

Research Article

Revisiting the Relationship between Economic Growth and Government Size

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The purpose of this paper is to explore the association between government size and economic growth in the United States using time-series data over the period 1950–2007. In particular, this paper examines the effects of two key components of government expenditure, namely, government consumption and government investment, on US economic growth. A simultaneous-equation model is used to deal with the problem of bi-directional relationship between government size and economic growth. The results suggest that an increase in government consumption slows economic growth, while a rise in government investment enhances economic growth. Furthermore, the results also show that government investment crowds out private investment. Therefore, the overall effect of total government expenditure on economic growth is ambiguous.

1. Introduction

The size of US government grew dramatically during the 20th century. The 2008 stimulus package in response to turmoil in the housing and the financial markets that primarily led the US economy into the longest and deepest recession since World War II was expected to result in a massive increase in the size of US government. The 2009 Congressional Budget Office (CBO) report [1] estimated that government expenditure would be equal to 24.9 percent of GDP in 2009, a size only exceeded during the later years of World War II. Although the budget deficit has begun to contract, it is still very large by historical standards. The 2012 CBO report [2] projects that the deficit will be nearly \$1.1 trillion in 2012. The projected deficit in 2012 is 7 percent when measured as a share of GDP which is larger than any budget deficit over the period 1947–2008. According to the 2011 CBO report [3], the shares of budget deficits in gross domestic product were 10.0 percent in 2009 and 8.9 percent in 2010 the largest deficit shares since 1945. The 2009 CBO report [1] stated that “Continued large deficits and the resulting increases in federal debt over time would probably constrain long-term economic growth by reducing national savings and investment, which in turn would cause productivity and

wage growth to gradually slow.” The relationship between government size and economic growth has long been a key topic of both theoretical and empirical analyses. Recently, public finance economists and policy makers have become concerned with the growing size of government and its effect on economic growth in the United States. With the size of US government expanding at an extraordinary pace, it is time again to examine the growth effect of government size.

Although there have been a number of studies that have examined the growth effect of government size, a large number of studies (e.g., Borchering et al. [4]; Fölster and Henrekson [5]; Agell et al. [6]; Grier [7]; Levine and Renelt [8] to cite just a few) are conducted at the aggregate level. In other words, the majority of previous empirical analyses examine the growth effect of total government spending. Since different types of government expenditure may have different output effects, the studies carried out at the aggregate level fail to capture the effects of different components of government expenditure on economic growth. This paper attempts to fill that void by conducting a study at a disaggregate level for the 1950–2007 period to analyze the growth effect of government size. In particular, this paper focuses on the effects of two key components of government expenditure, namely, government consumption

and government investment, on economic growth. Increases in government size as a result of increased government consumption are typically viewed as growth-impeding while increases in government size as a result of a rise in government investment spending are viewed as growth-enhancing.

The literature suggests that there is a likely simultaneity or bi-directional relationship between economic growth and government size. The well-known German Economist Wagner [9] in late 1800's developed his famous law, known as Wagner's Law, in which he viewed income as one of the determinants of government size. Wagner's Law has become very popular in the academic world since its publication. Researchers (e.g., Musgrave [10]; Goffman and Mahar [11]; Gupta [12]; Bird [13]; Ganti and Kolluri [14]; Gandhi [15]; Henrekson [16]; Bohl [17]; Payne and Ewing [18]; and Wahab [19] to cite just a few) have empirically tested and analyzed the law. Since most of these researchers provided empirical evidence supporting the presence of Wagner's Law, it is reasonable to assume that there might exist a bi-directional relationship between government expenditure and income growth.

A large number of previous studies investigating the output effect of government size suffer from a potential critical simultaneity problem which especially becomes severe for studies based on single-equation models using data over a long time period. Slemord et al. [20], and Fölster and Henrekson [5, 21] acknowledged the fact that the simultaneity bias is a severe problem in simple cross-country regression models. The best way to address the problem of simultaneity bias in regression models is to use a simultaneous-equation model (SEM). This paper, therefore, constructs a SEM to explore the growth effects of government size.

