroeconomics in the sense that it analyzes optimizing agents making decisions in a competitive equilibrium setting while conventional macro models do not. General equilibrium models form a convenient context for analyzing alternative government policies, because their construction requires feasible contingency plans for government actions, explicitly and completely spelled out, as well as a set of consistent assumptions about private agents' perceptions of the government's plans. A related attraction of general equilibrium models is their internal consistency: one is assured that agents' choices are derived from a common set of assumptions about government policy and about the preferences, technology, and endowments in the economy. In the past ten years, these strengths of general equilibrium models, and the corresponding deficiencies of Keynesian and monetarist models of the 1960s, have induced macroeconomists to begin applying general equilibrium models.³

The idea that there is not a unique effect of government purchases and taxes on the real economy but rather several ones according to the type of government purchases is considered in our theoretical model. I present the outline of a class of environments in which the path of government purchases is exogenously given and takes the form of public capital that increases the marginal product of the private production process. And also I consider an economy with two divisible goods, one is either consumed or allocated in private capital, the other is public capital. The available technology is a joint production process that requires both types of capital, private as well as public.

There is a single infinitely lived representative household that derives utility from consumption. Given the initial private capital stock and the stochastic process for public capital, the household has to allocate resources between consumption and capital for the next period's production. The government sets a stochastic process for the public capital which is known to the household.

The economy is composed of a 'representative' agent who attempts to maximize the utility functional

\[
\text{Max} \sum_{t=0}^{\infty} \beta^t (C_t + \theta GC_t) \quad (2-1)
\]

\[
s.t. C_t + K_{pt} + 1 = f(K_{pt}, K_{gt}) + (1 - \mu) K_{pt} - GC_t - GI_t
\]

\[
K_o, K_{go}, GC_t, GI_t \quad \forall t \text{ given}
\]

where, \( \beta \) is a subjective discount factor (constant), \( 0 < \beta < 1, \beta = 1/(1 + \rho) \) (\( \rho \): time preference rate), \( C \) denotes physical private consumption, \( GC \) and \( GI \) are government consumption and government investment expenditures on goods and services, respectively. \( U(.) \) is continuous and twice differentiable with \( U' > 0, U'' < 0 \).

\( C_t^* = C_t + \theta GC_t \), represents effective consumption at period \( t \) and assume that government purchases are allowed to influence utility directly by providing a current substitute for private consumption goods, i.e. government consumption spending adds to private utility, possibly as a substitute for private consumption goods (e.g., school lunches, library books) or as a complement to leisure activity (e.g., public parks, scenic highways), \( \theta (0 \leq \theta \leq 1) \) denotes the marginal rate of substitution between private and public consumption goods so that an incremental unit of publicly provided goods yields only a fraction of the utility to be derived from an extra unit of privately purchased goods. The provision of theses types of public services means that households obtain units of effective consumption that exceed the quantity of private real expenditures. This assumption is crucial for the modelling strategy since it implies that increases in government spending will impose negative wealth effects on the representative agent. 

\[\text{4} \]

The recent empirical work of Kormendi (1983), Ahmed (1986), and Aschauer (1985) report values for \( \theta \) in the range 2 to 4, so that it does not appear that this assumption is unrealistic.
The production function $Y_t = f(K_{pt}, K_{gt})$ exhibits constant returns to scale form and twice continuously differentiable, strictly concave on $K_{pt}$ and $K_{gt}$. The capital stock is $K_t = K_{pt} + K_{gt}$ ($K_{pt}$: private capital, $K_{gt}$: public capital). Labor supply is assumed to be perfectly inelastic (i.e., costant) over time. And we assume that $f_1, f_2 > 0$, $f_2$ denotes marginal product of public capital services as an input to private production processes. Private investment is $I_{pt} = K_{pt+1} - (1 - \mu) K_{pt}$. $\mu$: proportionate depreciation rate on private capital ($0 \leqslant \mu \leqslant 1$). Hence, net wealth in private sector consists of $W_t = Y_t + (1 - \mu) K_{pt}$. Each agent in the economy, after paying taxes to the government, uses its after tax income for consumption and investment.

The government sector has a flow budget constraint of the form:

$$ G_t = GC_t + GI_t = T_t $$  \hspace{1cm} (2-2) 

where $G$: total government expenditure, $GC$: government consumption, $GI$: government investment which is $GI_t = K_{gt+1} - (1 - \gamma) K_{gt}$. $\gamma$: proportionate depreciation rate on public capital ($0 \leqslant \gamma \leqslant 1$). The government finances its expenditures $G_t$ by lump-sum taxes $T_t$ in period $t$.

