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Effect of Sustainable Development and Institutional Quality on Growth

Wpływ zrównoważonego rozwoju i jakości instytucjonalnej na wzrost gospodarczy

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Abstract: The issue of compatibility of sustainable development policies, institutional quality, and economic growth gains on importance as the world races towards achieving the 2030 Agenda for Sustainable Development. This paper aims to examine the relationship between sustainable development, institutional quality, and economic growth between the years 2012 and 2021 in 116 countries. The quantile regression method has been employed in this study to capture various relationship nexuses in different quantiles of growth. The common 15th, 25th, 50th, 75th and 95th quantiles have been selected. The official Sustainable Development Goals (SDG) Index is applied to proxy the holistic conceptualization and policy achievement of the United Nation's SDGs. The findings show a negative relationship between sustainable development and economic growth, indicating that achieving sustainable development goals will harm the economic growth. Increasing negative coefficient values from lower to higher quantiles imply increasing opportunity cost of degrowth towards increasing sustainable development. Besides, institutional quality did not affect economic growth, either directly or indirectly. The study suggests the necessity to review the existing policies, institutional structures, and strategies to foster compatibility between sustainable development, institutional quality, and growth.

Keywords: Sustainable Development Goals, Institutional quality, Economic growth, Quantile regression

Streszczenie: Kwestia związku pomiędzy wdrażaniem polityki zrównoważonego rozwoju oraz jakością instytucjonalną, a wzrostem gospodarczym staje się coraz bardziej paląca w miarę, jak świat dąży do osiągnięcia celów Agendy na rzecz zrównoważonego rozwoju 2030. Artykuł prezentuje wyniki badania relacji pomiędzy zrównoważonym rozwojem, jakością instytucjonalną i wzrostem gospodarczym w 116 krajach, w latach 2012–2021. W przeprowadzonych badaniach zastosowano metodę regresji kwantylowej w celu uchwycenia powiązań w różnych kwantylach wzrostu. Wybrano wspólne kwantyle 15, 25, 50, 75 i 95. W celu odzwierciedlenia holistycznej konceptualizacji i osiągnięć polityki wdrażania celów SDG Organizacji Narodów Zjednoczonych, zastosowano oficjalny Indeks Celów Zrównoważonego Rozwoju (SDG). Wyniki badania wykazały negatywną zależność między zrównoważonym rozwojem a wzrostem gospodarczym, wskazując, że osiągnięcie celów zrównoważonego rozwoju będzie miało negatywny wpływ na wzrost gospodarczy. Zwiększanie ujemnych wartości współczynników od niższych do wyższych kwantyli oznacza zwiększenie kosztu alternatywnego postwzrostu w kierunku zwiększania zrównoważonego rozwoju. Poza tym jakość instytucjonalna nie miała wpływu na wzrost gospodarczy ani bezpośrednio, ani pośrednio. Badanie sugeruje konieczność ponownego przyjrzenia się istniejącym politykom, strukturom instytucjonalnym i strategiom w celu wspierania zgodności między zrównoważonym rozwojem, jakością instytucjonalną i wzrostem gospodarczym.

Słowa kluczowe: cele zrównoważonego rozwoju, jakość instytucjonalna, wzrost gospodarczy, regresja kwantylowa

Introduction

Growth has long been an important policy and academic research focus. The growth model has evolved from the classic model to the endogenous model, Schumpeterian model, and institutional economics, and many other growth models with sustainable development being the latest addition. The United Nation's Sustainable Development Goals (SDG) is an official and global benchmark for sustainable development. Countries have pledged to achieve the targets listed in the SDG by 2030 while maintaining a healthy economic growth. Therefore, there are doubts about the compatibility of the SDG targets and growth. Existing literature did not capture the contemporaneous and holistic aspects of their relationships. Sustainable development policies that strike a balance between economic expansion, social progress, and environmental preservation can improve resource use and encourage technical improvement in the long run. It also comes with higher cost of using environmentally friendly energy and green production methods or diverted resources to achieve the SDG. Institutional economies advocate good institutional quality to increase growth by reducing leakage, promote fair competition, stability, investment, and innovation (Arshed et al. 2022). However, past research findings still inconclusive. Therefore, the aim of this paper is to examine the effect of sustainable development and institutional quality on economic growth.

1. Literature review

1.1. Theoretical review

There are many past literatures on growth and sustainable development. However, the conceptualization of sustainable development is often not holistic. Past literature often overlooks the part of the sustainable development as a wholesome proxy of it. For example, past studies often narrowly linked growth to environment (Brown 2009; Weale 2009; Laksamana & Selvaratnam 2016), green production (Bera & Sadowska 2018), energy consumption, carbon dioxide pollution, and clean production (Motalo et al. 2018; Bhatti & Do 2019; Parker & Bhatti 2020; Hunjra et al. 2023; Amin et al. 2023) as representation of sustainable development. Those proxies per se are merely partial representation of the holistic concept of sustainable development. Sustainable development as in the United Nation's Sustainable Development Goals (SDG) encompasses all those mentioned proxies plus covering the sustainability aspects of welfare, equality, industrialization, and urbanization. Therefore, the SDG through its official SDG Index (SDGI) is a better representation of sustainable development wholeness (Har et al. 2023). The SDGI measures the achievement of SDG targets (Lafortune et al. 2018) but there is limited literature on this index probably due to the SDGI is a relatively new index with limited years of data.

According to Hirai (2022), when the SDG were originally finalized, it was noted a reverse relationship between economic growth and climate action (Goal 13) because Goal 13 cannot be achieved without a considerable economic decarbonization, which will negatively impact the growth rate. This was further confirmed by the discovery of potential conflicts between not only climate change and economic growth but also several other objectives, such as food security (Goal 2), energy access (Goal 7), resilient infrastructure (Goal 9), and sustainable production (Target 12.4). Thus, compatibility between policies to achieve the SDG and output growth policy remain an interesting issue. Theoretically, the classic growth theory assumed that the division of labor, trade gains, and capital accumulation were the main drivers of economic growth (Bru & Grant 2023). However, the endogenous growth theory assumed that internal factors like human capital and not merely quantity of labor have a bigger impact on economic growth. Higher human capital is linked to having higher productivity through greater expenditures in human capital

(Soegiarto et al. 2022). These two growth models have provided theoretical foundation for exports, capital formation, foreign direct investment, unemployment, and government expenditure on education as determinants of growth, and hence justification as control variables in this paper.

