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The Economic Consequences of Government Spending in South Korea

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Abstract

This paper sheds light on the relationship between government expenditures and economic growth for South Korea. Using annual data from 1953 to 2016, this paper does find there to be an inverted U-shaped relationship between government expenditures and the growth rate of real GDP and between private expenditures and the growth rate of real GDP for South Korea. This study shows that there is an optimal level of government expenditure ratio, private expenditure ratio, and total expenditure ratio, which promotes economic growth for South Korea, but there is a decline in economic growth once this optimal level is reached.

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1. Introduction

The relationship between government expenditures and economic growth has been studied for developed and developing countries but there has not been much research regarding private expenditures and economic growth. Previous work by Barro (1990), Armey (1995), Rahn and Fox (1996), and Scully (1989, 1991, 1994, 2000) has found there to be an inverted U-shaped relationship between government expenditures and economic growth, which is referred to as the BARS (Barro, Armey, Rahn and Scully) Curve (Di Matteo and Summerfield, 2018). The BARS Curve shows that after a certain optimal point, government expenditures has a negative effect on economic growth.

Di Matteo and Summerfield (2018) examine the BARS Curve from 1870 to 2013 for a variety of industrialized countries with the only Asian country being Japan. They find that the relationship between government expenditures and economic growth breaks down after 1973, which indicates that the BARS Curve might not apply to post-industrialized countries.

Altunca and Aydin (2013) study the relationship between government expenditures and the growth rate of real gross domestic product (GDP) for Turkey, Romania and Bulgaria from 1995 to 2011 in order to test for the Armey Curve. For all three countries, Altunca and Aydin (2013) find that all three countries exceeded the optimal level of government expenditures, which ranges from 22% to 25%.

From 1970 to 2013, Lahirushan and Gunasekara (2015) study government expenditures and economic growth for Singapore, Malaysia, Thailand, South Korea, Japan, China, Sri Lanka, India and Bhutan with respect to Wagner's Law and the Keynesian view of government expenditures and economic growth.[1]

Regarding the relationship between government expenditures and economic growth for South Korea, this paper builds upon the work of Lahirushan and Gunasekara (2015), who find that economic growth Granger causes government expenditures, which is indicative of Wagner's Law. They do find a negative relationship between government expenditures and economic growth, which indicates the possible existence of the BARS Curve, which this paper does find for South Korea.

Another key factor for economic growth is private expenditures. During economic downturns, governments tend to implement expansionary fiscal policy in order to increase economic growth. Beraldo, Montolio and Turati (2009) show that more private and public spending on health and education leads to higher economic growth for 19 OECD countries. Using a theoretical framework, Zagler and Dürnecker (2003) find that tax cuts have a direct effect on economic growth.

Regarding private expenditures and the economic growth of South Korea, this paper finds an inverted U-shaped relationship between private expenditures and economic growth. One possible explanation for the inverted U-shaped relationship is that as people get wealthier, they consume more luxury goods such as expensive exports or on experiences such as traveling abroad, thereby decreasing economic growth for South Korea past a certain optimal point. The inverted U-shape could also be capturing the Permanent Income Hypothesis on a macro level especially since the

[1] Wagner's Law refers to there being a positive correlation between government expenditures and economic growth and the Keynesian view is that government expenditures results in more economic growth (Lahirushan and Gunasekara, 2015). Wagner's Law also indicates that as an economy grows larger, it will require more government spending in order to sustain the increase in economic growth such as needing more infrastructure, education spending, etc.

second derivative of the utility function is negative. Another potential reason for the inverted U-shaped relationship between private expenditures and economic growth is that as people get wealthier, they are able to both consume and save. So, after a certain optimal, satiation point, private expenditure levels being to decrease indicating a shift from consumption to savings.

