Small States & Territories, 4(2), 2021, 245-258

Climate change, governance and economic growth: The case of small island developing states

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ABSTRACT: The paper investigates the climate change, governance and development nexus for 19 small island developing states (SIDS) from 1995 to 2018. The study uses the Vector Error Correction Model and the results point out that climate change and environmental degradation deter economic growth. Governance has a positive and significant impact on economic growth across the selected SIDS. The findings also confirm a bi-directional causal link between economic growth and governance, and that increasing growth contributes to higher levels of pollution. Finally, governance has no statistically significant effect on environmental degradation. This is attributed to weak governance arrangements in small (and mainly island) states, which fail to have well defined goals and strategies in the climate change sector. There is thus a need to administer policies, programmes, legal instruments, reforms and institutional interventions in a holistic and coordinated manner among and within various institutions across SIDS to build a proper governance structure to curb the impacts of climate change.

Keywords: climate change, economic growth, environmental degradation, governance, small island developing states (SIDS), vector error correction model

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Introduction

Small (and mainly island) developing states differ significantly in culture, history, geography and socio-economic circumstances (Leal et al., 2021) and as such diverge in terms of their vulnerability to changes in their environment and in climatic conditions. Their higher vulnerability compared to other countries, result mainly from their dependence on a few sectors namely fisheries, traditional agriculture, tourism (which are all highly vulnerable to changes in climate), lack of both new technologies and modern and efficient production techniques, amongst others. Climate change affects Small Island Developing States (SIDS) differently and, as such, their responses to changes in climate depend on their resources and governance structures.

Governance is a vital component in addressing the vulnerability and resilience of SIDS to climate change. Climate change governance is supported in many countries by a multitude of stakeholders and implementing agencies. Countries need institutions, which are capable of managing the effects of climate change through appropriate strategies for governance mitigation and adaptation. Institutional forms and capacities however vary across countries, as those with effective and resilient governance institutions will be in a better position to develop institutions more specifically adapted to manage climate change; whilst states with weak governance arrangements may not have well defined goals and strategies in the climate change sector (World Bank, 2009). Being mainly developing countries, SIDS are likely to place more emphasis on governance for adaptation and on sector specific mitigation activities.

As small economies with pre-existing economic, social and environment vulnerabilities, SIDS tend to pursue development-centric policies to achieve higher growth rates (Singh, 2008; World Bank 2010), and as such may neglect the environmental dimension. Prioritising economic growth and job creation over environmental protection affects the livelihoods of islanders. Policy makers in many SIDS tend to pursue a policy of 'grow first, clean up later' (Thai-Ha et al., 2017). Economic studies point to a close correlation between economic growth and environmental degradation (Grossman & Krueger, 1991; Meadows et al., 2004; Halkos & Tzeremes, 2009; Chakravarty & Mandal, 2020). In fact, the Environmental Kutznets Curve (EKC) hypothesis explains the environmental protection and economic growth nexus via an inverted U-shaped relationship between income per capita and environmental degradation. It is postulated that, in the early stages of economic growth, there is a rise in environmental degradation; but an increase in environmental quality is noted once a threshold level of income is attained (Grossman & Krueger, 1991). According to this line of thinking, economic growth is seen as a cure for environmental degradation and not a cause for the same (Chakravarty & Mandal, 2020). The EKC hypothesis has been tested mainly for developed economies (Panayotou, 1997) or a group of mixed sampled of low, middle and high-income countries (Halkos, 2003) and only recently for developing countries (Chakravarty & Mandal, 2020).

