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THE RELATIVE EFFECTS OF PUBLIC AND PRIVATE CAPITAL ON GUYANA'S ECONOMIC PERFORMANCE, 1980 TO 2018: A COINTEGRATION ANALYSIS

ABSTRACT

Using data from Guyana for the period 1980-2018, this paper examines two issues. The first issue studied in the paper is the relative effects of public and private capital on Guyana's economic performance. The second issue investigated is the sources of output growth for the economy. To examine the first issue, a Cobb-Douglas production function, expressed in the form of a conditional autoregressive distributed lag equation, is applied. While for the second issue, a growth accounting expression is used.

Two key empirical results emerge from this study. The first is that public capital has exerted, on the country's economic growth, a greater impact than private capital. Notwithstanding this finding, the second key result is that both public and private capital are found to be statistically significant in growing the economy over the long run. Given these results, a major implication arising from the empirical analysis in this study is the need for expansion in both public and private capital to facilitate the growth of the economy, over the long run.

Keywords: Guyana; Public Capital; Private Capital; Economic Growth; Sources of Economic Growth; Autoregressive Distributed Lag Model; Bounds Testing Approach
JEL Classification: E22; E23; O11; O54

RIASSUNTO

Gli effetti relativi del capitale pubblico e privato sulla performance economica della Guyana nel periodo 1980-2018: un'analisi di cointegrazione

Questo articolo prende in esame due problemi utilizzando i dati della Guyana nel periodo 1980-2018. Il primo sono gli effetti relativi del capitale pubblico e privato sulla performance economica del paese. Il secondo esamina le fonti della crescita economica del paese. Per analizzare il primo problema, si applica una funzione di produzione Cobb-Douglas, stimata con il

metodo ARDL. Per analizzare il secondo problema, invece, è utilizzata la contabilità della crescita.
Dallo studio emergono due risultati empirici chiave. Il primo è che il capitale pubblico ha un impatto maggiore del capitale privato sulla crescita economica del paese. Nonostante ciò, il secondo risultato chiave è che sia il capitale pubblico che quello privato risultano essere statisticamente significativi nella crescita economica di lungo periodo del paese. In considerazione di ciò, l'implicazione che emerge dall'analisi empirica di questo studio è la necessità di aumentare sia il capitale pubblico che quello privato per facilitare la crescita economica di lungo periodo del paese.

1. INTRODUCTION

The prevailing empirical literature on the relationship between economic growth and public and private capital can be broadly divided into two groups. Those studies focusing on developed countries and those paying attention to developing countries. For examples of the former studies, see Makuyana and Odhiambo (2016). That study identified 19 studies on developed countries which included the following: the USA, Portugal, the OECD countries, Japan, and the Netherlands, among others. Some of the authors for these studies are Aschauer (1989), Ligthart (2002), Munnell (1990), Zou (2006), Sturm *et al.* (1996), and Aubyn and Afonso (2008), to name a few.

For developing countries, the seminal work on the relationship between economic growth and public and private capital is that of Khan and Reinhart (1990). In that study, based on data for a cross section of 24 developing countries, for the period 1970-1990, it was found that economic growth was impacted more by expansion in private capital than public capital. In another cross-sectional study using data for 95 developing countries, covering the period 1970-1990, Khan and Kumar (1997) also found that private capital had a greater impact than public capital on economic performance. As reported by Makuyana and Odhiambo (2016), other studies have been conducted on developing countries by various authors including, Coutinho and Gallo (1991), Serven and Solimano (1992), Ghura (1997), Odedokun (1997), Ghali (1998), Beddies (1999), Haque (2013), Belloc and Vertova (2004), Aka (2007), Nazmi and Ramirez (1997), Ramirez and Nazmi (2003), Makuyana and Odhiambo (2018), among others. Collectively, the results from these studies were dissimilar and inconsistent. In consideration of the reported

outcomes from these studies, more country studies examining the connection between economic growth and public and private capital are warranted. To extend the empirical analysis on this issue, the experience of Guyana is well suited for consideration of the relationship between economic growth and public and private capital. For in the late 1980s, Guyana implemented a Structural Adjustment Program under the auspices of the International Monetary Fund (IMF), the World Bank (WB), and other international financial institutions[1]. A key element of this program was the adoption of policy measures to boost private capital formation at the expense of public capital formation. This change was made given the view that private capital was perceived as being more productive than public capital without empirical evidence.