Another important determinant of growth is institutional quality. The institutional economics school of thought credited relatively higher growth and prosperity to having good institutional quality (Brue & Grant 2013). Institutional quality encompassed the aspects of laws, custom, traditions, collective behavior, governance, and political systems (Samadi & Alipourian 2021). Good institutional quality may aid in lowering transaction costs and fostering conditions that encourages investment, innovation, and entrepreneurship in a compatible framework of sustainable development and economic growth. Institutional quality may also have an indirect impact on growth through its relationship with sustainable development. Har et al. (2023) found certain relationships nexus between institutional quality and the SDGI. Generally, higher institutional quality facilitates achievement of the SDG. This triggers the possibility of a moderation effect between institutional quality and SDGI to growth.

In addition, issues about the planetary crisis must not be ignored or dismissed merely because they may not be complementary to growth (Hirai 2022). The Executive Director of the United Nation Environment Programme, Anderson (2020) and Kameri-Mbote et. al (2023) have warned of three related planetary crises necessary for the survival of the human species, namely the climate, nature, and pollution crisis. As summaries, there are three theoretical literature gaps. First, effect of sustainable development on growth remains inconclusive and debatable. Second, the conceptualization and proxies for sustainable development in past literatures are too narrow and merely being a part of the holistic representation of sustainable development. Third, literature reviews on institutional quality and growth remain inconclusive and not linked to sustainable development-growth relationship nexus.

1.2. Empirical review

Past empirical literature mostly focused on correlation and regression between partial representation of sustainable development and growth. For example, Yan, Li & Li (2022) study the effect of environment pollution on economic growth in China from 1986 to 2018 by using the MS (M)-VAR (p) model. The study found that the growth rates of China's GDP and SO_2 emissions showed significant inertia. Tampakoudis, Fylantzopoulou & Nikandrou (2014) investigate the link between sustainable development and GDP growth rate in the Eurozone. "Resource productivity" and "Total renewable electricity net generation" present the highest coefficients. The negative sign of the "energy consumption by transport mode and related to GDP" together with the positive sign of "Gas emissions" and "Energy consumption by transport mode" demonstrate the distortions of the current economic model.

Maduka, Ogwu and Ekesiobi (2022) explore the impact of carbon dioxide emissions on the economic growth in Nigeria from 1990 to 2020, and the indirect (moderating) effect of institutional quality to economic growth. The study employs ARDL regression, quantile regression, and Granger causality tests to estimate the relationship. The results of the study show that there is a significant cointegration between CO_2 emissions and economic growth in Nigeria. Surprisingly, in the long term, the study indicates that corruption control greatly increases CO_2 emissions, however, when it interacts with income, it lowers CO_2 emissions. Furthermore, even when it interacts with income, regulatory quality has no appreciable long- or short-term effect on CO_2 emissions in Nigeria. Adrangi & Kerr (2022) analyzed the Sustainable Development Goals (SDG) and its correlation with

Gross Domestic Products (GDP) in developing economies. Three out of the eight indicators used were found to have a significant correlation with the GDP growth rate. Pursuing GDP growth might lead to lesser gender equity and increased emissions, but a lower mortality rate. The study draws the conclusion that focusing on GDP may not help us achieve certain aspects of the SDG. Singh et al. (2022) empirically found that different aspects of the SDG have different relationship with the GDP growth rate. Their used multiple regression to analyze data of Saudi Arabia in between 1990 and 2020.

Among related literature on institutional quality, Azam et al. (2021) investigate the correlation between governance and economic growth in 14 countries located in Latin American and Caribbean. ARDL is employed to conduct the research. The findings show that while political stability and government effectiveness have favorable long-term effects, they have a considerably negative short-term impact on growth. This suggests that while political stability and government effectiveness promote growth, corruption discourages it. Nawaz, Iqbal & Khan (2014) examined the institutional quality and economic growth nexus in selected Asian economies from 1996 to 2012, using the System Generalized Method of Moments (SGMM). According to the empirical findings, institutions play a significant role in determining the long-term economic growth in Asian economies, but the impacts depend on their level of economic development. Specifically, institutions appear to be more effective in promoting economic growth in developed Asian countries compared to developing countries.

Nguyen, Su & Nguyen (2018) investigate the impact of institutional quality on economic growth in 29 emerging countries from 2002 to 2015, using the SGMM. The study shows that high institutional quality has a considerable positive influence on economic growth. It also indicates that the positive effects of FDI and trade openness on economic development are hampered by weak institutional quality. Nonetheless, enhancing institutional quality can alleviate the competition arising from trade openness in the areas where FDIs are functioning, thereby maximizing their spillover effects. Mahran (2022) study the effect of governance on economic growth in 116 countries for the year 2017 with Spatial Regression Model. The results of the study suggest that good governance has a significant impact on economic growth. Specifically, if all other economic factors remain constant, a 1% increase in governance can lead to a corresponding 1% increase in economic growth, with statistical significance levels of 10%, 5%, and 1%. Additionally, the study found that a country's economic growth can have a positive and significant impact on the economic growth of its neighboring countries.

Omri & Mabrouk (2020) expands on the existing research on sustainability by demonstrating how good governance can help balance environmental, social, and economic aspects of sustainable development. The study focuses on 20 MENA economies between 1996 and 2014 and uses a simultaneous-equation modelling approach to show that political and institutional governance have a positive impact on sustainable development. The study also reveals that human development and economic growth are interconnected and can complement each other. Azam et al. (2021) study the relationship between institutional quality and sustainable development for 66 developing economies during the period 1984 to 2019 by using the fixed effects and system GMM. The study's primary findings suggest that institutional quality is beneficial for achieving sustainable development goals.

