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THE ROLE OF INFRASTRUCTURE IN THE SOCIO-ECONOMIC DEVELOPMENT OF CROSS RIVER STATE, NIGERIA.

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ABSTRACT

The role of infrastructure in the socio-economic development of Cross River State was examined in this study for the period 1998-2020 using the ordinary least square method. Expenditure on health, education, and transport were used as measures of infrastructure and the gross state product per capita as a proxy for socio-economic progress. The period taken was due to data availability, and the methodology was adopted because of its best linear unbiased estimator (BLUE) property. The descriptive statistics of the variables showed that the means and standard deviations were relatively small (i.e., all less than ten except for GSPC), which points to the stability of the variables and thus can be relied upon for the regression analysis. The regression result revealed that the public expenditure on health (HEC had a direct and significant relationship with the gross state product per capita (GSPC), while expenditure on transport had an inverse and significant relationship with GSPC. This implies that expenditure on health has the potential to improve the well-being of the people. The study recommended that the transition from the release of public funds to the implementation of the projects for which the funds were meant must be strengthened to ensure that the expected dividends of public expenses on infrastructure are enjoyed in the form of better socio-economic progress.

KEYWORDS: Infrastructure, Economic Progress, Cross River State, Expenditure.
JEL Classification: **I15, H51, C32**

INTRODUCTION

Infrastructure development is essential for socioeconomic growth. This is because rapid economic progress is synonymous with high public investments in roads, schools, railways, phone lines, health facilities, and electricity. The provision of infrastructure in the right quantity and quality not only enhances individual well-being but also increases the economic productivity of society, leading to high and sustained levels of economic growth and development. For instance, the economic miracle experienced by countries within the Asian region

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has been partly attributed to the high rate of investments in infrastructural development. China and Vietnam, which were among the fastest-growing economies within the region between 1975 and 2005 invested above ten percent of their gross domestic product on infrastructure development. Other countries in the region such as Japan, South Korea, Malaysia, Taiwan, and Indonesia also made substantial investments in infrastructure. As a result of these investments, the GDP of these countries grew ten-fold within this period, compared to that of the other countries, which did not invest as much in the development of infrastructure, which increased five-fold during the same period (Straub, Vellutini & Walters, 2008).

In Nigeria, the need to ensure rapid economic growth and development led to heavy government investment in infrastructure development. Such investment was especially high during the post-civil War years due to the need to provide the infrastructure destroyed during the war. Recent investment in the provision of infrastructural facilities has been anchored on the need to ensure the even socio-economic development of all parts of the country. In line with this, the capital expenditure on the provision of social and economic infrastructure has constituted a significant portion of the budget of states such as Cross River in recent times. Nevertheless, the rise in the investment in infrastructure as shown in infrastructure needs continue to surge; the public resources required for its provision continue to dwindle due to falling crude oil prices in the international market, the high cost of governance, the multiplicity of political institutions performing similar functions, and corruption. The result of the mismatch between infrastructure needs and falling public expenditure for its provision is the high infrastructure deficit or gap experienced in the country. For instance, the infrastructure stock of Nigeria is estimated to be 35 percent of the gross domestic product which is about fifty percent of the internationally recognized benchmark of 70 percent of GDP while public investment in infrastructure stands at 9.1 percent of GDP which is barely adequate to maintain infrastructure assets annually.

Results of empirical studies on the role of infrastructure in growth and socioeconomic development show mixed results. While the relationship between physical units of infrastructure and economic growth/socio-economic well-being may be positive, the result of this relationship using other measures of infrastructure such as spending flows and access remains unclear and inconclusive (Straub, 2008; Loayza and Odawara, 2010). Factors such as institutional and political environment, widespread corruption and inefficiency especially in developing nations and the nature of data may be responsible for the results obtained from these studies. This study is therefore well situated in this debate and investigates the impact of infrastructure on socioeconomic development. Specifically, the study aims to investigate the impact of infrastructure (with public expenditure on roads, health care, and education as a proxy) on socioeconomic development (gross domestic product per capita as a proxy) in Cross River State.