The purpose of this paper is two-fold. The first task is to provide empirical evidence on the relative effects of public and private capital on the economic growth of Guyana during the period 1980-2018. The second task is to determine the individual contribution to the growth in Guyana's output from growth in public and private capital. To examine the first issue, the study uses a simple Cobb-Douglas production function that includes variables such as the private capital, public capital, the labor force, and productivity within a conditional autoregressive distributed lag (ARDL) framework for the analysis. The estimated statistics generated by this model will provide a quantitative assessment of the impact on the country's economic growth due to growth in the country's public capital, and private capital, respectively. The second issue investigated in this paper uses a growth accounting equation. Through this model, the contribution to output growth from growth in public capital, private capital, and other controlling variables is examined.

The rest of the paper is organized in the following manner. Section 2 provides a brief literature review of the role played by public and private capital in the growth process of developing countries. Section 3 of the paper presents the methodologies underlying the study. Section 4, meanwhile, presents the data for analyzing the models in the study. This section also reports two sets of empirical results. The first set will be the results generated from estimating an ARDL model connecting public and private capital to the economic growth of Guyana. The second set of results to be reported will be from the growth accounting expression that identifies the

[1] For more details about Guyana's Structural Adjustment Program, see Egoumè-Bossogo *et al.* (2003).

sources of growth for the country's economy. Finally, Section 5 provides a summary of the main findings of the study along with policy implications.

2. Literature review

This literature review focuses on those empirical studies that have examined the relationship between economic growth and public and private capital for developing countries. The publication by Khan and Rhinehart (1990) is considered the lead article on this issue for developing countries. Following that investigation, several other studies examined the relationship between economic growth and public and private capital for developing countries. In Makuyana and Odhiambo (2016 and 2018), fourteen studies on this topic by developing countries are presented. Apart from Makuyana and Odhiambo (2018), the other authors of those studies are as follows: Coutinho and Gallo (1991), Erden and Holcombe (2005), Ghali (1998), Ghura (1997), Haque (2013), Khan and Kumar (1997), Mallick (2002), Nazmi and Ramirez (1997), Odedokun (1997), Ramirez (1996), Ramirez and Nazmi (2003), Sahoo *et al.* (2010), Serven and Solimano (1992). Some of the above-mentioned studies were cross sectional while others were time series in nature. As reported in Makuyana and Odhiambo (2016 and 2018), the overall results from these studies were mixed and inconclusive. For in some instances, it is reported that private investment exerted a bigger impact on economic growth than public investment. In other studies, however, the impact of public investment on GDP growth was found to be greater than the impact of private investment on GDP growth. Additionally, for some other countries, the results indicated that both public and private investments were similarly important in affecting GDP growth. In view of these conflicting results, it is evident that more empirical analysis of the relationship is warranted using time series data for a developing country. With an adequate number of time series data for the underlying variables in the model being available for Guyana, an analysis of the country's experience with regards to the relationship between economic growth and public and private capital can now be undertaken using modern techniques for analyzing time series data. Apart from being informative, the analysis of the Guyana experience would contribute to the literature in at least two ways. First, it would provide additional evidence on whether either private capital, or public capital, exerted a stronger impact on the country's economic growth over time. Second, the results would help

policy makers in the CARICOM[2] bloc articulate appropriate investment strategies for growing their economies.

3. METHODOLOGY

3.1 Model

To examine the relationship between economic growth, public capital, and private capital in Guyana, the following Cobb-Douglas production function is used:

$$Y = AK^{\alpha} G^{\beta} L^{\gamma} \quad (1)$$

In equation (1), Y = output; A = productivity; K = private capital stock; G = public capital stock; and L = labor. In this model, output is expected to increase as private capital, public capital, labor, and productivity are increased. By expressing the variables in equation (1) in the form of natural logs and applying constant returns to the entire production function, the model can be written as:

$$\ln y = a_0 + a_1 \ln k + a_2 \ln g \quad (2)$$

where $a_0 = \ln A$, $y = Y/L$, $k = K/L$, $g = G/L$.