2. Methodology

This paper covers annual panel data from 2012 to 2021 for 116 countries. These countries are listed in the Appendix according to their income status. The economic growth is represented by the growth of the Gross Domestic Product (GDP) in

annual percentage form. Sustainable development is proxied by the official United Nation's Sustainable Development Goal Index (SDGI). The SDGI has values ranging from zero to 100. A zero value means none of the SDG target is achieved. The SDGI will have a value of 100 if all SDG targets are achieved (Lafortune, Fuller, Moreno, Schmidt-Traub, Kroll 2018). The Worldwide Governance Indicators (WGI) is used to capture the institutional quality. Furthermore, control variables are also included to get a more accurate result, which are Foreign Direct Investment (FDI), Unemployment (UNEMP), Gross Fixed Capital Formation (GFCF), Export (EXP), and Government Expenditure on Education (EDUX). The data for GDP, FDI, UNEMP, GFCF, EXP, and EDUX are obtained from World Development Indicators (World Bank 2022a), while the data for WGI is collected from Worldwide Governance Indicators (World Bank 2022b), and the data for SDGI was obtained from Sustainable Development Solutions Network, a global initiative for United Nations. The variables used, its measurements and sources are summarized in Table 1.

Quantile regression is employed because it estimates the different relationship nexus on different growth level as opposed to those one-size-fit-all regressions. According to Benjamin and Manning (2013), quantile regression offers more flexibility to find various correlations at various points along the dependent variable's distribution. Capital investment, either from domestic capital formation or foreign direct investment, and export play important roles in the aggregate expenditure-based Classic growth model. This is reflected in growth model function in Equation (1) where capital, labor and export are important determinants of growth. The endogenous growth model adds human capital, usually in the form of education to the determinant of growth as in Equation (2). Consistent with recent happening, sustainable development and institutional quality should be incorporated into any growth model in Equation (3). Thus, sustainable development and institutional quality are additional variables added into Equation (3) as compared to Equation (2). The model in Equation (3) is quantified into two empirical quantile regression model (1) and Model (2).

Growth = *f* (capital, labor, export) ……
…… Equation (1)

Growth = *f* (capital, labor, human capital, export) ……
…… Equation (2)

Growth = *f* (sustainable development, institutional quality, capital, labor, human capital, export,) ……
…… Equation (3)

Model 1 captures the direct effect of sustainable development and institutional quality on growth. Model 2 analyze an indirect moderation effect of institutional quality through the sustainable development variable. $\beta(\tau)$ is the coefficient at each quantile τ level, while β_i represents the unobserved individual (country) effects. GDP_{it} in percentage refers to the country *i*'s annual economic growth level in year *t*.

$$GDP_{i,t}(\tau|X_{i,t}) = \beta_0 + \beta_{1,\tau} SDGI_{i,t} + \beta_{2,\tau} WGI_{i,t} + \beta_{3,\tau} FDI_{i,t} + \beta_{4,\tau} UNEMP_{i,t} + \beta_{5,\tau} GFCF_{i,t} + \beta_{6,\tau} EXP_{i,t} + \beta_{7,\tau} EDUX_{i,t} + \varepsilon i \quad \text{…… Model (1)}$$

$$GDP_{i,t}(\tau|X_{i,t}) = \beta_0 + \beta_{1,\tau} SDGI_{i,t} + \beta_{2,\tau} (WGI \times SDG)_{i,t} + \beta_{3,\tau} FDI_{i,t} + \beta_{4,\tau} UNEMP_{i,t} + \beta_{5,\tau} GFCF_{i,t} + \beta_{6,\tau} EXP_{i,t} + \beta_{7,\tau} EDUX_{i,t} + \varepsilon i \quad \text{…… Model (2)}$$

Table 1. Data Description

Variables	Description (measurement)	Sources
GDP	Gross Domestic Product growth (annual %)	World Bank
SDGI	Sustainable Development Goal Index score (0 to 100)	Sustainable Development Solutions Network
WGI	Worldwide Governance Indicators (-2.5 to 2.5)	World Bank
FDI	Foreign Direct Investment (net inflows, % of GDP)	World Bank
UNEMP	Unemployment (total % of labour force)	World Bank
GFCF	Gross Fixed Capital Formation (annual % growth)	World Bank
EXP	Exports of goods and services (% of GDP)	World Bank
EDUX	Government expenditure on education (% of GDP)	World Bank

GDP, FDI, UNEMP, GFCF, EXP, and EDUX are all in percentage form. SDGI and WGI are in index form. WGI is an index of the average of six components of institutional quality, namely political stability, voice and accountability, government effectiveness, regulatory quality, rule of law, and control of corruption. Auxiliary regressions test is used to detect existence of multicollinearity among independent variables. The R-squared (R2) in the auxiliary regression is the input to calculate the variance inflation factor (VIF) or its mirror index known as Tolerance (TOL=1/VIF). As VIF is calculated as $1/(1 - R2)$, the higher the R2 of the auxiliary regression implies multicollinearity is serious and is reflected in a higher VIF value. A general accepted cut-off points to reject the existence of multicollinearity is VIF value below 5.00.

In robustness check, countries' income status as per World Bank's categorization are added into both Model 1 and Model 2. Their respective robustness models are named as Model R1 and Model R2. Akaike information criterion (AIC) is estimated using the formula of AIC = 2K – 2(Pseudo R2) and used as best model selection criteria. Model with lower AIC value is considered as the better model.

3. Findings and Discussion

The descriptive statistics is shown in Table 2. In brief, average of GDP growth, Gross Fixed Capital Formation (GFCF) growth and unemployment rate are 2.818%, 4.413% and 7.137% respectively. On average, net FDI inflow and government expenditure on education are 4.819% and 4.560% of GDP respectively. Average score for SDGI is 67.639% while WGI is 0.089.

