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Do Market-Supporting Institutions Promote Sustainable Development? Evidence from Developing Economies

Muhammad Azam[a], Zied Ftiti[b]*, Ahmed Imran Hunjra[c, d], Wael Louhichi[e], Peter Verhoeven[f]

[a] Department of Economics, Ghazi University, Pakistan

[b] EDC Pairs Business School, France

[c] Rabat Business School, International University of Rabat, Morocco

[d] Department of Business Administration, Ghazi University, Dera Ghazi Khan, Pakistan

[e] ESSCA School of Management, France

[f] Faculty of Business and Law, Queensland University of Technology, Australia

Abstract

An institutional structure may affect traditional drivers of development, such as foreign direct investment and economic growth, and emerging economies' ability to achieve sustainable development. This study expands on this literature by assessing the role of market-supporting institutions in achieving sustainable development goals in 42 developing economies. Using various measures of market-supporting institutions and a dynamic panel data approach, we find that all institutions play an important role in achieving sustainable development. Furthermore, we show that foreign direct investment and economic growth have a positive indirect effect on sustainable development by promoting the quality of market-supporting institutions and adopting renewable power generation. Our results suggest that policymakers in developing countries should focus on the robustness of their market-supporting institutions to achieve sustainable development.

Keywords: Market institutions; Renewable energy generation; Sustainable development

JEL Classification: E01; P18; Q01

1. Introduction

Sustainable development goals (SDGs), adopted by all United Nations (UN) Member States in 2015, are the blueprint for achieving a better and more sustainable future for all (UNSDG, 2022). They address the main global challenges we face today, including climate change. The 1987 Bruntland Commission Report defines sustainable development as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*" (Report of the World Commission on Environment and Development, 1987). In a broader sense, sustainable development refers to the various processes and pathways to achieve it, such as governance, research and technology transfer, education, and training.

Thriving literature on sustainability shows that renewable power generation is critical to climate change mitigation and clean energy transition (Güney, 2019; Destek and Sinha, 2020; Nathaniel and Khan, 2020; Sharma et al., 2021; Twidell, 2021). The use of renewable energy can help reduce energy imports and fossil fuel use, which is the primary source of global carbon dioxide emissions (Mulvaney, 2020).

Although attaining sustainability requires clean energy transition, it must also address various fundamental issues at local, regional, and global levels. This study assesses the role of market-supporting institutions at the country-level in sustainable development, a subject that the literature has largely ignored. We argue that sustainable development objectives rely on human records, activities, and conducts that are socially implemented through the institutional framework of the market economy (Lehtonen, 2004). Market-supporting institutions establish property rights, address market failures, reduce transaction costs, and solve coordination problems. We classify market-supporting institutions into four main types: market-creating, market-regulating, market-stabilizing, and market-legitimizing institutions. We also construct a market-supporting institutions index (MII), which is consistent with Rodrik (2005).

For our panel of 42 developing countries from 1990 to 2018, we show that all types of market-supporting institutions are directly linked to sustainable development. Furthermore, we discover that foreign direct investment (FDI) and economic growth have a positive indirect effect on sustainable development by promoting market-supporting institutions and renewable power generation. Our results suggest that policymakers in developing countries should focus on the robustness of their market-supporting institutions to achieve sustainable development.

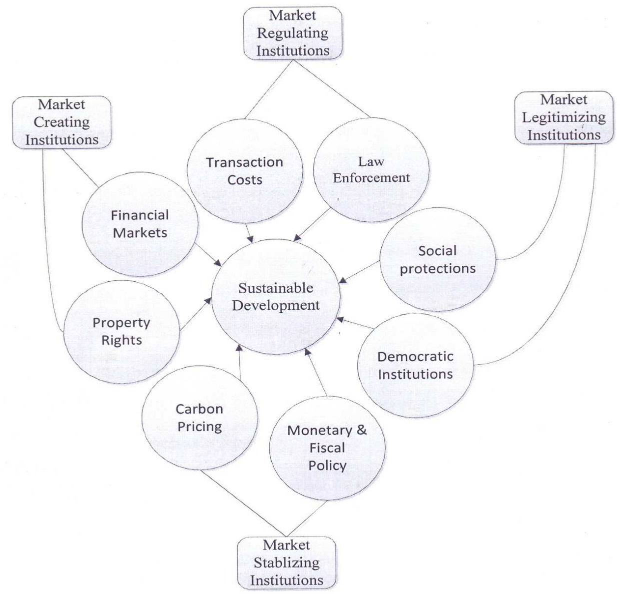
The remainder of this study is organized as follows. Section 2 provides the theoretical background. Section 3 discusses the empirical model and measurement. Section 4 discusses the data. Section 5 presents the empirical results. Finally, Section 6 concludes.

2. Theoretical background

2.1. Market-supporting institutions and sustainable development

Market-supporting institutions may be linked to sustainable development through market-creating, market-regulatory, market-stabilizing, and market-legitimizing institutions. Such institutions also establish property rights, address market failures, reduce transaction costs, and solve coordination problems (Fig.1).

Fig. 1. Conceptual map of market-supporting institutions and sustainable development



Market-creating institutions impact sustainability through financial institutions (Cherif et al., 2021). Sustainable development is reinforced through formal environmental risk management procedures and the integration of environmental management activities into loan agreements. Market-creating institutions can also promote sustainable development by reducing transaction costs (Asif et al., 2020). This comprises negotiating and controlling expenses and market and administrative costs that establish the framework for institutional administration. The lack of a formal institutional mechanism results in high transaction costs, which could lead to resource exploitation, thereby negatively affecting sustainability. The safety of private property ownership also ensures resource protection, which is critical for long-term economic prosperity (Bhattarai and Hammig, 2004).

Meanwhile, market-regulatory institutions are linked to sustainable development through an autonomous and transparent judicial process that fosters effective governance, which helps negate asymmetries of information relating to the market and establish formal rules and guidelines for the proper functioning of the market (Zuindeau, 2007). Market-supporting institutions provide the framework for social, political, and economic interactions by reducing information problems. They also work with a country's judiciary to establish civil or criminal liabilities for social and environmental malpractices, including taxes and fines, prison sentences, and financial penalties for any unlawful acts of resource extraction. Regulatory institutions are necessary components of emissions trading systems that not only shape the ways that markets operate but also condition the environmental value of the carbon credits they produce (Goron and Cassisa, 2017).

Market-stabilizing institutions take several forms. From a societal perspective, an independent monetary authority that controls interest rates and inflation is a unified constraint dictated by society itself, which then takes the form of an institution. The same logic can be applied to the financial constraints imposed by governments. Administrations communicate the impact of tax collection on sustainability through budgetary channels. It provides the financial resources for the economy's sustainability goals (Cheng et al., 2022; Tan et al., 2022). The impact of taxes is reflected in long-term economic growth via the economic capacity stream through governments' assistance with long-term policies. The funding gap of SDGs indicates that asset allocation is the main problem. In fact, if people are willing to accept that legal (public and private) investments necessitate initial savings, the only way to close the financial gap is to push the market to allocate more savings to such initiatives. This includes giving priority to increasing the number of sustainable financial assets in the form of sound money, thereby reflecting the policies of market-stabilizing institutions. To summarize, there is little distortion of economic resources in the presence of well-functioning market-supporting institutions, which ultimately promote sustainable development policies in the economy.

Recent studies have discussed the role of market-legitimizing institutions in sustainable development (Thacker et al., 2019). These institutions improve coordination and cooperation among different factions within the economy. They implicitly readjust the benefits and costs faced by factions when deciding on the optimal strategy to achieve their goals. Institutions that provide social protection and insurance are examples of market-legitimizing institutions. They are also involved in resource redistribution and conflict management, such as pension processes and social protection schemes in the form of unemployment allowances. These institutions make markets more socially stable and cohesive.

2.2 Indirect effects of FDI

According to the pollution halo effect, FDI from developed economies leads to improvements in the local institutional environment (Demena and Afesorgbor, 2020). This in turn could promote the adoption of best sustainable development management practices and technologies. FDI also indirectly impacts sustainable development through several greening effects (Gallagher and Zarsky, 2007). First, FDI promotes sustainable development by transferring technology that is more efficient and less polluting than domestic production. Second, by transferring best practices in environmental management to affiliated companies, domestic competitors, and suppliers, FDI promotes technological leapfrogging and controls pollution-spillover effects on domestic companies. Therefore, FDI is considered a valuable tool for achieving sustainable development, thereby positively contributing to sustainable growth goals (Demena and Afesorgbor, 2020). The use of green technologies and improvements in the quality of market-supporting institutions contribute to developing new sustainable products, which can further promote sustainable development.

