Economic policy for sustainable development: role of monetary policy, fiscal policy and regulatory policy

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Economic policy for sustainable development: role of monetary policy, fiscal policy and regulatory policy

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Abstract

This study empirically examines the effect of economic policy on sustainable development using annual data for 22 countries from 2011 to 2018. The study also proffers some economic policy strategies for increasing the level of sustainable development. In the empirical analysis, a sustainable development index was constructed comprising of SDG proxy indicators: healthcare expenditures to GDP ratio (SDG3), percentage of people using safely managed drinking water services (SDG6) and the share of renewable energy to final total energy consumption (SDG7). The results show that the economic policy index has a significant positive effect on the sustainable development index particularly in non-European countries and in developing countries and a negative effect in European countries and developed countries. Changes in monetary policy, fiscal policy and regulatory policy have a significant impact on the level of sustainable development. Expansionary monetary policy via increase in broad money to GDP ratio increases the attainment of SDG6 while contractionary monetary policy via increase in central bank interest rate increases the attainment of SDG7. Expansionary fiscal policy via increase in consumer spending leads to the attainment of SDG3 and SDG7 but it adversely affects the attainment of SDG6. Effective regulatory policy via increase in institutional governance quality increases the attainment of SDG3 and SDG6. There is uni-directional causality between economic policy and sustainable development. Monetary policy and regulatory policy also have a uni-directional relationship with sustainable development, implying that changes in monetary and regulatory policies cause changes in the level of sustainable development. This study is the first to empirically examine the contribution of economic policy to sustainable development using composite indices.

Keywords: sustainable development, economic policy, monetary policy, fiscal policy, regulatory policy, strategies

JEL code: G01, G21, G28, M4, Q02, Q28, Q25.

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1. Introduction

The United Nations emphasize that achieving the sustainable development goals (SDGs) will ensure that the present and future generations will have equal resource base to meet their needs (Brundtland Commission, 1987). Most SDG activities and projects are aimed at placing a constraint on present consumption so that future generations can have sufficient resource base to meet their needs (Daly, 2006). The significant increase in SDG activities and projects in many developed countries have led to growing interest in the determinants of sustainable development in the literature, and academics have continued to search for a wide range of determinants or factors that can accelerate the attainment of the sustainable development goals. Several SDG determinants have been identified in the literature. They include technological innovations, energy security, financial innovations, etc. (Doğan et al, 2023; Østergaard et al, 2020; Chishti and Sinha, 2022). But limited attention has been paid to economic policy as a potential determinant of sustainment development.

In recent years, there have been increasing calls for governments to support the attainment of the sustainable development goals (Sachs et al, 2019; Ilyas et al, 2020). This call arose from the realization that private sector agents cannot bear the full responsibility for the SDGs alone. This is due to the difficulty or inability of private sector agents to influence policy decisions in a significant way, the many regulations that affect them, their excessive focus on short-term profits and the presence of other private interests that coincide with the public interest motive of the sustainable development agenda (Waygood, 2011; Emblemsvåg, 2013; Janicka et al, 2021). While different opinions or perspectives exist on how governments can support the attainment of the SDGs, little attention has been paid to sound economic policy as a factor contributing to the realization of the sustainable development goals.

This study makes a strong case for the use of economic policy to achieve the SDGs. Economic policy is the use of various government policy tools to achieve some desired economic outcomes (Persson and Tabellini, 2004; Hodson and Mabbett, 2009). Economic policy broadly consists of monetary policy, fiscal policy, and regulatory policy (Baker et al, 2016). Economic policy is important for sustainable development for two reasons. One, sound economic policy – whether monetary policy, fiscal policy, or regulatory policy – will create an enabling economic environment for economic activities to thrive including SDG activities and projects.

Two, sound economic policy can influence the flow of money supply and credit, the pattern of expenditures and the behavior of economic agents in ways that accelerate the attainment of the sustainable development goals. For instance, monetary policy can influence the direction or flow of money and credit to activities that are beneficial for the environment and society. Fiscal policy can influence individuals and business to spend money in ways that benefit society and the environment while regulatory policy can influence the behavior of economic agents to ensure that their behavior is pro-sustainability. Given the importance of economic policy for sustainable development, there is a need to examine the effect of economic policy on sustainable development and explore some economic policy strategies that can support the realization of the sustainable development goals.

Existing studies have not paid much attention to the role of economic policy in promoting sustainable development. Although few studies such as Kamal et al (2021), Ahmad and Satrovic (2023), and Chishti et al (2021) examined government support for the SDGs through fiscal policy and monetary policies, these studies did not consider the important channels of monetary policy, and fiscal policy transmission, such as central bank interest rate, broad money to GDP, consumer spending and the share of tax revenue to GDP. The lack of knowledge on how these economic policy transmission tools affect the level of sustainable development makes it important to investigate the effect of economic policy on the level of sustainable development, and to suggest some economic policy strategies for achieving the SDGs. Therefore, this study extends the literature by, first, establishing an empirical relationship between economic policy and sustainable development; and second, by offering some economic policy strategies for achieving the sustainable development goals. The central argument in this article is that sound economic policy – whether monetary policy, fiscal policy, or regulatory policy – will create an enabling environment for SDG activities to thrive and it will provide incentives for individuals and businesses to undertake SDG-linked activities and projects that accelerate the realization of the sustainable development goals. This is the fundamental premise in this study. To the best of our knowledge, this study is the first study to empirically examine the relationship between sustainable development and economic policy in terms of its three components: fiscal policy, monetary policy, and regulatory policy.