The quantile regression results are shown in Table 3 for Model 1 and Table 4 for Model 2.

Findings for both models are very consistent and therefore, results are robust. Results in both models show a negative relationship between sustainable development

Table 2. Descriptive Statistic

	Obs.	Mean	Std. Dev.	Min.	Max.
GDP	1,160	2.818	4.276	-36.392	24.370
SDGI	1,160	67.639	10.208	38.884	86.477
WGI	1,160	0.089	0.899	-1.707	1.867
FDI	1,160	4.819	16.823	-117.420	279.347
UNEMP	1,160	7.137	5.133	0.140	28.770
GFCF	1,152	4.413	32.512	-68.077	983.777
EXP	1,156	42.037	31.021	4.549	211.433
EDUX	1,053	4.560	1.611	1.305	11.781

Note: Obs. is observations, Std. Dev. Is standard deviation, Min. is minimum value, and Max. is maximum value. The number of observations for each variable are different due to unbalanced panel data.

Table 3. Findings for Model 1

Variable	q.15	q.25	q.50	q.75	q.95
SDGI	-0.0220	-0.0634**	-0.0861***	-0.0974***	-0.1512***
	(0.0463)	(0.0258)	(0.0149)	(0.0179)	(0.0534)
WGI	0.4142	0.3868*	0.0253	-0.1330	-0.4717
	(0.4470)	(0.2127)	(0.1538)	(0.1394)	(0.5081)
FDI	0.0014	-0.0015	0.0114	0.0059	0.0709*
	(0.0109)	(0.0103)	(0.0087)	(0.0063)	(0.0383)
UNEMP	-0.1897***	-0.1166***	-0.1160***	-0.0955***	-0.0464
	(0.0516)	(0.0290)	(0.0181)	(0.0215)	(0.0463)
GFCF	0.1660***	0.1699***	0.1468***	0.1243***	0.1192***
	(0.0387)	(0.0277)	(0.0220)	(0.0174)	(0.0378)
EXP	-0.0024	-0.0014	0.0049*	0.0093***	0.0358***
	(0.0061)	(0.0043)	(0.0028)	(0.0035)	(0.0115)
EDUX	-0.3015*	-0.1650	-0.0220	-0.0511	0.0444
	(0.1761)	(0.1238)	(0.0596)	(0.0501)	(0.2390)
Constant	4.0168	6.8525***	9.0847***	10.9980***	14.8974***
	(2.9208)	(1.6676)	(1.0024)	(1.1052)	(3.7873)
Pseudo R2	0.1786	0.1821	0.2080	0.2182	0.1457
Obs.	1,050	1,050	1,050	1,050	1,050
AIC	17.6428	17.6358	17.584	17.5636	17.7086

Note: Standard errors in parentheses; *, ** and *** indicate significant at 10%, 5% and 1% level respectively.

and growth at almost all levels (quantiles) of growth. The negative value increasing with higher growth level (quantile) implying the efforts to achieve the SDG are increasingly straining the growth rate. The findings reflect a choice and its subsequent opportunity cost on the type of growth, namely growth with or without taking the sustainable development into consideration. The negative coefficient values represent the opportunity cost to choose sustainable growth. For example, at the 75th quantile, the cost to increase achievement of the SDG by 1 index point will lessen the growth rate by 0.0974%. This result is consistent with the degrowth theory (Hickel 2020). The theory has pointed out that achieving sustainable development requires a reduction in total economic activity, and hence lowering the growth rate. Achieving sustainable development such as reducing ecology footprint, sustainable use of resources, restructuring socio-economy for inclusiveness and green production, will devour many productive resources.

The United Nations Environment Program (UNEP) stated that it will require substantial investment in green infrastructure to reach the Sustainable Development Goals by 2030 and net zero emissions by 2050. To build a low-carbon and climate-resilient outlook by 2050, nearly $7 trillion in infrastructure investment would be required annually (UNEP n.d.). However, policy makers should also consider estimate of losses due to extreme weather, pollution, and other negative externalities for not taking action to implement the SDGs. Estimated losses due to extreme weather raised from $200 billion for years between 2001 to 2010 to $2.5 trillion for the subsequent ten years (Buchholz 2021). The United Nations (2021) also highlighted enormous impacts from climate changes related hazards between 1970 and 2019. These impacts include causing 50% of all disasters, 45% of all reported deaths and 74% of all reported economic losses.

Findings also reveal that institutional quality has no significant relationship with

Table 4. Findings for Model 2

Variable	q.15	q.25	q.50	q.75	q.95
SDGI	-0.0081	-0.0527**	-0.0798***	-0.0880***	-0.1462***
	(0.0360)	(0.0226)	(0.0146)	(0.0175)	(0.0433)
WSDG	0.0021	0.0035	-0.0007	-0.0036*	-0.0066
	(0.0044)	(0.0025)	(0.0021)	(0.0022)	(0.0063)
FDI	0.0018	-0.0010	0.0113	0.0058	0.0706*
	(0.0109)	(0.0101)	(0.0088)	(0.0069)	(0.0377)
UNEMP	-0.1941***	-0.1138***	-0.1144***	-0.0958***	-0.0510
	(0.0537)	(0.0303)	(0.0189)	(0.0192)	(0.0468)
GFCF	0.1649***	0.1733***	0.1455***	0.1202***	0.1203***
	(0.0360)	(0.0279)	(0.0231)	(0.0185)	(0.0369)
EXP	0.0000	0.0000	0.0056*	0.0100***	0.0353***
	(0.0056)	(0.0039)	(0.0029)	(0.0034)	(0.0118)
EDUX	-0.2293	-0.1608	-0.0168	-0.0490	0.0286
	(0.1795)	(0.1229)	(0.0641)	(0.0489)	(0.2194)
Constant	2.7234	6.0001***	8.6225***	10.3941***	14.7174***
	(2.1611)	(1.4835)	(0.9843)	(1.0852)	(3.1281)
Pseudo R2	0.1772	0.1805	0.2080	0.2194	0.1469
Obs.	1,050	1,050	1,050	1,050	1,050
AIC	17.6456	17.639	17.584	17.5612	17.7062

