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Government spending and economic growth in the OECD countries

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Using panel data from 1995 to 2011 for 34 OECD countries, we examine the effects of government consumption spending, public social spending, and public investment on economic growth. We use a generalized method of moments estimation technique to solve inconsistency problems with fixed effects and random effects panel estimation. We find that an increase in public social spending has a significant negative effect on subsequent economic growth. Government consumption spending and public investment have no significant effect on subsequent economic growth.

Keywords: economic growth; government consumption spending; public social spending; investment; generalized method of moments

JEL Classifications: O43; O47

1. Introduction

In an endogenous growth model where government spending is a factor of production, Robert Barro (1990)[1] suggests that: "The effects of government spending on growth involve two channels: … the negative effect of taxation on the after tax marginal product of capital, and … the positive effect of public services … on this marginal product."[2] At low values of government spending, the positive effect of increased government spending on capital's marginal product dominates, hence growth rises. As government spending rises beyond this point, the adverse effect of distorting taxation becomes more important, and growth reaches a maximum. For higher values of government spending, the taxation effect dominates and thus growth declines. This is depicted in Figure 1 from Barro (1990).

Basically, there are three main categories of government spending: (1) Public investment: gross capital formation of plant, property, and equipment, including public hospitals, schools and housing; (2) Government consumption spending: spending to produce non-market goods, such as defense, justice, police, fire and military payroll for collective consumption, as well as market goods and services provided as individual social goods, such as health care, housing and education[3]; (3) Public social spending: old age pensions, survivors and disability benefits, unemployment compensation mostly in cash and health, health services and housing – mostly services in kind (i.e. not any capital expenditure).

Several studies empirically test the relationship between government spending and economic growth. For example, Grier and Tullock (1989) find a significantly negative relation between real gross domestic product (GDP) growth rate and the growth rate of

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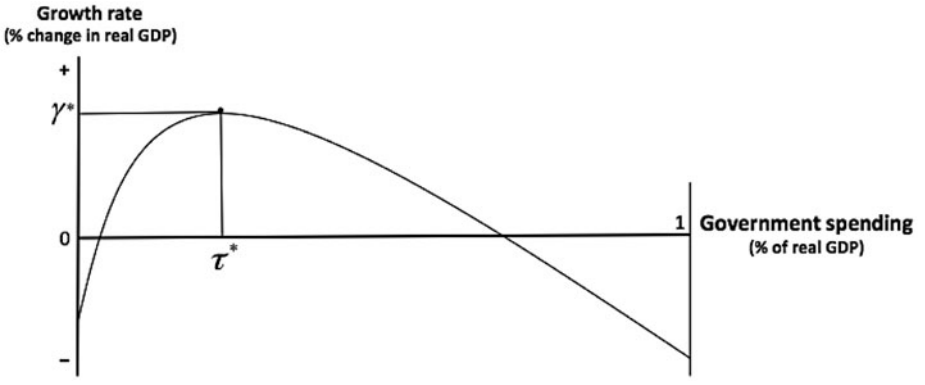

Figure 1. Government spending and the growth rate (Barro 1990).

the government share of GDP in a 115 country cross-sectional regression on the Summers and Heston database. Their measure of government spending excludes public investment and transfers. Barro (1991) defines non-productive government consumption spending as government consumption spending net of spending on defense and education. He finds a negative relationship between non-productive government consumption spending and economic growth in a 98 country cross-sectional regression on the Summers and Heston database. While the previous studies examine the relation between aggregate government spending or government consumption spending to economic growth, none examines the impact of public social spending on growth. As shown in Figure 2, average public social spending – 20% of GDP – is almost twice as large as government consumption spending – 11.4% of GDP – in the Organization for Economic Cooperation and Development (OECD) countries. Given the high levels of public social spending in the OECD, clearly exacerbated by the financial crisis of 2008–2009 where real GDP fell on average in 2009, it is worthwhile to empirically estimate the effects of public social spending on economic growth in these countries.