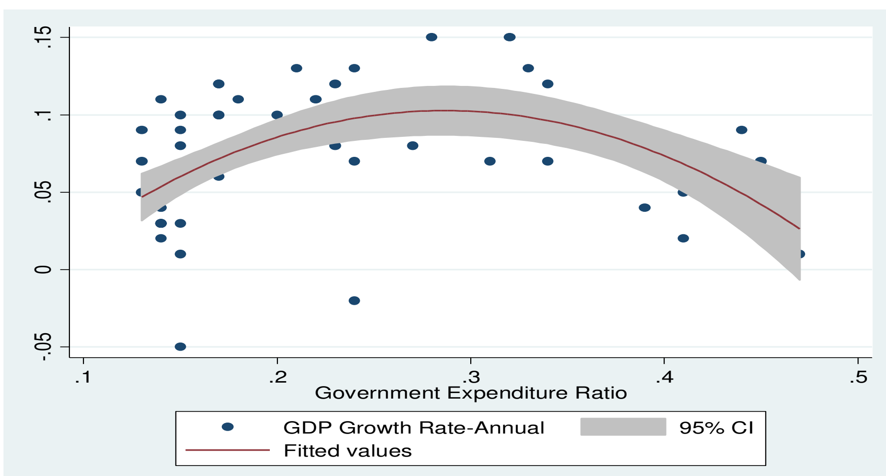
Using annual data from the Bank of Korea from 1953 to 2016, this paper does find there to be an inverse U-shaped relationship between government expenditures and the growth rate of real GDP and between private expenditures and the growth rate of real GDP for South Korea. In order to more formally test for the BARS Curve, a quadratic regression[2] is used along with the Granger Causality Test and their ensuing impulse response functions (IRFs).

The structure of this paper is as follows: Section 2 provides a discussion of the data, Section 3 presents the regression model and empirical results, and Section 4 concludes.

2. Data

A summary of the descriptive statistics is found in the Appendix 1. There is a total of 64 observations. The average growth rate for South Korea from 1953 to 2016 is 7.2%. The government expenditure-to-GDP ratio is 23.88%, the private expenditure-to-GDP ratio is 71.09%, which is a little higher than the U.S. levels of private expenditure-to-GDP ratio, and the total expenditure-to-GDP ratio is 94.97% with total expenditure referring to Government plus Private Expenditure.[3]

Figure 1: GDP Growth Rate and Government Expenditure Ratio



[2] Regarding the model selection among linear, quadratic, or cubic models, based on the plots of the data, it shows that the quadratic model fits reasonably well. Furthermore, Zucchini's (2000) model selection procedure is used to find the optimal model. As Zucchini (2000) proposes, the Akaike Information Criterion (AIC) for each model (linear, quadratic, and cubic) is calculated and then, the model with the smallest AIC is chosen as the optimal model. For more details, please see Zucchini (2000).

[3] Private expenditures refers to household consumption and consumption by non-profit organizations and hence forth, GDP is used to denote Real GDP.

Figure 2: GDP Growth Rate and Private Expenditure Ratio

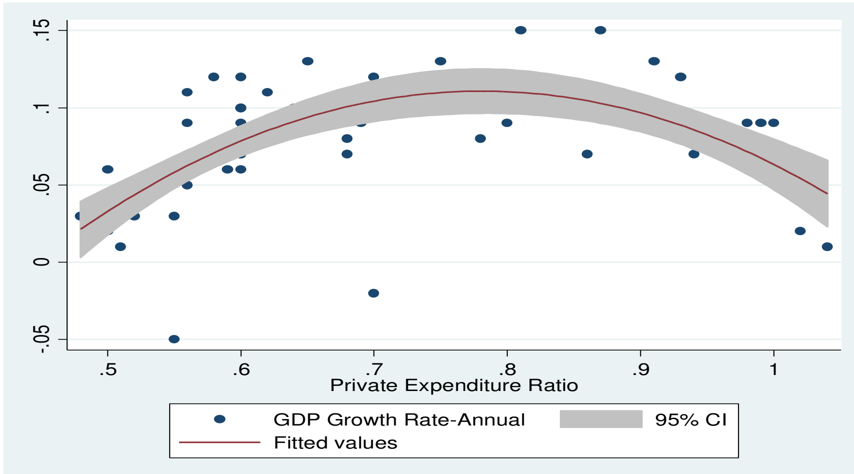
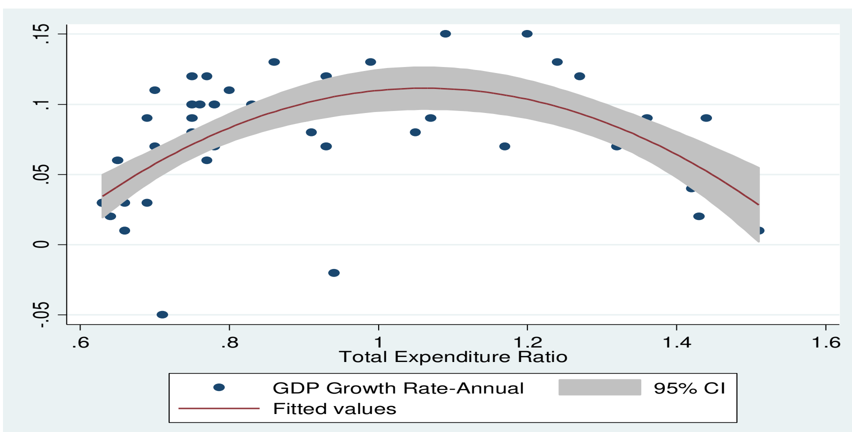