The optimality conditions for the agent’s problem may be obtained from the Lagrangian functional

$$ L = U(C_t + \theta GC_t) + \lambda_t (Y_t + (1 - \mu) K_{pt} - C_t - K_{pt+1} - G_t) + \beta \left\{ U(C_{t+1} + \theta GC_{t+1}) + \lambda_{t+1} (Y_{t+1} + (1 - \mu) K_{pt+1} - C_{t+1} - K_{pt+2} - G_{t+1}) \right\} + \ldots \ldots $$  \hspace{1cm} (2-3)

which, upon differentiation, yields the following first-order conditions if it is assummed to be the interior solution. They are:

$$ C_t: U' = \lambda_t \quad \forall \ t $$

$$ K_{pt+1}^\beta = \lambda_{t+1} \frac{(1 - \mu) (K_{pt+1} - K_{gt+1})}{\lambda_t} \quad \forall \ t $$  \hspace{1cm} (2-4)

the agent’s budget constraint:

$$ C_t + K_{pt+1} + G_t = f(K_{pt}, K_{gt}) + (1 - \mu) K_{pt} \quad \forall \ t $$

And the following relationships $U'(C_{t+1} + \theta GC_{t+1}) / U'(C_t + \theta GC_t) = \lambda_{t+1} / \lambda_t = 1 / \beta \left( f_1 (K_{pt+1}, K_{gt+1}) + 1 - \mu \right)$ yield the economy-wide equilibrium condition

$$ Y_t = C_t + GC_t + K_{pt+1} - (1 - \mu) K_{pt} + GI_t $$  \hspace{1cm} (2-5)

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5This type of production function can be found by looking at ch IV of Arrow & Kurz (1970), particularly pp. 87-93.

Considering the optimality conditions and the equilibrium condition together, we obtain the following:

\[ U'(C_t + \theta GC_t) = \beta \left( f_t \left( K_{pt+1}, K_{gt+1} \right) + 1 - \mu \right) \ U' \left( C_{t+1} + \theta GC_{t+1} \right) \quad \forall \ t \]  
\[ (2-6a) \]

\[ f(K_{pt}, K_{gt}) = C_t + GC_t + GI_t + K_{pt+1} - (1 - \mu) K_{pt} \quad \forall \ t \]  
\[ (2-6b) \]

Equation (2-6a) states that the agent adjusts his consumption profile so that the marginal rate of substitution between current and future consumption is equal to the marginal product of private capital minus net of depreciation. Eq. (2-6b) indicates the economy-wide equilibrium condition. Note that it is assumed that a resale market for physical capital exists.

In addition, the transversality condition at infinity is:

\[ \lim_{t \to \infty} \beta t U' \left( K_t \right) = 0 \]  
\[ (2-7) \]

which are imposed on the agent’s problem to rule out the possibility of the agent increasing current consumption without the penalty of a reduction in consumption at some point in the future. Given the initial condition \( C_0 = C^0, \ K_0 = K^0 \), eqs. (2-6) – (2-7) are necessary to insure an optimum for the agent’s problem as given in eq. (2-3).\(^7\)

Now we check the stability of this model.

At the first place, assume that \( \theta = 1 \) (i.e., the case of perfect substitute between private and public consumption goods). Then we can express the optimality conditions (2-6a) – (2-6b) as following:

\[ U' \left( C_t + GC_t \right) = \beta \left[ f_t \left( K_{pt+1}, K_{gt+1} + 1 - \mu \right) \ U' \left( C_{t+1} + GC_{t+1} \right) \right] \]  
\[ (2-8a) \]

\[ f \left( K_{pt}, K_{gt} \right) = C_t + GC_t + K_{pt+1} - (1 - \mu) \ K_{pt} + K_{gt+1} - (1 - \gamma) \ K_{gt} \]  
\[ (2-8b) \]

Substituting eq. (2-8b) into eq. (2-8a),

\[ U' \left( Y_t - I_t \right) = \beta \left[ f_t \left( K_{pt+1}, K_{gt+1} \right) + 1 - \mu \right] \ U' \left( Y_{t+1} - I_{t+1} \right) \]  
\[ (2-9) \]

where, \( I_t = [K_{pt+1} - (1 - \mu) K_{pt}] + [K_{gt+1} - (1 - \gamma) K_{gt}] = I_{pt} + GI_t \)

