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The Vector Auto Regressive Analysis identifying government expenditure policy impact on sustainable economic development

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ABSTRACT

This research investigates the effects of government expenditure in Uganda on infrastructure in promoting sustainable economic. The study used a longitudinal research design using financial records from financial years 1984-85 to 2015-16 as population with a sample size of 32 annual observations. The Johansen cointegration test indicates a long-run association between government expenditure in infrastructure, communication, electricity, and financial development. The Granger- Connection findings shows indirect connection between economic development rate and all the parts of public spending that were used with P-Value 0.04 and lastly, the Vector Auto Regressive (VAR) consequences indicated that public spending on infrastructure, communication, and energy, had a direct effect on economic development rate with P-Value 0.00. The paper recommended that extra spending on substantial infrastructures such as roads, airports, railways, water facilities, electricity, and communication add extensively to the economic development rate by growing the efficiency of the public and private sectors.

1. INTRODUCTION

Growth of Infrastructure is necessary for countries' development and growth since infrastructural services such as electricity, telecom projects, accessibility of water and sanitation, and transport are crucial to family circle behaviour and economic creation,

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which improve economic development [1, 2]. For example, in crossways Africa, Infrastructure adds ninety-nine foundation tips to per capita economic development from 1990 - to 2005, contrasting with sixty-nine foundation tips for extra structural programs [3, 11]. This development was possible because the long-lived engineered arrangements, facilities, equipment, and the services they give are used in economic creation by the trade sector and family circle [4]. According to the World Development (WD) report (1993), this infrastructure includes electricity, telecom projects, accessibility of water and sanitation, and transport [5]. Therefore, the growth index is the quantity and quality of the obtainable infrastructure and their convenience to the recipients[6, 8]. Moreover, the accessibility of valuable infrastructures has an essential impact on the excellence of life of citizens in the region [7]. Therefore, the excellence of life is one of the growth indices calculated by convenience to the essential requirements of living, which comprise openness to essential infrastructure [5, 9].

Spending on infrastructure is a type for development, and in the last two decades, most governments, especially those in developing nations, have spent a considerable quantity of money on infrastructural growth to improve economic growth. Furthermore, Africa's development enhanced noticeably in the last decade, with African economies registering a solid 4 % development a year from 2001 - 2005 [1,10]. In the SSA, nations like Tanzania, Kenya, Rwanda, Ethiopia, and Uganda have in the last five years completed the most significant investment in infrastructures such as hydropower dams, roads, and railways [3]. According to [12], savings in communication and telecommunication are categorized by the original massive quantity of funds and explained that results in the assistant externalities and the government is accountable for the stipulation most frequently at sponsored rates. Therefore, the different managements completed financial necessities for communication and telecommunication for a long time, which was explained by massive government expenditure [4].

Many countries spend more than their earnings. For example, according to the International Monetary Fund (IMF), Uganda's national borrowings keep increasing due to continuing ambitious organization savings by the government, showing that the continuing infrastructure speculation mounts up as an upsurge of the national borrowings. The federal borrowings are projected to peak in 2020/21. The rise is approximately 50 % of Gross Domestic Products and federal borrowings at about 36 % of GDP. The rise will go down when the scale-up procedure finishes [9].

IMF and WB reasoned that public spending on electricity, telecom projects, accessibility of water & sanitation, and transport infrastructure directs industrialization and urbanization [10]. Industrialization and urbanization guide economic expansion cost competence and stipulation of social services [7]. The government of Uganda schemes definite public spending as a priority on infrastructure while growing monetary resources to infrastructure [6]. Although the Ugandan economy increased infrastructure investments by 27%, it has not made predictable development. Uganda's standard GDP

development rate is 5%, which is lesser than its neighbours in the East African community [11]. With the above background, this research attempts to assess the effects of government expenditure in infrastructure on promoting sustainable economic development from developing countries [7].

1. Literature Reviews

According to Solow, there is a positive connection between economic development and elected components of public spending [7]. The study suggests indirect causality between economic development and elected components of public spending [9]. Research shows that in the developing lower-income nations, communication and telecommunication appear as a primary restraint on doing commerce, discouraging a company's efficiency by around 40%. Moreover, in most nations, the indirect impact of lacking communication and telecommunication is at the smallest amount[12,14]. Empirical evidence found that among Africa, Infrastructure added 99 foundation opinions to economic development from 1990 - 2005, associated with 68 foundation opinions for additional physical policies [7,13]. There is a long-run association between budget development and public spending [10]. To boost the development degree of the inexpensive, the management necessity opts severe panels on the situation spending on communication and transportation to decrease deception, finance distraction, and misconduct. Government spending on transport and health communication influences and upsurges financial growth on the opposing side. Management should boost mutually recurrent and capital spending, including outlays on education, and ensure that money planned for growth on these segments is properly employed [4,15].