Turning to the empirical analyses, a sample of twenty-two countries are analyzed using economic policy data and sustainable development data. A sustainable development index is

constructed using the principal component analysis (PCA) of three proxy indicators for SDG3, SDG6 and SDG7, while an economic policy index is constructed using the principal component analysis of the monetary policy indicators, the fiscal policy indicators, and the regulatory policy indicators. The findings show that economic policy has a significant positive impact on sustainable development, and changes in monetary policy, fiscal policy and regulatory policy have a significant impact on the level of sustainable development. Expansionary monetary policy increases the attainment of SDG6 while contractionary monetary policy increases the attainment of SDG7. Expansionary fiscal policy leads to the attainment of SDG3 and SDG7, but it adversely affects the attainment of SDG6. Regulatory policy effectiveness increases the attainment of SDG3 and SDG6.

The study contributes to the literature in several ways. The study is the first study to empirically examine the relationship between economic policy and sustainable development at a composite level. The study also contributes to the sustainable development literature that examine the role of economics in sustainable development (e.g., Munasinghe, 1993; Pearce et al, 2013; Nundy et al, 2021), but which have not captured the role of economic policy for sustainable development. Moreover, the study adds to the literature that examines the effect of economic policy on society at large (e.g., Persson and Tabellini, 2004; Jiang et al, 2019; Basheer et al, 2022). Our results confirm that sound economic policy is vital for attaining high levels of sustainable development. The results also emphasize the need for policymakers to develop sound economic policy frameworks that can support the realization of the sustainable development goals.

The rest of the paper is organized as follows. Section 2 presents the related literature. Section 3 describes the research design. Section 4 presents the discussion of results. Section 5 suggests some economic policy strategies for sustainable development. Section 6 presents the conclusion of the study.

2. Related Literature

A growing literature examined the role of government support in achieving the SDGs. Studies in this literature focus extensively on the environmental policies put in place by the government to achieve the SDGs. For instance, Hilson (2000) examined government policymaking in the sustainable development of the mining sector in Canada. Hilson (2000) pointed out that the Canadian government established regulations that played a central role in developing corporate environmental policies and management practices in the mining sector in Canada. In China, Zhang and Wen (2008) showed that the Chinese government provided policy support to achieve the SDGs by making changes in the structure of the economy, introducing policies for energy reform, developing the environmental industry, developing mechanisms to reduce pollution and encouraging ecological conservation. Ullah et al (2023) focused on the role of government incentives in Pakistan. In their study, they explored the role of government incentives (financial and non-financial) in influencing the association between green innovation and the SDGs among small and medium scale enterprises (SMEs) in Pakistan. They found that government financial and non-financial support strengthens the association between green innovation and environmental practices. The findings imply that the government should provide financial and non-financial incentives to SMEs to enable them to achieve the SDGs. In Poland, Kapera (2018) examined government support for the sustainable development of the tourism sector. The author undertook a survey of local governments and residents in Poland. The author found that most local governments acknowledge that they are committed to implementing tourism-related SDG programs, and they also state that they collaborate with residents in implementing the tourism-related SDG programs. However, the residents who participated in the survey state that their local government authority did not facilitate the exchange of knowledge and experiences gained from engaging in the tourism-related sustainable development programs. In a different study, Ilyas et al (2020) focused on private firms and argued that government support is needed to support the top management of firms in achieving the SDGs. Anwar et al (2020) argued that governments should also support not-for-profit organizations with financial and non-financial incentives. In their analysis, they found that government's non-financial incentives increased environmental quality, but it had an adverse effect on community development.

Other studies such as Vogel (2019), Othman et al (2020), Yahman and Setyagama (2023), Lehmann (2006), Alińska et al (2018), and Ashford and Hall (2011) analyzed government participation and its strategies for achieving the SDGs. For example, Vogel (2019) analyzed the effort of the government in achieving the SDGs in California, to determine why the government participates in SDG activities. The author noted that the government is actively involved in SDG activities to protect its attractive natural environment, to mitigate threats to environmental quality, to protect the natural environment where people live, and to support businesses who benefit from the State's environmental amenities. Othman et al (2020) considered the role of e-government innovation in achieving the SDGs. They analyzed several adopters of e-government innovations and found six factors that influence the adoption of e-government for sustainable development. The factors are policy factors, legal factors, organizational factors, collaboration, resources management and citizen engagement. In Indonesia, Yahman and Setyagama (2023) examined how government policy can support environmental development during periods where there are excessive focus on economic growth in Indonesia. They showed that economic growth which is supposed to benefit citizens leads to environmental degradation because it consumes a lot of natural and environmental resources. Therefore, they advocate that the government should introduce laws and regulations to regulate the use of natural resources to ensure that economic growth benefits the people without harming the environment in Indonesia. In contrast, Lehmann (2006) examined the case of Denmark and argued that rather than introducing many laws and regulations, it would be more appropriate to achieve the SDGs through dialogue and public–private partnerships that lead to the creation of an enabling environment that support the realization of the SDGs. Alińska et al (2018) examined the role of the public sector in sustainable development in Poland and argued that Poland needs huge financial resources to achieve its sustainable development goals, but the financial resources required to achieve the SDGs are enormous and the government alone cannot provide the resources. Therefore, the authors suggest that the government should seek the support of the financial sector in raising the financial resources that are needed to achieve the sustainable development goals. Ashford and Hall (2011) explored the complex relationship between environmental regulation, innovation, and sustainable development and argued that the difficulty in achieving the SDG is due to failure to design and implement policies that reinforce social and environment goals, and the failure to entrench economic and political interests that gain from

the present system. The authors further argued that the government should consider using industrial policy, environmental law and policy, and trade initiatives to address these failures and to stir society towards achieving the SDGs.