However, empirical work on EKC does not provide support for the inverted U-shaped link between environmental degradation and per capita income due to the presence of other structural factors; one of them being the governance structure and robust institutions and legal framework in place in a country. At early stages of growth, developing countries in particular, may not have adequate resources to tackle environmental degradation and have weak institutions and environmental regulations to deal with environmental protection and climate change effects. Vulnerabilities of SIDS can be reduced through the setting up of appropriate governance systems, which will create opportunities and solve environmental problems and other socio-economic shocks to ensure a sustainable livelihood for communities. Climate change policies along with strategies to reduce the vulnerability and improve the resilience of communities should be integrated within the system of governance of SIDS. Hence, a robust governance structure with appropriate institutions will create the political commitment needed to deal with shocks and empower SIDS' communities, making a difference in terms of their development. Thus, the connection between economic growth and climate change is highly influenced by governance structure, institutions and regulations, which play an important role for SIDS, in particular. As countries grow, citizens tend to value the environment more and demand stronger regulatory institutions (Dasgupta et al., 2005). This will put more pressure on government to implement stricter environmental regulations and policies. However, lack of political will has been identified as one root cause of ineffective governance in developing countries and especially across SIDS. Thus, at varied decision making levels of climate change and environmental protection, necessary compromises for the benefit of the environment may be foregone. Environmental priorities are in many instances deprioritised so much that failure to develop policies in favour of sustainable development and environmental protection will allow poor environmental governance to persist.

In this direction, the paper contributes to the existing literature by investigating the association between climate change, governance and economic growth for small island developing states. To our knowledge, empirical work on this complex relationship is rather scant for small island developing sates. The objective of the study is to assess the effects of climate change, environmental degradation and governance on economic growth across SIDS. The study further probes into the complex relationship between governance and environmental degradation. The existence of any causal relationship across the three variables is also assessed. Data is used for 19 SIDS from 1995 to 2018 from the World Bank Development indicators (2020); the countries are selected based on data availability of the different indicators used in the analysis. The 19 SIDS covered in the study are: Antigua and Barbuda, Barbados, Cabo Verde, Comoros, Cuba, Fiji, Grenada, Guyana, Jamaica, Maldives, Mauritius, Palau, Papua New Guinea, Solomon Islands, Suriname, Tonga, Trinidad and Tobago, Tuvalu and Vanuatu. The Vector Error Correction Model (VECM) is applied for estimation.

The structure of the paper is as follows: Section 2 reviews the existing literature on the association between climate change, governance and economic growth. Section 3 sets out the methodological approach adopted. The findings are discussed in Section 4. We conclude with relevant policy implications in Section 5.

Literature review

Small island developing states and their economies are particularly at risk to climate change. There is an extensive literature evaluating the effects of climate change on SIDS adopting different perspectives and across different sectors, such as specifically on its effects on agriculture (Mendelsohn, 2009; Deschenes & Greenstone, 2007) and more broadly on ocean fisheries, fresh water access, storm frequency, tourism and migration (IPCC, 2007). Other research has examined the effects of temperature change on mortality (Deschenes & Moretti, 2009), on crime (Field, 1992; Jacob et al., 2007), and of the effects of drought on conflict (Miguel et al., 2004). Across a wide range of disasters, an occurrence in a small country is proportionately more damaging than a corresponding event in a larger nation, which therefore makes recovery after the disaster more difficult, and challenging (International Monetary Fund, 2016). In essence, small developing economies encounter greater social and economic costs per capita resulting from climate change than larger countries (World Bank, 2010).They are constrained by their smallness, remoteness, along with limited natural resources and access to technologies and innovations (Armstrong & Read, 2003). They are relatively more fragile than other countries as many depend heavily on tourism as their main source of revenue and engine of growth. They encounter serious structural and geophysical constraints that create large economic, social and environmental challenges that hinder their development pathway. In addition, their high dependence on international trade, especially with regards to imports of food and oil, make them vulnerable to external shocks (Baldacchino, 2013; Briguglio, 2014). Further, SIDS have considerable portions of their populations living in locations exposed to climate hazards (such as coastal areas): such communities are also more vulnerable to the effects of climate change (Leal, 2015). Due to close connections between human communities and coastal environments, SIDS are particularly exposed to hazards associated with the ocean and cryosphere, including sea-level rise, ocean acidification, marine heatwaves, coral bleaching as well as extreme sea levels. They also face changes in rainfall patterns, increased frequency and intensity of extreme weather events and more severe tropical cyclones (Poloczanska et al., 2018).

