Does the Government Expenditure on Utility Enhancing Public Capital Increase the Economic Growth?

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ABSTRACT

This note studies the role of the preference for public consumption (utility enhancing public capital) on economic growth to answer if the investment on utility enhancing public capital increases the economic growth. It shows that, without uncertainty, the preference for public consumption accelerates the economic growth. Under uncertainty, however, the preference for public consumption may increase or decrease growth depending on the magnitudes of the elasticity of intertemporal substitution and risk aversion. It is possible for the preference for public consumption to decrease the rate of economic growth.

JEL Classification: H11, H41, H54
Keywords: Public consumption, Economic growth

INTRODUCTION

There is an extensive literature exploring the effect of government expenditures on economic growth. In the literature, it has been common that government expenditures can be classified as public investment (productivity enhancing government expenditure), such as power and water supply, transportation and communication, and so on, and public consumption (utility enhancing government expenditure), such as law and order, postal services, national parks, defense, and so on. Here, we can cast a question. If people want more public services to enhance their utility, may this preference increase the economic growth rate? In general, the more advanced public infrastructure, the higher the economic growth rate is. In other words, the preference for public consumption (utility enhancing government expenditure) can increase the economic growth rate.

Barro (1990) analyzed endogenous growth models with tax-financed government services that affect production or utility and found growth and saving rates fall with an increase in utility-type expenditures; the two rates rise initially with productive government expenditures but subsequently decline. Turnovsky (1998) studied the impact of public investment on growth and welfare. Turnovsky’s model (1998) extends the Barro (1990) model of productive government expenditure by introducing stochastic production shocks. Park and Philippopoulos (2003) analyzed a dynamic general equilibrium model of endogenous growth with productive government expenditures (public production services) and non-productive ones (public consumption services and redistributive transfers). Chatterjee and Ghosh (2007) examined the impact of fiscal policy on macroeconomic performance and welfare when public capital provides both productive and utility services to the private sector. Economides, Park, and Philippopoulos (2011) presented a standard general equilibrium model of endogenous growth with productive and nonproductive public goods and services to study the optimal policy about the paths of the income tax rate and the allocation of collected tax revenues between productivity-enhancing and utility-enhancing public expenditures. Ganelli and Tervala (2010) studied the trade-off faced by governments in deciding the allocation of public expenditures between productivity-enhancing public infrastructures and
utility-enhancing public consumption in a two-country model. Getachew and Turnovsky (2015) studied
the effects of productive government spending on the relationship between growth and inequality. Felice
(2016) found government productive expenditure affects the long-run growth rate through its size and
composition.

None of these papers studied the role of the preference for public consumption in the utility
function on economic growth. The objective of this note, therefore, is to analyze the role of the preference
for public consumption on economic growth under uncertainty. We show that the preference for public
consumption may increase or decrease the economic growth depending on the magnitudes of the
elasticity of intertemporal substitution and risk aversion when uncertainty exists.

The remainder of this study is presented as follows. In Section 2, we describe the basic model and
derive a closed solution. Section 3 analyzes the role of the preference for public consumption on
economic growth. Concluding remarks are found in the last section.

THE BASIC MODEL

Imagine an economy in which \( N \) identical representative agents who consume and produce a single
good. Production of the representative agent is determined by the individual capital stock \((k_t)\) and the
level of services of public expenditure for production \((G_{pt})\) derived from the use of a public good.
\[
dy_t = z_t(dt + du) = aG_{pt}^{\phi}k_t^{1-\phi}(dt + du)
\]
(1)

where \( du = \sigma ds.\) \( ds\) is the increment to a standard-normal Wiener Process \( s.\) The parameter \( \sigma\)
is the instantaneous standard deviation of the innovation. \( z_t\) is the expected rate of private output flow. In
each period, the deterministic flow of production is \( aG_{pt}^{\phi}k_t^{1-\phi}dt\) which is \( z_t dt.\)

The productive services derived by the agent from the deterministic expenditure of productive
government expenditure \((G_{pt})\) are represented by
\[
G_{pt} = h_1 \tau Z_t
\]
(2)

where \( h_1\) is the policy maker’s choice of the deterministic size of productive government
expenditure and \( \tau\) is the income tax rate. \( Z_t = Nz_t\) denotes the aggregate expected rate of output flow.

If we use (2), the production of the representative agent is
\[
dy_t = (a(h\tau)^{\phi}N^{\Phi})^{1-\phi}k_t(dt + du)
\]
(3)

Since all agents are identical, in equilibrium, private output follows the equation (3).