3.2 The ARDL Model and the Bounds test for Cointegration

The ARDL model as outlined by Pesaran and Shin (1999), and Pesaran *et al.* (2001) is used in this analysis. The ARDL framework is quite useful for several reasons. First, the ARDL framework makes the application of the bounds test for cointegration quite straightforward, unlike other traditional tests for cointegration such as the Engle and Granger (1987) residual-based method, and the Johansen and Juselius (1990) full maximum likelihood approach. Second, the ARDL approach is applicable even if the order of integration for the variables in the model are mixed with values of I(0) or I(1). Third, the ARDL method can be used in studies, like this one, where the sample size is small. Fourth, the ARDL framework can be used to estimate long-run and short-run coefficients for the variables in the model. The ARDL expression for the model used in this study is as follows:

[2] CARICOM is a group of 20 countries in the Caribbean region. A key objective of this bloc of countries is to adopt measures that would increase the standard of living of individuals within the member countries.

$$\Delta \ln y_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta \ln y_{t-I} + \sum_{i=0}^{m} \beta_{2i} \Delta \ln k_{t-I} + \sum_{i=0}^{m} \beta_{3i} \Delta \ln g_{t-I}$$

$$+ \theta_1 \ln y_{t-1} + \theta_2 \ln k_{t-1} + \theta_3 \ln g_{t-1} + \varepsilon_t. \quad (3)$$

For the long-run estimates of the model, the following ARDL specification is used:

$$\text{Ln } y_t = \alpha_0 + \sum_{i=1}^{m} \theta_1 \ln y_{t-I} + \sum_{i=0}^{m} \theta_2 \ln k_{t-I} + \sum_{i=0}^{m} \theta_3 \ln g_{t-i} + \varepsilon_t. \quad (4)$$

Meanwhile, to generate the short run estimates for the model, the following error correction model within an ARDL framework is applied:

$$\Delta \ln y_t = \beta_0 + \sum_{i=1}^{m} \beta_{1i} \Delta \ln y_{t-i} + \sum_{i=0}^{m} \beta_{2i} \Delta \ln k_{t-i} + \sum_{i=0}^{m} \beta_{3i} \Delta \ln g_{t-i} + \gamma \, ecm_{t-1} + \varepsilon_t. \quad (5)$$

In equation (5), ecm refers to the error correction term which is lagged by one time-period. The symbol, γ, is the coefficient for the ecm variable. All of the other variables in equation (4) and (5) were defined previously.

3.3 Sources of Economic Growth

In this study, the connection between economic growth and public and private capital is further explored using a growth accounting equation. With that model, the contribution of factors, like public capital growth, private capital growth, labor growth, and productivity growth to output growth for the economy is evaluated. The expression applied in this exercise is the following:

$$r_Y = r_A + \alpha_K r_K + \beta_G r_G + y_L r_L \quad (6)$$

In this equation, r_y = rate of growth in output; r_A= rate of growth in productivity; r_K = rate of growth in private capital; r_G = rate of growth in public capital; r_L= rate of growth in labor; α_K = elasticity of output with respect to private capital; β_G = elasticity of output with respect to public capital; γ_L= elasticity of output with respect to labor. Equation (6) says that the growth in total output rests on the contribution to output growth by different inputs, such as, private capital, public capital, labor, and productivity growth.

4. DATA AND EMPIRICAL ANALYSIS

4.1 Data and Cointegration Test Results

The empirical analysis for this study is based on annual data for Guyana covering the period 1980 to 2018. Data for the key variables in the study, gross domestic product, the price level, private investment, public investment, the labor force, and the efficiency factor for public investment spending are taken from the following sources:

- Bank of Guyana (2018), Annual Report
- World Bank (2018), Worldwide Governance Indicators
- International Monetary Fund (2019), World Economic Outlook Database
- United Nations (2019), Statistics Division: National Accounts

The summary statistics for the fundamental variables underlying the study are shown in Table 1. For the period under review, the results indicate that Guyana's real GDP grew at an average annual rate of 9.7 percent. At the same time, private and public investments grew at an average annual rate of 13 percent, and 8 percent, respectively. In the private sector, investment expenditures facilitated the acquisition of capital goods for activities in areas like mining, telecommunications, housing, and manufacturing. In the public sector, the investment expenditures are focused on boosting the country's infrastructure in areas such roads, bridges, drainage, and irrigation, among other things.