\(^7\)Michel (1990) showed that the transversality condition defined as the limit property in the necessary and sufficient conditions for optimality had been established in a general form applying to concave discrete time infinite horizon optimal problems.
When \( K_t = K^* \) (= constant)\(^8\) for all \( t \), applying the first order linear approximation expansion by Taylor into eq. (2-9),

\[
\alpha_2 (K_{pt+2} - K^*_p) + \alpha_1 (K_{pt+1} - K^*_p) + \alpha_0 (K_{pt} - K^*_p) + \beta_2 (K_{gt+2} - K^*_g) + \beta_1 (K_{gt+1} - K^*_g) + \beta_0 (K_{gt} - K^*_g) = 0
\]

(2-10)

where \( \alpha_2 = -\beta \{ f_1 (K^*_p, K^*_g) + 1 - \mu \} U''(Y^*) \)

\[
\alpha_1 = \beta f_{11} (K^*_p, K^*_g) U'(Y^*) + U''(Y^*) \left[ \beta \{ f_1 (K^*_p, K^*_g) + 1 - \mu \}^2 + 1 \right]
\]

\[
\alpha_0 = -U''(Y^*) \left[ f_1 (K^*_p, K^*_g) + 1 - \mu \right]
\]

\[
\beta_2 = -\beta \{ f_1 (K^*_p, K^*_g) + 1 - \mu \} U''(Y^*)
\]

\[
\beta_1 = \beta f_{12} (K^*_p, K^*_g) U'(Y^*) + U''(Y^*) \left[ \beta \{ f_2 (K^*_p, K^*_g) + 1 - \gamma \} \times f_1 (K^*_p, K^*_g) + 1 \right]
\]

\[
\beta_0 = -U''(Y^*) \left[ f_2 (K^*_p, K^*_g) + 1 - \gamma \right]
\]

Assuming that \( K_{gt} = K^*_g \) for all \( t \) in the eq. (2-10)

\[
\alpha_2 (K_{pt+2} - K^*_p) + \alpha_1 (K_{pt+1} - K^*_p) + \alpha_0 (K_{pt} - K^*_p) = 0
\]

(2-11)

The characteristic equations of the eq. are

\[
H(Z) = \alpha_2 Z^2 + \alpha_1 Z + \alpha_0 = 0
\]

(2-12)

But,

\[
H(0) = \alpha_0 = -[f_1 (K^*_p, K^*_g) + 1 - \mu] U''(Y^*) > 0
\]

\[
H(1) = \alpha_0 + \alpha_1 + \alpha_2
\]

\[
= U''(Y^*) \left[ \beta \{ f_1 (K^*_p, K^*_g) + 1 - \mu \} - 1 \right] [f_1 (K^*_p, K^*_g) - \mu] + \beta f_{11} (K^*_p, K^*_g) U'(Y^*) - \\
< 0 \text{ if } \beta \{ 1 + f_1 (K^*_p, K^*_g) - \mu \} - 1 \geq 0, f_1 (K^*_p, K^*_g) > \mu
\]

Therefore if \( \beta \{ 1 + f_1 (K^*_p, K^*_g) - \mu \} - 1 \geq 0 \), i.e. \( \beta (1 + f_1 (K^*_p, K^*_g) - \mu) \geq 1 \) is the stability condition of this model.

In the stationary state, \( dG = dT \), eventually, the stability condition would be fulfilled when \( \beta \{ 1 + f_1 (K^*_p, K^*_g) - \mu \} = 1 \), the economy has convergent path characterizing the saddle point.

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\(^8\)We may assume this here since this model excludes population growth and treats the representative agent’s behaviour.
III. STATIONARY STATE EQUILIBRIUM MULTIPLIER

As considered deterministic situation we assume the model has perfect foresight one for simplicity of analysis. Now the endogenous variables in the model are constant as the exogenous variables constantly given under stationary state. Under these conditions the optimal conditions (2-6a) – (2-6b) can be expressed as follows:

\[
U'(C^* + \theta G C^*) = \beta \{1 + f_1 (K_p^*, K_g^*) - \mu\} \quad \Rightarrow \quad U'(C^* + \theta G C^*)
\]

\[
f(K_p^*, K_g^*) = C^* + G C^* + \mu K_p^* + \gamma K_g^*
\]

(2-14a)

(2-14b)

But under steady state, eq. (2-14a) means the agent's expectation term can not affect the utility function any more. Therefore we can express these equations as following:

\[
\beta [f_1 (K_p^*, K_g^*) + 1 - \mu] = 1
\]

\[
f(K_p^*, K_g^*) = C^* + G C^* + \mu K_p^* + \gamma K_g^*
\]