There is also clear evidence that human activity is changing the global climate and creating greater risks of significant adverse consequences to the environment as well to the economy and livelihoods of people (Schellnhuber et al., 2006). The link between per capita income and environmental quality has been discussed in the literature to follow the inverted U-shaped curve pattern as per the EKC hypothesis (Lipford & Yandle, 2010). However, within that link, the governance or institutional quality plays an important role. This is supported by Wood & Herzog (2004) who argue that economic freedom (one measure of quality of economic institutions), is of utmost significance in the income and environment linkage.

Carlsson & Lundstrom (2001) analyse the effects of governance and institutional quality on the environment via four channels. The first one arises via the *government size effect* whereby when the government is small, the largest share of public expenditures is allocated to basic infrastructures like roads, hospitals and education institutions. As government size increases, expenditures will be directed to mitigate income inequality and lower inequality has a positive effect on the demand for a cleaner environment (Magnani, 2000). If environment protection is considered as a luxury public good, then it will only be demanded or achieved at large levels of government size when demand for other public goods has been met (Thai-Ha et al., 2017).

The next mechanism is the *efficiency effect,* which is derived from the hypothesis that economic freedom contributes to efficient and competitive markets. In essence, an efficient use of resources will reduce emissions per unit of environmental resources and as such meet government regulations and consumer preferences. Competitive pressures will further compel firms to adapt to that market environment with stringent environmental regulations and strong consumer demand for environmental protection.

The third channel is the *trade regulation effect* that relates mainly to trade restrictions, whereby trade liberalisation may have both positive and negative influences on the environment. Trade openness can improve allocation of resources as free trade leads to cross border diffusion of new and clean technologies and production techniques that decrease pollution. In contrast, freer trade increases output through the scale effect or changes the industry composition. A more intensive use of factor endowments may in turn cause environmental degradation.

Lastly, the *stability effect* refers to a stable macroeconomic environment with the right economic fundamentals, which will not only facilitate investment in general, but also long-term environmental investments. However, it can also promote investment and consumption that harm the environment.

Various empirical work has analysed the environment and governance link (Bernauer & Koubi, 2009; Leitao, 2010; Wood & Herzog, 2014). For instance, Bhattarai & Hammig (2001) observe positive effects of better political institutions and governance on preservation of forests. Leitao (2010) and Bernauer & Koubi (2009) opine that political institutions play a critical role in improving environmental quality. They further observe that democracy has a positive effect on air quality and show that green parties fight for environment protection while the reverse holds for labour unions, which tend to deprioritise environmental considerations. Moreover, Wood & Herzog (2014) argue that economic freedom is vital for tackling local environmental problems. These studies show that there is a positive link between institutions, governance and environmental protection. This paper breaks new ground by explicitly integrating governance in this complex relationship between climate change, environmental degradation and economic growth.

Whilst institutions and good governance play an important role in the economic prospects of a nation, what matters most for climate change and environmental protection is climate change governance. As climate change imposes vital economic consequences, climate change policies and responses need to move in step with other economic fundamentals like trade policy, investment flows and development assistance (World Bank, 2010). Hence, integrating measures to tackle climate change into regular economic policies is likely to have positive influences on economic growth over the medium and longer term. SIDS need institutions that are capable of undertaking climate change governance, despite the fact that their institutional forms and capacities may vary. It is recognised, however, that a sound and holistic governance structure is crucial for environmental change and reforms; the reality across many SIDS is that reforms are not occurring at the desired speed; so much that environmental degradation is affecting many economic sectors as well as the livelihoods of the most vulnerable segments of their populations.

The transition to a low carbon emission economy infers an important transformation of key economic sectors like transport, construction, agriculture, forestry and energy. This necessitates extensive investment in new technologies, innovations and research to come forward with new ways of doing things in a sustainable manner and to shift to a low carbon development path. This is however; very difficult for SIDS to achieve and as such, it may lead to their marginalisation from the global economy because they lack resources to invest in new and clean technologies. With their inherent vulnerable characteristics, SIDS are at the greatest disadvantage. Enormous challenges in shaping governance and institutions to suit SIDS needs and contexts remain. Climate change governance can only be achieved by taking into consideration the uniqueness of SIDS in terms of their higher inherent disadvantages in terms of such factors as remoteness, small size, vulnerability to external shocks, their high dependence on international markets, lack of competitiveness and resource scarcity. In so doing, a proper climate change governance can help in reducing environmental degradation and promote economic growth and sustainable development.