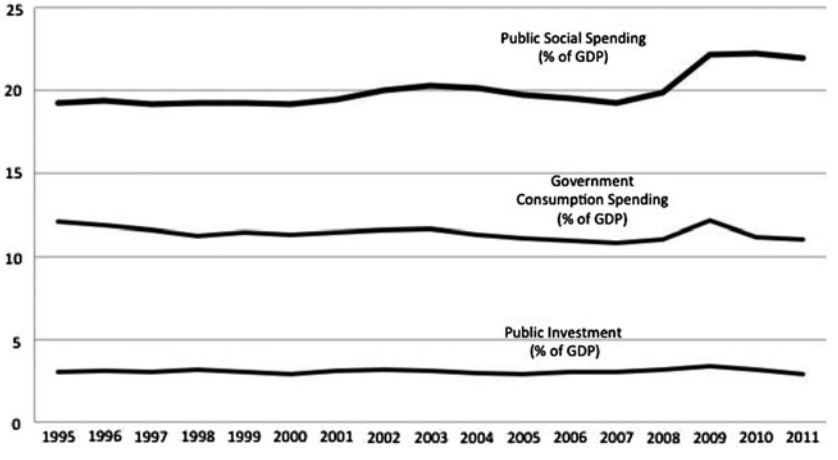

Figure 2. Average government spending in the OECD countries. (Source: OECD iLibrary).

We analyze annual panel data from 1995 to 2011 for 34 OECD countries to examine how each of the three categories of government spending might affect economic growth. We use panel estimation to control for time-invariant country-specific effects, therefore eliminating a potential source of omitted-variable bias. Fixed effects and random effects estimation have two problems: first, country-specific effects are correlated with other right-hand-side variables due to the dynamic nature of the growth equation; second, the explanatory variables may be endogenous. Both are common problems in the literature that examines government spending and growth.[4] In particular, lower economic growth may cause higher government consumption spending through automatic stabilizers, but more government consumption spending may also cause lower economic growth. To disentangle these problems, we employ a generalized method of moments (GMM) estimation technique developed by Arellano and Bond (1991). This estimator first-differences each variable so as to eliminate the country-specific effects and then uses all possible lagged values of each of the variables as instruments, a technique widely used in the growth literature. Caselli, Esquivel, and Lefort (1996) use this method to estimate the Solow growth model and Forbes (2000) to examine the relationship between inequality and growth. Acemoglu et al. (2008, 2014) apply this methodology to study the relationship between democracy and growth.

The GMM estimation result suggests that government consumption spending and public investment have no significant effect on subsequent economic growth. Public social spending, however, has a small but significant negative effect on subsequent economic growth. A one percentage point increase in public social spending as a percent of GDP leads to 0.09% lower growth rate in GDP in the next year, suggesting that increased public social spending inhibits economic growth in the OECD countries.

2. Methodology

2.1. *Growth equations*

To examine the effects of government consumption spending and public social spending on economic growth, we estimate the following growth equation:

$$y_{i,t} - y_{i,t-1} = \theta y_{i,t-1} + X_{i,t-1}\beta + \eta_i + \varepsilon_{i,t} \tag{1}$$

where $y_{i,t}$ is the logarithm of real GDP per capita of country i in year t, $X_{i,t-1}$ is a vector of determinants of economic growth, η_i is a country-specific effect and $\varepsilon_{i,t}$ is an error term.

We put $y_{i,t-1}$ on the right-hand side of the growth equation to test the convergence hypothesis. A negative θ means higher initial income reduces economic growth. Vector $X_{i,t-1}$ includes our regressors of interest: country i's government consumption spending as a share of GDP (Government Consumption Spending), country i's public social spending as a share of GDP (Public Social Spending), and country i's public investment as a share of GDP (Public Investment) in year $t-1$. We focus on stock variables measured at the start of the periods, rather than flow variables measured throughout the periods. This should at least partially reduce the endogeneity problem. $X_{i,t-1}$ also includes other determinants of economic growth, including country i's secondary education enrollment as a percent of the population of the corresponding official school age (Human Capital), country i's private investment as a share of GDP (Private Investment), country i's population growth rate (Population Growth Rate), country i's life

expectancy at birth (Life Expectancy), and country i's fertility rate (Fertility Rate) in year t–1. Since the period of estimation includes the expansion of 2003–2006, and the recession period 2008–2012, we include year dummies in $X_{i,t-1}$ to control for the boom and the bust. The country-specific effect η_i is used to pick up other time-invariant variables that may affect economic growth, such as a country's geography, institution and culture.

Equation (1) can be re-written as:

$$y_{i,t} = \gamma y_{i,t-1} + X_{i,t-1}\beta + \eta_i + \varepsilon_{i,t} \tag{2}$$

where $\gamma = 1 + \theta$.

So estimating Equation (1) is equivalent to estimating Equation (2), which is a dynamic equation with a lagged dependent variable. In Equation (2), $\gamma < 1$ implies that $\theta < 0$, so we can test the convergence hypothesis with the estimated coefficient of γ.