2.3. Indirect effects of economic growth

Economic growth indirectly affects sustainable development via market-supporting institutions. First, a country's high economic activity is closely related to the quality of its institutional markets. A high level of economic activity ensures property rights protection and lowers the cost of abatement policies that ultimately encourage saving behavior. Moreover, economic growth establishes the financial and regulatory capacity to implement resource protection standards at various market levels. It boosts resource sustainability in the economy (Jalilian et al., 2007). Furthermore, economies with sustainable economic growth patterns have more stable market policies (Ziolo et al., 2017). Economic growth improves the market's regulatory capacity (Ashford and Hall, 2011), which smoothens the resource production and consumption pattern essential for a country's sustainable development (Bengtsson et al., 2018).

High levels of economic activity lead to property rights protection, thereby indicating a more stable regulatory environment. This ensures a safe and profitable investment in green energy projects and promotes savings behavior, which is essential for sustainable development (Singh et al., 2019). In contrast, low economic growth signals a weak market-regulatory framework, creates a burden on the economy, and makes it impossible to fund green technological development, which is essential to reduce harmful emissions as discussed in the environmental Kuznets curve hypothesis. It also provides a lower level of regulatory capacity to control the resource distortion burden, thereby negatively affecting the achievement of SDGs (Organization for Economic Cooperation and Development, 2010).

Economic growth may also have an indirect impact on sustainable development through renewable energy generation. Increased economic growth accelerates renewable energy capacity, thereby stimulating investment in renewable energy projects (Asif and Muneer, 2007; Singh et al., 2019).

3. Model specification and measurement

We test our claims by employing the following empirical model (Equation 1):

$$ANS_{i,t} = \alpha_0 + \alpha_1 ANS_{i,t-1} + \alpha_2 MII_{i,t} + \alpha_3 (FDI_{i,t} \times MII_{i,t}) + \alpha_4 (GDP_{i,t} \times MII_{i,t}) + \alpha_5 RPG_{i,t} + \alpha_6 FDI_{i,t} + \alpha_7 GDP_{i,t} + \alpha_8 SSE_{i,t} + \alpha_9 TRO_{i,t} + b\alpha_{10} (FDI_{i,t} \times RPG_{i,t}) + \alpha_{11} (GDP_{i,t} * \times RPG_{i,t}) + u_i + z_{i,t} \tag{1}$$

where u_i represents country fixed-effects and $z_{i,t}$ represents the residual term. The dependent variable is sustainable development, represented by adjusted net savings per capita (*ANS*) (Güney, 2019).[1] It measures a country's sustainability through the change in comprehensive wealth over a specified accounting period. Moreover, it checks the extent to which today's rents from various natural resources (i.e., change in natural capital) and changes in human capital are balanced by net savings (i.e., change in artificial capital), that is, this generation's bequest to future generations. The data for this variable are taken from the World Bank (Kamoun et al., 2019; Güney, 2019).

[1] The definitions of all variables used in the empirical analysis are presented in Table 1.

Per the World Bank dataset, the background formula for the *ANS* computation is as follows (Equation 2)[2]:

$$ANS = (NNS + ED - \sum Rn,i - ENV)/GNI \tag{2}$$

where *NNS* is the net national savings obtained from the gross national savings minus the consumption of fixed capital. *ED* represents the public sector's expenditure on education, and $\sum Rn.i$ is the sum of natural resource depletion for country i (which includes mineral, net forest, and energy depletion). *ENV* represents the total cost of environmental damage from carbon dioxide and particulate emissions. *ANS* is expressed as a percentage of gross national income (*GNI*).

To evaluate the composite impact of the market-supporting institutions' various components on sustainable development, we construct an MII by employing the standard principal component analysis. The index is built around four key proxies: (i) sound money index (*SMI*), reflecting market-stabilizing institutions; (ii) index of regulation (*REG*), reflecting market-regulating institutions; (iii) polity II index (*POLIT2*) of the Centre for International Development and Conflict Management, University of Maryland, reflecting market-legitimizing institutions; and (iv) regulatory quality index (*RQI*), reflecting market-creating institutions (Das and Quirk, 2016; Rodrik, 2005). A lower score for all these institutional measures means lower institution quality.

Renewable power generation (*RPG*) is expressed in billion kilowatts (kW) of power generated. The role of renewable energy technologies in sustainable development has been widely discussed in the literature (Solangi et al., 2021). Besides reducing the harmful emissions of fossil fuels that cause climate change (Østergaard et al., 2020), generating renewable energy domestically has other advantages, including increased access to and security of energy sources. Thus, increasing the share of renewables in the energy sector promotes economic growth and development through increased investments and trades and more affordable energy prices, thereby leading to job creation, wellbeing, and the overall improvement of human welfare.

Economic growth is proxied by the gross domestic product (*GDP*) growth rate. According to Koirala and Pradhan (2020), income per capita and economic development have a substantial,

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[2] See https://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/econ_development/adjusted_net_saving.pdf (accessed May 12, 2022)

direct, positive influence on sustainable development. Meanwhile, Phimphanthavong (2013) emphasized the importance of economic growth for sustainable development, which is a combination of economic development, social progress, and environmental sustainability. Economic growth is crucial for long-term development because elements of advancement, economic expansion, and social progress are important to protect the environment. The impact of economic progress is also transmitted to all sections of society through poverty alleviation, minimization of existing inequalities, and conservation of natural resources. Kaimuri and Kosimbei (2017) evidenced a long-term negative relationship between residential consumption rates and sustainable growth. They also found that power generation and unemployment rate have short-term negative repercussions on sustainable advancement. However, they found no evidence that real GDP per capita, resource efficiency, or trading conditions directly affect sustainability.

Symbol	**Description**	**Definition**	**Reference**

Table 1. Variable definitions

ANS	Sustainable development	Adjusted net savings (2010 US Dollars)	Güney (2019) and Kamoun (2019)
SMI	Market-stabilizing institutions	Sound money index	Rodrick (2005), Das and Quirk (2016)
REG	Market-regulating institutions	Index of regulations	Rodrick (2005) Das and Quirk (2016)
RQI	Market-creating institutions	Regulatory quality index	Rodrick (2005) Das and Quirk (2016)
POLIT2	Market-legitimizing institutions	Political regularity	Rodrick (2005) Das and Quirk (2016)
MII	Market-supporting institutions index	This index is constructed by employing standard principal component analysis based on four key indicators reflecting market-stabilizing; (ii) market-regulating; (iii) market-legitimizing; and (iv) market-creating institutions.	Rodrick (2005) Das and Quirk (2016)
RPG	Cleaner production	Renewable electricity output (percentage of total electricity output)	Giannetti et al. (2020), Kamoun et al. (2017)
FDI	Foreign direct investment	Net inflows (new investment flows minus divestment) as a percentage of GDP	Aust et al. (2020)
GDP	Economic growth	Percentage growth of GDP (in billion 2010 US Dollars)	Azam et al. (2021)
SSE	Educational quality	Secondary school enrollment (percent of all eligible children)	Rodrick (2005)
TRO	Trade liberalization policies	Trade openness measured as exports plus imports as a percentage of GDP	Destek and Sinha (2020)

FDI is computed as net FDI inflows (new investment flows minus divestment) as a percentage of *GDP*. It is thought to be crucial in promoting sustainable development. In financial markets, FDI impacts sustainable economic development through environmental quality standards. Governments attract FDI as a result of the consumption of fossil fuel resources, which contributes to the development of natural resources. As the economy's income reaches a certain level, further FDI inflows into ecofriendly technologies can help protect natural resources. This dynamic behavior of foreign investors poses a lower risk to sustainable economic development.

Trade openness *(TRO)* is proxied by the sum of exports and imports as a percentage of GDP. According to the growth hypothesis, TRO will have a net positive effect on sustainable development. It includes knowledge spillover returns to scale resulting from TRO (Destek and Sinha, 2020; Nassani et al., 2021).