2. Theory

Recently, the role that government plays in enhancing economic performance has been a major concern in the growth literature. In neoclassical growth models, inspired by the Solow-Swan growth model [22, 23], per capita income can only grow if (i) capital per worker or (ii) total factor productivity increases. Since neoclassical growth models assume diminishing returns to capital, capital accumulation alone cannot lead to a sustained growth in per capita income. Consequently, a continued rise in per capita income can only occur as a result of persistent total factor productivity growth. Since all determinants of growth in neoclassical models are assumed to be exogenous, government policy can only raise the steady state level of real income but not the long-run rate of economic growth.

Starting in 1980s, however, when endogenous growth models were developed by Romer [24], Lucas [25], Barro [26], and Rebelo [27] the view on the role of government in growth process has changed. According to this new theory of growth, government can influence growth either directly or indirectly. However, it is not known, a priori, whether government expenditure has a positive effect or negative effect on economic growth. There is no strong theoretical reasoning for the expected sign of the growth effect of government expenditure.

3. Empirical Evidence on Economic Growth and Government Size

While there has not been a strong theoretical analysis of the effect of government expenditure on economic growth, this relationship has been examined empirically in a number of studies including Mo [28], Schaltegger and Torgler [29], Borchering et al. [4], Fölster and Henrekson [5, 21], Agell et al. [6], Grier [7], Hansson and Henrekson [30], Easterly and Rebelo [31], Levine and Renelt [8], Barro [32], Grier and Tullock [33], Landau [34, 35], Kormendi and Meguire [36], among others. Although a number of studies have indicated a negative growth effect of government size, the results of previous studies have been quite diverse. The comparability of earlier studies is also impaired as they vary in many dimensions.

4. The Model

To test the relationship between government size and economic growth, the following regression model is specified in this paper,

$$\text{Gr}(Y) = a_0 + a_1\text{Gr}(K) + a_2\text{Gr}(L) + a_3\left(\frac{g_I}{Y}\right) + a_4\left(\frac{g_C}{Y}\right), \quad (1)$$

where $\text{Gr}(Y)$, $\text{Gr}(K)$, and $\text{Gr}(L)$ are the growth rates of real gross domestic product, private capital stock, and labor force. g_I/Y , and g_C/Y are the shares of gross government investment and government consumption in GDP, respectively. Model (1) indeed looks like the well known *sources of growth* equation derived in a conventional manner from the neoclassical production function, which takes on the familiar Cobb-Douglas form:

$$Y = AK^\alpha L^{1-\alpha}, \quad (2)$$

where Y , K , and L are real GDP, capital stock, and labor, respectively. A is a parameter which measures the total factor productivity and it is assumed to be greater than zero.

Converting (2) into log linear form yields

$$\dot{Y} = \dot{A} + \alpha\dot{K} + (1 - \alpha)\dot{L}, \quad (3)$$

where \dot{Y} , \dot{A} , \dot{K} , and \dot{L} are the growth rates of real GDP, total factor productivity, capital, and labor, respectively. α and $1 - \alpha$ are the relative shares of capital and labor. In practice, researchers generally use the ratio of gross private domestic investment to output, I/Y , in place of $\text{Gr}(K)$ in (1). Following the common practice, this paper also substitutes I/Y for $\text{Gr}(K)$. This substitution is often made because researchers do not have actual capital stock data, only annual investment data. In fact, even the data on the US capital stock from the US Department of Commerce are estimated using the perpetual inventory method, which simply sums annual investment and applies an assumed rate of depreciation to adjust the accumulated investment over time. Reliable information on actual depreciation is not available, so an arbitrary assumption is made. This means

that year-to-year variations in the time series of capital stocks is effectively driven by annual investment from the national accounts, precisely the same investment that appears in the numerator of I/Y . Econometrically, therefore, the use of I/Y in place of $Gr(K)$ results in a different estimated value of the regression coefficient, but the substitution implies little if any loss of information or distortion of the significance of the relationships between the other variables. Replacing $Gr(K)$ with I/Y in (1) yields

$$Gr(Y) = a_0 + a_1 \left(\frac{I}{Y} \right) + a_2 Gr(L) + a_3 \left(\frac{g_I}{Y} \right) + a_4 \left(\frac{g_c}{Y} \right). \quad (4)$$

In addition to variables defined earlier, g_I/Y , and g_c/Y are the shares of gross government investment and government consumption in GDP, respectively.