TABLE 1 - *Descriptive Statistics for Key Variables, 1980-2018*

Statistics	RY	RIP	RIG	LF
Mean	222558.1	34943.39	21687.8	273336.8
Median	261616.8	39168.60	21955.87	275950.0
Maximum	476730.7	105984.0	46233.80	302000.0
Minimum	16480.23	290.8882	1877.551	231547.0
Std. Dev.	146046.2	27908.13	14324.94	12971.01
C.V.	65.62	79.86	151.39	4.74
Growth Rate (%)	9.67	13.20	8.01	0.33

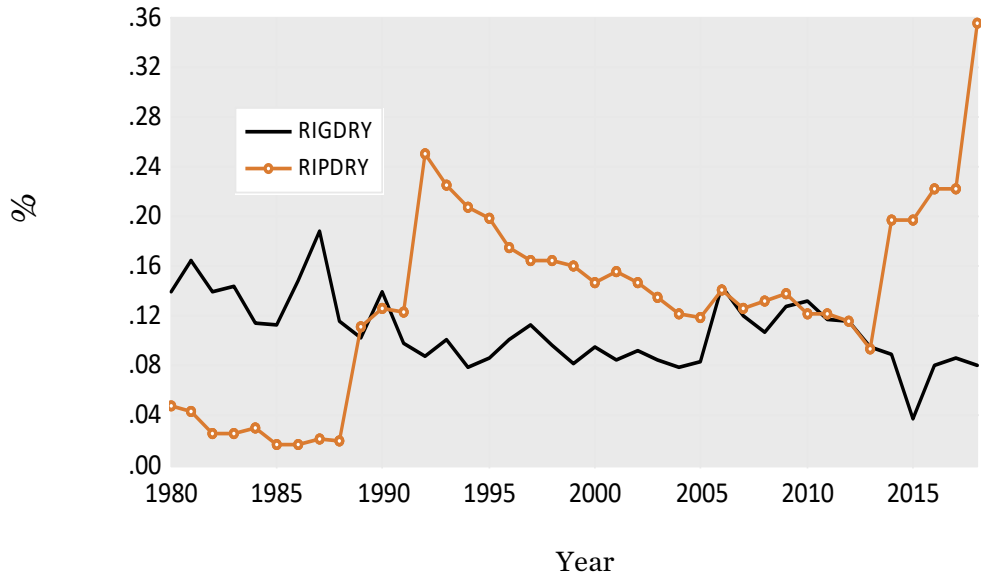
Notes: RY=real GDP; RIP=real private investment; RIG=real public investment; Std. Dev. = Standard Deviation; LF=labor force; C.V. =Coefficient of Variation.

To estimate the model, given that there are no published data for either public capital or the private capital, the following modified perpetual inventory expression was used to build the public capital stock series:

$$G_t = G_{t-1} - \delta * G_{t-1} + q * I_{t-1} \quad (7)$$

where G= public capital stock; δ= the depreciation rate for the public capital stock; I= public investment spending; q= the efficiency factor for public investment spending. The value of this efficiency factor could be between 0 and 1. To apply equation 5, the Harberger (1978) method as presented in Nehru and Dhareshwar (1993) was employed to estimate the initial capital stock. Moreover, a constant depreciation rate of 5% was applied to the equation. Finally, with the efficiency factor for public investment spending, q, being less than 1, the efficiency-adjusted level of public investment spending was calculated and incorporated into the perpetual inventory model. Figure 1 displays the public and private investment data that underlies the estimation of the public and private capital stock[3].

FIGURE 1 – *Public (RIGDRY) and Private (RIPDRY) Investment Spending as a percent of GDP*



[3] The private capital stock series was generated using a perpetual inventory model like that used for the public capital stock with q having a value of 1.

As this study uses time series data, the bounds test for cointegration was performed on the data used in the study. The results from this test indicated that the null hypothesis of no cointegration among the variables in the model was not to be accepted. Those results are shown in Table 2.

TABLE 2 - *Bounds Test for Cointegration*

Model	Computed F-statistic	Outcome
1: Model with the disaggregated values for public capital and private capital	17.14	Cointegrated
2: Model with the aggregated values for public capital and private capital	12.95	Cointegrated

Note: from Narayan (2005), the critical upper bound value is 4.84 at the 5% level.