Some studies such as Arranz et al (2022), Husseina and Hamdanb (2020), Brusselaers et al (2022) and Ozili (2022) examined how economic policy affects the circular economy which contributes to sustainable development. de Melo et al (2022) pointed out that the circular economy is an alternative economic system that promotes the circulation, reuse, and recycling of materials while Kazancoglu et al (2021) showed that the circular economy achieves this by creating value through closed-loop systems, reverse logistics, product life cycle management, and clean production. Hill (2016) showed that countries are interested in 'circular economy' thinking especially in the UK, but interest in the circular economy in the UK has been driven mostly by political interest. Arranz et al (2022) identified some institutional pressures that affect the growth of circular economy in firms. They identified coercive pressures, mimetic behaviour and normative pressures as institutional pressures that affect the growth of circular economy in firms. Husseina and Hamdanb (2020) showed that even though the circular economy contributes to sustainable development, countries like Iraq are not interested in the circular economy, and its economic policy tools do not provide stimulus and financing for the transition to circular economic activities in Iraq. Brusselaers et al (2022) examined the economic policy impact of the growing circular economy measures adopted in Belgium. They focused on the impact of fiscal policies and found that fiscal policy tools can be used to steer an economy into a more circular direction which contributes to sustainable development. Ozili (2022) examined the potential use case of a central bank digital currency in the circular economy. The author showed that central bank digital currency can be used to serve fiscal policy purposes because it can be used to provide stimulus funding to support circular businesses during crises.

Few studies such as Kamal et al (2021), Chishti et al (2021), Dafermos et al (2018) and Sachs et al (2019) focused on the role of fiscal policy and monetary policy in achieving the SDGs. For example, Kamal et al (2021) argued that fiscal policy can create incentives for low carbon investment. In their analysis, they found that fiscal policy significantly increase environmental pollution which contradicts their argument. Ahmad and Satrovic (2023) examined whether governmental intervention limits or promotes environmental sustainability. They examined

the effectiveness of fiscal policy instruments, such as tax revenue and government expenditure, in moderating the influence of economic openness on electricity production and greenhouse gas production among the G7 countries from 1990 to 2019. They found that contractionary fiscal policy mitigates the effect of climate change on electricity production and greenhouse gas production. Chishti et al (2021) linked fiscal and monetary policies with carbon dioxide emission in BRICS countries from 1985 to 2014 and found that expansionary fiscal policy increases carbon emission while contractionary fiscal policy mitigate the adverse effects of carbon emission. They also found that expansionary monetary policy decreases environmental quality while contractionary monetary policy improves environmental quality. Dafermos et al (2018) examined the impact of climate change damages on the price of financial assets and the financial position of firms and banks. They examined a global sample of countries from 2016 to 2020. They found that climate change damages increase loan default, and it had an adverse effect on bank debt. It also caused a deflation in asset price. However, they showed that monetary policy, such as green quantitative easing (GQE), can help to reduce climate-induced financial instability. Sachs et al (2019) argued that finance is important for the development of infrastructure projects including energy projects, and that financial institutions need to provide green financing for green projects that provide environmental benefits. They also suggest that green financing should include fiscal policy, green central banking tools and green bonds, among others.

While the above studies have examined the role of government support through fiscal policy and monetary policies, these studies did not consider some important channels of monetary policy, fiscal policy, and regulatory transmission such as central bank interest rate, broad money to GDP, consumer spending and the share of tax revenue to GDP. The lack of knowledge on how these economic policy transmission tools affect the level of sustainable development makes it important to investigate the effect of economic policy on the level of sustainable development. The present study also fills a gap in the literature by suggesting some economic policy strategies for achieving the SDGs.

3. Research design

3.1. Data

The data were collected from the world development indicators (WDI), the global financial development indicators (GFDI) and the world governance indicators (WGI) of the World Bank (see table 1). Twenty-two countries were analyzed from 2011 to 2018. The sample period (2011-2018) was selected to cover only the non-crisis years – the periods in which global crises were absent. This allows us to focus on the real effect of economic policy on the level of sustainable development in good years. The 22 countries were selected because these countries had substantial available data for the empirical analysis. The excluded countries either had missing data or insufficient data observations. The countries in the sample include Argentina, Brazil, Cote d'Ivoire, Georgia, Ghana, India, Indonesia, Japan, Kenya, Korea Republic, Malaysia, Mexico, Nigeria, Pakistan, Philippines, Russian Federation, Singapore, Tanzania, Thailand, United Kingdom, United States and Vietnam. The sample is an unbalanced panel sample because some countries had missing data for some years.

Table 1. Variable description

Variable	*Indicator Name*	*Short definition*	*Source*
SDGI	Sustainable development index	The sustainable development index is derived from the principal component analysis of the SDG3, SDG6 and SDG7 variables	WDI, Author
SDG3	Good health and well-being	The proxy used is the healthcare expenditures to GDP ratio	WDI
SDG6	Clean water and sanitation	The proxy used is the percentage of people using safely managed drinking water services in the population	WDI
SDG7	Affordable and clean energy	The proxy used is the share of renewable energy to final total energy consumption	WDI
EPI	Economic policy index	The economic policy index is derived from the principal component analysis of the MP2, MP3, FP2, FP3 and ISI variables.	WDI, Author
MP2	Monetary policy indicator	Broad money to GDP ratio. It measures the level of money supply in the economy	WDI

MP3	Monetary policy indicator	Central bank interest rate	IMF International Financial Statistics
FP2	Fiscal policy indicator	Final consumption expenditure to GDP ratio	WDI
FP3	Fiscal policy indicator	Tax revenue to GDP ratio	WDI
ISI	Regulatory policy index	Average of the six world governance indicators, namely the voice and accountability index, political stability and absence of violence/terrorism index, government effectiveness index, control of corruption index, regulatory quality index and rule of law index.	WGI, Author
ZSCORE	Banking sector solvency risk	Measures the stability or solvency of the banking sector	GFDI
GDPR	Economic growth	Annual growth rate in real gross domestic product (GDP)	WDI