Methodology

The study investigates into the relationship between climate change, governance and growth for selected SIDS over the period 1995 to 2018. The proposed research questions are as follows:

- Does climate change, environmental degradation and governance have an impact on economic development?
- Does the promotion of an appropriate governance structure reduce environmental degradation?
- Is there reverse causation in the model for the main variables?

The model below is grounded in growth theory (e.g. Mendelsohn et al., 2009; Kahn et al., 2019; Seetanah et al., 2020), whereby the Solow growth model is initially augmented to include climate change proxies and governance as ingredients of growth.

$$GDP = f\ (ED, CC, GI, HC, OP, FDI) \quad (1)$$

where GDP represents real Gross Domestic Product. Real GDP is used to capture the economies' output.

The proxy used for environmental degradation is ED and climate change is represented by CC. ED is measured by CO_2 emissions (metric tons per capita). Various studies have shown that environmental degradation is closely linked to carbon dioxide emissions and have used similar proxies (Han & Lee, 2013; Tiwari, 2011; Fauzel, 2017). More so, precipitation is considered as an important climate variable. This variable is denoted by CC and is measured by the level of precipitation. Similar proxy was used by Barrios et al. (2010) who investigate the impact of rainfall trends on the growth performance of sub-Saharan African nations relative to other developing countries. Their results reveal that rainfall has been significantly affecting economic growth in African nations compared to non-African ones. Data on the average precipitation in depth (mm per year) is computed from the World Bank Development Indicators (2020).

GI represents the Governance Index developed by Kaufmann et al. (2010). Governance is proxied by government effectiveness capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Estimate of the Governance Index gives the country's score on the aggregate indicator, in units of a standard normal distribution, ranging from approximately -2.5 to 2.5. The governance variable is included to measure the link between governance, environmental degradation and economic growth. Stojanović et al. (2016, p. 558) view good governance as "the new approach that recognises the role of the state in the economy where the joint participation of state and non-state actors, civil society and private sector, is essential in the process of public governance". Governance is built on key elements of accountability, transparency, combating corruption, enabling legal and judicial framework as well as enhanced citizen participation. A similar proxy has been used by Seetanah et al. (2020).

The other control variables are secondary school enrolment, trade openness and FDI. Secondary enrolment rate is denoted by HC and proxies the human capital dimension. The literature supports a positive link between education and economic growth. OP and FDI represent trade openness and Foreign Direct Investment. Trade openness is measured by the sum of imports and exports to GDP. Indeed, trade liberalisation benefits nations in terms of market access, higher demand for local goods and services, greater economies of scale and better growth prospects (Altaee and Jafari, 2015). Hence, it is advocated that freer trade can benefit productivity, aid in the implementation and usage of better technology and investment promotion, which represent means of boosting economic prosperity. Finally, net FDI inflows as a percentage of GDP (FDI) is integrated in the model as FDI helps countries to be innovative and creates new and better ways of production, brings more resources used for development and leads to higher growth and expansion of economies (Awunyo & Sackey, 2018; Fauzel et al., 2015). Data for the above variables have all been collected from the World Bank Development Indicators database (2020).

The natural logarithm of the variables is used to reduce the problem of heteroscedasticity. This technique also makes interpretation of the results easier and more meaningful. This results in the following equation:

$$lnGDP_{it} = \beta_0 + \beta_1 \ln ED_{it} + \beta_2 lnCC_{it} + \beta_3 \, lnGI_{it} + \beta_4 \, lnHC_{it} + \beta_5 lnOP_{it} + \beta_6 lnFDI_{it} + \varepsilon_{it} \quad (2)$$

where i represent country, t represents time; ε is the random error term. The parameter estimates are $\beta_1 \ldots \beta_6$.