4.1. Dealing with the Simultaneity Bias. The coefficient estimates of (4) would most likely be biased and inconsistent due to the presence of likely simultaneity between $Gr(Y)$ and g_c/Y , and $Gr(Y)$ and g_I/Y . As mentioned earlier, the problem of simultaneity bias is an inherent problem in any single-equation growth models. In this paper, the following simultaneous-equation model is specified to estimate the effect of government size on economic growth,

$$\begin{aligned} Gr(Y) &= a_0 + a_1 \left(\frac{I}{Y} \right) + a_2 Gr(L) + a_3 \left(\frac{g_I}{Y} \right) \\ &\quad + a_4 \left(\frac{g_c}{Y} \right) + t + \varepsilon_1, \\ \frac{g_I}{Y} &= b_0 + b_1 Gr(Y) + b_2 \left(\frac{P_{gI}}{P} \right) + b_3 \left(\frac{X}{Y} \right) + t + \varepsilon_2, \\ \frac{g_c}{Y} &= c_0 + c_1 Gr(Y) + c_2 \left(\frac{P_{gc}}{P} \right) + c_3 Gr \left(\frac{\text{self}}{N} \right) + c_4 Gr \left(\frac{\text{old}}{N} \right) \\ &\quad + c_5 Gr(N) + t + \varepsilon_3, \\ \frac{I}{Y} &= d_0 + d_1 Gr \left(\frac{Y}{N} \right) + d_2 \left(\frac{g_I}{Y} \right) + d_3 \left(\frac{g_c}{Y} \right) + d_4 Gr(K_f) \\ &\quad + t + \varepsilon_4. \end{aligned} \quad (5)$$

In addition to those variables introduced earlier, P_{gI}/P , P_{gc}/P , and X/Y are the relative prices of government investment to all other goods, government consumption to all other goods, and the share of export in GDP, respectively. $Gr(N)$, $Gr(\text{old}/N)$, $Gr(\text{self}/N)$, $Gr(Y/N)$, and $Gr(K_f)$ are the growth rates of population, proportion of elderly people in total population, proportion of self employed people in total population, real per capita GDP, and inflow of real foreign capital flows, respectively. $\varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4$, are stochastic error terms with mean zero and finite variance.

Equation (4) is the first equation of the SEM. The second and third equations of model (5), which explain g_I/Y and g_c/Y , respectively, are inspired by Borchering et al. [4]. The second equation specifies that government

investment share depends on economic growth, the relative price of government investment to all other goods and openness while the third equation specifies that the share of government consumption depends on economic growth, the relative price of government consumption to all other goods, proportion of self-employed people in total population, proportion of elderly people in total population, and the growth rate of population. As stated earlier in this paper, Wagner's law predicts that government size will increase as economy grows. Wagner views national income as one of the determinants of government size thus making government size an endogenous factor. Since the literature provides ample empirical evidence supporting Wagner's law, the growth rate of real GDP is included in both equations explaining the shares of government investment and government consumption in GDP. Thus, the second equation in model (5) addresses the issue of the simultaneity between $Gr(Y)$ and g_I/Y while the third equation addresses the issue of the simultaneity between $Gr(Y)$ and g_c/Y .

The price of government and the price elasticity of demand for government goods and services both determine whether public sector expands or shrinks. If the demand for government good is price inelastic, then government spending will increase when the price of government goods or services increases. On the other hand, government size can expand when the demand for government is price elastic and the price of government is declining. However, in the literature there has been evidence in support of an increasing price and inelastic demand for government goods and services.