3.2. Justifying the variables

The dependent variable is the sustainable development index (SDGI) which is derived from the principal component analysis of the SDG3, SDG6 and SDG7 proxy variables. The three SDG proxy indicators were selected because previous studies have used these indicators to measure the level of sustainable development (see, for example, Anton and Nucu, 2020; Shahbaz et al, 2020; Brollo et al, 2021; Ozili, 2024). For instance, Brollo et al (2021) and Ozili and Iorember (2023) used the healthcare expenditures to GDP ratio as a proxy indicator to measure the attainment of SDG3 which reflects 'good health and well-being'. These studies argue that higher health expenditures relative to GDP will lead to higher provision of healthcare services and lead to positive health outcomes for society and which aligns with the sustainable development goals particularly SDG 3 'good health and well-being'. Regarding SDG6, previous studies, such as Fukuda et al (2019), Gizaw et al (2022) and Ozili and Iorember (2023), used the percentage of people using safely managed drinking water services in the population as an indicator to measure the attainment of SDG6 which reflects the provision of 'clean water and sanitation'. Their reasoning is that the provision of clean water and good sanitation leads to good health, and good health leads to a healthy population and a healthy society which aligns with the sustainable development goals particularly SDG 6 'clean water and sanitation' (Fukuda et al, 2019; Gizaw et al, 2022; Ozili and Iorember, 2023). Regarding

SDG7, existing studies such as Anton and Nucu (2020) and Shahbaz et al (2020) used the share of renewable energy to final total energy consumption as a proxy indicator to measure SDG7 which reflects the provision of 'affordable and clean energy'. Therefore, the share of renewable energy to final total energy consumption is used to measure SDG7 in this study.

The economic policy index is the explanatory variable of interest in the analyses. The economic policy index is derived from the principal component analysis of five variables which are two monetary policy variables (MP2 & MP3), two fiscal policy variables (FP2 & FP3) and one regulatory policy variable (ISI). The expectation is that effective economic policies – whether monetary policy, fiscal policy, or regulatory policy – will create an enabling economic environment that allows economic activities to thrive including activities and projects that contribute to the realization of the sustainable development goals. Therefore, a positive relationship between EPI and the level of sustainable development is predicted. Regarding the monetary policy variables, the MP2 variable is the broad money to GDP ratio. It measures the level of money supply in the economy. A high broad money to GDP ratio means an increase in money supply which is caused by the expansionary monetary policy decision of the monetary authority or the central bank (Jothr and Jummaa, 2023). Increase in money supply will ensure that there is enough money in circulation to support all economic activities including SDG activities and projects. Therefore, a positive relationship between MP2 and the level of sustainable development is predicted. The MP3 variable is the central bank interest rate. The central bank interest rate is the interest rate upon which all other interest rates are anchored (Sims and Wu, 2021). A low MP3 variable means a decrease in the central bank interest rate which is caused by the expansionary monetary policy decision of the monetary authority or the central bank (Sims and Wu, 2021). A decrease in the central bank interest rate will ensure that credit is cheaper so that banks can give out more loans to borrowers including SDG-linked borrowers. It will increase access to credit for SDG activities and projects and accelerate the realisation of the sustainable development goals. Therefore, a negative relationship between MP3 and the level of sustainable development is predicted. Regarding the fiscal policy variables, the FP2 variable is the final consumption expenditure to GDP ratio. The F2 variable is a fiscal policy proxy indicator because it measures the level of consumer spending in the economy. Fiscal policy is used to influence the level of consumer spending in the economy (López and Figueroa, 2016). An increase in final consumption expenditures

relative to GDP reflects increase in consumer spending. As consumer spending increases, a part of the spending will be channelled to SDG activities and projects. Therefore, a positive relationship between FP2 and the level of sustainable development is predicted. The FP3 variable is the tax revenue to GDP ratio. FP3 is a fiscal policy indicator. This variable is used as a proxy to measure government's ability to generate revenue from taxes. A high tax revenue to GDP ratio will decrease consumer spending (Zhou et al, 2023; López and Figueroa, 2016). As tax increases, consumer spending will decrease and spending towards to the SDGs will also decrease. This will have a detrimental impact on the level of sustainable development (López and Figueroa, 2016; Zhou et al, 2023). Therefore, a negative relationship between FP3 and the level of sustainable development is predicted. The regulatory policy variable, or the ISI variable, is the average of the six world governance indicators. The ISI variable captures the effectiveness of regulatory policy in the economy. It is argued that effective regulatory policy, which is facilitated by the presence of strong institutions, will lead to the enforcement of laws, policies and regulations that ensure the realization of the sustainable development goals for the benefit of people and society (Jahanger et al, 2022; Ozili and Iorember, 2023). Therefore, a positive relationship between regulatory policy and the level of sustainable development is expected.

Regarding the control variables, the ZSCORE variable controls for the stability or the solvency of the banking sector. The higher the ZSCORE, the more stable or solvent the banking sector is. Intuitively, if the banking sector is fragile or unstable (that is, having a low ZSCORE), banks will rather focus on their survival and will have little or no incentives to support the realization of the sustainable development goals at that time (Ozili and Iorember, 2023). Therefore, the stability of the banking system is a precondition for banks to provide credit facilities for SDG activities and projects; thus, a positive relationship between the ZSCORE and the level of sustainable development is predicted. We also control for the rate of economic growth (GDPR) because economic growth tends to have a complementary effect on the level of sustainable development. Negative economic growth will lead to a reduction in the level of investment in the economy. Investors will become cautious about investing in SDG-link projects during periods of negative economic growth due to fears of a prolonged recession and negative return on investment. This will have a detrimental impact on the level of sustainable development (Ozili and Iorember, 2023). Similarly, positive economic growth will

lead to increase in the level of investment in the economy. Investors will become optimistic about investing in SDG-link activities and projects during periods of positive economic growth. This will have a beneficial effect on the level of sustainable development.