We define the equilibrium mean productivity of capital as:
\[
\Omega(h, \tau) = \left(a(h\tau)^{\phi}N^{\Phi}\right)^{\frac{1}{1-\phi}}k_t = \frac{Z_t}{K_t} = \frac{z_t}{k_t}
\]
\(\Omega_h > 0, \Omega_{\tau} > 0\)

In the economy, given the income tax, the resource constraint of the representative agent is
\[
dk_t = ((1-\tau)\Omega k_t - c_t)dt + (1-\tau)\Omega k_t \sigma du
\]
(4)

Another government expenditure is the utility-enhancing government expenditure \((G_u)\). People
derive utility from utility-enhancing government expenditure as well as individual consumption. The
utility-enhancing government expenditure is expressed by
\[
G_u = h_2 \tau Z_t
\]
(5)

where \( h_2 = 1 - h_1\) is the policy maker’s choice of the deterministic size of utility-enhancing
government expenditure.
The government finances its expenditures with an income tax and runs a balanced budget in each period. The government expenditure is expressed by
\[ G_t = G_{pe_t} + G_{ut_t} = \tau Z_t = \tau Y_t \]

Our objective is to analyze the role of the preference for public consumption and desire to disentangle the effects of the elasticity of intertemporal substitution, risk aversion, and intra-period substitution between individual consumption and public consumption. For these reasons, we adopt a class of preferences that is tractable, yet rich enough to capture these three distinct forces:

\[ (1 - \gamma)U_t = \lim_{\Delta t \to 0} e^{-\rho t} \left\{ c_t^\alpha G_{ut_t}^\beta \right\} \Delta t + e^{-\rho \Delta t} [E_t (1 - \gamma)U_{t+\Delta t}]^{\beta(1-\gamma)} \]

This is a form of GIE preferences defined over the two “goods,” consumption \( c_t \), and the public consumption \( G_{ut_t}^\beta \). The rate of time preference is \( \rho > 0 \). Here the parameter \( \gamma \) is the coefficient of relative risk aversion for timeless lotteries, while \( \varepsilon = 1/(1-\theta) \) is the elasticity of intertemporal substitution for riskless consumption paths.

In the analysis of our model, the magnitudes of \( \varepsilon \) and \( \gamma \) are crucial. According to the survey of empirical estimates of these two crucial preference parameters, there is a consensus that \( \gamma > 1 \). While the conventional wisdom is that \( \varepsilon < 1 \), there is a plausible case that \( \varepsilon > 1 \).

The representative agent’s problem is to choose a consumption policy to maximize (6) subject to two flow constraints, (4), over an infinite planning horizon. The equilibrium consumption is

\[ c_t = \eta k_t = \frac{\varepsilon \alpha^p + \alpha (1 - \varepsilon)}{\varepsilon + \alpha (1 - \varepsilon)} \frac{1}{(1-\gamma)\Omega + \frac{1}{2}(\alpha + \beta)(1-\gamma) - 1}(1-\gamma)\Omega^2\sigma^2} k_t \]

The expected growth rate is \(^1\)

\[ \varphi = E_t \left( \frac{dk_t}{k_t} \right) = E_t \left( \frac{dy_t}{k_t} - \frac{d\gamma_t}{k_t} - \frac{c_t^*}{k_t} dt \right) = [(1 - \tau)\Omega - \eta] \]

\[ = (1 - \tau)\Omega - \varepsilon \frac{(1 - \varepsilon)}{\varepsilon + \alpha (1 - \varepsilon)} \left[ (1 - \gamma)\Omega + \frac{1}{2}(\alpha + \beta)(1-\gamma) - 1 \right] \]

\[ \frac{(1-\gamma)\Omega^2\sigma^2}{\varepsilon + \alpha (1 - \varepsilon)} \]

**THE ROLE OF THE PREFERENCE FOR PUBLIC CONSUMPTION**

How does the preference for public consumption affect economic growth?

\[ \frac{\partial \varphi}{\partial \beta} = \left( \frac{\alpha}{\alpha + \beta} \right)^2 \frac{1}{\varepsilon + (1 - \varepsilon)\alpha} + \]

\[ \frac{\alpha}{\alpha + \beta} \frac{1 - \varepsilon}{\varepsilon + (1 - \varepsilon)\alpha} (1-\gamma)^2\Omega^2\sigma^2 \frac{1}{2}(1 - \gamma)(\alpha + \beta - 1) - 2) \]

As we discussed in the introduction, public consumption (utility enhancing government expenditure) is part of public infrastructure. There is a positive relationship between public infrastructure and the

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\(^1\) The derivation of expected growth rate is as follows:

\[ E_t \left( \frac{dk_t}{k_t} \right) = E_t \left( \frac{dy_t}{k_t} - \frac{d\gamma_t}{k_t} - \frac{c_t^*}{k_t} dt \right) = [(1 - \tau)\Omega - \eta] \]

where \( c_t^* \) is the optimal consumption policy and \( g = G_t/N \).
economic growth. We can observe this relationship in equation (8). Assuming \( \gamma > 1 \), without uncertainty, the preference for public consumption accelerates growth because

\[
\frac{\partial \varphi}{\partial \beta} = \frac{\alpha}{(\alpha + \beta)^2} \frac{\varepsilon \rho}{\varepsilon + (1 - \varepsilon)\alpha} > 0.
\]