Our final variable is educational quality, proxied by secondary school enrollment (*SSE*). Educational expenditure includes enrollment rates and demographics. The nexus between educational expenditure and human capital formation leads to a higher level of income subject to complex lags and cost variations. Labor income indices are considered important proxies of human capital. However, it is difficult to explain income-based measures using human capital stock. School enrollment is considered a more appropriate measure to evaluate the impact of human capital on sustainable development. In developing economies, human capital development is expected to harm education. Some critical factors hinder the positive effects of education in developing economies. First, in most developing economies, a high level of mismatch exists between educational content and sustainable development programs. For example, the syllabus is missing content related to natural resource preservation. Second, the educational implementation programs in developing economies have structural flaws. A restriction on unsustainable behavior can reduce the process of environmental damage and reduce support for sustainable development. Therefore, education is the most important factor because of its ability to shape people's behavior. The practices and behaviors that show respect for the environment are formed at an early age (Mahat et al., 2017). Geng et al. (2017) revealed that adolescents and young people are more receptive, and it is easier for them to engage in sustainable behavior. Meanwhile, students are current and future consumers who can make significant contributions while learning and maintaining good habits (Vantamay et al., 2018). Additionally, they are future policymakers in charge of sustainable development and marketing planners (Joshi and Rahman, 2017).

To test the indirect effect of economic growth (*GDP*) and FDI on the relationship between MII and sustainability (*ANS*) and between *RPG* and sustainability (*ANS*), we include the following interaction terms in the regression model: ($FDI \times MII$), ($GDP \times MII$), ($FDI \times RPG$), and ($GDP \times RPG$). A definition for each regression variable is provided in Table 1.

4. Data

Our empirical tests are performed on a sample of 42 developing countries[3] for the period 1990–2018. We focus on lower-middle-income countries because they are more affected by sustainable development issues and have greater cross-country variation in RPG, market-

[3] The Appendix presents the list of countries used in the empirical analysis.

supporting institutions, and sustainability. Annual data are gathered from the World Bank's World Development Indicators, Economic Freedom of the World, Polity II, International Country Risk Guide, and the US Energy Information Administration databases.

Table 2 shows the sample's descriptive statistics. The mean value of sustainable development (*ANS*) is 2.18, ranging widely from −5.77 to 4.44. Economic theory posits that a positive *ANS* indicates an increasing value of social welfare. Conversely, a persistently negative *ANS* indicates that a country's economy is on an unsustainable path either because its natural resources are depleting or it is facing rising costs due to the damage incurred from carbon dioxide emissions. A higher *ANS* value is preferred, emphasizing human capital investments, which are fabricated resources that add up to gross savings.

Table 2. Descriptive statistics

Variables	Obs.	Mean	S.D	Min	Max	Q1	Q3	Skew.	Kurt.
ANS	943	2.18	0.84	−5.77	4.44	−0.84	3.41	−2.08	13.73
SMI	838	7.37	1.69	0.00	9.81	1.21	9.69	−1.22	5.65
REG	839	6.43	0.99	2.41	8.66	3.19	8.40	−0.72	4.21
RQI	798	−0.22	0.46	−2.00	0.84	−1.52	0.66	−0.37	3.37
POLIT2	1218	3.90	5.23	−9.00	10.00	−7.00	9.00	−0.88	2.30
RPG	1127	1.65	2.16	−4.60	7.33	−3.21	6.12	−0.18	2.84
FDI	1163	5.01	2.02	4.60	5.67	4.60	4.87	0.07	2.80
MMI	713	0.00	1.00	−4.46	2.27	−2.61	2.03	−0.69	4.49
GDP	1214	4.25	1.77	0.58	9.29	1.06	8.29	0.32	2.34
SSE	929	4.05	0.53	1.66	4.79	2.11	4.66	−1.63	6.38
TRO	1213	4.05	0.47	2.62	5.39	2.89	5.20	−0.051	3.00

Note: Table 1 presents the variable definitions.

The mean value of the SMI is 7.37, ranging from 0 to 9.81, thereby implying a high average level of stabilizing institutions across the sample. Meanwhile, the RQI has a mean value of −0.22 that ranges from −2.00 to 0.84, thereby indicating a lack of government effectiveness and good governance. The mean value of legitimizing institutions (*POLIT2*) is also low at 3.90, ranging from −0.90 to 10.00, thereby indicating that the sample countries have insufficient legal regulations and sanctions to compensate for resource deficiencies. Moreover, the mean value of the index of regulations (*REG*) is low at 1.65, ranging from −4.6 to 7.34, thereby reflecting low financial system soundness. *MII* averages 0.0 and ranges between −4.47 and 2.27.

The average value of RPG is low at 1.65, with values ranging from −4.60 to 7.33 that suggest low adoption of cost-effective strategies (Palmer and Burtraw, 2005). The average GDP growth rate is 4.26%, ranging from 0.58% to 9.29%. Meanwhile, the average FDI inflow, as a percentage of GDP, is 5.01%, ranging from 4.60% to 4.87%. The mean value of SSE is 4.05, with a range of 1.66–4.79, and that of TRO is 4.05, ranging from 2.63 to 5.39.

5. Empirical results and discussion

5.1. Generalized method of moments (GMM) results

We use the systems-generalized method of moments (SYS-GMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998) to avoid a potential endogeneity bias in our regression estimates due to the potential endogenous relationship between MII and sustainable development (Twidell, 2021). Table 3 summarizes the results of the diagnostic tests.

The standard Durbin–Wu–Hausman method indicates no evidence of endogeneity in the baseline equation. Heteroscedasticity is rejected based on the Breusch–Pagan-Cook–Weisberg test. Meanwhile, the Arellano–Bond (AB, 1991) tests fail to reject the null hypothesis that there is no two-period serial correlation in the residual terms. According to the Hansen test, the estimation regression does not have too many instrumental variables. The AB test is used to determine the validity and efficiency of SYS-GMM. The test focuses on the autocorrelation properties of the lag term of the disturbance term. The values of AR (1) and AR (2) indicate that the terminals remain at the same time as the first and second autocorrelations of the first and second order, respectively.

Table 3. Diagnostic tests

Variable	(1)	(2)	(3)	(4)	(5)
Panel A: Multicollinearity (VIF)					
ANS_L1	---	1.040	1.080	1.040	1.040
MII	0.451	---	---	---	---
SMI	---	1.130	---	---	---
RQI	---	---	1.270	---	---
REG	---	---	---	1.300	---
POLIT2	0.631	---	---	---	1.100
FDI	0.531	2.980	3.090	2.980	2.860
RPG	0.20	2.070	2.100	2.460	2.010
GDP	0.339	3.350	3.250	3.390	3.370
SSE	0.999	1.650	1.650	1.640	1.660
TRO	---	1.790	1.770	1.790	1.690
Mean VIF	---	2.000	2.030	2.080	1.960

Panel B: Test of endogeneity (Durbin–Wu–Hausman test) (p-values)					
SMI	0.387	0.387	---	---	---
MII	---	---	---	---	---
RQI	---	---	0.107	---	---
REG	---	---	---	0.859	---
POLIT2	---	---	---	---	0.926
RPG	0.767	0.767	0.287	0.806	0.795
GDP	0.323	0.323	0.549	0.226	0.579
FDI	0.092	0.092	0.327	0.084	0.089
SSE	0.315	0.315	0.442	0.372	0.112
TRO	0.155	0.155	0.973	0.671	0.377
Panel C: Test of heteroscedasticity (Breusch–Pagan test)					
Chi2	0.310	0.161	0.320	0.040	0.070
p-value	0.576	0.688	0.573	0.849	0.795
Panel D: Test of autocorrelation (Breusch–Godfrey LM test)					
Chi2	214.076	195.657	210.184	195.954	238.995
p-value	0.000	0.000	0.000	0.000	0.000

Note: Variable definitions are provided in Table 1.

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In Table 4, we compute the Pearson correlations between each pair of regression variables to test for potential multicollinearity issues in our regressions. The results show that the correlation between the variables is not particularly high (<0.6). We also examine whether multiple variables can explain the variation in one variable using variance inflation factors (VIF). We find no evidence of multicollinearity.