3.3. The model

To estimate the impact of economic policy on the level of sustainable development, a model similar to the model used in Ozili and Iorember (2023) was employed. In the model, the level of sustainable development is a function of economic policy and some control variables, as shown below.

$$(SDGI)i,t = \beta 0 + \beta 1(EPI)i,t + \beta 2(ZSCORE)i,t + \beta 3(GDPR)i,t + ei,t \ldots\ldots\ldots Eq\ (1)$$

After breaking down the EPI variable into its individual components, the model is re-specified and shown in equation 2.

$$(SDGI)i,t = \beta 0 + \beta 1(MP2)i,t + \beta 2(MP3)i,t + \beta 3(FP2)i,t + \beta 4(FP3)i,t + \beta 5(ISI)i,t + \beta 6(GDPR)i,t + \beta 7(ZSCORE)i,t + ei,t \ldots\ldots\ldots Eq\ (2)$$

Where i, t represents country and year. SDGI = sustainable development index. EPI = economic policy index. MP2 = a monetary policy indicator, broad money to GDP ratio. MP3 = a monetary policy indicator, central bank interest rate. FP2 = a fiscal policy indicator, financial consumption expenditure to GDP ratio. FP3 = a fiscal policy indicator, tax revenue to GDP ratio. ISI = a regulatory policy index. ZSCORE = banking sector solvency risk. GDPR = economic growth rate. εit is the error term.

The descriptive statistic for the variables is reported in table 2. The median values are reported rather than the mean values due to the skewness in the data which would affect the mean values if reported. The economic policy index (EPI) is higher in Malaysia and the United Kingdom and is very low in Ghana and Tanzania during the period examined. SDGI has higher values in Vietnam and Kenya while it has lower values in Pakistan and Ghana. Also, SDG3 has higher values in the United States and the United Kingdom while it has lower values in Pakistan and Indonesia. SDG6 has higher values in Singapore and in the United Kingdom while it has lower values in Nigeria and Ghana. SDG7 has higher values in Tanzania and Nigeria while it has a lower value in Singapore. The Pearson correlation analysis in table 3 shows that the

explanatory variables and the dependent variables are significantly correlated. The EPI, MP2, FP3, ISI, ZSCORE variables are significant and positively correlated to the SDGI variable, indicating that sound economic policy, greater money supply, effective regulatory policy, a higher tax revenue and banking system stability are correlated with high levels of sustainable development. In contrast, the FP2, MP3 and GDPR variables are significant and negatively correlated to the SDGI variable, indicating that a decrease in consumer spending, a low central bank interest rate and low economic growth are correlated with high levels of sustainable development.

Table 2. Country-level and aggregate descriptive statistic for the variables

Countries	MP2	FP2	FP3	MP3	ISI	SDG3	GDPR	SDG6	SDG7	ZSCORE	EPI	SDGI
	Median	Median	Median	Median	Median	Median	Median	Median	Median	Median	Median	Median
Argentina	27.3	83.1	12.3	7.8	-0.2	9.7	0.6	-	9.3	7.6	-1.2	-
Brazil	84.9	82.9	13.8	10.5	-0.08	8.6	1.5	81.58	44.5	14.8	-0.2	0.2
Cote D'Ivoire	26.0	76.9	10.9	5.5	-0.6	3.5	7.2	34.8	68.4	16.01	-1.4	-2.1
Georgia	37.3	90.95	22.9	6.625	0.3	7.8	4.6	65.1	28.4	7.6	0.5	0.01
Ghana	25.5	82.1	11.6	18.5	0.04	4.1	6.7	32.2	46.3	12.7	-2.05	-1.59
India	77.4	69.0	10.9	7.75	-0.2	3.4	6.6	-	35.2	18.4	-0.4	-
Indonesia	39.2	66.3	10.7	6	-0.2	2.9	5.1	-	28.1	4.4	-0.7	-
Kenya	39.3	88.5	14.9	10	-0.5	5.3	4.7	-	73.6	21.3	-1.3	1.7
Korea, Rep.	134.2	64.6	13.9	1.75	0.7	6.5	3.1	98.5	2.6	11.4	2.1	-
Malaysia	133.3	66.3	14.4	3	0.3	3.6	5.2	93.5	3.2	18.4	61.7	1.2
Mexico	34.1	80.8	11.2	4.5	-0.2	5.5	2.7	42.2	9.2	19.6	-0.9	0.6
Nigeria	24.8	-	-	12.5	-1.1	3.3	3.4	19.6	82.3	14.2	-	-0.3
Pakistan	47.3	91.8	-	9.5	-1.0	2.7	4.7	36.2	46.3	12.2	-	-2.7
Philippines	69.7	83.3	13.0	3.75	-0.3	3.9	6.5	46.2	26.5	19.8	-0.2	-1.6
Russia	56.7	70.7	12.2	8.125	-0.7	5.2	1.8	75.6	3.2	7.05	-1.01	-0.8
Singapore	126.8	46.4	13.2	0.82	-0.05	3.9	4.2	100	0.6	24.1	1.7	0.5
Tanzania	22.3	74.6	11.0	14	-0.4	4.1	6.7	-	84.1	13.6	-1.9	0.9
Thailand	124.2	68.6	15.6	1.875	-0.2	3.6	3.2	#NUM!	22.8	8.9	1.2	-
United Kingdom	145.2	84.1	25.2	0.5	1.4	9.9	2.01	99.8	7.9	14.1	3.6	-
United States	89.1	82.1	10.7	0.255	1.2	16.3	2.3	96.3	9.1	33.8	1.4	1.5
Vietnam	92.1	67.5	-	6.5	-0.4	4.6	6.2	-	34.2	17.7	-	2.4
												-
Aggregate Stats:												
Median	59.48	78.07	12.95	6.25	-0.24	4.61	4.18	75.61	27.04	15.19	-0.46	0.22
Maximum	248.12	99.61	25.82	26.00	1.51	16.84	14.04	100.0	87.1	35.004	3.71	2.43
Minimum	20.01	44.46	7.57	-0.10	-1.17	2.34	-5.37	18.32	0.47	3.76	-3.41	-2.88
Std. Dev.	53.44	10.97	4.13	5.39	0.70	3.32	2.72	28.94	26.64	6.72	1.55	1.48
Observations	176	168	141	168	176	176	176	120	176	176	137	120