However, with uncertainty, the preference for public consumption may accelerate or retard growth, depending on the magnitudes of the elasticity of intertemporal substitution and risk aversion. We consider three different cases, such as \( \alpha + \beta = 1 \), \( \alpha + \beta > 1 \) and \( \alpha + \beta < 1 \). If \( \alpha + \beta = 1 \) or \( \alpha + \beta > 1 \) (Table 1), the preference for government expenditure accelerates or retards growth, depending on the magnitude of the elasticity of intertemporal substitution. If \( \varepsilon > 1 \), \( \frac{\partial \varphi}{\partial \beta} > 0 \) because \( \frac{\alpha}{(1 - \tau)^2 \Omega^2 \frac{\sigma^2}{2} ((1 - \gamma)(\alpha + \beta - 1) - 2)} > 0. \)

If \( \varepsilon < 1 \), \( \frac{\partial \varphi}{\partial \beta} < 0 \) because \( \frac{\alpha}{(1 - \tau)^2 \Omega^2 \frac{\sigma^2}{2} ((1 - \gamma)(\alpha + \beta - 1) - 2)} < 0. \) When \( \alpha + \beta = 1 \) and \( \alpha + \beta > 1 \), the magnitude of \( \varepsilon \) is crucial.

### Table 1: Growth rate under \( \alpha + \beta = 1 \) and \( \alpha + \beta < 1 \)

<table>
<thead>
<tr>
<th>( \varepsilon &gt; 1 )</th>
<th>( \varepsilon &lt; 1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase</td>
<td>Uncertain</td>
</tr>
</tbody>
</table>

If \( (\alpha + \beta) < 1 \) (Table 2), the analysis is a little more complicated. In this case, we consider three ranges of magnitudes of risk aversion, such as \( 1 < \gamma < 1 + \frac{2}{1 - (\alpha + \beta)} \), \( \gamma = 1 + \frac{2}{1 - (\alpha + \beta)} \) and \( \gamma > 1 + \frac{2}{1 - (\alpha + \beta)} \). If \( \gamma = 1 + \frac{2}{1 - (\alpha + \beta)} \), the preference of public consumption stimulates growth, which means growth is independent of uncertainty. If \( \gamma > 1 + \frac{2}{1 - (\alpha + \beta)} \), the preference for public consumption stimulates or retards growth depending upon the magnitude of \( \varepsilon \). If \( \varepsilon > 1 \), \( \frac{\partial \varphi}{\partial \beta} > 0 \). If \( \varepsilon < 1 \), \( \frac{\partial \varphi}{\partial \beta} > 0 \). If \( 1 < \gamma < 1 + \frac{2}{1 - (\alpha + \beta)} \), when \( \varepsilon > 1 \), \( \frac{\partial \varphi}{\partial \beta} > 0 \) and when \( \varepsilon < 1 \), \( \frac{\partial \varphi}{\partial \beta} < 0 \). Both the elasticity of intertemporal substitution and risk aversion play crucial roles for growth under uncertainty. As explained by Smith (1999), a change of \( \beta \) can vary the “precautionary premium,”

\[
\varphi = \frac{(1 - \varepsilon)\alpha}{\varepsilon + (1 - \varepsilon)\alpha} ((\alpha + \beta)(1 - \gamma) - 1)(1 - \tau)^2 \Omega^2 \frac{\sigma^2}{2}. \]

When \( \varepsilon < 1 \) in the cases of \( \alpha + \beta = 1 \) and \( \alpha + \beta < 1 \) and \( 1 < \gamma < 1 + \frac{2}{1 - (\alpha + \beta)} \) and \( \varepsilon > 1 \) and \( \gamma > 1 + \frac{2}{1 - (\alpha + \beta)} \) in the case of \( \alpha + \beta < 1 \), the preference of public consumption reduces the precautionary premium. If there is a sufficient decrease in the precautionary premium, the preference for public consumption can make growth slowed down.

### Table 2: Growth rate under \( (\alpha + \beta) < 1 \)

<table>
<thead>
<tr>
<th>( \gamma &lt; 1 + \frac{2}{1 - (\alpha + \beta)} )</th>
<th>( \varepsilon &gt; 1 )</th>
<th>( \varepsilon &lt; 1 )</th>
</tr>
</thead>
<tbody>
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<td>Uncertain</td>
<td></td>
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<table>
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<tr>
<th>( \gamma = 1 + \frac{2}{1 - (\alpha + \beta)} )</th>
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CONCLUDING REMARKS

In this note, we try to answer how the preference for public consumption influences economic growth.

Without uncertainty, the preference for public consumption accelerates the economic growth. However, under uncertainty, the preference for public consumption may accelerate or retard growth depending on the magnitudes of the elasticity of intertemporal substitution and risk aversion.

In summary, it is possible for the preference for public consumption to decrease the rate of economic growth. By increasing the investment on utility enhancing public services we may reduce the economic growth.

REFERENCES