Table 4. Correlation matrix of pairs of variables

Variable	*ANS*	*ANS_L1*	*SMI*	*RQI*	*REG*	*P2*	*RPG*	*FDI*	*MMI*	*GDP*	*SSE*
ANS	0.32**										
ANS_L1	0.83***										
SMI	0.01	0.01									
RQI	–0.21*	–0.20*	0.49**								
REG	–0.08	–0.08	0.41**	0.50**							
POLIT2	–0.08	–0.06	0.11	0.28*	0.18						
RPG	–0.07	–0.08	–0.07	–0.02	–0.36**	0.18*					
FDI	–0.10	–0.12*	0.10	0.26*	–0.06	0.06	0.65**				
MMI	–0.08	–0.08	0.41**	0.50**	1.00	0.18*	–0.36*	–0.06			
GDP	–0.03	–0.05	0.02	0.09	–0.06	0.06	0.62**	0.67***	–0.06		
SSE	–0.14*	–0.14*	0.24*	0.32**	0.07	0.16*	0.38**	0.54**	0.07	0.36**	
TRO	0.05	0.06	0.119	0.20*	0.07	–0.11	–0.22*	–0.06	0.07	–0.51***	0.12

Note: Variable definitions are provided in Table 1.

Table 5 shows the GMM regression results for sustainable development. As predicted, we find a statistically significant positive coefficient for the *MII* in Specification (1). We find that all the individual components of market-supporting institutions in Specifications (2)–(5) have a statistically significant positive coefficient. These findings strongly support the critical role of market-supporting institutional policies in achieving sustainable development.

The market-supporting institution that shows the strongest economic relationship with sustainable development is market-legitimizing institutions (*POLIT2*). A one standard deviation increase in *POLIT2* is associated with a 0.22 standard deviation increase in sustainable development (*ANS*).[4] The next strongest economic relationship is with market-stabilizing institutions (*SMI*) and market-regulating institutions (*REG*). A one standard deviation increase in *SMI* and *REG* is associated with 0.19 and 0.16 standard deviation increases in sustainable development (*ANS*), respectively. Market-creating institutions (*RQI*) have the smallest economic impact on sustainable development; a one standard deviation increase in *RQI* is associated with a 0.08 standard deviation increase in sustainable development (*ANS*).

Table 5. Generalized method of moments (GMM) results for sustainable development

Variables	(1)	(2)	(3)	(4)	(5)
ANS_L1	0.403***	0.328***	0.432***	0.063	0.047***
	(0.033)	(0.041)	(0.027)	(0.048)	(0.017)
MII	0.574***	---	---	---	---
	(0.058)				
SMI	---	0.092***	---	---	---
		(0.028)			
RQI	---	---	0.150*	---	---
			(0.080)		
REG	---	---	---	0.136**	---
				(0.053)	
POLIT2	---	---	---	---	0.036***
					(0.020)
RPG	0.128	0.103**	0.165***	0.187***	0.295***
	(0.102)	(0.043)	(0.041)	(0.054)	(0.034)
GDP	0.024	0.116**	0.126*	0.088	0.041
	(0.059)	(0.051)	(0.067)	(0.129)	(0.099)
FDI	−0.137***	0.041*	−0.037*	0.077***	0.068***
	(0.032)	(0.023)	(0.020)	(0.024)	(0.026)
SSE	- 0.338***	−0.823***	−0.522***	−1.016***	−1.063***

[4] To compute the economic effect, we multiply the standard deviation of *POLIT2* (5.23) with the regression coefficient on *POLIT2* (0.036) and then divide by the standard deviation of *ANS* (0.84) (i.e., 0.22 = 5.23*0.036/0.84).

	(0.113)	(0.071)	(0.112)	(0.138)	(0.199)
TRO	0.067	0.0437***	0.527***	0.311***	0.831***
	(0.065)	(0.122)	(0.099)	(0.093)	(0.151)
Constant	2.240***	1.807***	0.433	3.356***	2.319*
	(0.679)	(0.536)	(0.365)	(0.605)	(1.234)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
AR_1 (p-value)	0.028	0.025	0.029	0.016	0.041
AR_2 (p-value)	0.538	0.246	0.676	0.375	0.995
Hansen test (p-value)	0.633	0.819	0.757	0.795	0.969
Observations	467	536	507	697	697
Constants	40	40	40	42	42

Note: Variable definitions are provided in Table 1. Standard errors are presented in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

We find a positive and statistically significant relationship between RPG and sustainable development, thereby supporting the resource conservation hypothesis (Güney, 2019; Kamoun et al., 2019). This finding suggests that RPG promotes sustainable development by replacing fossil fuel as the dominant energy source. Twidell (2021) argued that renewable energy technology helps reduce pollution and ensures sustainable energy supplies. In economic terms, Specification (2) shows that a one standard deviation increase in RPG is associated with a 0.26 standard deviation increase in sustainable development (*ANS*).[5]

Although our findings for *FDI* and economic growth (*GDP*) are mixed, we find strong evidence that TRO has a direct positive impact on sustainable development. This finding supports the argument that trade promotes efficient green technologies for future generations. TRO may have a positive impact on sustainability by restricting low environmental standard industries, putting less strain on natural endowments, and even assisting in the restructuring of local industry. Many environmentalists and dependence theorists argue that open trade benefits developing countries, and our findings back up their claims. Shahbaz et al. (2014) noted that TRO positively impacts the domestic economic structure, including technology diffusion, economies of scale, and production factors, through compound effects. Meanwhile, Onifade et al. (2021) argued that open trade promotes the spread of technology, which is critical for sustainable development in developing countries.

Across the regression specifications, we find a consistent negative impact of SSE on sustainable development. This finding contradicts our argument that secondary school education

[5] To compute the economic effect, we multiply the standard deviation of *RPG* (2.16) with the regression coefficient on *RPG* (0.103) and then divide by the standard deviation of *ANS* (0.84) (i.e., 0.26 = 2.16*0.103/0.84).

builds environment-conscious behavior in students from childhood, thereby promoting young people's understanding of the global impact of local actions. However, this element of secondary education may be missing in our sample of developing countries, which negatively affects sustainable development in these economies (Moussa, 2020). Our findings are consistent with Pigou's (1938) public interest theory on resource welfare outcomes.

Table 6 presents the results of the indirect impact of FDI on the relationship between market-supporting institutions and sustainable development. The interaction terms of FDI coefficient with all market-supporting institutions (*MII*, *SMI*, *RQI*, *REG*, and *POLIT2)* are positive. This finding suggests that FDI inflows help promote sustainable development by improving market-supporting institutions' quality in the target country. Foreign multinational corporations (MNCs) arguably play a vital role in upgrading the developing countries' legislative and institutional market infrastructure. Additionally, local companies benefit from them as partners. Furthermore, foreign MNCs may have bargaining power with local governments, thereby enabling them to formulate market rules and regulations by improving policy implementation and enhancing the legal system and environment.

The interaction term between *FDI* and *RPG* is also positive and statistically significant, thereby supporting the notion that FDI promotes local adoption of renewable power generation by developing energy-efficient technologies. RPG, through new foreign business investment in green investment projects in developing countries, has a positive impact on sustainability (Kamoun et al., 2019; Giannetti et al., 2020).

Table 6. GMM results of the indirect effect of FDI on sustainable development

Variables	(1)	(2)	(3)	(4)	(5)	(6)
ANS_L1	0.603** (0.29)	−0.042** (0.007)	0.439*** (0.029)	5.353*** (0.200)	7.446*** (0.186)	7.502*** (0.186)
MII	0.208*** (0.032)	---	---	---	---	---
*MII*FDI*	0.025** (0.014)	---	---	---	---	---
SMI	---	0.600** (0.290)	---	---	---	---
*SMI*FDI*	---	0.570*** (0.190)	---	---	---	---
RQI	---	---	0.115 (0.070)	---	---	---
*RQI*FDI*	---	---	0.065** (0.030)	---	---	---
REG	---	---	---	0.094* (0.053)	---	---