Note: Standard errors in parentheses; *, ** and *** indicate significant at 10%, 5% and 1% level respectively.

growth in almost all quantiles, either direct (in Model 1) or moderation effect (Model 2). These findings are like Dore & Teixeira (2023) but not in line with expectation nor the institutional economic school of thought. The findings reflect two important implications. Firstly, the construct of institutional quality is bias to free market and democracy. Autocracy regime and strong government intervention into the economy is labelled as bad institutional quality. However, respected Eastern and Western philosophies like socialism, Plato (*the Republic*), Confucianism and Legalism do see the goodness in having a not so democratic institution system and had propel nations into great prosperity (Har et al. 2022). Secondly, an aggregated institutional quality such as the WGI may have incongruent relationship within their six constructs. Thus, the aggregate institutional quality may need to be reconstructed as applied in Har et al. (2022) and Asongu et al. (2023) to get a better representation of relationship.

Unemployment (UNEMP) has a negative relationship with GDP at all quantiles except for the 95th quantile. This finding has validated the Okun's Law (Okun, 1962) and is consistent with studies done by Kukaj (2018), Hijazeen, Seraj & Ozdeser (2021), Makaringe & Khobai (2018), and Michael, Emeka & Emmanuel (2016). In both Model 1 and Model 2, gross fixed capital formation (GFCF) has a positive and significant relationship with growth at all quantiles. Export (EXP) has a positive relationship with growth at the 50th quantile (significant at 10%), 75th quantile (significant at 1%) and 95th quantile (significant at 1%). These findings are consistent with classic growth models where capital investment and export are part of the aggregate expenditure that can increase economic growth. Past literatures with similar findings for GFCF are Gibescu (2010) and Pasara & Garidzirai (2020). EDUX has an insignificant relationship with growth except marginally negative and significant at 10% level in Model 1. This finding does not support the endogenous

growth model. Lastly, insignificant results for FDI are consistent with Ramli, Marikan & Hashim (2016) and Samsuddin & Amar (2020).

Robustness check both on Model 1 and Model 2 are performed by adding the income status level based on World Bank's country classification. Higher status level means higher income status. Low-income countries are given status level "1", lower middle-income countries are given status level "2", upper middle-income countries are given status level "3", and high-income countries are given status level "4". Findings for robustness check for Model 1 is shown in Table 5 as Model R1. There are only two differences between both Model 1 and Model R1. Firstly, the EDUX is only significant at the 15% quantile (q15) in Model 1 but only significant at q75 in Model R1. Secondly, SDGI is insignificant at q95 in R1 but significant in the corresponding quantile in Model 1. This implies the Model 1 is robust due to the reason that coefficients of both models are consistent. In addition, a country's status levels are significant but negative at q50 and above. These imply countries with higher income status level are having less GDP growth relatively to lower income status level, which is a common reality and consistent with classic growth model such as Harrod-Domar growth model.

AIC values for Model 1 are smaller than the corresponding AIC values for Model R1. Hence, Model 1 is the better model. Findings for robustness check for Model 2 is shown in Table 6 as Model R2. There is one difference between Model 2 and Model R2. The SDGI is not significant at the highest q95 for Model R2 but significant for Model 2. Due to the reason that almost all coefficients of both models are consistent, the Model 2 can still be considered as robust. Meanwhile, the relationship between status and GDP growth in Model R2 is like Model R1, again implying consistent and robust findings.

Table 5. Robustness check for Model 1

Variable	q.15	q.25	q.50	q.75	q.95
	Model R1	Model R1	Model R1	Model R1	Model R1
SDGI	-0.0496	-0.0614**	-0.0611***	-0.0575***	-0.0323
	(0.0571)	(0.0298)	(0.0186)	(0.0195)	(0.0405)
WGI	0.3163	0.3807*	0.2624	0.1292	0.1848
	(0.4684)	(0.2285)	(0.1998)	(0.1744)	(0.4828)
FDI	0.0003	-0.0015	0.0125	0.0077	0.0830**
	(0.0119)	(0.0101)	(0.0100)	(0.0061)	(0.0381)
UNEMP	-0.2008***	-0.1159***	-0.1001***	-0.0703***	-0.0348
	(0.0521)	(0.0308)	(0.0183)	(0.0198)	(0.0344)
GFCF	0.1639***	0.1694***	0.1460***	0.1264***	0.1170***
	(0.0382)	(0.0272)	(0.0220)	(0.0151)	(0.0334)
EXP	-0.0030	-0.0013	0.0057*	0.0102***	0.0371***
	(0.0058)	(0.0039)	(0.0032)	(0.0035)	(0.0100)
EDUX	-0.2818	-0.1665	-0.0793	-0.1099**	-0.0845
	(0.1923)	(0.1276)	(0.0710)	(0.0514)	(0.1798)
Status	0.3841	-0.0182	-0.4859**	-0.6863***	-1.7125***
	(0.5522)	(0.2933)	(0.2022)	(0.1789)	(0.3655)
Constant	4.7631*	6.7679***	8.8928***	10.2555***	12.1446***
	(2.8062)	(1.5343)	(1.0143)	(1.0773)	(2.5272)
Pseudo R2	0.1791	0.1821	0.2101	0.2247	0.1755
Obs.	1,050	1,050	1,050	1,050	1,050
AIC	19.6418	19.6358	19.5798	19.5506	19.649

Note: Standard errors in parentheses; *, ** and *** indicate significant at 10%, 5% and 1% level respectively.