4.2 Long-Run and Short-Run Elasticities of the Model

Given the results from the bounds test for cointegration, the next step in the analysis was to estimate the long-run and the short-run representations of equation 3. In these expressions, additional explanatory variables were added. In the long-run expression of the model, two variables were included. One was a capacity utilization variable, cu. The second variable was an interaction variable, z=d*g. For this variable, d is a dummy variable with a value of 0 for the period 1980 to 1988 and 1 for the remaining period. As defined earlier, g is the public capital stock. This interaction variable allows one to determine if the impact of public capital on the economy improved in the period after the adoption of the Structural Adjustment Program. Meanwhile, for the short-run version of the model, apart from the interaction variable, z, two other variables were included. The first is a variable that allows for the expansion of international trade, (tr), measured by the value of total exports and imports of goods and services. The second is a variable representing human capital, hc, measured by the proxy variable, Guyana's school enrollment at the secondary level in percent. The regression results from estimating these models are shown in Table 3. For the long-run period, the results indicated that the elasticity of output with respect to public capital is positive. In addition, this

TABLE 3 - *Long-Run and Short-Run Elasticities for Equations 4 and 5 in ARDL Format*

Panel A: Long-run elasticities

Dependent variable: ln y_t

Regressor	Estimated Coefficient	tStatistic
Constant	-0.77	18.47**
ln g_t	0.40	8.28**
zl_t	0.06	15.17**
ln k_t	0.13	1.88**
cu_t	0.01	10.68**

Panel B: Short-run elasticities

Dependent variable: Δ ln y_t

Regressor	Estimated Coefficient	t Statistic
Constant	-0.01	-1.18
Δ ln y(-1)	0.13	3.20**
Δ ln y(-2)	-0.03	-0.71
Δ ln y(-3)	-0.19	-4.68**
Δ ln g_t	0.46	3.09**
Δ zl_t	0.04	11.42**
Δ ln k_t	0.06	0.66
Δ cu_t	0.01	12.69**
Δ ln tr	0.12	3.70**
Δ ln hc	0.06	0.73
ect1(-1)	-0.58	-3.39**

Diagnostic Test Results: R^2= 0.983; Adjusted R^2=0.977; SER=0.033; F-Statistic=164.58; J-B Statistic: 0.5581(0.7564); BG Test: $X^2_{auto}(2)$=7.8410; BPG Heteroscedasticity Test: $\chi^2_{(10)}$= 7.17; AIC=-3.69; SIC=-3.21 .

Notes: tr = total value of exports and imports of goods and services; hc = human capital measured by school enrollment at the secondary in percent; SER is the standard error of the regression; J-B Statistic is the Jarque-Bera statistic for residuals being normally distributed; BG Test is the Breusch-Godfrey test for serial correlation; BPG is the Breusch-Pagan-Godfrey test for heterocedasticity. The two asterisks, **, indicate that the t-statistic is statistically significant at the 5% level. The critical chi-squares values for $\chi^2_{(2)}$ (.01) and $\chi^2_{(10)}$ (0.01) are 9.21 and 23.20, respectively.

elasticity is statistically significant at the 5% level with a value of 0.40 during the period 1980 to 1988 and a value of 0.46 in the period thereafter. While positive and statistically significant at the 5% level, the output elasticity with respect to the private capital stock was only 0.13. Looking at the regression output for the short-run model, the results for the period before and after 1988 indicate that the elasticity of output with respect to public capital were positive with values of 0.46 and 0.50. Additionally, these estimated coefficients were statistically significant at the 5% level, on an individual basis. The elasticity of output with respect to private capital, while being positive with a value of 0.06, is not statistically significant. For the short-run version of the model, diagnostic tests for normality of the residuals, autocorrelation, and homoscedasticity indicate that the null hypotheses of normally distributed residuals, no serial correlation, and no heteroscedasticity are not to be rejected. Additionally, the CUSUM and CUSUM of squares tests fail to reject the null hypothesis of parameter stability for the model. The displays for the CUSUM and CUSUM of squares tests, at the 5% level, are shown in Figures 2 and 3, respectively.

All in all, the results from the ARDL model indicate that the expansion of public capital has been more productive than private capital in growing the economy of Guyana. Notwithstanding this result, the long-run growth of the economy requires both public and private capital to drive the growth of the economy.