Estimation Issues

Applying regression on time series data may generate spurious results (Granger and Newbold, 1974; Philips, 1986) due to the possibility of non-stationarity data. Hence, checking the stationarity of data is a prerequisite for applying co-integration tests. As a result, the Augmented Dickey-Fuller (ADF) test (Dickey-Fuller, 1979, 1981) and the Phillips-Perron test (Phillips & Perron 1988) are applied. Once, the variables are stationary of the same order, the second step is to check for co-integration test or long run co-integration relationship amongst the variables. The Johansen Co-integrating Test (Johansen 1988; Johansen & Juselius, 1990), which uses maximum likelihood testing process, is used to investigate the number of co-integration vectors in the Vector Auto Regressive (VAR) setting.

The static single equation often fails to take into account the presence of dynamic feedback among relevant variables. Accordingly, a VAR approach is used to study the main relationship between climate change, environmental degradation, governance and economic growth. Such an approach does not impose a priori restriction on the dynamic relations among the different variables. It is similar to simultaneous equation modelling, whereby several endogenous variables are considered together.

The common form of VAR is as given;

$$Z_t = \lambda + \gamma_t Z_{t-1} + \ldots\ldots\ldots\ldots + \gamma_k Z_{t-k} + \varepsilon_t \quad (3)$$

where Z is an (n x 1) vector of k variables having integrated of order 1 that is I(1), λ is a (n x 1) vector of intercepts, $\gamma_t, \ldots.\gamma_{t-k}$, are parameters and ε_t is a normally distributed residual term. The common VAR based model in equation (3) may also take the form of the Vector Error Correction Model (VECM) as follows:

$$\Delta Z_t = \lambda + \Gamma \Delta Z_{t-1} + \prod Z_{t-1} + \varepsilon_t \quad (4)$$

$$Z_{it} = lnGDP_{it}, lnED_{it}, lnCC_{it}, lnGI_{it}, lnHC_{it}, lnOP_{it}, lnFDI_{it} \quad (5)$$

Further, Δ is the difference operator and Γ and ∏ are coefficient matrices. ∏ is also known as the impact matrix as it explains the long run equilibrium relationship of the variables; while Γ explains the short run effects. The VECM links the short term and long-term causality between the different variables in the model and is set as follows:

$$\Delta lnGDP_t = \alpha_0 + \sum_{j=1}^{n} .\alpha_1 \Delta lnED_{t-j} + \sum_{j=1}^{n} .\alpha_2 \Delta lnCC_{t-j} + \sum_{j=1}^{n} .\alpha_3 \Delta lnGI_{t-j} + \sum_{j=1}^{n} .\alpha_4 \Delta lnHC_{t-j} + \sum_{j=1}^{n} .\alpha_5 \Delta lnOP_{t-j} + \sum_{j=1}^{n} .\alpha_6 \Delta lnFDI_{t-j} + \eta ECT_{T-1} + \varepsilon_t \quad (6)$$

The coefficient of the error correction term (ECT_{t-1}) indicates whether there exists a short run relationship among the time series variables. The sign and value of the coefficients provide information about the speed of convergence or divergence of the variables from their long run co-integrating equilibrium. A negative and significant coefficient of ECT_{t-1} is favourable for the stability of long run equilibrium.

Findings

Prior to estimation, robustness checks are performed. The correlation matrix between the variables used in the analysis is shown in Table 1 below and no serious multicollinearity issues can be noted.

Table 1: Correlation Matrix.

	LGDP	LED	LCC	LGI	LHC	LOP	LFDI
LGDP	1	-0.1806	-0.2198	0.0440	0.0756	-0.2319	-0.2027
LED	-0.1806	1	0.6751	0.2076	-0.0946	0.0991	0.5874
LCC	-0.2198	0.6751	1	0.2269	-0.0263	-0.0493	0.5304
LGI	-0.0440	0.2076	0.2269	1	-0.2310	-0.1179	0.1503
LHC	0.0756	-0.0946	-0.0263	-0.2310	1	0.1534	-0.1461
LOP	-0.2319	0.0991	-0.0493	-0.1179	0.1534	1	0.1719
LFDI	-0.2027	0.5874	0.5304	0.1503	-0.1461	0.1719	1

Source: Authors' computation

Additionally, the results of Levin, Lin and Chu (LLC), Im, Pesaran and Shin (IPS), Fisher-ADF panel unit root tests and Phillips–Perron Fisher (PP) unit root tests show that the variables are stationary at first level. Moreover, the Pedroni's (2004) cointegration test is being applied by allowing for individual fixed effects and time trends. The results are shown in Table 2 confirming the presence of a long-run relationship among the variables.