Table 6. Robustness check for Model 2

Variable	q.15	q.25	q.50	q.75	q.95
	Model R2	Model R2	Model R2	Model R2	Model R2
SDGI	-0.0389	-0.0650**	-0.0543***	-0.0539**	-0.0139
	(0.0478)	(0.0271)	(0.0189)	(0.0218)	(0.0458)
WSDG	0.0016	0.0028	0.0007	-0.0003	-0.0002
	(0.0047)	(0.0028)	(0.0023)	(0.0028)	(0.0069)
FDI	0.0021	-0.0015	0.0123	0.0076	0.0840**
	(0.0116)	(0.0091)	(0.0093)	(0.0057)	(0.0364)
UNEMP	-0.2066***	-0.1165***	-0.0980***	-0.0751***	-0.0356
	(0.0537)	(0.0303)	(0.0201)	(0.0214)	(0.0332)
GFCF	0.1625***	0.1714***	0.1461***	0.1211***	0.1162***
	(0.0376)	(0.0284)	(0.0229)	(0.0157)	(0.0347)
EXP	-0.0031	-0.0004	0.0067**	0.0098***	0.0373***
	(0.0069)	(0.0045)	(0.0030)	(0.0033)	(0.0108)
EDUX	-0.2295	-0.1373	-0.0684	-0.1005	-0.0622
	(0.1752)	(0.1272)	(0.0729)	(0.0614)	(0.1919)
Status	0.4180	0.1860	-0.3790*	-0.5587**	-1.7239***
	(0.5373)	(0.3066)	(0.2246)	(0.2208)	(0.4054)
Constant	3.7915*	6.2314***	8.0431***	9.6839***	10.8756***
	(2.2067)	(1.4227)	(0.9148)	(1.1153)	(2.6727)
Pseudo R2	0.1781	0.1806	0.2092	0.2243	0.1751
Obs.	1,050	1,050	1,050	1,050	1,050
AIC	19.6438	19.6388	19.5816	19.5514	19.6498

Note: Standard errors in parentheses; *, ** and *** indicate significant at 10%, 5% and 1% level respectively.

Table 7. Multicollinearity check for Model 2

Variable	VIF	1/VIF
SDGI	2.47	0.406
WSGD	2.54	0.393
FDI	1.08	0.930
UNEMP	1.04	0.960
GFCF	1.02	0.978
EXP	1.36	0.733
EXUD	1.26	0.791
Mean VIF	1.54	

AIC values for Model 2 are smaller than the corresponding AIC values for Model R2. Hence, Model 2 is the better model. To address the possibility of multicollinearity in Model 2, the variance inflation factor (VIF) test is performed. The findings are shown in Table 7. All VIF findings including the mean VIF value are below 5.00, implying no serious multicollinearity problem.

Conclusion

Sustainable development is a noble cause and should be encouraged. However, the findings show an increasingly negative relationship between sustainability and economic growth, prompting the issue of choice and subsequent increasing of the opportunity cost. This is seen as a cost of economic transition towards sustainable growth. However, policy makers should understand

that the effort to achieve the SDG is not a choice or an alternative, but a necessity given immense negative externalities due to climate change, pollutions, and unsustainable growth. Empirical findings provide estimation of the opportunity costs to growth for trying to achieve the SDG. It is the duty of policy makers to find more growth catalyst to neutralize these opportunity costs. Findings imply that policies aiming to reduce unemployment, attract gross fixed capital investment and increase export can boost economic growth.

Surprisingly, good institutional quality only has direct and positive effect on economic growth (Model 1) at the 25^{th} quantile and negative moderating effect through sustainable development factor (Model 2) at the 75^{th} quantile. The findings imply a possibility of structural flaws in governance or a pseudo institutional quality because higher institutional quality is not rewarded with higher economic growth. Therefore, the findings also prompt the necessity of a qualitative review of economic fundamental and the construct of institutional quality. Overall, policy makers should be flexible to navigate a more compatible transition path towards sustainable economy and achieve the SDG targets rather than either abandoning or rushing to achieve the SDG at all costs.

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References

Adrangi, Bahram, and Lauren Kerr. 2022. "Sustainable Development Indicators and Their Relationship to GDP: Evidence from Emerging Economies." *Sustainability* 14(2): 658. https://doi.org/10.3390/su14020658.

Amin, Nabila, Muhammad Salman Shabbir, Huaming Song, Muhammad Umar Farrukh, Shahid Iqbal, and Kashif Abbass. 2023. "A step towards environmental mitigation: Do green technological innovation and institutional quality make a difference?" *Technological Forecasting & Social Change* 190: 122413. https://doi.org/10.1016/j.techfore.2023.122413.

Anderson, Inger. 2020. "The triple planetary crisis: Forging a new relationship between people and the earth." Accessed August 10, 2023. https://www.unep.org/news-and-stories/speech/triple-planetary-crisis-forging-new-relationship-between-people-and-earth.

Arshed, Noman., Nadia Hanif, Osama Aziz and Martin Croteau. 2022. "Exploring the potential of institutional quality in determining technological innovation." *Technology in Society* 68: 101859: 1-12. https://doi.org/10.1016/j.techsoc.2021.101859.

Asongu, Simplice A., Samba Diop, and Amsalu K. Addis. 2023. "Governance, inequality and inclusive education in Sub-Saharan Africa." *Forum for Social Economics* 52(1): 43-68. https://doi.org/10.1080/07360932.2020.1856166.

Azam, Muhammad, Ahmed Imran Hunjra, Elie Bouri, Yan Tan, and Mamdouh Abdulaziz Saleh Al-Faryan. 2021. "Impact of institutional quality on sustainable development: Evidence from developing countries." *Journal of Environmental Management* 298(15): 113465. https://doi.org/10.1016/j.jenvman.2021.113465.

Benjamin, Le Cook and Willard G. Manning. 2013. "Thinking beyond the mean: a practical guide for using quantile regression methods for health services research." *Shanghai Archives of Psychiatry* 25(1): 55-9. https://doi.org/10.3969/j.issn.1002-0829.2013.01.011.