Kau and Rubin [37] shows in their paper that an increase in the proportion of self-employed people in the population increases tax avoidance as self-employment provides greater opportunity to hide income. Therefore, higher tax rates are expected to increase the likelihood of people becoming self-employed and evading taxes. Therefore, the variable $Gr(\text{self}/N)$ is included in the third equation to capture the effect of relative cost of tax avoidance on the share of government consumption. The growth of the proportion of population older than sixty five is expected to increase demand for social services and so is expected to be positively associated to the share of government consumption in GDP. The fourth equation for the ratio of investment to output is developed following Sprout and Weaver [38] and Esfahani [39].

5. Data

Model (5) is estimated using annual data covering the 1950–2007 span. The Appendix provides a detailed description of variables and data sources. Some of the time-series variables in model (5) may be nonstationary. Regressions involving independent nonstationary variables tend to generate “spurious” results; that is, conventional time-series tests are biased toward finding a significant relationship among variables in levels when in fact none exists. (known as the spurious regression problem, it was popularized and studied extensively by Granger and Newbold [40].) The standard method for detecting nonstationary behavior in a time-series is to test for the presence of a unit root. Testing can be extended to incorporate the prospect of a deterministic trend

TABLE 1: Stationarity tests.

Variables	PP test
Gr(Y)	-7.1042*
I/Y	-3.9429*
Gr(L)	-3.9391*
g_I/Y	-4.7238*
g_c/Y	-4.5677*
$P_{g_I/P}$	-1.7115
$P_{g_c/P}$	-1.4254
Gr(self/N)	-4.8996*
Gr(old/N)	-1.8367
X/Y	-2.7462
Gr(N)	-2.4599
Gr(Y/N)	-6.9874*
Gr(K_f)	-9.0995*

Notes: *significant at the 10 percent level.

The critical value for the PP test with constant and trend at the 10 percent significance level is -3.132.

as well as the stochastic type of trend represented by a unit root. A number of tests can be found in Said and Dickey [41], Kwiatkowski et al. [42], Perron [43], Phillips [44] and Phillips and Perron [45]. The PP test is applied to detect the existence of unit roots in the variables in model (5). The test assumes the null hypothesis of a unit root.

Table 1 reports our unit root test results. The test results confirm the presence of a unit root in $P_{g_I/P}$, $P_{g_c/P}$, Gr(N), X/Y, and Gr(old/N). A common method of dealing with the presence of unit roots is to take first differences of the variables prior to estimating a model containing them. All variables that were found to be nonstationary are differenced. The differenced variables are then analyzed with the PP test and they are found to be stationary. All variables that were found to be nonstationary in levels were entered into the model in their first differenced form. A time trend, t , is added in each equation to capture the effect of a potential deterministic trend in the variables estimated in levels.

6. Estimating the Single-Equation Model

Most studies examine the growth effect of government size using a single-equation model. This paper, therefore, estimates the relationship between economic growth and government size using both single-equation model and simultaneous-equation model in order to compare the coefficient estimates of a single-equation model to those of a simultaneous-equation model. Equation (4), the growth equation and the first equation of the SEM, is thus estimated by ordinary least squares (OLS).

Table 2 column A reports the ordinary least squares coefficient estimates. The results show that neither the share of government consumption in GDP, g_c/Y , nor the share of government investment in GDP, g_I/Y , has any significant effect on economic growth. The coefficient estimate of I/Y is positive and significant.

7. Estimating the Simultaneous-Equation Model

The results from estimating equation (4) by OLS fail to show any statistically significant effects of either government consumption or government investment on economic growth. Perhaps, the coefficient estimates are biased and inconsistent due to the presence of simultaneity between Gr(Y) and g_c/Y , and between Gr(Y) and g_I/Y . As mentioned earlier in this paper, simultaneity bias is an inherent potential problem in single-equation growth models. This paper thus estimates a SEM specified by model (5) to test the growth effects of government consumption and government investment.