Empirical evidence shows that government spending affected financial growth and that there was no connection between GFC construction and GDP [11,16]. The effectiveness of public spending on such services and goods will affect absolutely and powerfully on development [17,18]. According to [6] emphasized, infrastructure is an essential aspect of the wealth and health of a country, helping private businesses and persons to create goods and services more competently. The results show that transport facilities are an input differentiating aspect in explaining the development gap and point to the role of telecommunication in dipping the burden of segregation [9,19].

Peacock and Wiseman (1961) showed new learning founded on Wagner's Law to test whether the law is valid or not. They studied the public expenditure for the United Kingdom from 1891 to 1955 and initiated Wagner's rule is motionless legal. Further, they stated that "The rise in public expenditure greatly depends on revenue collection." In 1976 Peacock and Wiseman achieved an examination called theory with the

assumption that the level of taxation is a limitation of the increase in expenditures and proposed the idea of a tolerable level of taxation. This theory states that "changes in public expenditures cause changes in public revenues." An increase in expenditures to meet unusual events will be temporary. However, spending will lead to an upsurge in tax revenues generated by tax increases. This assumption indicates that public expenditure determines the direction of government revenue. Administrations are similar to devote more currency, the people fix not similar to wage more duties, and that managements essential to pay some care to the needs of their persons. However, it does not cover the part of the benefit received by people on their taxes paid to the government. This weakness is covered up by received theory.

The philosophy initially tackles public expenditure and taxes as an instrument of changeable and inspiring GDP. Also, the assumption considers that weak economic growth is accredited by the shortage in the utilization spending and general demands of goods and services in the wealth. In this vision, the theory recommends improving economic development by fixing its expenditure and income via economic policies [8]. In addition, the basis of the government budget (fiscal) for supporting its expenditure and raising its economic growth is not just incomplete to assessment but also via borrowing. Therefore, the government can sponge from its internal sources outside sources of from both sources. Internal sources that also make internal debts comprise Treasury certificates, treasury bills, treasury bonds, and Federal government development stocks [9] [13][15].

In the Tanzanian background, the ministry of finance and planning for 2018/19 has also classified internal debts in the exact measurement, such as treasury bills, special bonds, and government stocks. The author is not interested in examining the effects of these categories of internal debts, including public spending, on economic growth. Similarly, [12] have used public spending on investment, savings, and consumption as a substitute for internal borrowings to examine their effects on economic growth. So, the study does not propose using parallel variables in the investigation.

Similarly, the government budget can be supported through outside sources (foreign debts) or by lending from international organizations like the IMF, World Bank, and other developed country partners. For example, the government of Tanzania, through MoFP, has been informed to have borrowed money from bilateral multilateral and commercials. Besides that, [12] have also observed that public spending, exports of the nation, investment spending, subsidies, and imports of the nation's taxes, government stocks, and subsidies are the indicators of foreign debts. The author has used these indicators to find their association with economic growth.

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This theory holds that the theory initially tackles public expenditure and taxes as an instrument of changeable and inspiring GDP. Also, the assumption considers that weak economic growth is accredited by the shortage in the utilization spending and general demands of goods and services in the wealth [18]. Therefore, in this vision, the theory recommends improving economic development by fixing its expenditure and income via economic policies [11, 19].

2. RESEARCH METHODOLOGY

This research accepted a numerical approach while using public spending in infrastructure and gross domestic product development from Uganda. The time series for financial records from financial year 1984-85 to 2015-16 using secondary data with thirty one observations. Uganda is taken as a learning location because Uganda is one of the East African countries that spend more on public spending in infrastructures related to different nations in East Africa Nations. The information is composed of various trust sources, which includes the World Bank (WB).