*REG*FDI*	---	---	---	1.924*** (0.640)	---	---
POLIT2	---	---	---	---	−0.603 (0.390)	---
*POLIT2*FDI*	---	---	---	---	0.536*** (0.184)	---
RPG	0.059 (0.085)	0.890** (0.41)	0.132*** (0.042)	0.480 (0.402)	0.193** (0.097)	0.379** (0.192)
*RPG*FDI*	---	---	---	---	---	0.076*** (0.011)
FDI	0.215 (0.361)	0.341 (0.361)	0.043** (0.007)	0.010 (0.015)	0.038*** (0.007)	0.472 (0.400)
GDP	0.190* (0.103)	0.570*** (0.190)	0.247*** (0.054)	1.924*** (0.655)	−0.665** (0.285)	0.721** (0.288)
SSE	−0.043*** (0.007)	7.763*** (0.19)	−0.600*** (0.088)	0.577** (0.267)	−0.057*** (0.012)	0.480 (0.500)
TRO	0.890*** (0.41)	0.391 (0.258)	0.542*** (0.240)	0.176 (0.609)	−0.665** (0.285)	0.720*** (0.288)
Constant	1.2611 (2.490)	5.60*** (1.071)	0.839** (0.340)	4.805 (7.760)	1.626 (2.410)	2.710 (2.450)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
AR1 (p-value)	0.026	0.046	0.033	0.05	0.041	0.057
AR2 (p-value)	0.36	0.243	0.57	0.748	0.71	0.73
Hansen test (p-value)	0.68	0.82	0.61	0.542	0.47	0.95
Observations	461	520	501	668	521	682
Constants	40	40	40	42	40	42

Note: Variable definitions are provided in Table 1. Standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The results of the indirect role of *GDP* in the relationship between market-supporting institutions and sustainable development are provided in Table 7. We observe a positive coefficient in the interaction terms of *GDP* with *MII*, *SMI*, *RQI*, *REG*, and *POLIT2*. These findings imply that economic growth strengthens the link between market-supporting institutions and sustainable development. According to Banerjee and Iyer (2005) and Aixalá and Fabro (2008), a region's economic growth can improve the government's financial ability to effectively regulate market-supporting institutions, which is critical for sustainable development.

We also find empirical evidence that economic growth promotes sustainable development through RPG. This implies that improving a country's economic conditions may encourage renewable energy production, with substantial spillover effects on the country's sustainable development (Tabrizian, 2019).

Table 7. GMM results of the indirect effect of GDP on sustainable development

Variables	(1)	(2)	(3)	(4)	(5)	(6)
ANS_L1	5.444*** (0.199)	4.344*** (0.199)	5.126*** (0.197)	5.419*** (0.203)	4.264*** (0.180)	5.482*** (0.230)
MII	0.261* (0.147)	---	---	---	---	---
*MII*GDP*	4.264*** (0.187)	---	---	---	---	---
SMI	---	−0.111** (0.057)	---	---	---	---
*SMI*GDP*	---	0.261* (0.147)	---	---	---	---
RQI	---	---	−0.261* (0.15)	---	---	---
*RQI*GDP*	---	---	0.061** (0.020)	---	---	---
REG	---	---	---	0.557* (0.290)	---	---
*REG*GDP*	---	---	---	0.050* (0.030)	---	---
POLIT2	---	---	---	---	−1.161* (0.662)	---
*POLIT2*GDP*	---	---	---	---	0.053** (0.020)	---
RPG	0.360*** (0.085)	0.210*** (0.058)	0.153*** (0.045)	0.060 (0.074)	0.169*** (0.050)	0.48*** (0.100)
*RPG*GDP*	---	---	---	---	---	0.070** (0.024)
FDI	−0.230*** (0.035)	0.200*** (0.025)	1.161* (0.66)	0.150** (0.06)	0.251** (0.141)	0.160*** (0.020)
GDP	6.940 (0.200)	1.200*** (1.290)	0.104** (0.040)	6.940*** (0.200)	0.384 (0.747)	0.117 (0.889)
SSE	−0.260** (0.030)	−1.600*** (0.251)	−0.557*** (0.190)	−1.880*** (0.162)	−1.428*** (0.180)	0.660*** (0.171)
TRO	0.914*** (0.279)	0.306*** (0.0963)	0.110** (0.035)	0.306*** (0.0953)	0.915*** (0.273)	2.818 (1.995)
Constant	0.341*** (0.067)	0.626*** (0.190)	0.61*** (0.200)	0.338*** (0.090)	0.0879 (0.173)	0.814 (1.792)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
AR1 (p-value)	0.037	0.005	0.046	0.056	0.051	0.022
AR2 (p-value)	0.540	0.420	0.682	0.785	0.894	0.731
Hansen (p-value)	0.69	0.87	0.80	0.52	0.782	0.86
Observations	477	560	520	502	656	697
Number of constants	40	40	40	42	42	42

Note: Variable definitions are provided in Table 1. Standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

5.2. Feasible generalized least squares (FGLS) results

To check the robustness of our empirical results, we conduct additional analysis by replacing the dynamic SYS-GMM method with the static cross-sectional time-series FGLS regression method, which does not allow for the inclusion of a lagged dependent variable among the set of predictors. Tables 8–10 show the estimation results. The signs and significance of the coefficients of the market-supporting institution variables are consistent with the SYS-GMM results. Furthermore, the coefficient of the interaction terms of *FDI* and *GDP* with all market-supporting institutions remains positive. RPG is positively associated with sustainable development in most specifications. To summarize, our findings indicate that our GMM results are largely robust with this alternative estimation method.

Table 8. Feasible generalized least squares (FGLS) results of sustainable development

Variables	(1)	(2)	(3)	(4)	(5)
MMI	0.086**	---	---	---	---
	(0.042)				
SMI	---	0.027	---	---	---
		(0.024)			
POLIT2	---	---	0.016***	---	---
			(0.006)		
RQI	---	---	---	0.315***	---
				(0.081)	
REG	---	---	---		0.415***
					(0.090)
RPG	–0.024	0.001	–0.003	–0.023	–0.031
	(0.026)	(0.025)	(0.021)	(0.023)	(0.025)
FDI	–0.077**	–0.076**	–0.084***	–0.066**	–0.075**
	(0.032)	(0.032)	(0.027)	(0.031)	(0.041)
GDP	0.124***	0.0781**	0.0745**	0.111***	0.211***
	(0.037)	(0.038)	(0.034)	(0.035)	(0.05)
SSE	–0.211*	–0.169	–0.056	–0.136	–0.306
	(0.113)	(0.108)	(0.089)	(0.106)	(0.16)
TRO	0.355***	0.233**	0.174*	0.346***	0.356***
	(0.113)	(0.115)	(0.096)	(0.105)	(0.15)
Constant	1.100*	1.364**	1.433***	0.810	0.710
	(0.649)	(0.640)	(0.518)	(0.614)	(0.514)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	467	536	697	507	480
Constants	40	40	42	40	40

Note: Variable definitions are provided in Table 1. Standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.10.

Table 9. FGLS results of the indirect effect of FDI on sustainable development

Variables	(1)	(2)	(3)	(4)	(5)	(6)
MMI	–0.075*	---	---	---	---	---
	(0.050)					
*MMI*FDI*	0.025*	---	---	---	---	---
	(0.030)					
SMI	---	0.048	---	---	---	---
		(0.014)				
*SMI*FDI*	---	0.021***	---	---	---	---
		(0.002)				

RQI	---	---	0.275*** (0.094)	---	---	---
*RQI*FDI*	---	---	0.200** (0.055)	---	---	---
REG				0.043*** (0.007)		
*REG*FDI*	---	---	---	0.005*** (0.006)	---	---
POLIT2	---	---	---	---	0.897** (0.416)	---
*POLIT2*FDI*	---	---	---	---	0.007*** (0.009)	---
RPG	−1.138*** (0.431)	0.793*** (0.190)	0.642** (0.290)	0.455*** (0.166)	1.285** (0.640)	0.0225** (0.008)
*RPG*FDI*	---	---	---	---	---	0.006*** (0.008)
FDI	0.603** (0.293)	0.578*** (0.293)	0.480*** (0.190)	0.897** (0.410)	0.0430*** (0.00781)	0.611*** (0.183)
GDP	0.043*** (0.007)	0.053*** (0.008)	0.517** (0.260)	1.285** (0.648)	0.517** (0.260)	0.600*** (0.180)
SSE	−0.39*** (0.110)	−0.120 (0.108)	−1.470** (0.656)	−0.180** (0.080)	0.008 (0.083)	0.021** (0.008)
TRO	0.420** (0.280)	0.290** (0.440)	0.560** (0.101)	0.150 (0.091)	−0.0815 (0.090)	−0.065 (0.074)
Constant	2.512*** (0.534)	2.059*** (0.508)	1.499*** (0.320)	2.244*** (0.584)	0.014*** (0.003)	−0.055 (0.080)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	460	526	517	687	697	690
Constants	40	40	40	42	42	42

Note: Variable definitions are provided in Table 1. Standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.10.