The remaining part of the paper is structured thus: section two provides the literature review and theoretical framework. It begins with literature across the world and narrows into the Nigerian case. Section three describes the methodology, and data, and explains the model. Section four shows a description of some trends in the relationship between per capita gross domestic product and public infrastructure expenditure and provides results of the regression estimates of this relationship. Section five is a summary of the paper, its limitations, and suggestions for further research, conclusion, and policy recommendations.

Theoretical and Literature Review

Theoretical review

The theoretical relationship between infrastructure and economic development has been studied by many economists. Among the early researchers in this area are Arrow and Kurz (1970), who were among the foremost to provide a formal analysis of the effects of public capital expenditures on output and welfare under alternative financing schemes. In their framework, public capital enters as an input in the economy's aggregate production function, in the context of a Ramsey model with long-run growth exogenously determined.

Endogenous growth theory also called the new growth theory was developed in the 1980s as a response to criticisms leveled against the earlier developed neo-classical growth theory. The theory holds that economic growth is endogenous, generated by factors within the production process as against factors from

outside the model that is exogenous. The literature on endogenous growth theory has different approaches as put forward by scholars on how to model the role of infrastructure (as an endogenous factor) in bringing about economic growth and socio-economic well-being. The theory considers the effects of infrastructure, human capital, and technology on output growth and the different mechanisms of technology diffusion. Technological change becomes endogenous to the model and output growth becomes the outcome of forces emanating from within the model.

The endogenous growth model which incorporates the role of factors such as public expenditures on infrastructure was developed by Barro (1990) who assumed that the government's contribution to current production is driven by its flow of productive expenditure, and later extended by Futagami, Morita, and Shibata (1993) to include both public and private capital stock accumulation. A key insight of the latter framework is that the welfare-maximizing and growth-maximizing levels of infrastructure spending are not identical, with the latter typically exceeding the former.

Empirical review

The empirical link between public investment in infrastructural provision and the growth of the economy has occupied a central place in academic research since the seminal work by Aschauer (1989). The paper found that public infrastructure investment was important for the stimulation of economic growth. Aschauer's work investigated the link between aggregate output and both stock and flow of government spending on key physical infrastructure such as highways, airports, and transportation which were referred to as "core" infrastructure. The conclusion of this investigation was that infrastructure investments should be prioritized and given higher ranks than investments in other sectors in government developmental roles due to their central place in enhancing economic productivity and growth. This study although conducted in developed nations, has played a pivotal role in stimulating the discourse between infrastructure and economic growth in the developed world as well as in developing countries.

Loayza and Rei Odawara (2010) examined how infrastructure affects economic growth in Egypt. The findings of the study suggest a permanent increase in infrastructure expenditures has a gradually rising effect on per capita GDP growth. As the infrastructure stock builds up, it translates into increased growth; on the other hand, as GDP per capita is increases, growth becomes more difficult (due to diminishing capital returns). The authors were of the view that improving infrastructure in that country requires combined larger expenditures on it and more efficient investment. The analysis provided in the paper suggests that an increase in infrastructure expenditures from 5 to 6 percent of gross domestic product would raise the annual per capita growth rate of gross domestic product by about 0.5 percentage points in a decade's time and 1 percentage point by the third decade.

Calderon and Serven (2008) while analysing the effect infrastructure has on economic growth among African countries using panel data for the period 1960-2005, employed growth regression estimates with the use of the Generalized Method of Moments estimator. They examined various infrastructure assets including quality service measures. Their findings suggest that both the levels of accumulation of infrastructure, as well as the quality, are directly related to real GDP per capita, and this was significant too.

Equally, Calderon (2009) evaluated how higher infrastructural development in Africa impacts on its growth over the last 15 years (comparing 2001-05 to 1991-1995). At the country level, Egypt has attained the largest contribution of infrastructure development to growth (1.51 percent) within countries in North Africa, with a rate higher than the average of the African region which is 0.99 percent.

In other studies, in Africa dealing with specific infrastructure, Diao and Yanoma (2003) show that growth in the agricultural sector is constrained by high marketing costs, which largely reflect poor transport (in addition to other facilities) infrastructure. Estache and Vagliasindi (2007) were of the view that an inadequate generation capacity, in terms of power limits growth in Ghana. Also, Lumbila (2005) finds that deficient infrastructure may hinder the growth impact of FDI in Africa. In addition, access to infrastructure services is critical for improving the economic opportunities of the poor (Estache 2003, World Bank 2006), and therefore the deficient quantity and quality of Africa's infrastructure is potentially a key stumbling block to the eradication of poverty in the continent.