2.2. *Estimation*

The standard methods of panel estimation are fixed effects or random effects. Two problems arise when applying these estimators to Equation (2). First, the lagged dependent variable $y_{i,t-1}$ is correlated with the country-specific effect η_i, which leads to the "dynamic panel bias" (Nickell 1981). To see this, notice that

$$E[\eta_i y_{i,t-1}] = E[\eta_i(\gamma y_{i,t-2} + X_{i,t-2}\beta + \eta_i + \varepsilon_{i,t-1})] \neq 0, \tag{3}$$

where inequality holds because $E[\eta_i]^2 \neq 0$.

Second, at least some of the variables in $X_{i,t-1}$ are endogenous. For example, it is reasonable to suppose that government expenditure is determined simultaneously with the economic growth rate.

A good method to address these problems is the GMM estimator developed by Arellano and Bond (1991). This estimation technique not only corrects the bias introduced by the lagged dependent variable $y_{i,t-1}$, but also permits a certain degree of endogeneity in the other regressors. The GMM method first takes first differences of Equation (2) to eliminate the country-specific effect:

$$y_{i,t} - y_{i,t-1} = \gamma(y_{i,t-1} - y_{i,t-2}) + (X_{i,t-1} - X_{i,t-2})\beta + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \tag{4}$$

Then, we use all possible lagged values of each of the variables as instruments. For example, for $(y_{i,t-1} - y_{i,t-2})$, we have $t-2$ instruments: $y_{i,t-2}, y_{i,t-3}, \ldots, y_{i,1}$. Two critical assumptions must be satisfied for this estimator to be consistent and efficient. First, the error terms cannot be serially correlated: $E[\varepsilon_{i,t}\varepsilon_{i,t-s}] = 0$ for all $s > 1$. Second, $X_{i,t-1}$ must be predetermined by at least one period: $E[X_{i,t}\varepsilon_{i,s}] = 0$ for all $s > t$. This is a relatively weak predeterminacy assumption about the explanatory variables. As long as this assumption is satisfied, the instruments are valid, and we avoid potential endogeneity bias. In Section 4, we provide evidence that these assumptions are satisfied.

3. Data

The data are from the OECD iLibrary, the online library of the OECD, and the World Bank website. The OECD iLibrary provides economic databases for the OECD countries, including per capita GDP, total investment, public investment, public social

Table 1. Summary statistics.

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Logarithm of GDP per person[a]	578	10.12	0.43	9.0	11.2
Government Consumption Spending[b] (% of GDP)	561	11.40	2.94	1.1	21.2
Public Social Spending (% of GDP)[c]	559	20.01	6.01	3.2	32.2
Public investment (% of GDP)	491	3.1	1.1	0.11	6.6
Private investment (% of GDP)	491	20.8	3.8	11.0	34.6
Secondary Education Enrollment[d]	553	104.3	15.7	57.1	160.6
Population Growth Rate (% per annum)	578	0.64	0.64	−1.7	2.9
Fertility[e]	578	1.69	0.40	1.08	3.03
Life expectancy	578	77.8	3.0	67.0	82.9

Data sources are: the OECD iLibrary and the World Bank website. The sample includes panel data of 34 OECD countries from 1995–2011.

[a]GDP per person is measured in 2005 prices adjusted by PPP exchange rates.

[b]Government consumption expenditure consists of expenditure incurred by government in its production of non-market final goods and services (except gross fixed capital formation) but excludes market goods and services provided as social transfers in kind. We exclude market goods provided as in kind social benefits – education, health, and housing – from government consumption spending to avoid double counting.

[c]Public social spending includes both cash transfers and in-kind benefits in the following social policy categories: old age, survivors, incapacity-related benefits, health, family, active labor market programs, unemployment, housing, and other social policy areas. The highest public social spending (32.2 % of GDP) occurs in France in 2010.

[d]Secondary education enrollment rate is the ratio of children of official school age who are enrolled in secondary school to the population of the corresponding official school age. It can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition. (World Bank).

[e]The fertility rate represents the number of children that would be born to a woman if she were to live to the end of her child-bearing years and bear children in accordance with current age-specific fertility rates. (World Bank).

spending, and government consumption spending. It also provides data for other important explanatory variables of economic growth, such as population growth rate. The World Bank provides data on secondary education enrollment, life expectancy, and fertility rate.

In the OECD iLibrary, public social spending is defined as cash and in-kind benefits provided for social purposes, while government consumption spending is broken down into spending on collective goods such as defense and justice, and in-kind market goods such as education, health, and housing.[5] We exclude market goods provided as in-kind social benefits – education, health, and housing – from government consumption spending to avoid double counting.

The sample consists of 34 OECD countries from 1995–2011. Table 1 provides summary statistics for the sample of 578 observations. The mean public social spending is 20% of GDP, government consumption averages 11% of income, and average public investment is 3% of GDP.