Table 10. FGLS results of the indirect effect of GDP on sustainable development

Variables	(1)	(2)	(3)	(4)	(5)	(6)
MII	0.151* (0.230)	---	---	---	---	---
*MII*GDP*	4.140*** (0.270)	---	---	---	---	---
SMI	---	−0.211** (0.067)	---	---	---	---
*SMI*GDP*	---	0.310* (0.107)	---	---	---	---
RQI	---	---	−0.161* (0.250)	---	---	---
*RQI*GDP*	---	---	0.051** (0.030)	---	---	---
REG	---	---	---	0.550* (0.390)	---	---
*REG*GDP*	---	---	---	0.060* (0.080)	---	---

POLIT2	---	---	---	---	1.261* (0.562)	---
*POLIT2*GDP*	---	---	---	---	0.030** (0.080)	---
RPG	−0.011 (0.025)	0.310*** (0.040)	0.163*** (0.025)	0.070 (0.084)	0.190*** (0.020)	0.280*** (0.500)
*RPG*GDP*	---	---	---	---	---	0.080** (0.034)
FDI	−0.300*** (0.014)	0.300*** (0.015)	1.110* (0.55)	0.180** (0.08)	0.351** (0.10)	0.100*** (0.030)
GDP	0.043*** (0.003)	0.025*** (0.008)	0.104** (0.040)	0.089*** (0.026)	0.206* (0.114)	0.270 (0.500)
SSE	0.040*** (0.012)	1.710*** (0.450)	−0.400*** (0.290)	−1.680*** (0.262)	−1.580*** (0.280)	0.700*** (0.271)
TRO	0.810*** (0.150)	0.450*** (0.076)	0.310** (0.060)	0.201*** (0.093)	0.814*** (0.350)	2.810 (1.600)
Constant	2.412*** (0.634)	2.090*** (0.608)	1.990*** (0.420)	2.250*** (0.680)	0.017*** (0.008)	−0.057 (0.090)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	497	521	623	688	680	695
Constants	40	40	42	42	42	42

Note: Variable definitions are provided in Table 1. Standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.10.

5.3. Alternative proxy for sustainability

To test the robustness of our findings, we replace *ANS* with the wellbeing index (*WBI*), keeping Brundtland's definition of sustainability in mind. The WBI is based on complementary components that reflect a subset of the 17 UN SDGs, such as environmental sustainability metrics, carbon dioxide emissions per capita, energy consumption (kg of oil equivalent per capita), forest area (percent of land), health expenditures, and public education spending, as well as human development components (see Costanza et al., 2016). A higher WBI value means higher sustainability.

The estimation results provided in Tables 11–13 are based on the GMM approach. The regression results remain largely intact when we replace *ANS* with the *WBI* as the proxy for sustainable development. We find a positive coefficient for *RPG*, *MII*, *SMI*, *RQI*, *REG*, and *POLIT2*, thereby suggesting that renewable power generation and all types of market-supporting institutions promote wellbeing. Furthermore, we find the coefficient of the interaction terms of *FDI* and *GDP* with market-supporting institutions to be mostly positive. This is consistent with the notion that *FDI* and *GDP* indirectly promote wellbeing by improving market-supporting institutions. We also find a positive coefficient of the interaction term of *RPG* with *FDI* and

GDP, thereby suggesting that *FDI* and *GDP* indirectly improve wellbeing by promoting renewable power generation.

Table 11. GMM results using the wellbeing index (WBI)

Variables	(1)	(2)	(3)	(4)	(5)
WBI_L1	0.190*	0.236	0.0250*	–0.781***	1.609
	(0.103)	(0.181)	(0.0145)	(0.295)	(2.538)
MII	0.740***	---	---	---	---
	(0.048)				
SMI	---	0.082***	---	---	---
		(0.048)			
RQI	---	---	0.140*	---	---
			(0.090)		
RPG	---	---	---	0.160**	---
				(0.083)	
POLIT2	---	---	---	---	0.056***
					(0.010)
RPG	0.130	0.203**	0.150***	0.167***	0.215***
	(0.20)	(0.033)	(0.061)	(0.064)	(0.054)
GDP	0.040	0.110**	0.160*	0.078	0.051
	(0.069)	(0.041)	(0.057)	(0.120)	(0.089)
FDI	–0.120***	0.051*	–0.027*	0.057***	0.080***
	(0.012)	(0.010)	(0.040)	(0.034)	(0.046)
SSE	- 0.300***	–0.813***	–0.422***	–1.020***	–1.083***
	(0.123)	(0.061)	(0.212)	(0.158)	(0.299)
TRO	0.077	0.0337***	0.627***	0.411***	0.731***
	(0.055)	(0.322)	(0.089)	(0.083)	(0.251)
Constant	3.240***	1.705***	0.533	3.250***	2.210*
	(0.879)	(0.630)	(0.205)	(0.705)	(1.430)
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
AR_1 (p-value)	0.038	0.035	0.039	0.026	0.051
AR_2 (p-value)	0.438	0.46	0.76	0.75	0.95
Hansen test (p-value)	0.52	0.71	0.57	0.95	0.99
Observations	461	521	521	660	689
Constants	40	40	40	42	42

Note: Variable definitions are provided in Table 1. Standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 12. GMM results of the indirect effect of FDI on the WBI

Variables	(1)	(2)	(3)	(4)	(5)	(6)
WBI_L1	0.601**	–0.050**	0.590***	5.53***	7.56***	7.602***
	(0.370)	(0.080)	(0.039)	(0.300)	(0.280)	(0.080)
MII	0.108***	---	---	---	---	---
	(0.052)					
*MII*FDI*	0.015**	---	---	---	---	---
	(0.024)					
SMI	---	0.700**	---	---	---	---
		(0.090)				

*SMI*FDI*	---	0.450*** (0.290)	---	---	---	---
RQI	---	---	0.250 (0.060)	---	---	---
*RQI*FDI*	---	---	0.075** (0.020)	---	---	---
REG	---	---	---	0.080* (0.020)	---	---
*REG*FDI*	---	---	---	−1.820*** (0.740)	---	---
POLIT2	---	---	---	---	−0.403 (0.200)	---
*POLIT2*FDI*	---	---	---	---	0.430*** (0.284)	---
RPG	0.090 (0.095)	0.790** (0.510)	0.320*** (0.052)	0.500 (0.502)	0.183** (0.080)	0.279** (0.102)
*RPG*FDI*	---	---	---	---	---	0.056*** (0.025)
FDI	0.150 (0.451)	0.441 (0.251)	0.050** (0.017)	0.020 (0.005)	0.048*** (0.009)	0.572 (0.300)
GDP	0.290* (0.09)	0.370*** (0.290)	0.350*** (0.064)	1.824*** (0.755)	−0.550** (0.185)	0.720** (0.288)
SSE	−0.030*** (0.017)	7.730*** (0.190)	−0.500*** (0.098)	0.770** (0.670)	−0.070*** (0.024)	0.450 (0.600)
TRO	0.890*** (0.410)	0.591 (0.100)	0.534*** (0.340)	0.150 (0.590)	−0.750** (0.500)	0.820*** (0.188)
Constant	1.161 (2.590)	5.700*** (1.010)	0.839** (0.340)	4.050 (7.060)	1.600 (2.210)	2.100 (2.150)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
AR_1 (p-value)	0.060	0.060	0.030	0.040	0.059	0.070
AR2 (p-value)	0.360	0.243	0.570	0.748	0.710	0.910
Hansen test (p-value)	0.68	0.82	0.51	0.64	0.57	0.87
Observations	461	521	521	650	210	582
Constants	40	40	40	42	40	40

Note: Variable definitions are provided in Table 1. Standard errors are in parentheses *** p < 0.01, ** p < 0.05, * p < 0.10.