Lawal et al. (2022) used time-series data spanning the years 1991 to 2019 to analyze the relationship between government health

spending, population, and economic growth in Nigeria. According to the report, both capital and ongoing government health spending have a detrimental effect on Nigeria's economic expansion. Both capital and ongoing health spending resulted in reductions in economic growth of 0.08 percent and 1 percent, respectively. It was advised that the government raise its budgetary allocation to the health sector in accordance with the Abuja Declaration and United Nations benchmark to ensure the citizens' good health and well-being based on the study's findings.

Yoshino and Nakahigashi (2000) estimated the effect of social capital stock on productivity by industry, sector, and region, and clarified the relationship between social capital stock and economic development. The result revealed that: the productivity effect of social capital stock is: large in information and telecommunication as well as environment, when analysed by sector; large in the tertiary industry when analysed by industry; large in regions with mostly urban settlements when analysed by region. To see the result of their analysis from the viewpoint of developing countries, the relationship between social capital and economic growth is reexamined from statistical data.

Yoshida (2000) presented an analysis from different points of view of the correlations between economic growth and infrastructure in Japan. These included transport, electricity, and energy sectors over the last century in order to derive lessons that can be useful to developing countries. He divided Japan's development era into five major epochs and discussed the patterns of demand and investment in infrastructure over one century. He found that the growth rate of demand in infrastructure was much higher than that of per capita GNP in the early stage of development, and public investment in infrastructure was big. And he also found that infrastructure investment in rural areas had a trend to correct the regional income disparities.

Azolibe and Okonkwo (2020) discovered that the amount and quality of telecommunication infrastructure is the most important factor influencing industrial sector productivity in an empirical study that used a panel least square estimation technique on panel data from the SSA region from 2003 to 2018. The authors attribute the region's low industrial sector productivity to poor electrical and transportation infrastructure, as well as inadequate water supply and sanitary facilities.

Some studies have looked at the impact of specific infrastructure on growth. One such study was carried out by Fan et al. (2005) on the impact of road investment in promoting production growth in China. They consistently showed the importance of road investments in promoting production growth in China. To access the contribution of road infrastructure to economic growth, a number of studies specified an aggregate production function that included transportation infrastructures among the explanatory variables. Some studies have been found to indicate in order to generate growth and development, and economic diversification, the development of infrastructure, including soft infratrsurute such as the quality of institutions through an environment for productive activities, should be aggressively pursued (Omimakinde, 2022; Ebi & Eke, 2018).

Canning and Bennathan (2000), using a co-integration method, estimated the rate of returns to paved roads for 41 countries over a period of four decades. Canning found out that the highest rate of return to road infrastructure occurs in countries with well-developed infrastructure. Aschauer (1989), in the extension of his investigation, includes the impact of infrastructure on growth, productivity, poverty, and similar outcomes related to development with the use of various measures, data, and methodologies. The study by Calderón and Servén (2008) gave part of the literature on the growth and inequality effects of infrastructure; more comprehensive surveys include Estache (2006), Romp and De Haan (2007), and Straub (2007).

Most of the works on the role of infrastructure in economic development were national or cross-country level but this study investigates this relationship at the state (sub-national) level and the result is going to be useful to policymakers, the government, and researchers in this field.

METHODOLOGY

Study Design/Area

The study was carried out in Cross River State which is situated in the South-South region with a population of over 2.8 million people. The state has 18 local government areas and an area of 23,000sq km and is bounded by the Cameroon Republic to the east, Benue state to the north, the Atlantic Ocean to the south and Ebonyi, Abia, and Akwa Ibom states to the west.

The state is mainly agrarian with about 75 percent of the population engaged in subsistence farming. The state cultivates a rich variety of crops such as cocoa, cashew, yam, cassava, rubber, plantain, and pineapples. Poverty is endemic in the state with over 70 percent of the population living below $1 per day (CR-SEEDS, 2007). The state has made remarkable progress in the diversification of its economic base through an aggressive tourism programme, especially since the advent of the current democracy in 1999.