For comparison purposes, a restricted version of equation 1 is estimated. In that model, the public and private capital stock variables are combined into a single total capital stock variable (tk). When the bounds test for cointegration was applied to the comparison model, the null hypothesis of no cointegration was rejected. Table 2 reports the results for this cointegration test. The long- and short-run results from the estimation of this alternative model are shown in Table 4. To determine if the model with the disaggregated capital stock variables performs better than the model with the aggregate specification of the total capital stock, the Akaike Information Criterion (AIC), and the Schwarz Information Criterion (SIC) tests are applied to the two models, respectively. From this test, it is determined that the preferred model is the model with the disaggregated capital stock variables. The AIC and the SIC values for the long-run version of the disaggregated capital stock variables model are -3.24 and -2.89, respectively. This compares to AIC and SIC values of -1.73 and -1.51 for the combined capital stock variable model. For the short-run versions of the models, the AIC and SIC values displayed a similar pattern in favor of the model with the disaggregated capital stock variables.

FIGURE 2 – *CUSUM Test of Parameter Stability*

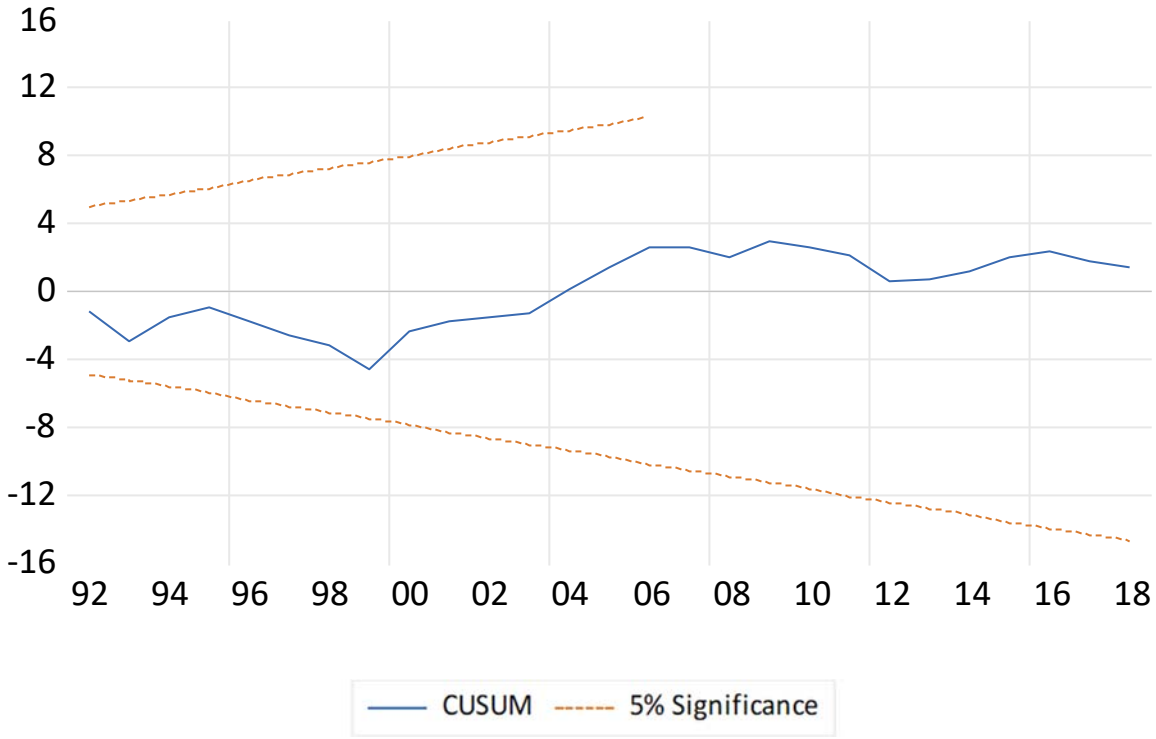


FIGURE 3 - *CUSUM of SQUARES Test of Parameter Stability*