Figure 3: GDP Growth Rate and Total (Government and Private) Expenditure Ratio



The growth rate of GDP, and the government expenditure-to-GDP, the private expenditure-to-GDP, and the total expenditure-to-GDP ratios are tested for a unit root and all variables are found to be stationary using the augmented Dickey-Fuller (ADF) test.[4]

A precursory examination of the relationship between the annual growth rate of GDP for the South Korean economy and the share of government expenditure-to-GDP ratio shows a slightly inverted U-shape in Figure 1. A more pronounced inverted U-shape between the growth rate of GDP and private expenditure-to-GDP ratio is shown in Figure 2. Figure 3 shows the most pronounced inverted U-shape between GDP growth rate and total expenditure-to-GDP ratio.

3. Regression Model and Empirical Results

In order to formally capture and test for curvature, a quadratic regression is used and is of the following form:

[4] Unit root test results are available upon request.

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_t^2 + \varepsilon_t \quad (1)$$

where Y_t represents the growth rate of GDP, X_t is the explanatory variable, which can be one of the expenditure ratios (government expenditure-to-GDP, private expenditure-to-GDP, or total expenditure-to-GDP ratio) and ε_t is the idiosyncratic error term. In addition, Equation (1) is re-tested using the 1-year lagged value of the explanatory variable since it will take time for the variable to have an effect on the dependent variable.

Table 1. Regression Results

Variable	Current Year	1 Year Lag	Current Year	1 Year Lag	Current Year	1 Year Lag
Government Expenditure Ratio	1.304***	1.276***				
	(0.279)	(0.253)				
Square of Government Expenditure Ratio	-2.274***	-2.140***				
	(0.499)	(0.443)				
Private Expenditure Ratio			1.544***	1.278***		
			(0.248)	(0.278)		
Square of Private Expenditure Ratio			-0.989***	-0.805***		
			(0.163)	(0.182)		
Total Expenditure Ratio					0.876***	0.802***
					(0.145)	(0.151)
Square of Total Expenditure Ratio					-0.413***	-0.372***
					(0.070)	(0.073)
Constant	-0.084**	-0.086***	-0.492***	-0.403***	-0.354***	-0.324***
	(0.034)	(0.031)	(0.089)	(0.100)	(0.069)	(0.073)
Observation	63	63	63	63	63	63
R^2	0.269	0.307	0.410	0.297	0.390	0.390

Notes: Standard error in parentheses. *, ** and *** denote significance at the 10, 5 and 1% level, respectively.

From Table 1, it can be seen from the regression involving the growth rate of GDP and the current and 1-year lag of government expenditure-to-GDP ratio and their respective quadratic terms that all the estimated slope coefficients are statistically significant at the 1% significance level. The sign of the estimated coefficients are positive for both the current year value and the 1-year lag of government expenditure-to-GDP ratio. Alternatively, the sign of the estimated coefficients are negative for the squared terms, which indicates that there is a statistically significant inverted U-shaped relationship between the growth rate of GDP and the squares of the current and 1-year lag of government expenditure-to-GDP ratio.

The same pattern holds for the regression involving the growth rate of GDP and the private expenditure-to-GDP ratio and for the regression involving the growth rate of GDP and the total expenditure-to-GDP ratio.

Hence, the BARS Curve holds for the relationship between the growth rate of GDP and the government expenditure-to-GDP, the private expenditure-to-GDP, and the total expenditure-to-GDP ratios.

It is also worth noting that the estimated coefficients for government spending and the square of government spending are statistically significant for Hong Kong, Indonesia, Japan, Malaysia, Philippines, Singapore, Thailand and the U.S. as is shown in Appendix 2, which indicates that the BARS Curve holds for the aforementioned countries. For China and Malaysia, the appropriate sign of the estimated coefficients are captured by the quadratic regression. The estimated coefficient for government spending is positive and the square of government spending is negative for both countries but both estimated coefficients are not statistically significant for China while only the estimated coefficient for the square of government spending is not statistically significant for Malaysia.[5]

The vertex for the current year government expenditure ratio is 28.67% and 29.81% for the one-year lag of the government expenditure ratio, which is within the 30% Post WWII boundary as suggested by Di Matteo and Summerfield (2018). For the private expenditure ratio, the vertex for the current year and one-year lagged variable is 78.06% and 79.38% respectively and the vertex for the current year and one-year lagged total expenditure ratio is 106.50% and 107.80%, respectively.