The research design for this study is a quantitative analysis using the ordinary least square method because of its BLUE property. Time series secondary data on the gross state product per capita, public expenditures on healthcare, education, and transportation, and the state population for the period 1998 – 2020 were used for the study. The data was obtained from the state statistical digest published by the Cross River State Statistical Bureau and the Cross River State Economic Report

Model specification

The long-run impact of infrastructure on income is examined within the framework of neoclassical and endogenous growth models in this study. Increased expenditure on infrastructure by the public sector raises the living condition and enhances improved education facilities, good health, better roads and rails, and improves human capacities as well as manpower skills. These improvements have positive effects on productivity, socio-economic development, and long-run economic growth. In investigating the infrastructure-socio-economic progress nexus, the study uses public expenditure on health, education, and transportation as infrastructure investment and per capita state gross domestic product as a measure of socio-economic progress. Therefore, the empirical model for this study is anchored on endogenous growth theory following the work by Futagami, Morita, and Shibata (1993). The study applied the modified and augmented Cobb-Douglas production to show how the formal neo-classical growth theory can be unrestricted to include expenditure which promotes skills and technology and makes for increasing returns to scale with a positive effect on the state output or gross domestic product. The function is stated as:

$Y= AK_{\alpha} L+ U$

But "A" (efficiency parameter) is a function of infrastructure. Infrastructure in this study is captured by public expenditure on transportation while capital and labour in the C-D function in this study is proxy by expenditure on education and health, and population, respectively.

The multiple regression ordinary least square model is thus specified as:

GDPC = f (HEC, EDU, TRP, POP) 2

The estimated equation with the inclusion of the error term is specified as follows:

$GDPC_t = \beta_0 + \beta_1 HEC_t + \beta_2 EDU_t + \beta_3 TRP_t + \beta_4 POP_t + e_t$ 3

where:

GDPC = State gross domestic product per capita which is a proxy for economic progress measured in billion naira

HEC = Public expenditure on healthcare which proxy infrastructure in the health sector is the total budgetary provision for healthcare by the government of Cross River State measured in millions of naira.

EDU = Public expenditure on education which proxy education infrastructure is the total budgetary provision for education by Cross River State government measured in million naira

TRP = Public expenditure on transport which proxy infrastructure on roads and bridges is the total budgetary provision for transportation in million naira

Studies such as Ikubor et al, 2021 and Lawal et al. 2022 have used government expenditure on health and education to investigate the effect of infrastructure on growth at the national level. Ikubor (2022) also measured infrastructure using government expenditure on infrastructure. Gross Domestic Product was also used by the two authors to measure economic growth, this study uses these measures but analyses the impact of infrastructure on economic growth at the sub-national (State) level, which no known study addresses. The data used for analysis in this study was obtained from the Cross River State Statistical Yearbook 2020, published by the Cross River State Planning Commission.

The a priori expectation or the expected pattern of behavior of the independent variables (public expenditures on health, education, transport, and population) on the dependent variable (gross state product) are: β_1, β_2, β_3, and $\beta_4>0$

ANALYSIS OF RESULT AND DISCUSSION

The descriptive statistics of the dependent and independent variables used in the analysis is presented in Table 1. The result shows that for the period of analysis (23 years), the means of the independent variables were 3.4, 2.9, 9.0, and 3.0 for health, education, transport expenditures, and population respectively while it was 100 for the gross state product per capita. The standard deviations of the variables were found to be 2.8, 7.8, 8.5, and 0.3 for education, health, and transport expenditures and population respectively while it was 44.3 for gross state product per capita. This result shows that both the means and standard deviation for the independent variables were relatively small (i.e. were all less than ten) which points to the stability of the variables and thus can be relied upon for the regression analysis

Table 1: --Descriptive statistics

	GSPC	HEC	EDU	TRP	POP
Mean	100.3291	3.47E+08	2.90E+09	9.01E+09	3.044348
Median	123.2686	2.15E+08	2.52E+09	9.60E+09	3.070000
Maximum	159.4197	3.77E+09	8.43E+09	1.89E+10	3.540000
Minimum	6.978901	0.000000	0.000000	0.000000	2.330000
Std. Dev.	44.30849	7.80E+08	2.86E+09	8.54E+09	0.385520
Skewness	-0.990749	3.881713	0.211035	-0.043267	-0.384113
Kurtosis	2.531068	17.54874	1.533974	1.118268	1.852014
Jarque-Bera	3.973472	260.6061	2.230400	3.400554	1.828541
Probability	0.137142	0.000000	0.327850	0.182633	0.400809
Sum	2307.570	7.98E+09	6.66E+10	2.07E+11	70.02000
Sum Sq. Dev.	43191.33	1.34E+19	1.80E+20	1.60E+21	3.269765
Observations	23	23	23	23	23

Source: Authors' compilation (2022).