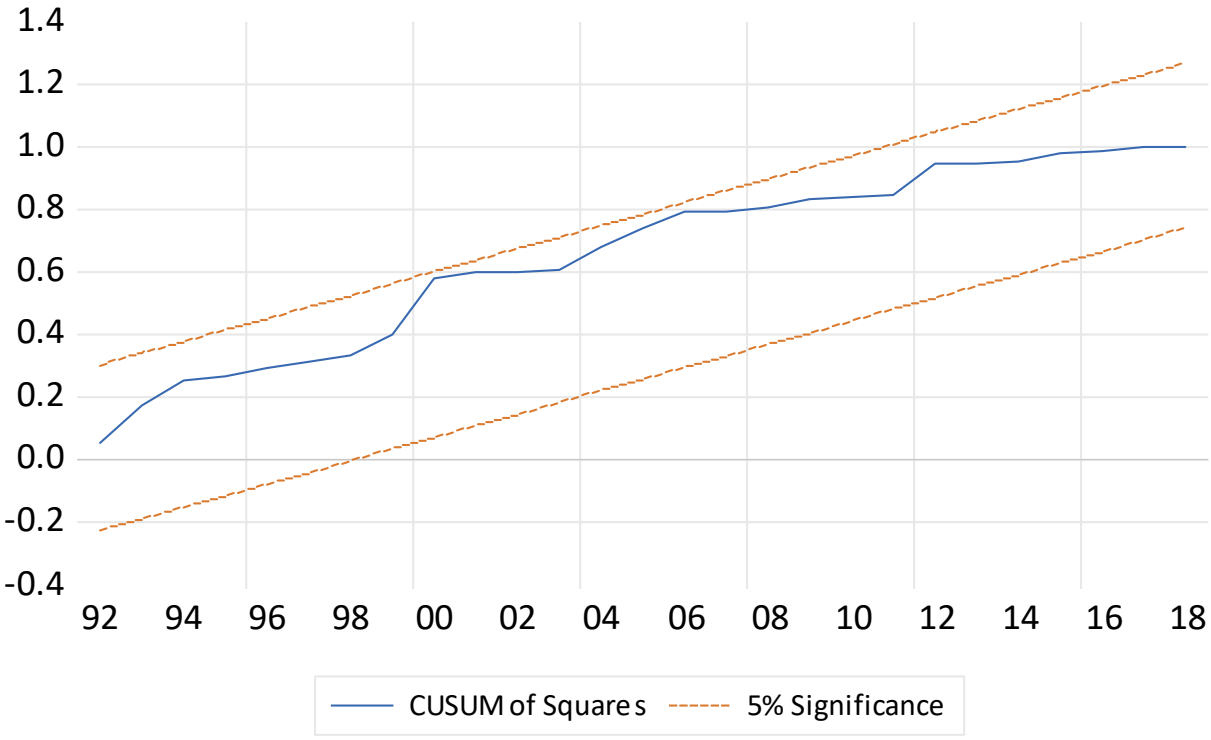


TABLE 4 - *Long-Run and Short-Run Elasticities for Comparison Model in ARDL Format*

Panel A: Long-run elasticities

Dependent variable: $\ln y_t$

Regressor	Estimated Coefficient	tStatistic
Constant	-0.22	-3.63**
$\ln k_t$	0.91	9.84**
$z2_t$	-0.58	-11.39**
cu_t	0.009	4.96**

Panel B: Short-run elasticities

Dependent variable: $\Delta \ln y_t$

Regressor	Estimated Coefficient	t Statistic
Constant	0.02	2.06
$\Delta \ln y(-1)$	0.17	4.07**
$\Delta \ln y(-2)$	0.08	1.08
$\Delta \ln y(-3)$	-0.07	-1.08
$\Delta \ln y(-4)$	-0.01	-0.24
$\Delta \ln k_t$	0.45	1.65***
$\Delta z2_t$	-0.43	-13.08***
Δcu_t	0.01	13.81**
ect2(-1)	-0.46	-3.58**

Diagnostic Test Results: R^2= 0.97; Adjusted R^2=0.96; SER=0.04; F-Statistic=130.21; J-B Statistic: $X^2_{norm}(2)$ = 24.26; BG Test: $X^2_{auto}(2)$=0.5.68; BPG Heteroscedasticity Test: $\chi^2_{(8)}$= 6.12; AIC=-3.27; SIC=-2.89

Notes: SER is the standard error of the regression; J-B Statistic is the Jarque-Bera statistic for residuals being normally distributed; BG Test is the Breusch-Godfrey test for serial correlation; BPG is the Breusch-Pagan-Godfrey test for heterocedasticity. Two and three asterisks, **, ***, indicate that the t-statistic is statistically significant at the 5% and 10% level, respectively. The critical chi-squares values for $\chi^2_{(2)}$ (.05) and $\chi^2_{(8)}$ (0.05) are 5.99 and 15.50.