MP2 = a monetary policy indicator**,** broad money to GDP ratio. MP3 = a monetary policy indicator, central bank interest rate.

FP2 = a fiscal policy indicator, final consumption expenditure to GDP ratio. FP3 = a fiscal policy indicator, tax revenue to GDP ratio.

ISI = a regulatory policy index. ZSCORE = banking sector solvency risk. GDPR = economic growth rate. SDGI = sustainable development index.

EPI = economic policy index.

.

Table 3. Pearson correlation matrix

Variables	SDGI	EPI	SDG3	SDG6	SDG7	FP2	FP3	MP2	MP3	ISI	ZSCORE	GDPR
SDGI	1.000											

EPI	0.799***	1.000										
	(0.00)	-----										
SDG3	0.672***	0.386***	1.000									
	(0.00)	(0.00)	-----									
SDG6	0.910***	0.842***	0.441***	1.000								
	(0.00)	(0.00)	(0.00)	-----								
SDG7	-0.787***	-0.649***	-0.180*	-0.689***	1.000							
	(0.00)	(0.00)	(0.08)	0.00	-----							
FP2	-0.275***	-0.321***	0.361***	-0.497***	0.478***	1.000						
	(0.00)	(0.00)	(0.00)	0.00	0.00	-----						
FP3	0.235**	0.519***	0.145	0.274***	-0.128	0.260**	1.000					
	(0.02)	(0.00)	(0.16)	(0.00)	(0.21)	(0.01)	-----					
MP2	0.734***	0.880***	0.189*	0.883***	-0.635***	-0.542***	0.256**	1.000				
	(0.00)	(0.00)	(0.06)	(0.00)	(0.00)	(0.00)	(0.01)	-----				
MP3	-0.606***	-0.777***	-0.302***	-0.573***	0.559***	0.292***	-0.207**	-0.584***	1.000			
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.00)	-----			
ISI	0.729***	0.777***	0.696****	0.616***	-0.425***	0.120	0.453***	0.589***	-0.431***	1.000		
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.24)	(0.00)	(0.00)	(0.00)	-----		
ZSCORE	0.316***	0.189*	0.412***	0.195**	-0.157	-0.160	-0.443***	0.193*	-0.374***	0.242**	1.000	
	(0.00)	(0.06)	(0.00)	(0.05)	(0.13)	(0.12)	(0.00)	(0.06)	(0.00)	(0.01)	-----	
GDPR	-0.456***	-0.116	-0.405***	-0.399***	0.279***	0.064	0.015	-0.231**	-0.068	-0.162	-0.001	1.00000
	(0.00)	(0.26)	(0.00)	(0.00)	(0.00)	(0.53)	(0.88)	(0.02)	(0.51)	(0.11)	(0.99)	-----

P-values are reported in parenthesis. ***, **, * represent statistical significance at the 1%, 5% and 10% levels. The 2SLS Instruments are the lagged independent variables.

3.4. Estimation method

The two stage least squares (TSLS) method is the method used to estimate the model. The TSLS regression method addresses potential endogeneity issues that may arise when the explanatory variables are correlated with the error term (Cumby et al, 1983; Kelejian, 1971). The quantile regression is also used as a robustness test to validate the earlier results obtained using the 2SLS estimation. We re-estimate the model using the quantile regression method because quantile regression is less influenced by long tailed and skewed distributions which are typical in cross-country studies. Quantile regression also enables robust estimation when the variables are non-normally distributed and have nonlinear relationships with the predictor variables (Koenker, 2005). In our study, a 0.5 quantile (or 50^{th} percentile) is used in the estimation. This means that 50 percent of the data points are less than the value of the median. Previous studies have used the quantile method when investigating topics related to sustainable development (see, for example, Liu et al, 2022; Hung, 2023; Yan et al, 2019).

4. Discussion of results

4.1. Effect of economic policy on the level of sustainable development

This section presents the baseline empirical result for the effect of economic policy on the level of sustainable development. The 2SLS result is reported in column 1 of table 4. The EPI variable is significant and positively related to the SDGI variable. This result indicates that the economic policy index has a significant positive effect on the sustainable development index. This implies that a sound economic policy will lead to positive improvement in the level of sustainable development. This result is supported by Chishti et al (2021) who show that economic policy, such as expansionary monetary policy, leads to better sustainability outcomes. In terms of economic significance, the EPI coefficient shows that a 1 percent increase in economic policy effectiveness will increase the level of sustainable development by 0.546 percent. Regarding the control variables, the ZSCORE variable reports a significant positive relationship with the SDGI variable. This result is consistent with Ozili and Iorember (2023) who show that a stable banking system is a precondition for banks to provide credit for SDG-linked activities and projects. The GDPR variable reports a significant negative

relationship with the SDGI variable. This result is contrary to the expectation that economic growth has a complementary effect on sustainable development as documented in Ozili and Iorember (2023).