Table 2: Pedroni Cointegration Test

	Individual Fixed Effects	**Individual Fixed Effects and time trends**
	Statistics	
Panel v-Statistic	0.044	-0.699
Panel rho-Statistic	0.978	1.747
Panel PP-Statistic	1.127	8.165
Panel ADF-Statistic	0.829	2.257
Group rho-Statistic	1.673	2.405
Group PP-Statistic	1.131	8.978
Group ADF-Statistic	1.284	1.858

Source: Authors' computation

The cointegration test is applied after allowing individual fixed effects and time trends; all the statistics reported are distributed as standard normal variates. When considering the 10% level of confidence, the null hypothesis of no cointegration is rejected. Hence, a long run equilibrium relationship among the variables has been established. The next step is to specify and estimate a VECM including the error correction term to investigate the dynamic nature of the model. In this study, the VECM is estimated using an optimum lag length of 1. Table 3 below reports the long run results of the model. To capture reverse causation, the results relating to the environmental degradation and governance equations are shown below.

Table 3: Long Run Results

Variable	Dependent Variable: LGDP – Economic Growth	Dependent Variable: LCO2 – Environmental Degradation	Dependent Variable: LGI – Governance
LGDP	1.000	0.201 [1.81]**	0.540 [4.59]***
LED	-0.214 [-2.23]***	1.000	-0.115 [0.24]
LCC	-7.5550 [-4.17]***	5.039 [5.22]***	4.076 [4.46]**
LGI	1.854 [2.10]***	-0.099 [-0.23]	1.000
LHC	2.716 [2.98]***	-0.798 [1.98]**	1.465 [3.99]***
LOP	-2.069 [0.05]	-0.959 [-1.81]*	-1.116 [-1.88]**
LFDI	2.741 [2.98]***	-1.350 [-3.87]***	-1.479 [-0.34]
Constant	30.630	-25.302	-16.525

*,** and *** show significance at 10%, 5% and 1% respectively. The values in parentheses [] are the t-statistics.

Source: Authors' computation

The results reveal an inverse link between the climate change proxy and economic growth that is, an increase in precipitation has a negative impact on economic growth for the group of SIDS considered under the present study. This result is in line with the argument put forward by Mendelsohn & Dinar (2007) where low income countries tend to be most affected by climate change. These islands are particularly vulnerable to hurricanes and cyclones, which are becoming more frequent and extreme thus resulting in environmental devastation, which is very costly for economic growth (Meade, 2021). The agricultural sector as well as the tourism sector are at high risk. For the agricultural sector, high precipitation impacts negatively staple food and commercial crops with significant long-term declines in yields. Small islands are highly dependent on their tourism sector as a revenue-generating sector but climate change can affect tourists' arrivals. For instance, adverse occurrences such as beach erosion, deterioration of coral reefs and damage to cultural heritage through floods as a result of increases in sea levels make small islands less attractive to tourists. Flooding of both coastal and inland regions also threatens sanitation systems and freshwater supplies, leading to the spread of diseases. Islands are also increasingly experiencing cyclones and hurricanes, which adversely affects tourist flows (Fauzel et al.; forthcoming 2022).