4.3 Sources of Economic Growth

In this section of the paper, the growth accounting expression is used to determine the contribution from the growth of private capital, public capital, labor, and productivity to output growth in Guyana. The results from that analysis are shown in Table 5. Looking at the period 1980-2018, the data show that total output grew at an average annual rate of 9.67%. Private capital, public capital, labor, and productivity contributed 4.48%, 3.84%, 0.05%, and 1.30%, respectively, to the country's overall economic growth.

TABLE 5 - *Guyana's Average Sources of Growth (Percentages)*

A: Contributions to growth

Sources of Growth	1980-2018	1980-1988	1989-2000	2001-2018
Labor	0.05	0.35	0.07	0.06
Private Capital	4.48	0.55	12.11	1.49
Public Capital	3.84	0.53	7.27	2.60
Total Input	8.37	0.33	19.45	4.15
Productivity	1.30	-5.86	-4.66	0.29
Total Output	9.67	-5.53	14.79	4.44

B: Shares of Contributions

Sources of Growth	1980-2018	1980-1988	1989-2000	2001-2018
Labor	0.52	6.33	0.47	1.35
Private Capital	46.33	-9.95	81.88	33.56
Public Capital	39.71	9.58	49.15	58.55
Total Input	86.56	5.96	131.50	93.46
Productivity	13.44	-105.96	-31.50	6.54
Total Output	100.00	100.00	100.00	100.00

When divided into sub-periods, 1980-1988, 1989-2000, and 2001-2018, there are noteworthy variations in the relative contributions of private capital, public capital, and productivity in accounting for the growth of total output. In the sub-period, 1980-1988, policy makers had embraced a centrally planned economic system as a means for allocating the country's economic resources. In this period, total output declined at an average annual rate of 5.53%. The factors underlying the performance of the economy, in this period, are the contractions in the contributions of private capital, 0.55%, and productivity, 5.86%, to total output. The positive contributions of the labor input, 0.35%, and public capital, 0.53%, however, were not substantial enough to foster overall growth in the economy in this period. In the sub-period, 1989-2000, the implementation of Guyana's Structural Adjustment Program was a significant event. Consequently, in this period, many reform measures were adopted. As a result, after many years of economic decline, there was growth in total output, averaging 14.79% per year. The contributions of private capital, public capital, and labor, to the expansion of the economy's total output in this sub-period were 12.11%, 7.27%, and 0.27%, respectively. However, while there was some improvement in the effectiveness with which the physical inputs of production were being used in the economy, the contribution of productivity to total output, was now only a negative value of 4.66% compared to a negative value of 5.86% in the previous sub-period. In the period, 2001-2018, the economy expanded at an annual average rate of 4.44%. The contribution of public capital, private capital, labor, and productivity to total output were 2.60 %, 1.49%, 0.06%, and 0.29%, respectively. All in all, except for the results from the sub-period 1980-1988, the contribution of both private and public capital in the various sub-periods and the period 1980 to 2018 amounted to 85% or more of the average growth in total output for the related years. Labor force's contribution to average growth in output, meanwhile, has been very small with values ranging from 0.47% to 6.33% across the different sub-periods of the sources of growth analysis. Not surprisingly, the contribution of the productivity variable to output growth in the sub-period 1980-1988 was negative. Indeed, for this period 1980-1988, the results indicated that any combination of the physical inputs in 1988 produced less output compared to 1980. In the following period, 1989-2000, with the adoption of the economic reform measures, there was some improvement in productivity. Finally, in the period 2001-2018, the contribution of the productivity variable to output growth became positive but small.

5. SUMMARY AND CONCLUSIONS

In this paper two issues are examined using data for Guyana from the period 1980-2018. To examine the first issue, a Cobb-Douglas production function, within an autoregressive distributive lag framework, is used to estimate the relative effects of public and private capital on the country's economic performance. The second issue examined in this paper is the sources of output growth for the Guyana economy. For that analysis, a growth accounting expression is used, covering the period 1980-2018, and sub-periods 1980-1988, 1989-2000, and 2001-2018.

From the empirical analysis in this paper, three key results emerge. The first is that public capital has exerted a greater impact on the country's growth process than private capital. Notwithstanding this finding, the second key result is that both public and private capital are statistically significant in growing the economy over the long run. The third key result is that productivity growth has been negative or with low values for most of the sub-periods studied in this paper. Based on these results, it is recommended that policy makers in Guyana adopt measures that would facilitate the expansion of both public and private capital in the economy.

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