Table 2. Granger Causality Test Results

Null Hypothesis	1-Year Lag		2-Year Lag	
	F-test	Probability	*F*-test	Probability
Government Expenditure Ratio does not Granger Cause GDP Growth Rate	9.410	0.003***	4.720	0.013**
GDP Growth Rate does not Granger Cause Government Expenditure Ratio	0.650	0.424	7.160	0.002***
Private Expenditure Ratio does not Granger Cause GDP Growth Rate	10.740	0.002***	5.080	0.009***
GDP Growth Rate does not Granger Cause Private Expenditure Ratio	0.410	0.524	0.050	0.948
Total Expenditure does not Granger Cause GDP Growth Rate Ratio	10.490	0.002***	0.980	0.327
GDP Growth Rate does not Granger Cause Total Expenditure	0.530	0.471	0.080	0.924

Note: *p*-values from the *F*-tests. *, ** and *** denote the null hypothesis is reject at 10%, 5% and 1% significance levels, respectively.

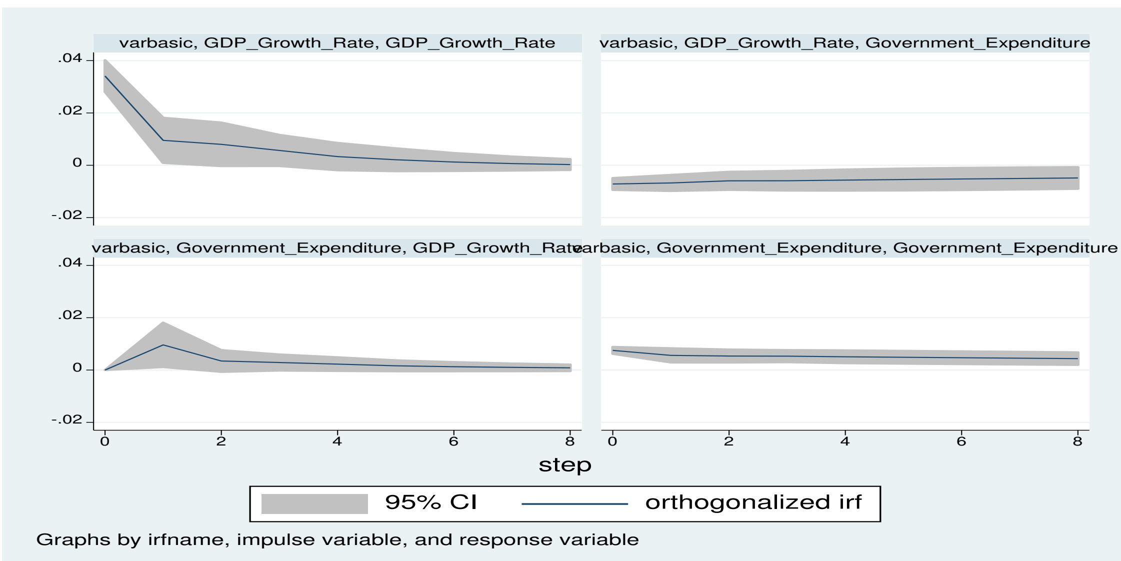
Table 2 presents the Granger Causality Test Results, which support the estimated results provided in Table 1. Two sets of the Granger Causality Tests are performed. When only one lag is used in the Granger Causality tests, as is shown in the first and second columns of Table 2, there is a causal relationship between the current year GDP growth rate and the 1-year lag of the expenditure ratios since the null hypotheses of no Granger causality are rejected. It implies that the 1-year lag of the three expenditure ratios (government expenditure ratio, private expenditure ratio, and total expenditure ratio) Granger causes the current year GDP growth rate, while the

[5] The data for government spending and the growth rate of GDP from 1961 to 2017 are obtained from the World Development Indicators (WDI), which is developed by the World Bank. Nevertheless, the extension of this study to other countries (i.e. Pan-Asian countries) is left for future research.

opposite direction does not hold. However, when the 2-year lag is added, as is shown in the third and the fourth columns of Table 2, the causal relationship becomes less obvious, which is expected. Interestingly, the null hypotheses of no Granger causality for the 2-year lag of both government and private expenditure ratios to GDP growth rate are rejected while total expenditure is not rejected.