Model (5) is estimated by three stage least squares (3SLS). Table 3 presents the complete 3SLS estimates of model (5). In economic growth equation, the first equation of the SEM, the variable g_I/Y has a positive and significant coefficient. The positive coefficient shows that a rise in government investment enhances economic growth, all other things equal. The coefficient on g_c/Y is negative and significant. The negative coefficient indicates that an increase in government consumption impedes economic growth. The variable, I/Y, has a positive and significant effect on economic growth. Note that Table 2 column B reports the same 3SLS estimates for only the first equation of the SEM for easy comparison to the coefficient estimates of the single-equation model.

In the second equation, which explains g_I/Y , the coefficient on Gr(Y) is not significant. This shows that there is no reverse relationship from growth to the share of government investment in GDP. The coefficient on the relative price of government investment, $P_{g_I/P}$, is negative and significant. The coefficient on X/Y is not statistically significant.

In the third equation, which explains g_c/Y , the coefficient on Gr(Y) is negative and significant. The statistically significant coefficient on Gr(Y) confirms a bi-directional relationship between Gr(Y) and g_c/Y ; the use of a simultaneous-equation model in this paper is therefore justified. Furthermore, the sign of the coefficient reflects the fact that the income elasticity of government expenditure is less than one. A number of previous studies also found that the income elasticity of government expenditure for rich countries is less than one. The coefficient of Gr(old/N) is significant with an expected positive sign. As proportion of elderly people in population grows, government expenditure rises which in turn increases the size of government.

In the fourth equation, which explains I/Y, Gr(Y/N) has a positive and significant coefficient. This captures the reverse relationship between growth and investment. The coefficient estimate for the share of government investment in GDP, g_I/Y , is negative and significant. The negative coefficient indicates that government investment indeed crowds out private investment.

Since the results do not indicate any reverse relationship from economic growth, Gr(Y), to the share of government investment in GDP, g_I/Y , model (5) is estimated without the second equation that explains g_I/Y by 3SLS.

Table 4 reports the results. Note that Table 2 column C reports the same 3SLS estimates of only the first equation of model (5) without the equation for g_I/Y . The exclusion

TABLE 2: OLS and 3SLS estimates of coefficients of (4).

Dependent Variable: Gr(Y)	(A)	(B)	(C)
Independent Variables			
I/Y	0.94 (3.55)**	1.41 (6.45)**	1.43 (6.51)**
$Gr(L)$	-0.10 (-0.21)	$0.33E - 01$ ($0.85E - 01$)	$0.25E - 01$ ($0.63E - 01$)
g_I/Y	0.83 (1.11)	1.46 (2.24)**	1.78 (2.71)**
g_c/Y	-0.30 (-0.88)	-0.54 (-1.80)*	-0.50 (-1.66)*

Notes: t -ratios are in parentheses, E indicates scientific notation.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

TABLE 3: Estimated equations (Model (5)).

Equation (1)	Equation (2)	Equation (3)	Equation (4)
$Gr(Y)$	g_I/Y	g_c/Y	I/Y
$1.41 (I/Y)$ (6.45)**	$-0.24E - 01 Gr(Y)$ (-0.86)	$-0.13 Gr(Y)$ (-2.37)**	$0.37 Gr(Y/N)$ (7.13)**
$0.33E - 01 Gr(L)$ ($0.85E - 01$)	$-0.65E - 01 P_{gl}/P$ (-2.09)**	$0.63E - 01 P_{gc}/P$ (0.47)	$-1.36 (g_I/Y)$ (-5.11)**
$1.46 (g_I/Y)$ (2.24)**	$-0.26E - 01 X/Y$ (-0.21)	$0.29E - 01 Gr(self/N)$ (0.70)	$-0.19 (g_c/Y)$ (-1.37)
$-0.54 (g_c/Y)$ (-1.80)*	$-0.54E - 03t$ (-14.37)**	$1.29 Gr(old/N)$ (2.32)**	$-0.55E - 03 Gr(K_f)$ (-0.72)
$0.23E - 03t$ (.59)	$0.58E - 01$ (34.24)**	$1.58 Gr(N)$ (1.27)	$-0.59E - 03t$ (-3.43)**
-0.17 (-1.90)*		$-0.35E - 03t$ (-4.84)**	0.26 (8.03)**
		0.18 (55.02)**	

Notes: t -ratios are in parentheses, E indicates scientific notation.