The correlation matrix demonstrates how the variables employed in the model relate to one another, and the findings are shown in Table 2. Gross State Product per Capita (GSPC) and Transportation Spending Per Capita (TRP) show a 59% association between them, while population (POP) and health care expenditure (HEC) have a 14% poor correlation,

Table 2: Correlation Matrix between variables

	GSPC	HEC	EDU	TRP	POP
GSPC	1.000000				
HEC	0.276074	1.000000			
EDU	0.578891	0.157330	1.000000		
TRP	0.599866	0.382797	0.409703	1.000000	
POP	0.300850	0.145918	0.363048	0.283680	1.000000

Source: Authors' compilation (2022).

The regression result shows that the constant term had a negative and statistically significant relationship with the dependent variable. HEC (health care expenditure) had a positive and significant impact on the GSPC. The result shows that a 1% increase in healthcare expenditure by the state government led to a 2.5% increase in the gross domestic product, and this was significant with p = 0-004. This finding disagrees with that of Lawal et al who found that expenditure on healthcare was negatively related to economic growth in Nigeria. Also, education expenditure had a positive effect on state GSPC with the result revealing that an increase in education expenditure by 1% led to a 2.1% increase in the gross state product per capita. This relationship was however found to be insignificant with p = 0.630. This reveals that investment in health facilities like primary health care in the state especially in the rural areas improves the socio-economic life and by extension the welfare of the people and enhancement of their productive capacity. This could be a result of the concerted efforts made by successive administrations in the state since the return to democracy in 1999 to ensure that attention is given to the healthcare system through increased budgetary expenditures and the introduction of free healthcare services to children under five years and pregnant women code-named project comfort. The Public expenditure on transport which proxy infrastructure on roads and bridges negatively impacts gross domestic product per capita in the state. In the result, a 1% increase in this expenditure leads to 5.7% reduction in gross domestic product per capita. This result does not agree with the studies by Yoshida (2020) for Japan and Loayza and Odawara (2010) which found that investment in infrastructure tend to have a positive effect on economic growth. This finding mirrors the poor state of road infrastructure in the state and tends to support the belief that there is a wide gap between budgetary provisions and actual expenditure in the intended sectors and monitoring and evaluation for impact. The poor state of the roads has increased the cost of travel in money and time, the incidence of road accidents, and the cost of maintaining vehicles. This has increased the cost of carrying out economic activities in the state. This result also implies that there is a problem in the structure and composition of government investment in the construction of roads It could also be a result of corruption and embezzlement of the funds.

Table 3: Regression estimates of Variables

Dependent Variable: GSPC				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-418.6374	75.37657	-5.553947	0.0000
TRP	-5.70E-09	1.89E-09	-3.012024	0.0075
HEC	2.52E-08	7.69E-09	3.273003	0.0042
EDU	2.15E-09	4.39E-09	0.488915	0.6308
POP	12.44E-05	27.96656	6.523523	0.0000
R-squared 0.814819		F-stat		19.80052
Adjusted R-squared 0.773667		Prob (F-stat)		0.000002
Durbin-Watson stat 1.863861				

Source: Authors' compilation 2022.

The coefficient of the population has a positive and significant impact on the GSPC indicating that the population growth in the state leads to an increase in the size and quality of labour force and the stock in entrepreneurship which will create an enabling environment leading to socio-economic progress. In the result, a 1% rise in the population of the state culminates in a 12% increase in the gross state product per capita.

It was determined that the model is significant at a 5% critical level with an f-stat value of 19.80052 and a probability value of 0.0000 using the F-statistics, which measures the model's overall significance level. Finally, the model is free from the issue of serial autocorrelation, as evidenced by the Durbin-Watson statistic value of 1.86, which is extremely close to 2.