4.2. Sensitivity/Robustness tests

4.2.1. Unbundling the indexes

This section unbundles the economic policy index and the sustainable development index into their individual components to examine the impact of each economic policy variable on each sustainable development variable using the model below.

$$(SDG3, SDG6, SDG7)i,t = \beta 0 + \beta 1(MP2)i,t + \beta 2(MP3)i,t + \beta 3(FP2)i,t + \beta 4(FP3)i,t + \beta 5(ISI)i,t + \beta 6(GDPR)i,t + \beta 7(ZSCORE)i,t + ei,t \dots\dots\dots Eq\ (3)$$

First, we examine the effect of each economic policy variable on the sustainable development index. The result of this estimation is shown in column 2 of table 4. Thereafter, we examine the effect of each economic policy variable on each sustainable development dependent variable. The result of this estimation is shown in columns 3, 4 and 5 of table 4. The results in column 2 of table 4 show that the MP3 and FP2 variables have a significant negative effect on the sustainable development index. The result indicates that a decrease in the central bank interest rate and a decrease in consumer spending increase the level of sustainable development. The negative MP3 coefficient confirms the expectation that a decrease in the central bank interest rate will ensure that credit is cheaper so that banks can give out more loans to SDG-linked borrowers. The low central interest rate will increase access to credit for SDG activities and projects and accelerate the realisation of the sustainable development goals. This result is supported by Sims and Wu (2021) and Schmidt et al (2019). Meanwhile, the ISI variable has a significant positive effect on the sustainable development index in column 2. The result indicates that regulatory policy effectiveness leads to increase in the level of sustainable development. The positive ISI coefficient confirms the expectation that an effective regulatory policy will lead to the enforcement of laws, policies and regulations that ensure the realization of the sustainable development goals for the benefit of people and society. This result is consistent with the findings of Jahanger et al (2022) and Ozili and Iorember (2023). However, the MP2, FP3 and ZSCORE variables are insignificant while the

GDPR variable reports a negative effect of economic growth on the level of sustainable development which is contrary to the expectation of a positive coefficient sign for the GDPR variable.

Regarding the effect of each economic policy variable on each sustainable development dependent variable, reported in columns 3 to 5 in table 4, the results show that the MP2 variable has a significant positive effect on the SDG3 and SDG6 dependent variables. This result indicates that a high broad money to GDP ratio leads to increase in good health and well-being and it also improves the provision of clean water and sanitation. This result is consistent with Chishti et al (2021) who show that monetary policy has a significant effect on sustainable development outcomes. The MP3 variable has a significant negative effect on the SDG3 and SDG6 dependent variables and it also has a significant negative effect on the SDG7 dependent variable. The result indicates that a low central bank interest rate decreases good health and wellbeing, decreases the provision of clean water and sanitation, and it improves the provision of affordable and clean energy. The FP2 variable has a significant positive effect on the SDG3 and SDG7 dependent variables and it also has a significant negative effect on the SDG6 dependent variable. The result indicates that increase in consumer spending increases good health and wellbeing, promotes greater provision of affordable and clean energy, but it decreases the provision of clean water and sanitation. This result is consistent with Kamal et al (2021) and Chishti et al (2021) who show that fiscal policy has a significant effect on sustainable development outcomes. The FP3 variable has a significant negative effect on the SDG3 dependent variable. The result indicates that a low tax to GDP ratio leads to a decrease in good health and well-being. This result supports Kamal et al (2021) and Chishti et al (2021) who show that fiscal policy has a significant effect on sustainable development outcomes. The ISI variable has a significant positive effect on the SDG3 and SDG6 dependent variables and it also has a significant negative effect on the SDG7 dependent variables. The result indicates that higher regulatory policy effectiveness increases good health and wellbeing, increases the provision of clean water and sanitation, and decreases the provision of affordable and clean energy.

Table 4. Effect of economic policy on sustainable development

Two-stage least squares estimation (2SLS) regression

Variable	(1)	(2)	(3)	(4)	(5)
	SDGI	SDGI	SDG3	SDG6	SDG7
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
C	0.149 (0.36)	2.397*** (0.00)	4.470*** (0.00)	95.953*** (0.00)	-48.052*** (0.00)
EPI	0.546*** (0.00)				
MP2		0.002 (0.53)	0.026*** (0.00)	0.261*** (0.00)	-0.027 (0.69)
MP3		-0.065*** (0.00)	-0.143*** (0.00)	-0.574** (0.02)	1.882*** (0.00)
FP2		-0.019** (0.01)	0.085*** (0.00)	-0.559* (0.00)	0.490** (0.02)
FP3		-0.006 (0.75)	-0.105** (0.04)	0.533 (0.15)	0.614 (0.26)
ISI		1.003*** (0.00)	3.671*** (0.00)	9.994*** (0.00)	-14.147*** (0.00)
ZSCORE	0.030*** (0.00)	0.004 (0.76)	0.085*** (0.00)	-0.006 (0.97)	0.596** (0.01)
GDPR	-0.163*** (0.00)	-0.160*** (0.00)	-0.480*** (0.00)	-2.275*** (0.00)	2.633*** (0.00)
Adjusted R^2		82.43	78.54	85.97	54.85
F-Statistic	369.68	63.34	72.14	82.44	16.97
Pr (LR Statistic)	0.000	0.000	0.000	0.000	0.000
Instrument rank		8	8	8	8

P-values are reported in parenthesis. ***, **, * represent statistical significance at the 1%, 5% and 10% levels. The 2SLS Instruments are the lagged independent variables.