**Significant at the 95 percent level.

*Significant at the 90 percent level.

of the equation for g_I/Y does not change the sign and the statistical significance of the growth effect of either government consumption or government investment, confirming the robustness of the relationship between economic growth and government size.

Although the 3SLS method yields smaller estimated standard errors of coefficients than do the two stage least squares (2SLS) method, the 3SLS coefficient estimates of a SEM are more sensitive to the specification of the entire model, that is, a misspecification in one equation can adversely affect the coefficient estimates of other equations in the system. This problem can be addressed by using both methods to estimate a SEM and then comparing the 3SLS estimates with the 2SLS estimates. Thus, in this paper, model (5) is also estimated by the 2SLS method. The results indicate that the 3SLS and 2SLS estimates are similar. The 2SLS coefficient estimates of model (5) are available from the author upon request. Except for the variable, g_c/Y , the signs of the 3SLS and 2SLS estimated coefficients are the same, and those that were expected, while

the t -ratios for the 3SLS estimates are larger than those for the 2SLS estimates. In other words, estimated standard errors for the 3SLS estimates are smaller than those of the 2SLS estimates reflecting the fact that the 3SLS estimator here is indeed asymptotically more efficient than the 2SLS estimator.

8. Summary and Conclusions

This paper estimates a simultaneous-equation model to test the growth effect of government size in the United States for the period 1950–2007. This study is conducted at a disaggregate level, as opposed to most studies that are conducted at the most aggregate level, that is, estimating the growth effect of total government expenditure. This paper, specifically, examines growth effects of two key components of government expenditure, namely, government investment and government consumption. In order to address the likely simultaneity between government expenditure and economic growth, a simultaneous-equation model has been

TABLE 4: Estimated equations (Model (5) without the equation for g_t/Y).

Equation (1)	Equation (2)	Equation (3)
Gr(Y)	g_c/Y	I/Y
1.43 (I/Y)	-0.13 Gr(Y)	0.38 Gr(Y/N)
(6.51)**	(-2.38)**	(7.15)**
$0.25E - 01$ Gr(L)	$0.55E - 01$ P_{gc}/P	-1.33 (g_t/Y)
(0.63E - 01)	(0.39)	(-5.03)**
1.78 (g_t/Y)	$0.69E - 01$ Gr(self/N)	-0.19 (g_c/Y)
(2.71)**	(1.63)	(-1.36)
-0.50 (g_c/Y)	1.24 Gr(old/N)	-0.55E - 03 Gr(K_f)
(-1.66)*	(2.15)**	(-0.71)
$0.40E - 03t$	1.42 Gr(N)	-0.57E - 03t
(1.03)	(1.11)	(-3.36)**
-0.20	-0.37E - 03t	0.26
(-2.20)**	(-5.11)**	(8.00)**
	0.18	
	(55.03)**	

Notes: t -ratios are in parentheses, E indicates scientific notation.

** Significant at the 95 percent level.

* Significant at the 90 percent level.

employed to test the growth effects of government expenditure. To the best of my knowledge, no previous studies used simultaneous-equation model for testing the growth effects of different components of government spending. Even studies carried out at the aggregate level very rarely addressed the issue of simultaneity.

The results of this paper indicate that government consumption impedes economic growth while government investment enhances growth. Hence, the overall effect of government expenditure on economic growth is ambiguous, which explains why studies examining the growth effects of total government expenditure have produced mixed results. Furthermore, the reverse relationship from economic growth to government consumption expenditure is statistically significant, thereby, justifying the use of a simultaneous-equation model in this paper. However, no statistically significant reverse relationship from economic growth to government investment is found and so the SEM without the equation explaining government investment has been estimated. The results indicate that the coefficient estimates of both models are similar in respect of signs and statistical significance, attesting to the robustness of the results. A single-equation model is also estimated for the easy comparison of the single-equation model results to the simultaneous-equation model results. The results from the single-equation model suggest no statistically significant relationship between economic growth and either of government investment share or government consumption share indicating the fact that the simultaneity bias may be the likely reason for the failure of the single-equation model to generate any significant output effects of government spending.