Econometric Model Description: The Vector Auto Regressive Model (VAR) was used. The reliant variable of the study is "continuous in nature," therefor multiple linear regression model is opt.

$$RGDP_t = \beta_0 + \beta_1 EXINF_t + \beta_2 TELEX_t + \beta_3 EXEL_t + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

Whereby: RGDPt=Economic Development β0= Intercept Term; EXINFt=Public Spending on Infrastructure; TELEXt= Investment in Telecommunication Projects with Private participation; EXELt= Investment in Energy Projects with Private Participation; ε= Error or Disturbance Term; t=Time Series (Economic Annual Data).

3. RESULTS AND DISCUSSION

The Stationarity Tests: The time sequence data were verified for stationarity via the Phillips Perron (PP) tests and Augmented Dicky Fuller (ADF) tests. This study used both tests due to the truth that they all show various meanings. Once confirm that faults are white-noise the ADF retains the soundness of the tests founded on white-noise faults in the regression model. While Phillips Perron (PP) precise for ongoing relationship finished a non-parametric improvement to the standard measurement, It also turns to alter the data after the calculation in instruction to clarify the result that auto-linked errors have on the penalties [15] a shown in Table 1.

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Table 1: Unit Roots Tests Results

Variables		Augmented Dickey Fuller Test		Philips Peron Test		Order of Integration
		t- statistic	Critical Value (5%)	t-statistic	Critical Value (5%)	
GDP	At levels	-3.473	-2.983	-3.340	-2.983	I (0)
	After differencing					
EXINF	At levels	3.669	-2.983	2.422	-2.983	I (1)
	After differencing	-6.046	-2.989	-6.035	-2.989	
EXEL	At levels	-4.887	-2.983	-4.884	-2.983	I (0)
	After differencing					
TELEX	At levels	-2.096	-2.983	-2.157	-2.983	I (1)
	After differencing	-4.473	-2.986	-4.377	-2.986	

Calculations with: *STATA, 2021*

The Johansen Co-integration Test: The Johansen test was then permitted to scrutinize whether there was more than one cointegration association between financial development and public spending variables. The answers to the Johansen tests of adjustable quantity is shown in Table 2 below.

Table2: The Johansen Co-integration Test Results

Hypothesized No. of CE(s)	Eigenvalue	T-Statistics	Critical Value (5%)
0		63.0763	47.21
1	0.60509	35.2033	29.68
2	0.47889	15.6493	15.41
3	0.40400	0.1237*	3.76
4	0.00411		

Calculations with: *STATA, 2021*

The Vector Auto Regressive (VAR) Analysis: The cointegration test results indicated that the equal method variables had a long-run association. Therefore, the model

approximation should be shown using the VAR model. Furthermore, the VAR results described in Table 3 were similar to standard regression equations since they resulted from the physical equation.

The findings highlight a cointegrating connection between GDP growth rate, State expenditure on energy, physical infrastructure, and telecom projects. In addition, the T-statistic test showed three (3) cointegrating equivalences at a 5 % significance level showing that the variables had a positive association.

Table 3: The Vector Auto Regressive (VAR) Results

N (adjusted): 1985- 2016

Number of observations: 32 years

Standard Errors and T-Statistics in parentheses

Variables	Lags	EXINF	EXEL	TELEX
	Lag (-1)	7.62	2.01	1.12
Standard errors		(2.93)	(0.87)	(0.55)
T-statistics		(0.003)	(0.02)	(0.04)
	Lag (-2)	-2.08	-0.55	- 0.42
Standard errors		(2.92)	(0.50)	(0.54)
T-statistics		(0.001)	(0.000)	(0.043)

Calculations with: *STATA, 2021*

The VAR results illustrated in Table 3 above indicate that public spending on infrastructure has a favourable result on economic development at the first and second lag, with a 1% alteration in spending on infrastructure ensuing in a 7.6% rise in GDP. The P-Value is 0.00, which means it is statistically connected at a 5% level. This finding parallels [5], who observed a positive impact between infrastructure spending and economic development. The study also that public spending on telecom projects and energy has a favourable result on economic development only at the first lag. Both had a negative effect with a 1% change in spending on telecommunication and energy in the second lag, resulting in 0.42% and 0.55%decrease in GDP. Both have a statistically significant P-Value of 0.04 and 0.02 at a 5% significance level, respectively, at first lag. The positive finding parallels those observed that government expenditure on communication and electricity has an essential impact on financial development. Though the VAR analysis observed that public spending on energy, telecommunication

and infrastructure has a positive effect on economic development, it fixed not opinion the bearing of the long-run association between variables.