Table 13. GMM results of the indirect effect of GDP on the WBI

Variables	(1)	(2)	(3)	(4)	(5)	(6)
WBI_L1	6.344*** (0.199)	7.780*** (0.190)	0.190* (0.103)	0.236 (0.181)	0.025* (0.014)	−0.218 (0.360)
MII	0.251* (0.100)	---	---	---	---	---
*MII*GDP*	4.400*** (0.177)	---	---	---	---	---
SMI	---	−0.211** (0.045)	---	---	---	---
*SMI*GDP*	---	0.210* (0.106)	---	---	---	---
RQI	---	---	−0.151* (0.240)	---	---	---
*RQI*GDP*	---	---	0.050** (0.030)	---	---	---
REG	---	---	---	0.457* (0.290)	---	---
*REG*GDP*	---	---	---	0.045* (0.025)	---	---
POLIT2	---	---	---	---	−2.110* (0.220)	---
*POLIT2*GDP*	---	---	---	---	0.050** (0.020)	---
RPG	0.26*** (0.095)	0.310*** (0.045)	0.253*** (0.025)	0.070 (0.054)	0.160*** (0.050)	0.370*** (0.20)
*RPG*GDP*	---	---	---	---	---	0.060** (0.034)
FDI	−0.200*** (0.045)	0.300*** (0.050)	1.161* (0.660)	0.250** (0.006)	0.300** (0.141)	0.260*** (0.030)
GDP	5.940 (0.300)	2.200*** (1.109)	0.200** (0.050)	6.840*** (0.100)	0.840 (0.240)	0.700 (0.190)
SSE	−0.160** (0.050)	−1.500*** (0.151)	−0.550*** (0.190)	−1.980*** (0.020)	−1.420*** (0.100)	0.760*** (0.267)
TRO	0.914*** (0.279)	0.306*** (0.096)	0.110** (0.035)	0.306*** (0.095)	0.915*** (0.273)	2.818 (1.995)
Constant	0.341*** (0.067)	0.626*** (0.190)	0.610*** (0.200)	0.338*** (0.090)	0.087 (0.173)	0.814 (1.792)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
AR_1 (p-value)	0.037	0.005	0.046	0.056	0.051	0.022
AR_2 (p-value)	0.540	0.420	0.682	0.785	0.894	0.731
Hansen (p-value)	0.69	0.87	0.80	0.52	0.78	0.86
Observations	477	560	520	502	656	697
Constants	40	40	40	42	42	42

Note: Variable definitions are provided in Table 1. Standard errors are in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

5.4. Theoretical and practical implications

This study's findings hold several potential policy implications for promoting sustainable development in developing countries. First, governments should accelerate their country's clean energy transition by implementing a strategy that encourages investment in green technology. Second, to achieve sustainable development, governments must improve the quality and efficiency of market-supporting institutions. Third, to green their economies, governments should implement policies that encourage FDI in the country to boost support for green projects and technology transfer and help improve the quality of the country's market-supporting institutions.

6. Conclusion

The topics of renewable energy generation, market-supporting institutions, and economic development are well documented in the existing sustainability literature. We merged these studies in our analysis by capturing the partial effect of RPG and market-supporting institutions on sustainable development. We applied SYS-GMM to a panel data sample for 42 developing countries from 1990 to 2018. We find that RPG and market-supporting institutions are critical for sustainable development. Furthermore, FDI and economic growth play important roles in driving the relationship between market institutional quality and sustainable development. Through market-supporting institutions and RPG, FDI and economic growth have an indirect impact on sustainable development.

Various studies in the existing literature have discussed the role of institutions in sustainable development and RPG before project implementation (e.g., Azam et al., 2021). However, to our knowledge, there is a dearth of research on developing economies in this field. This study extensively covers the renewable energy production perspective for sustainable development in relation to other dimensions, which is critical for industrial investment. We also thoroughly investigated the significance of different market institutions by exploring the impact of RPG in detail. This research will likely help governments, stakeholders, and policymakers achieve sustainable production and development by adopting suitable financial taxation rules and social safety networks.

References

Aixalá, J., Fabro, G., 2008. Does the impact of institutional quality on economic growth depend on initial income level? *Econ. Affairs*. 28(3), 45-49. https://doi:10.1111/j.1468-0270.2008.00844.x

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Rev. Econ. Stud.* 58(2), 277-297. https://doi:10.2307/2297968

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. *J Econ.* 68(1), 29-51. https://doi:10.1016/0304-4076(94)01642-D

Ashford, N.A., Hall, R.P., 2011. The importance of regulation-induced innovation for sustainable development. *Sustainability*. 3(1), 270-292. https://doi:10.3390/su3010270

Asif, M., Muneer, T., 2007. Energy supply, its demand and security issues for developed and emerging economies. *Renew. Sustain. Energy Rev.* 11(7), 1388-1413. https://doi:10.1016/j.rser.2005.12.004

Asif, M., Khan, K.B., Anser, M.K., Nassani, A.A., Abro, M.M.Q., Zaman, K., 2020. Dynamic interaction between financial development and natural resources: Evaluating the 'Resource curse' hypothesis. *Resources Policy*. 65, 101566. https://doi:10.1016/j.resourpol.2019.101566

Aust, V., Morais, A.I., Pinto, I., 2020. How does foreign direct investment contribute to Sustainable Development Goals? Evidence from African countries. *J. Cleaner Prod.* 245, 118823. https://doi:10.1016/j.jclepro.2019.118823

Azam, M., Liu, L., Ahmad, N., 2021. Impact of institutional quality on environment and energy consumption: Evidence from developing world. *Environ. Dev. Sustainability*. 23(2), 1646-1667. https://doi: 10.1007/s10668-020-00644-x

Banerjee, A., Iyer, L., 2005. History, institutions, and economic performance: The legacy of colonial land tenure systems in India. *Amer. Econ. Rev.* 95(4), 1190-1213. https://doi:10.1257/0002828054825574

Bengtsson, M., Alfredsson, E., Cohen, M., Lorek, S., Schroeder, P., 2018. Transforming systems of consumption and production for achieving the sustainable development goals: Moving beyond efficiency. *Sustainability Sci.* 13(6), 1533-1547. https://doi:10.1007/s11625-018-0582-1

Bhattarai, M., Hammig, M., 2004. Governance, economic policy, and the environmental Kuznets curve for natural tropical forests. *Environ. Dev. Econ.* 9(3), 367-382. https://doi:10.1017/S1355770X03001293

Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. *J. Econometrics*. 87(1), 115-143. https://doi:10.1016/S0304-4076(98)00009-8

Cheng, B., Qiu, B., Chan, K.C., Zhang, H., 2022. Does a green tax impact a heavy-polluting firm's green investments? *Applied Econ.* 54(2), 1-17. https://doi:10.1080/00036846.2021.1963663

Cherif, R., Hasanov, F., Pande, A., 2021. Riding the energy transition: Oil beyond 2040. *Asian Econ. Policy Rev.* 16(1), 117-137. https://doi:10.1111/aepr.12317

Costanza, R., Daly, L., Fioramonti, L., Giovannini, E., Kubiszewski, I., Mortensen, L.F.,... Wilkinson, R., 2016. Modelling and measuring sustainable wellbeing in connection with the UN Sustainable Development Goals. *Ecol. Econ.* 130, 350-355. https://doi:10.1016/j.ecolecon.2016.07.009

Das, K., Quirk, T., 2016. Which institutions promote growth? Revisiting the evidence. *Econ. Papers.* 35(1), 37-58. https://doi:10.1111/1759-3441.12128

Demena, B.A., Afesorgbor, S.K., 2020. The effect of FDI on environmental emissions: Evidence from a meta-analysis. *Energy Policy.* 138, 111192. https://doi:10.1016/j.enpol.2019.111192

Destek, M.A., Sinha, A., 2020. Renewable, non-renewable energy consumption, economic growth, trade openness and ecological footprint: Evidence from organisation for economic Co-operation and development countries. *J. Cleaner Prod.* 242, 118537. https://doi:10.1016/j.jclepro.2019.118537

Gallagher, K.P., Zarsky, L., 2007. *The enclave economy: Foreign investment and sustainable development in Mexico's Silicon Valley*. The MIT Press, Cambridge.