4. Empirical results

Table 2 reports estimates of Equation (2) using fixed effects, random effects, and Arellano and Bond's GMM technique. Different techniques generate different results, so, we test the validity of the assumptions underlying each method. First, we perform a Hausman (1978) specification test to compare the fixed effects estimates in column 1 with the random effects estimates in column 2. The test statistic is $\chi^2(23) = 53.30$. This rejects the null hypothesis that random effects are the preferred model at any significance level. Therefore, we prefer the fixed effects estimation to the random effects estimation. However, both fixed effects and random effects estimation are inconsistent due to the presence of the lagged dependent terms. We use Arellano and Bond's GMM technique to address this problem.

Column 3 in Table 2 presents estimation results using their GMM technique. The estimated coefficient of the lagged logarithm of GDP per capita is significant at the 1% level, and it is less than one. This provides evidence of growth convergence consistent with Barro (1991), Barro and Sala-i-Martin (1992), and Mankiw, Romer, and Weil (1992). Since higher social spending on unemployment compensation, welfare payments, and the like is financed by new debt (Ricardo 1820; Barro 1974), we may not expect any rise in growth due to Ricardian equivalence. This hypothesis is not rejected by the estimation result.

The estimated coefficient of public social spending is negative and significant at the 1% level, suggesting that an increase in a country's public social spending has a significant negative effect on subsequent economic growth. A one percentage point increase in public social spending as a percent of GDP leads to an estimated 0.09% lower growth rate in GDP in the next year. The estimated coefficient of lagged government

Table 2. Estimation results.

	Fixed effect	Random effect	Arellano and bond
Lagged logarithm of GDP per person	0.9193***	0.9970***	0.9970***
	(0.0194)	(0.0055)	(0.0056)
Lagged Gov. consumption spending	0.0000	0.0005	0.0003
	(0.0015)	(0.0005)	(0.0006)
Lagged public social spending	−0.0027***	−0.0010***	−0.0009**
	(0.0010)	(0.0003)	(0.0004)
Lagged public investment	−0.0027	−0.0013	−0.0003
	(0.0021)	(0.0013)	(0.0019)
Lagged private investment	−0.0008	−0.0007*	−0.0005
	(0.0005)	(0.0004)	(0.0004)
Lagged secondary education enrollment	−0.0002	0.0000	0.0001
	(0.0001)	(0.0001)	(0.0001)
Lagged population growth rate	−0.0014	−0.0011	−0.0008
	(0.0037)	(0.0030)	(0.0019)
Lagged fertility rate	−0.0519***	−0.0074	−0.0047
	(0.0132)	(0.0051)	(0.0062)
Lagged life expectancy	−0.0016	−0.0026***	−0.0027***
	(0.0030)	(0.0008)	(0.0010)
Observations	434	434	434
R^2	0.9745		

Note: The dependent variable is the logarithm of real GDP per person. Robust standard errors are in the parentheses. The significance levels of 1, 5, and 10% are noted by ***, **, and * respectively..

consumption spending and the estimated coefficient of lagged public investment, however, are not significant. This suggests that changes in government consumption spending or public investment have no significant effect short term on subsequent growth.

The coefficient of lagged secondary education enrollment is not significant,[6] consistent with most studies on the relationship between growth and education. For example, Krueger and Lindahl (2001, 1130) find that

> … education was statistically significantly and positively associated with subsequent growth only for the countries with the lowest level of education. For countries in the middle of the education distribution, growth was typically unrelated or inversely related to education, and for countries with a high level of education growth was typically inversely related to the level of education.The estimated coefficient of lagged population growth and lagged fertility rate is not significant. The estimated coefficient of life expectancy is negative and significant at 1% level.

Further, two critical assumptions must be satisfied for the GMM estimator to be consistent and efficient. First, the error terms cannot be serially correlated $E[\varepsilon_{i,t}\varepsilon_{i,t-s}] = 0$ for all $s > 1$. To test this assumption, we perform a test for second-order serial correlation developed by Arellano and Bond (1991). The test result shows that we are unable to reject the null hypothesis of no second-order serial correlation at any standard level of significance. The second assumption is that $X_{i,t-1}$ must be predetermined by at least one period $E[X_{i,t}\varepsilon_{i,s}] = 0$ for all $s > t$. Although there is no formal test of this assumption, estimates obtained from regressing government spending on lagged growth suggest that they are predetermined by at least one period. Components of public social spending and government consumption spending are defined in Tables 3 and 4 respectively.

Table 3. Components of public social spending.