Lastly, it is worth noting that for all 3 cases, where government, private, and total expenditures ratios are the independent variables and the GDP growth rate is the dependent variable, the 1-year lag is suggested as the optimal lag length by the Schwarz Bayesian information criterion (SBIC). The Akaike information criterion (AIC) also suggests that the 1-year lag as the optimal lag length except for one case where the 2-year lag of the government expenditures ratio is the independent variable and the GDP growth rate is the dependent variable.

Figure 4: Impulse Response Function (GDP Growth Rate and Government Expenditure)



A vector autoregression (VAR) is used to investigate how government expenditure and economic growth could be affected if there is a shock to either. Impulse response function graphs with 5% error bands, generated by 500 Monte Carlo simulations, are presented in Figure 4, which show the impulse response of one variable to a one standard deviation shock in the other variable. The IRFs results are similar to that of the Granger-Causality test. The response of the growth rate of GDP to an orthogonal shock to the growth rate of GDP has a spike of about 0.035, which declines in the first period and then dies off at approximately the sixth period. Alternatively, the response of the growth rate of GDP to an orthogonal shock to the government expenditure ratio has a slight negative response, which, very gradually, approached zero after seven periods. The IRF seems to capture an inverse relationship and this runs counter to Wagner's Law. An orthogonal shock to the government expenditure ratio causes an increase to approximately 0.01 for the first period and then, the IRF declines immediately after the first period and is at zero by the fourth period. Regarding the response of an orthogonal shock to the government expenditure ratio by the government expenditure ratio, there is a faint positive shock of about 0.005 and it very gradually approaches zero by the eighth period.

4. Conclusion

This paper examines the relationship of the government expenditure ratio, private expenditure ratio, and total expenditure ratio to the growth rate of GDP for South Korea using annual data from 1953 to 2016.

Regarding the relationship between the government expenditure ratio and the private expenditure ratio with respect to the growth rate of GDP, this paper finds that the BARS Curve holds. Hence, there is an inverted U-shaped relationship for the current and first lag of the government expenditure ratio and the private expenditure in relation to the growth rate of GDP. The optimal level of the government expenditure ratio is 28.67% and 29.81% for the current and one-year lag of the government expenditure ratio, which is within the 30% bounds for a developed nation.

The BARS Curve for the private expenditure ratio, the optimal values for the current year and one-year lagged variable is 78.06% and 79.38% respectively and the optimal values for the current year and one-year lagged total expenditure ratio are 106.50% and 107.80% respectively.

In summary, this paper seems to indicate that there is an optimal level of government expenditure ratio, private expenditure ratio, and total expenditure ratio, which promotes economic growth for South Korea but there is a decline in economic growth once this optimal level is reached.

Appendix 1. Descriptive Statistics

Variable	Obs	Mean	Std.Dev	Min	Max
GDP	64	469,458.4	478206.9	19054.41	1508265
GDP Growth Rate	63	0.0720635	0.0394788	-0.05	0.15
Government Expenditure	64	73,509.63	64045.18	9265.98	221179.1
Government Expenditure Ratio	64	0.23875	0.1085766	0.13	0.49
Private Expenditure	64	260,886.8	235812.1	17844.43	725003.2
Private Expenditure Ratio	64	0.7109375	0.1859486	0.48	1.04
Total Expenditure	64	334,396.4	299455.1	27139.62	946182.3
Total Expenditure Ratio	64	0.9496875	0.2911225	0.63	1.51
Government/Private Expenditure Ratio	64	0.3228125	0.0630814	0.24	0.52
Private/Government Expenditure Ratio	64	3.214687	0.57934	1.92	4.25

Note: * All variables measured in Korean currency (Billion Won).

Appendix 2. Results of Other Countries

	China	HK	Indonesia	Japan	Malaysia	Philippines	Singapore	Thailand	US
Govt Spending	1.334	3.030***	10.810***	1.361***	0.706***	15.842***	2.527***	1.752***	1.009***
	(0.962)	(0.359)	(2.142)	(0.149)	(0.205)	(3.147)	(0.627)	(0.256)	(0.371)
Govt Spending^2	-0.055	-0.283***	-0.557***	-0.071***	-0.018	-0.738***	-0.176***	-0.100***	-0.051**
	(0.070)	(0.043)	(0.120)	(0.009)	(0.014)	(0.153)	(0.059)	(0.019)	(0.023)
Observation	57	57	57	57	57	57	57	57	57
R^2	0.402	0.720	0.409	0.693	0.795	0.356	0.576	0.662	0.490

Notes: Standard error in parentheses. *, ** and *** denote significance at the 10, 5 and 1% level, respectively.

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