Notably, findings also show that government investment crowds out private investment, which in turn reduces the net positive growth effect of government investment. This

result is consistent with the conclusion of the Keynesian model, which is that public investment crowds out private investment to some extent.

The results of this paper have two important policy implications. First, since the results indicate a positive effect of government investment and a negative effect of government consumption, a reallocation of resources from consumption expenditure to investment expenditure is likely to reduce the growth impeding effects of public spending. Second, as government investment crowds out private investment, US policymakers are faced with a difficult task of finding a combination of public and private investment that minimizes the crowding out effect of public investment. According to the 2009 CBO report [1], all components of government expenditure will continue to grow over time. Therefore, it is imperative to assess the growth effect of government spending, particularly, the effects of key components of government expenditure on growth because the impacts of different types of government expenditure are not the same.

This analysis can be extended to address many other relevant and intriguing questions. For example, one important question that was not addressed in this paper is how the various components of government investment are related. It will be interesting to examine the directions and magnitude of the impacts of each component of government investment.

Another important question is how to effectively identify components of government investment that raise the productivity of private investment, which is referred by Aschauer [46] as *crowding in* effect of public investment. The positive growth effect of government investment can be significantly increased by increasing those components of government spending that considerably crowds in private investment. All these questions and many other intriguing questions must await further research.

Appendix

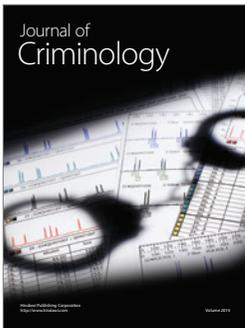
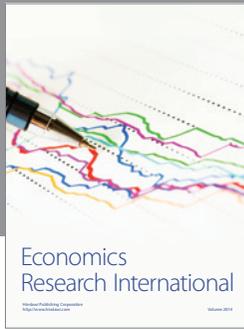
A. Variable List and Data Sources

Y :	Real GDP—Bureau of the Economic Analysis (BEA).
$Gr(Y)$:	Growth rate of real GDP—derived.
$Gr(Y/N)$:	Growth rate of real per capita income—derived.
I :	Gross private domestic investment—BEA.
I/Y :	Ratio of investment to GDP—derived.
L :	Labor force-Economic Report of the President.
$Gr(L)$:	Growth rate of labor—derived.
g_I :	Gross government investment—BEA.
g_c :	Government consumption—BEA.
g_I/Y :	Share of gross government investment in GDP—derived.
g_c/Y :	Share of government consumption in GDP—derived.
P_{gI} :	Gross government investment price index—BEA.
P_{g_c} :	Government consumption price index—BEA.
P :	Consumer price index—BEA.
P_{gI}/P :	Relative prices of gross government investment to all other goods—derived.
P_{g_c}/P :	Relative prices of government consumption to all other goods—derived.
N :	Population-International Monetary Fund, International Financial Statistics, online version, 2009.
Self:	Self employed people—Bureau of Labor Statistics (BLS).
Old:	Total number of elderly people (people over 65 years of age) —Economic Report of the President.
self/ N :	Proportion of self employed people in total Population—derived.
Old/ N :	Proportion of elderly people in total population—derived.
$Gr(\text{self}/N)$:	Derived.
$Gr(\text{old}/N)$:	Derived.
X :	Export-International Monetary Fund, International Financial Statistics, online version, 2009.
X/Y :	Share of export in GDP—derived.
K_f :	Inflow of real foreign capital—calculated by subtracting import from export and adding net foreign factor income from abroad. The data source for net foreign factor income abroad, export and import is the International Monetary Fund, International Financial Statistics, online version, 2009. The inflow of real foreign capital is derived by dividing inflow of nominal foreign capital by the GDP deflator.

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