Geng, D., Liu, J., Zhu, Q., 2017. Motivating sustainable consumption among Chinese adolescents: An empirical examination. *J. Cleaner Prod.* 141, 315-322. https://doi:10.1016/j.jclepro.2016.09.113

Giannetti, B.F., Agostinho, F., Eras, J.C., Yang, Z., Almeida, C.M.V.B., 2020. Cleaner production for achieving the sustainable development goals. *J. Cleaner Prod.* 271, 122127. https://doi:10.1016/j.jclepro.2020.122127

Goron, C., Cassisa, C., 2017. Regulatory institutions and market-based climate policy in China. *Global Environ. Polit*. 17(1), 99-120. https://doi.org/10.1162/GLEP_a_00392

Güney, T., 2019. Renewable energy, non-renewable energy and sustainable development*.* *Int. J. Sustain. Dev. World Ecol.* 26(5), 389-397. https://doi:10.1080/13504509.2019.1595214

Jalilian, H., Kirkpatrick, C., Parker, D., 2007. The impact of regulation on economic growth in developing countries: A cross-country analysis. *World Dev.* 35(1), 87-103. https://doi:10.1016/j.worlddev.2006.09.005

Joshi, Y., Rahman, Z., 2017. Investigating the determinants of consumers' sustainable purchase behaviour. *Sustain. Prod. Cons.* 10, 110-120. https://doi: 10.1016/j.spc.2017.02.002

Kaimuri, B., Kosimbei, G., 2017. Determinants of sustainable development in Kenya. *J. Econ. Sustain. Dev.* 8(24), 17-36.

Kamoun, M., Abdelkafi, I., Ghorbel, A., 2019. The impact of renewable energy on sustainable growth: Evidence from a panel of OECD countries. *J. Knowl. Econ.* 10(1), 221-237. https://doi:10.1007/s13132-016-0440-2

Kellenberg, D.K., 2009. An empirical investigation of the pollution haven effect with strategic environment and trade policy. *J. Inter. Econ.* 78(2), 242-255. https://doi:10.1016/j.jinteco.2009.04.004

Koirala, B.S., Pradhan, G., 2020. Determinants of sustainable development: Evidence from 12 Asian countries. *Sustain. Dev.* 28(1), 39-45. https://doi:10.1002/sd.1963

Lehtonen, M., 2004. The environmental–social interface of sustainable development: Capabilities, social capital, institutions. *Ecol. Econ.* 49(2), 199-214. https://doi:10.1016/j.ecolecon.2004.03.019

Mahat, H., Hashim, M., Nayan, N., Saleh, Y., Haron, S.M.S., 2017. Sustainable consumption practices of students through practice oriented approach of education for sustainable development. *Int. J. Acad. Res. Bus. Soc. Sci*. 7(6), 703-720.

Moussa, N., 2020. Effects of quality education on sustainability in developing countries, in: Al-Sartawi, A.M.A., Hussainey, K., Hannoon, H., Hamdan, A. (Eds.), *Global Approaches to Sustainability Through Learning and Education*. IGI Global, pp. 69-77. https://doi:10.4018/978-1-7998-0062-0.ch005

Mulvaney, D., 2020. Energy and the environment I: Fossil Fuels, in: Mulvaney, D. (Ed.), *Sustainable Energy Transitions*. Palgrave Macmillan, Cham, pp. 81-108. https://doi:10.1007/978-3-030-48912-0_4

Nassani, A.A., Abro, M.M.Q., Batool, R., Shah, S.H.A., Hyder, S., Zaman, K., 2021. Go-for-green policies: The role of finance and trade for sustainable development. *Int. J. Fin. Econ.* 26(1), 1409-1423.

Nathaniel, S., Khan, S.A.R., 2020. The nexus between urbanization, renewable energy, trade, and ecological footprint in ASEAN countries. *J. Cleaner Prod.* 272, 122709. https://doi:10.1016/j.jclepro.2020.122709

Onifade, S.T., Erdoğan, S., Alagöz, M., Bekun, F.V., 2021. Renewables as a pathway to environmental sustainability targets in the era of trade liberalization: Empirical evidence from Turkey and the Caspian countries. *Environ. Sci. Pollution Res.* 1-12. https://doi:10.1007/s11356-021-13684-1

Organization for Economic Cooperation and Development (OECD), 2010. Regulatory policy and the road to sustainable growth. OECD Publishing, Paris. https://www.oecd.org/regreform/policyconference/46270065.pdf (accessed 17 May 2022).

Østergaard, P.A., Duic, N., Noorollahi, Y., Mikulcic, H., Kalogirou, S., 2020. Sustainable development using renewable energy technology. *Renew. Energy*. 146, 2430-2437. https://doi:10.1016/j.renene.2019.08.094

Palmer, K., Burtraw, D., 2005. Cost-effectiveness of renewable electricity policies. *Energy Econ.* 27(6), 873-894. https://doi.org/10.1016/j.eneco.2005.09.007

Phimphanthavong, H., 2013. The impacts of economic growth on environmental conditions in Laos. *Int. J. Bus. Man. Econ. Res.* 4(5), 766-774.

Pigou, A., The Economics of Welfare, 4th ed. (London: Macmillan, 1938).

Report of the World Commission on Environment and Development (WCED), 1987. Our Common Future. Brundtland Report. https://www.are.admin.ch/are/en/home/media/publications/sustainable-development/brundtland-report.html (accessed 9 May 2022).

Rodrik, D., 2005. Growth strategies. *Handbook of Econ. Growth*. 1, pp. 967-1014. https://doi:10.1016/S1574-0684(05)01014-2

Shahbaz, M., Nasreen, S., Ling, C.H., Sbia, R., 2014. Causality between trade openness and energy consumption: What causes what in high, middle and low income countries. *Energy Policy*. 70, 126-143. https://doi:10.1016/j.enpol.2014.03.029

Sharma, R., Sinha, A., Kautish, P., 2021. Does renewable energy consumption reduce ecological footprint? Evidence from eight developing countries of Asia. *J. Cleaner Prod.* 285, p.124867. https://doi:10.1016/j.jclepro.2020.124867

Singh, N., Nyuur, R., Richmond, B., 2019. Renewable energy development as a driver of economic growth: Evidence from multivariate panel data analysis. *Sustainability.* 11(8), 2418. https://doi:10.3390/su11082418

Solangi, Y.A., Longsheng, C., Shah, S.A.A., 2021. Assessing and overcoming the renewable energy barriers for sustainable development in Pakistan: An integrated AHP and fuzzy TOPSIS approach. *Renew. Energy*. 173, 209-222. https://doi:10.1016/j.renene.2021.03.141

Tabrizian, S., 2019. Technological innovation to achieve sustainable development—Renewable energy technologies diffusion in developing countries. *Sustain. Dev.* 27(3), 537-544. https://doi:10.1002/sd.1918

Tan, Z., Wu, Y., Gu, Y., Liu, T., Wang, W., Liu, X., 2022. An overview on implementation of environmental tax and related economic instruments in typical countries. *J. Cleaner Prod.* 330, 129688. https://doi:10.1016/j.jclepro.2021.129688

Thacker, S., Adshead, D., Fay, M., Hallegatte, S., Harvey, M., Meller, H.,... Hall, J.W., 2019. Infrastructure for sustainable development. *Nature Sustainability*. 2(4), 324-331. https://doi:10.1038/s41893-019-0256-8

Twidell, J., 2021. Renewable energy resources, fourth ed. Routledge, London. https://doi.org/10.4324/9780429452161

United Nations Sustainable Development Goals (UNSDG), 2022. https://unric.org/en/united-nations-sustainable-development-goals/ (accessed 9 May 2022).

Vantamay, N., 2018. Investigation and recommendations on the promotion of sustainable consumption behavior among young consumers in Thailand. *Kasetsart J Soc. Sci.* 39(1), 51-58. https://doi:10.1016/j.kjss.2018.01.007

Ziolo, M., Fidanoski, F., Simeonovski, K., Filipovski, V., Jovanovska, K., 2017. Sustainable finance role in creating conditions for sustainable economic growth and development, in: Filho W.L., Pociovalisteanu, D-M., Al-Amin, A.Q. (Eds.), *Sustainable Economic Development*. A

Zuindeau, B., 2007. Régulation school and environment: Theoretical proposals and avenues of research. *Ecol. Econ.* 62(2), 281-290. https://doi:10.1016/j.ecolecon.2006.12.018

Appendix

Table A. List of countries

Albania	India	Paraguay
Argentina	Indonesia	Peru
Bangladesh	Jamaica	Philippines
Brazil	Jordan	Romania
Bulgaria	Kenya	Russia
Cameroon	Malawi	Senegal
China	Malaysia	Sri Lanka
Colombia	Mali	Tanzania
Dominican Republic	Mexico	Thailand
Ecuador	Morocco	Togo
Egypt	Namibia	Tunisia
Ghana	Nicaragua	Turkey
Guatemala	Nigeria	Uganda
Honduras	Pakistan	Venezuela