Bera, Anna. and Beata Sadowska. 2018. "Clean Production as an Element of Sustainable Development." In S*ustainable Production: Novel Trends in Energy, Environment and Material Systems*, edited by Grzegorz M. Królczyk, Małgorzata Wzorek, Anna Król, Orest Kochan, Jun Su, Janusz Kacprzyk, 1-9. Switzerland: Springer.

Bhatti, M. Ishaq and Hung Quan Do. 2019. "Recent development in copula and its applications to the energy, forestry, and environmental sciences." *International Journal of Hydrogen Energy*

44(36): 19453-19473. https://doi.org/10.1016/j.ijhydene.2019.06.015.

Brown, Katrina. 2009. "Human development and environmental governance: A reality check." In *Governing sustainability*, edited by Neil W. Adger and Andrew Jordan, 32-51. Cambridge: Cambridge University Press.

Brue, Stanley L. and Randy R. Grant. 2013. *The Evolution of Economic Thought*. Mason: South-Western, Cengage Learning.

Buchholz, Katharina. 2021. "Climate change: This is the impact of extreme weather events on the economy." Last modified 10 September 2021. https://www.weforum.org/agenda/2021/09/extreme-weather-events-show-that-climate-change-comes-at-a-cost.

Dore, Natalia I., and Aurora A.C. Teixeira. 2023. "The role of human capital, structural change, and institutional quality on Brazil's economic growth over the last two hundred years (1822–2019)." *Structural Change and Economic Dynamics* 66: 1-12. https://doi.org/10.1016/j.strueco.2023.04.003.

Gibescu, Octavia. 2020. "Does the gross fixed capital formation represent a factor for supporting the economic growth?" MPRA Paper No. 50135.

Har, Wai Mun, Law Siong Hook, Mohd Naseem Niaz Ahmad, and Nur Syazwani Mazlan. 2023. "Does government and institution quality matter to Sustainable Development Goals?" *Journal of Sustainability Science and Management* 18(1): 181-197. http://doi.org/10.46754/jssm.2023.01.011.

Har, Wai Mun, Law, Siong Hook, Mohd Naseem Niaz Ahmad & Nur Syazwani Mazlan. 2022. "Does recomposed institutions quality alleviate extreme income inequality?" *Jurnal Ekonomi Malaysia* 56(2): 1-16. http://dx.doi.org/10.17576/JEM-2022-5602-01.

Hickel, Jason. 2020. "The sustainable development index: Measuring the ecological efficiency of human development in the Anthropocene." *Ecological Economics* 167: 106331. https://doi.org/10.1016/j.ecolecon.2019.05.011.

Hijazeen, Hala, Mehdi Seraj, and Huseyin Ozdeser. 2021. "The nexus between the economic growth and unemployment in Jordan." *Future Business Journal* 7(42): 1-8. https://doi.org/10.1186/s43093-021-00088-3.

Hirai, Tadashi. 2022. "A balancing act between economic growth and sustainable development: Historical trajectory through the lens of development indicators." *Sustainable Development* 30(6): 1900-1910. https://doi.org/10.1002/sd.2357.

Hunjra, Ahmed Imran, Muhammad Azam, Maria Giuseppina Bruna, and Elie Bouri. 2023. "A cross-regional investigation of institutional quality and sustainable development." *Journal of International Financial Markets, Institutions & Money* 84(101758): 1-17. https://doi.org/10.1016/j.intfin.2023.101758.

Kameri-Mbote, Patricia, Balakrishna Pisupati, Smagadi Aphrodite, Allan Meso, Hyun Sung, and Alvin Gachie. 2023. "The Role of Environmental Law and Governance in Transformational Change to Address the Triple Planetary Crisis." *Law, Environment and Development Journal* 19(1): 251-265.

Kukaj, Diellza. 2018. "Impact of Unemployment on Economic Growth: Evidence from Western Balkans". *European Journal of Marketing and Economics* 1(1): 9-17. https://doi.org/10.26417/ejme.v1i1.p10-18.

Lafortune, Guillaume, Grayson Fuller, Jorge Moreno, Guido Schmidt-Traub and Christian Kroll. 2018. "SDG Index and Dashboards: Detailed Methodological paper." Last modified September 2018. https://github.com/sdsna/2018GlobalIndex/raw/master/2018GlobalIndexMethodology.pdf.

Laksamana, Ridho J.U. and Doris Padmini Selvaratnam. 2016. "Analysis of impacts of tourism industry development in Pariaman community based on sustainable development approach." *Journal of Global Business and Social Entrepreneurship* 2(3): 155-168.

Maduka, Anne Chinonye, Stephen Obinozie Ogwu and Chukwunonso S. Ekesiobi. 2022. "Assessing the moderating effect of institutional quality on economic growth-carbon emission Nexus in Nigeria – environmental science and pollution research." *Environmental Science and Pollution Research* 29: 64924-64938. https://doi.org/10.1007/s11356-022-20346-3.

Mahran, Hisham Abdeltawab. 2023. "The impact of governance on economic growth: spatial econometric approach." *Review of Economics and Political Science* 8(1): 37-53. https://doi.org/10.1108/REPS-06-2021-0058.

Makaringe, Sibusiso Clement & Khobai. Hlalefang. 2018. "The effect of unemployment on economic growth in South Africa (1994-2016)". *MPRA Paper No. 85305*.

Michael, Eze Onyebuchi, Atuma Emeka & Egbeoma Nwigboji Emmanuel. 2016. "The Relationship between Unemployment and Economic Growth in Nigeria: Granger Causality Approach." *Research Journal of Finance and Accounting* 7(24): 153-162.

Motalo, Vasyl, Bogdan Stadnyk, Andriy Motalo and Ihor Likhnovsky. 2018. "Hydrocarbon Gases Quality: Impact on Sustainable Development Goals and Environment." In S*ustainable Production: Novel Trends in Energy, Environment and Material Systems*, edited by Królczyk, Grzegorz M., Małgorzata Wzorek, Anna Król, Orest Kochan, Jun Su, Janusz Kacprzyk, 105-129. Switzerland: Springer.