Moreover, the results demonstrate that environmental degradation in the long run impacts negatively on economic growth. More specifically, a 1% increase in CO_2 emissions have led to a 0.2% decrease in economic growth. This result is in line with Cowan et al. (2014), highlighting the existence of an inverse link between carbon emissions and economic growth in the long run. Hence, both the climate change and the environment degradation proxies inversely affect growth of SIDS. This can be explained by the fact that climate change and environment degradation both affect per capita productivity via a reduction in labour productivity, loss of infrastructure associated with extreme events like floods and reduction in agricultural yields, to name a few. Moreover, governance is viewed as an important determinant of economic growth in the literature. Several studies like Law et al. (2006); Haggard et al. (2011); Anwar et al. (2012); Liu et al. (2018) and Seetanah et al. (2020) have reported a positive impact of governance on economic growth. A similar result is obtained in the present analysis whereby governance is an important institutional factor enabling economic growth. A broader governance perspective with a conducive ecosystem for economic activity has the possibility to create the requirements to promote economic activity thus stimulating investment, which in turn fosters economic growth (Kaufmann et al., 1999; Gani, 2011). However, inappropriate governance can have negative effects on economic growth, mainly by inflating transaction costs and by creating unnecessary delays in the investment process. Moreover, a positive relationship between human capital and economic growth is observed. Similar results were obtained by Hanushek & Wößmann (2010), Kalaitzidakis et al. (2001) and Marquez-Ramos et al. (2019) among others, where education and training represent a key determinant of economic well-being. Zooming further on the results, Foreign Direct Investment is found to be crucial for economic growth across the 19 SIDS under study. Similar results were obtained by Feeny et al. (2014) for a similar category of SIDS.

The next step was to investigate the existence of reverse causation. An analysis of column 3, confirms the theory that good governance and economic development are closely interrelated. For instance, several authors (Rodrik et al., 2004, Grindle, 2004, 2007; Wilson, 2016) argue that increasing levels of economic growth can improve the quality of governance. This is explained by the fact that high growth rates provide the required financial resources for the implementation of reforms and appropriate institutions, which remain a prerequisite for good governance. Hence, the results provides support for a bi directional causal link between economic growth and governance. Importantly, while the result shows that environmental degradation leads to a reduction in growth rate, it can also be observed that growth rates have resulted in an increase in carbon emissions. A 1% increase in economic growth has resulted in a 0.20% increase in carbon emissions. Similar results were obtained by Garret (2009), Carrington (2019) and Osadume et al. (2021), suggesting that global economic wealth was positively linked to global carbon emissions. Hence, the present study supports the fact that economic growth has a negative impact on the environment. While economic growth is associated with an improvement in quality of life, it has also been related to wasteful consumption, degradation of the environment and social inequality (Osadume et al., 2021). Another objective of the study was to investigate the association between governance and environmental degradation. The findings suggest that, across SIDS, good governance and infrastructure have no statistically significant effect on environmental degradation. This is attributed mainly to the fact that the governance structure of many SIDS in the sample still lags behind and as such has not contributed in reducing environmental degradation. Similar results were obtained by Asongu et al. (2021). Finally, it is noteworthy to point out that the short run variables are insignificant; which can be explained by the fact that the variables take time to influence each other.

Conclusion

This paper set out to investigate the link between climate change, governance and economic growth for a sample of 19 SIDS over 1995-2018. Results suggest that improved governance, education and foreign direct investment positively influence economic growth in the long run. In contrast, climate change measured through annual average rainfall and environmental degradation proxied by an increase in CO_2 deter economic growth. Results also confirm the presence of bi-directional causality and feedback effects between economic growth and governance. On the other hand, economic growth is seen to be polluting for the sample of SIDS under study. Finally, no significant link between governance and pollution could be found. Thus, this study provides new evidence in the climate change-governance-growth nexus for SIDS using a recent co-integration approach in a dynamic framework.

The findings urge SIDS to direct their resources in the form of policies, programmes, legal instruments, reforms and institutional interventions in a holistic and coordinated manner among and within various entities to build a proper governance structure to curb the impacts of climate change. Along with other policies and tools, climate change governance is key to design effective climate change policies and implement climate actions to shore up the resilience of SIDS in the event of external shocks. Suitable climate change actions can be set up by considering specific social, cultural, environment and economic country settings. For example, governments can devise better transport systems and greener methods of production to provide a better quality of public goods, in turn helping to reduce CO_2 emissions and preserve the environment. Both populations and their governments should abide by rules and policies put in place to preserve the environment and be sanctioned if they fail to abide by the same.

Disclaimer

This article did not benefit from research funding.

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