(2-15)

Hence after adjusting in the long run, we can get the relationships: subjective rate of time preference \((1/\beta) - 1)\) (marginal product of private capital – depreciation rate) = constant under steady state. Total differentiating eq. (2-15) for comparative statics we obtain,

\[
\beta f_{11} dK_p^* + \beta f_{12} dK_g^* = 0
\]

\[
(f_1 - \mu) dK_p^* + (f_2 - \gamma) dK_g^* = dC^* + dGC^*
\]

(2-16)

Transforming these eqs. into matrix form.

\[
\begin{bmatrix}
0 & \beta f_{11} \\
-1 & f_1 - \mu
\end{bmatrix}
\begin{bmatrix}
dC^* \\
dK_p^*
\end{bmatrix}
= 
\begin{bmatrix}
-\beta f_{12} dK_g^* \\
dGC^* - (f_2 - \gamma) dK_g^*
\end{bmatrix}
\]

(2-17)

And the sign of the determinant \(W = f_{11}/f_{11} \beta < 0\). Using Cramer's Rule, we get the stationary state multipliers as follows:

\[
\frac{\partial C}{\partial G C} = -f_{11}/(f_{11} \beta) = -1
\]

\[
\frac{\partial C}{\partial G I} = \beta (-f_2 - \gamma) f_{11} + (f_1 - \mu f_{12}) / (-f_{11} \beta)
\]

\[
= (f_2 - \gamma) - (f_1 - \mu) (f_{12}/f_{11}) > 0 \text{ if } f_{12} > 0, f_2 > \gamma, f_1 > \mu
\]

\[
\frac{\partial K_p}{\partial G I} = -f_{12}/(f_{11} \beta) = -f_{12}/f_{11} > 0 \text{ if } f_{12} > 0
\]
<table>
<thead>
<tr>
<th></th>
<th>$\partial C$</th>
<th>$\partial K_p$</th>
</tr>
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<tbody>
<tr>
<td>$\partial GC$</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>$\partial GI$</td>
<td>+</td>
<td>+</td>
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$\partial Y / \partial GC = 0$

$\partial Y / \partial GI > 0$

The result of solution of the model shows that, in the steady state, government consumption expenditures crowd out private consumption fully—the multiplier is zero—as the case of M. Bailey (1971), but government investment expenditures raise private investment and so real output, producing a positive multiplier.

Considering the composition ratio of total government spending into government consumption vs. investment, we can express $GC = \sigma G, GI = (1 - \sigma) G, 0 < \sigma < 1$. So in the stationary state total government spending $G$ is $G^* = GC^* + \gamma K_g^*$, and government investment is $GI^* = (1 - \sigma) G^* = \gamma K_g^*$. We substitute $GC^*$ and $K_g^*$ in the eq. (2-16) into these relationship including parameter $\sigma$ and exogenous variable $G^*$, and take them the matrix form like eq. (2-17) as follows:

$$
\begin{bmatrix}
0 & \beta f_{11} \\
-1 & f_1 - \mu
\end{bmatrix}
\begin{bmatrix}
dC^* \\
      dK_p^*
\end{bmatrix} = 
\begin{bmatrix}
-\beta f_{12} \left[(1 - \sigma)/\gamma\right] dG^* \\
[\gamma - (f_2 - \gamma) \{(1 - \sigma)/\gamma\}] dG^*
\end{bmatrix}
\frac{1}{W}
(2-18)
$$

And the sign of det. $W$ is $W = f_{11} \beta < 0$. Using Cramer’s Rule here the stationary state multipliers are as following:

$$
\begin{align*}
\partial C / \partial G &= -\beta \left\{ \left[ f_{12} \left( f_1 - \mu \right) - f_{11} (f_2 - \gamma) \right] \left[ (1 - \sigma)/\gamma \right] + f_{11} \sigma \right\} / \beta f_{11} \\
&= \left\{ (f_2 - \gamma) - f_{12} \left( f_1 - \mu \right) / f_{11} \right\} \left[ (1 - \sigma)/\gamma \right] - \sigma \\
&+ \quad + \\
\partial K_p / \partial G &= -\beta \left[ (1 - \sigma)/\gamma \right] / \beta f_{11} = -f_{12} \left[ (1 - \sigma)/\gamma \right] / f_{11} > 0
\end{align*}
$$