Post estimation tests

Table 4: Serial Correlation and Heteroscedasticity Test Result

Test	F-Stat	Prob.
Breusch-Godfrey Serial Correlation LM Test:	0.449344	0.6459
Heteroskedasticity Test: Breusch-Pagan-Godfrey	0.849564	0.5123

Source: Authors' compilation 2022.

Breusch-Godfrey and Breusch-Pagan Godfrey tests for heteroscedasticity and serial correlation, respectively, showed that the model does not exhibit autocorrelation and that the null hypothesis that there is no constant variance was rejected. The model is stable, that is, it complies to the BLUE property, according to the CUSUM test result, which evaluates the model's stability using the 5% upper and lower bound.

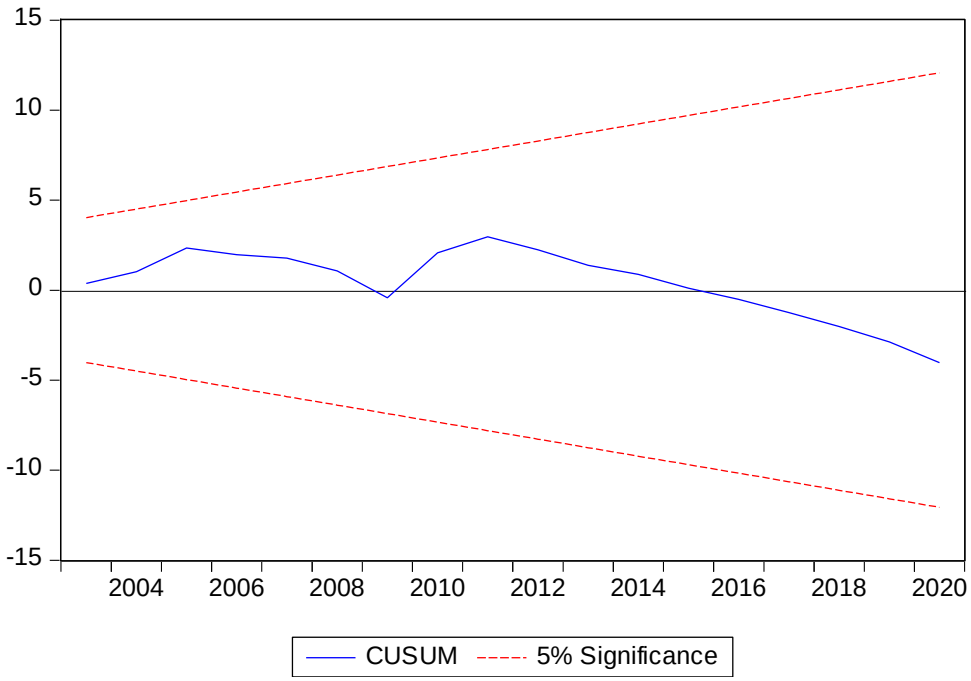

Fig 1: CUSUM Stability test

CONCLUSION AND POLICY RECOMMENDATIONS

Conclusion

This study investigated the role of infrastructure on the socio-economic development of Cross River State using data for the period 1998 to 2020. The result shows that capital expenditure on infrastructure has the potential to improve the socio-economic well-being of the people of the state with the positive relationship between public expenditures on education and healthcare on per capita gross state product. However, the reality on the ground is that the state of infrastructure in the state is a far cry from what is expected thus there is the possibility of a lag in transition from actual expenditures and implementation of what these financial resources were meant for.

Policy recommendations and suggestions for further studies

The outcome of this investigation requires that the following recommendations be implemented by relevant state government ministries, departments, agencies to ensure value for public expenditure:

1. The Legislature and other relevant government agencies should ensure that budgeted sums are released for the intended infrastructural projects.
2. Project monitoring should be strengthened to ensure that the expected dividends of public expenses on infrastructure are enjoyed in the form of better socio-economic development. This can be done through the empowerment of the project monitoring Department and anti-corruption agencies in the state to ensure a transparent bidding process and reduction of corrupt practices in government contracts.
3. There should be a new model of public-private arrangement of road management (for an initial period) with the long-term target of a wholly privately run scheme of road management.
4. For further in-depth investigation of this topic, we suggest that relatively longer data points and tests for stationarity of such series can be undertaken.

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