1. Old age	Cash benefits: pension; early retirement pension; other cash benefits
	Benefits in kind: residential care/ home help service; other benefits in kind
2. Survivors	Cash benefits: pension; other cash benefits
	Benefits in kind: funeral expenses; other benefits in kind
3. Incapacity-related benefits	Cash benefits: disability pensions; pensions (occupational injury and disease); paid sick leave; other cash benefits
	Benefits in kind: residential care/ home help service; rehabilitation services; other benefits in kind
4. Health	Benefits in kind
5. Family	Cash benefits: family allowances; maternity and parental leave; other cash benefits
	Benefits in kind: day care/ home-help services; other benefits in kind
6. Active labor market programs	Employment service and administration; labor market training; youth measures; subsided employment; employment measures for disabled
7. Unemployment	Cash benefits: unemployment compensation/severance pay; early retirement for labor market reasons Benefits in kind
8. Housing	Benefits in kind: housing assistance; other benefits in kind
9. Other social policy areas	Cash benefits: income maintenance; other cash benefits Benefits in kind: social assistance; other benefits in kind

Note: Sources: OECD [2007].

Table 4. Components of government consumption spending.

1. Collective consumption expenditure by government	Compensation of employees (collective services relating to defense); compensation of employees (collective services other than defense); intermediate consumption (collective services relating to defense); intermediate consumption (collective services other than defense); gross operating surplus; net taxes on production
2. Individual consumption expenditure by government	Housing Recreation and culture Education Social protection Health benefits and reimbursements: pharmaceutical products; other medical products; therapeutic appliances and equipment; out-patient medical services; out-patient dental services; out-patient pharmaceutical services; hospital services Production of health services: compensation of employees (physicians); compensation of employees (nurses and medical staff); compensation of employees (non-medical staff); intermediate consumption (pharmaceutical products); intermediate consumption (other medical goods); intermediate consumption (therapeutic appliances and equipment); intermediate consumption n.e.c.; gross operating surplus; net taxes on production

Note: Government consumption expenditure consists of expenditure incurred by government in its production of non-market final goods and services (except gross fixed capital formation) and market goods and services provided as social transfers in kind. The first category of government final consumption "… reflects expenditures for collective consumption (defence, justice, etc.) which benefit society as a whole, or large parts of society, and are often known as public goods and services. The second reflects expenditures for individual consumption (health care, housing, education, etc. that reflects expenditures incurred by government on behalf of an individual household. " (OECD iLibrary. Since the second category of government consumption expenditure is also included in public social spending, we deduct it from government consumption spending in this paper to avoid double counting..
Source: OECD/Eurostat [2012].

5. Conclusion

At some point, increased government spending, particularly on non-productive consumption: defense, justice, police, fire, and military payroll, reduces economic growth (Barro 1990). In this study, we empirically test the effect of three different kinds of government spending on economic growth. Using a GMM estimation technique developed by Arellano and Bond (1991), we find that neither government consumption spending nor public investment has a significant effect on subsequent economic growth. An increase in public social spending, however, has a significant negative effect on subsequent economic growth.

This suggests that increased public social spending may inhibit economic growth: that is, the OECD countries may be on the "wrong side" of the Barro-Laffer curve in growth with respect to entitlements. In general, our results suggest there may not be any positive growth effect from any increase in government spending in the OECD countries.

Disclosure statement

No potential conflict of interest was reported by the authors.

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Notes

1. The Barro model of growth with government as an input is basically $y = Ak^{1-\alpha}g^{\alpha}$, where y is GDP per worker, A is total factor productivity, k is physical capital per worker, and g is government spending per worker. The budget is balanced, so τ, taxes as a percent of gross domestic product (GDP), are equal to g/y. The tax rate that maximizes economic growth is α, the elasticity of GDP with respect to government spending.
2. Barro and Sala-i-Martin (1995, 154–155).
3. This does not include government investment spending in hospitals, schools or housing, which are categorized as public investment.
4. One exception is Barro and Redlick (2011), who estimate multipliers for defense spending using US annual data. Using war as an instrument, they find the multipliers for defense spending are all significantly less than one, suggesting greater government consumption crowds out other components of GDP. But they do not provide reliable multipliers for nondefense purchases due to the lack of good instruments.
5. "The first category of government final consumption reflects expenditures for collective consumption (defence, justice, etc.) which benefit society as a whole, or large parts of society, and are often known as public goods and services. The second reflects expenditures for individual consumption (health services, housing, education, etc.), that reflect expenditures incurred by government on behalf of an individual household." (OECD iLibrary).
6. Using the Summers and Heston database, Mankiw, Romer, and Weil (1992) find secondary education enrollment has a positive and significant effect on growth, while our results do not.

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