Hence the effect of government spending on private consumption ($\partial C / \partial G$) may be uncertain, and the effect of government spending on private investment ($\partial K_p / \partial G$) is positive as long as there exists complementary relationship between government spending and private investment, so that the sign of the effect of government spending on output ($\partial Y / \partial G$) depends on the relative size of the forces between the two. The solution also shows that the larger the share of consumption components in total government spending, the more the government spending crowds out the private spending. The theoretical results imply that the multiplier effect of government investment expenditures is bigger when the marginal product of government capital stock and the intensity of the complementary relationship between government capital stock and private capital stock are bigger, regardless of marginal rate of substitution of government consumption for private consumption.
Taking the Cobb-Douglas production function form (i.e., \( Y = AK_p^k K_g^{1-k} \), \( 0 < k < 1 \), \( A \): positive constant as an indicator of the state of technology),

\[
\begin{align*}
  f_1 &= k A (K_p/K_g)^{k-1}, \\
  f_2 &= (1-k) A (K_p/K_g)^k, \\
  f_{11} &= k(k-1) A (K_p/K_g)^{k-1} (1/K_p), \\
  f_{12} &= k(1-k) A (K_p/K_g)^k (1/K_p)
\end{align*}
\]

in case of disregarding depreciation terms, we can derive
\[
\frac{\partial Y}{\partial GI} = f_2 + (f_{12} f_1 / (-f_{11})) = (K_p/K_g)^k.
\]

If we apply Euler theorem into the production function using the property of homogeneous of degree one, using the following equation
\[
Y = f_1 K_p + f_2 K_g = f(\cdot),
\]
we can get the relationship
\[
( -f_{21} / f_{11} ) = K_p/K_g,
\]
the multiplier is
\[
\frac{\partial Y}{\partial GI} = f_2 + (f_{12} f_1 / (-f_{11})) = Y/K_g.
\]

Therefore, taking the Cobb-Douglas production function form, we can find that the size of the government investment multiplier depends upon the ratio of [private capital stock/public capital stock] and the output elasticity of private capital or [total output/government capital stock].

If we assume that government capital is chosen below the optimal level, increasing \( K_g \) at some point in time provides a bigger production possibilities for this economy. This will result in a higher level of output for some periods and most likely a larger path for consumption.

Comparing this model to existing models, for example, Aschauer & Greenwood (1985) set up the elaborate one as mentioned before but excluded bond financing case and analyzed two period one, and they would not make clear the mechanism explicitly how fiscal variables affect output channel through private consumption and investment directly or interest rate indirectly. And they use the production function like \( F \) (\( L, GL, I, GI \)) (where, \( L \): labor, \( GL \): government production service, \( I \): investment, \( GI \): government investment), but transform that arbitrarily again as \( Y = A + f (L, GL) + h(I, GI) + I \) (where, \( A \): constant). Other while our model here excludes labor factor in the production function assuming labor supply perfectly inelastic but focus on fiscal policy effect on the composition of capital stock or national income. As the results in Aschauer & Greenwood (1985) show that the rise of labor supply results in the rise of output as government spending increases, in our model the rise of capital stock results in the rise of output through complementary relationship between public capital and private capital.

Our theoretical model has improved upon the Aschauer type model in the sense of distinguishing between government consumption components and government investment components explicitly in the dynamic optimizing general equilibrium model based on the microfoundation of macroeconomics in the infinite time horizon. It can also be pointed out that existing models have passed over the fact that public capital stock would be important to determine the size of the government investment multiplier.

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*The work by Hulten and Peterson (1984) illustrate the fact that to set state and local government purchases below optimal level is a reasonable assumption.*
IV. CONCLUDING REMAKRS

The above results of the theoretical model suggest that a model treating government expenditures as a single expenditure component is not adequate.

To capture the effect of some government expenditures on real output, it seems more appropriate to treat this kind of purchase as public capital that increases the marginal product of the private production process, as considered externalities between public capital and private capital.

Several limitations of this study may exist. First, the empirical analysis about the theoretical results shown above should be followed. Second, we should give consideration to the fact that there exists some discrepancy between real world and theoretical abstraction owing to abstraction from real world into a simplified logical model-for example, coming from several assumptions, i.e., two-good economy with private and public capital, fixed labor supply, no technological change, etc. Third, this positive analysis should follow a more through assessment of the normative aspect further. Fourth, it is also desirable to analyze the policy effect when distinguishing between temporary and permanent change in government expenditures. Further research on these problems would be fruitful.

REFERENCES