Furthermore, the continuation of cointegration further indirectly that around necessity is Granger-causality from GDP development rate to public spending. Consequently, the following stage was to transmit Granger-causality assessments, a procedure to check for the connection among variables after cointegration and decide whether one variable helped forecast another [9].

VAR Diagnostic Tests: Many analytical tests were attained to guarantee the accuracy of the foreseeable VAR;to guarantee the study does not finish up with false VAR approximation findings. Table 4 highlights the outcome shows that the VAR scheme was unchanging at both lag 1 and 2. Even though there was no serial connection at lag of order 2, the VAR scheme of lag of order 1 was favoured. The lag barring test presented lag one as significant in the VAR system, which provisions the lag assortment conditions.

Table 4: VAR Diagnostic Statistics

VAR Condition Check	Statistic	Conclusion
Steadiness form	Origins are inside unit cycle withHighest at 0.91%	All the eigenvalues lie inside the unit circles. AR satisfies stability condition
Lag Omission Test	Wald test for 1 lag, 15df, Chi-square = 80.90139, p-value = 0.000	1 lag is significant
Outstanding Serial Relationship	LM test statistic	Displays no serial relationship at both, however, lag 1 is used
Outstanding Multivariate Regularity	Jarque-Bera test statistic (joint) = 91.675 p-value = 0.0000	Residuals are multivariate standard.

Calculations with: STATA, 2021

As of the planned Jarque-Bera statistics and conforming P-Values that remained to be used to test the null hypotheses, the remainders are multivariate standards. Therefore, since the P-Values for all (combined) are minor, the 0.01 level of meaning signifying the null hypothesis of standard supply can be excluded. Moreover, this has a solemn proposition since Jarque-Bera test statistics for separate sequences had P-Values remained all less than 0.01, signifying that the null hypothesis of standard supply can be excluded.

The Granger Causality Tests: After the VAR model with least Akaike and Schwarz in arrangement principle and the best lag was nominated as better model development, the Granger - interconnection test was achieved on the classical model. Refusal of the null

hypothesis of no interconnection indirect that a sequential alter in groups of public spending cause to continuing to alter in GDP growth rate. On the extra side, weakening to refuse the null hypothesis of no connection intended that GDP expansion rate was not straight clarified through the groups of public spending. The findings of the Granger-causality tests are shown in Table 5.

Table 5: Granger Causality Tests Results

Null Hypothesis	F-Statistic	df	Probability	Conclusion
GDP growth does not Granger - Cause state spending on Infrastructure	27.934	2	0.000	Bi-directional
State spending on infrastructure does not Granger - Cause GDP growth	34.459	6	0.000	
GDP growth does not Granger - Cause State spending on energy.	5.6211	2	0.000	Bi-directional
State spending on energy doesnot Granger - Cause GDP growth	18.701	6	0.000	
GDP growth does not Granger – Cause State spending on telecom project.	18.645	2	0.000	Bi-directional
State spending on telecom project does not Granger - Cause GDP growth	24.397	6	0.000	

Calculations with: *STATA, 2021*

The Granger causality test outcomes observed bidirectional interconnection among public spending on physical electricity, telecommunication projects, infrastructure, and economic development. The Granger causality tests significant experimental material on the association among this study's variables suggest that Public spending on physical electricity, infrastructure and telecommunication schemes forecasts economic development. These findings confirm the VAR model's use, recognizing that there was unintended causality between public expenditure on physical Infrastructure, telecommunication projects, Infrastructure and economic growth.

The granger causality results indicate that there was a criticism impact between all the public spending sectors and GDP development rate and it chains Wagner's hypothesis that states that increase in Gross Domestic Products lead development in the public spending and the Keynesian Theory that conditions that increase in public expenditure lead Gross Domestic Products to rise. Therefore, this study recommends that the delivery of public capital must be calculated watchfully in instruction to

encourage the nation's financial development. However, the findings do not align with [9], which found no positive association between public spending on infrastructure and economic development.

4. CONCLUSIONS

In the long-run, spending on physical infrastructure, energy, and telecom projects positively affects economic development. Therefore, the government should play an essential function in formalizing the economic development model through public spending reforms, which find out directly somewhere and how much of an economy's funds should be invested, redirected or used and how those funds should be distributed in order to add the economic expansion. Consequently, the consequences of this study lay in highlighting the fact that public spending on infrastructure is imperative in examining economic development. The authors suggest that future researchers use different key sectors of social services and expand the number of observations.

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