Nawaz, Saima, Nasir Iqbal & Muhammad Arshad Khan. 2014. "The impact of institutional quality on economic growth: Panel evidence." *Pakistan Development Review* 53(1): 15-31. https://doi.org/10.30541/v53i1pp.15-31.

Nguyen, Canh Phuc, Thanh Dinh Su, and Thai Vu Hong Nguyen. 2018. "Institutional Quality and economic growth: The case of emerging economies." *Theoretical Economics Letters* 8(11): 1943-1956. https://doi.org/10.4236/tel.2018.811127.

Omri, Anis and Nejah Ben Mabrouk. 2020. "Good governance for sustainable development goals: Getting ahead of the pack or falling behind?" *Environmental Impact Assessment Review* 83: 106388. https://doi.org/10.1016/j.eiar.2020.106388.

Parker, Steven and M. Ishaq Bhatti. 2020. "Dynamics and drivers of per capita CO2 emissions in Asia." *Energy Economics* 89: 104798. https://doi.org/https://doi.org/10.1016/j.eneco.2020.104798.

Pasara, Michael Takudzwa and Rufaro Garidzirai. 2020. "Causality effects among gross capital formation, unemployment and economic growth in South Africa." *Economies* 8(2): 1-12. https://doi.org/10.3390/economies8020026.

Ramli, Norimah, Dayang Affizzah Awang Marikan and Emilda Hashim. 2016. "The Effect of Foreign Direct Investment, Exports and Employment on Economic Growth Model." *International Journal of Academic Research in Business and Social Sciences* 6(11): 361-376. http://dx.doi.org/10.6007/IJARBSS/v6-i11/2405.

Samadi, Ali Hussein and Masoumeh Alipourian. 2021. "Institutions and Institutional Change: Concepts and Theories." In *Dynamics of Institutional Change in Emerging Market Economies*, edited by Faghih Nezameddin and Ali Hussein Samadi, 107-132. Switzerland AG: Springer.

Samsuddin, M. Afdal, and Syamsul Amar. 2020. "Determinants of Economic Growth in Developing Countries of G20 Members." *Advances in Economics, Business and Management Research* 152: 177-183. https://doi.org/10.2991/aebmr.k.201126.021.

Singh, Harman Preet, Ajay Singh, Fakhre Alam, and Vikas Agrawal. 2022. "Impact of sustainable development goals on economic growth in Saudi Arabia: Role of Education and training." *Sustainability* 14(21): 14119. https://doi.org/10.3390/su142114119.

Soegiarto, Eddy, Yonathan Palinggi, Faizal Reza1, and Silviana Purwanti. 2022. "Human Capital, Diffusion Model, And Endogenous Growth: Evidence from Arellano- Bond Specification." *Webology* 19(2): 6265-6278.

Tampakoudis, Ioannis A., Dimitra Fylantzopoulou, and Konstantina Nikandrou. 2014. "Examining the linkages between GDP growth and sustainable development in the Eurozone." *Journal of Economics and Business* 17(2): 15-37.

UNEP (United Nation Environment Programme). n.d. "Sustainable Infrastructure Investment." Last modified not dated. https://www.unep.org/explore-topics/green-economy/what-we-do/sustainable-infrastructure-investment.

United Nations. 2021. "Climate and weather related disasters surge five-fold over 50 years, but early warnings save lives – WMO report." Last modified 1 September 2021. https://news.un.org/en/story/2021/09/1098662.

Weale, Albert. 2009. "Governance, government and the pursuit of sustainability." In *Governing sustainability*, edited by Adger, W. Neil. and Andrew Jordan, 55-75. Cambridge: Cambridge University Press.

World Bank. 2022a. "World Development Indicators." Accessed August 15, 2023. https://datatopics.worldbank.org/world-development-indicators.

World Bank. 2022b. "World Governance Indicators." Accessed August 15, 2023. https://info.worldbank.org/governance/wgi.

Yan, Chao, Li Huixuan, and Li Zhigang. 2022. "Environmental pollution and economic growth: Evidence of SO2 emissions and GDP in China." *Front Public Health* 10: 930780. https://doi.org/10.3389/fpubh.2022.930780.

Appendix: List of countries and income status

Low income	Lower middle income	Upper middle income	High income
Burkina Faso	Algeria	Albania	Australia
Burundi	Angola	Argentina	Austria
Central African Republic	Bangladesh	Armenia	Bahrain
Chad	Benin	Belarus	Belgium
Gambia, The	Bhutan	Belize	Canada
Madagascar	Bolivia	Brazil	Chile
Mali	Cambodia	Bulgaria	Croatia
Mozambique	Cameroon	Colombia	Cyprus
Niger	Congo, Rep.	Costa Rica	Czechia
Rwanda	Cote d'Ivoire	Dominican Republic	Denmark
Sierra Leone	Eswatini	Ecuador	Estonia
Togo	Ghana	El Salvador	Finland
Uganda	Guinea	Gabon	France
	Haiti	Georgia	Germany
	Honduras	Guatemala	Greece
	India	Indonesia	Hungary
	Iran, Islamic Rep.	Jamaica	Iceland
	Jordan	Kazakhstan	Ireland
	Kenya	Malaysia	Israel
	Kyrgyz Republic	Mauritius	Italy
	Lebanon	Mexico	Japan
	Mongolia	Moldova	Latvia
	Morocco	Namibia	Lithuania
	Nepal	Paraguay	Luxembourg
	Nicaragua	Peru	Malta
	Pakistan	Russian Federation	Netherlands
	Philippines	South Africa	New Zealand
	Senegal	Thailand	Norway
	Tanzania	Turkiye	Panama
	Ukraine		Poland
	Uzbekistan		Portugal
	Vietnam		Singapore
	Zimbabwe		Slovak Republic
			Slovenia
			Spain
			Sweden
			Switzerland
			United Arab Emirates
			United Kingdom
			United States
			Uruguay