4.2.2. Robustness test using quantile estimation

In this section, the initial results are re-estimated using the quantile regression estimation method to address any potential outliers in the data. The results are considered robust if the coefficients in the quantile regression estimation is consistent with the results obtained in the 2SLS estimation. The quantile regression estimation is reported in table 5. The EPI variable remains positively significant in relation to the SDGI dependent variable both in the quantile and 2SLS estimations. This indicates that the result is robust, and it confirms that a sound economic policy has a positive effect on the level of sustainable development.

The MP2 variable also remains positively significant in relation to the SDG6 dependent variable both in the quantile and 2SLS estimations. This indicates that the result is robust, and it confirms that greater money supply, in terms of higher broad money to GDP ratio, has a significant positive impact on the provision of clean water and sanitation. This result is consistent with Chishti et al (2021) who show that fiscal policy has a significant effect on sustainable development outcomes. The MP3 variable also remains negative and significant in relation to the SDGI dependent variable, and it also remains positively significant in relation to the SDG7 dependent variable both in the quantile and 2SLS estimations. This indicates that the result is robust, and it confirms that a decrease in central bank interest rate increases the level of sustainable development even though it adversely affects the provision of affordable and clean energy. The FP2 variable also remains negatively significant in relation to the SDGI and SDG6 dependent variables and it also remains positively significant in relation to the SDG3 and SDG7 dependent variables both in the quantile and 2SLS estimations. This indicates that the result is robust, and it confirms that an increase in consumer spending adversely affects the provision of clean water and sanitation, but it improves the provision of good health and well-being and affordable clean energy. This result is consistent with Kamal et al (2021) who show that fiscal policy has a significant effect on sustainable development outcomes. The FP3 variable does not have a robust significant effect on the SDG variables. The GDPR variable also remains negatively significant in relation to the SDGI, SDG3 and SDG6 dependent variables and it also remains positively significant in relation to the SDG7 dependent variable both in the quantile and 2SLS estimations. This indicates that the result is robust, and it confirms that positive GDP growth adversely affects good health and wellbeing and the provision of clean water and sanitation, but it improves the provision of affordable and clean energy. The

ZSCORE variable also remains positively significant in relation to the SDGI and SDG3 dependent variables both in the quantile and 2SLS estimations. This indicates that the result is robust, and it confirms that a stable banking sector is a precondition for progress in sustainable development and this result is consistent with the findings of Ozili and Iorember (2023).

Table 5. Robustness test for the effect of economic policy on sustainable development: Quantile regression estimation

Variable	(1)	(2)	(3)	(4)	(5)
	SDGI	SDGI	SDG3	SDG6	SDG7
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
C	0.229 (0.36)	1.286 (0.17)	5.283*** (0.00)	95.367*** (0.00)	-43.013** (0.05)
EPI	0.554*** (0.00)				
MP2		0.002 (0.45)	-0.024** (0.02)	0.227*** (0.00)	0.022 (0.80)
MP3		-0.045*** (0.00)	-0.061 (0.41)	-0.353 (0.44)	1.643*** (0.00)
FP2		-0.018*** (0.00)	0.048** (0.02)	-0.589*** (0.00)	0.569** (0.02)
FP3		0.015 (0.50)	-0.021 (0.83)	0.524 (0.28)	0.094 (0.84)
ISI		1.132*** (0.00)	3.325*** (0.00)	11.992*** (0.00)	-8.455 (0.16)
ZSCORE	0.019 (0.18)	0.033*** (0.00)	0.095* (0.07)	0.394 (0.12)	0.143 (0.57)
GDPR	-0.154*** (0.00)	-0.142*** (0.00)	-0.522*** (0.00)	-2.669*** (0.00)	2.448* (0.06)
Pseudi-R^2	60.78	64.44	45.64	64.61	37.75
Quasi-LR statistic	227.74	329.99	168.86	220.08	106.81

P-values are reported in parenthesis. ***, **, * represent statistical significance at the 1%, 5% and 10% levels.

4.2.3. Granger causality test

A granger causality test is conducted in this section. We conduct an Augmented Dickey-Fuller (ADF) panel unit root test to check for the stationarity of the panel data for the relevant variables to avoid obtaining spurious causation. The ADF panel unit root test in table 6 shows that the panel data for the SDG3, EPI, FP3, MP2, MP3, ZSCORE and GDPR variables have p-values which are less than 5 percent. This indicates that the panel data for the seven variables do not have a unit root and are therefore stationary. In contrast, the panel data for the SDGI, SDG6, SDG7, FP2 and ISI variables have p-values which are greater than 5 percent. This indicates that the panel data for these variables have a unit root and are therefore non-stationary. As a result, there is a need to take the first difference of the panel data for five variables (SDGI, SDG6, SDG7, FP2 and ISI) before conducting the Granger causality test.

Table 6. Summary of Augmented Dickey-Fuller (ADF) Unit root test for the variables

Time series data	t-statistic	p-value	Decision rule: (If P>0.5, data has unit root and is non-stationary)	Remark
SDGI	30.23	0.453	P>0.05; the data has a unit root	Data is non-stationary
SDG3	61.79	0.039**	P<0.05; the data does not have a unit root	Data is stationary
SDG6	13.796	0.465	P>0.05; the data has a unit root	Data is non-stationary
SDG7	39.055	0.683	P>0.05; the data has a unit root	Data is non-stationary
EPI	60.362	0.007***	P<0.05; the data does not have a unit root	Data is stationary
FP2	38.901	0.608	P>0.05; the data has a unit root	Data is non-stationary
FP3	53.183	0.032**	P<0.05; the data does not have a unit root	Data is stationary
MP2	70.327	0.007***	P<0.05; the data does not have a unit root	Data is stationary
MP3	68.103	0.004***	P<0.05; the data does not have a unit root	Data is stationary
ISI	47.507	0.332	P>0.05; the data has a unit root	Data is non-stationary
ZSCORE	72.589	0.004***	P<0.05; the data does not have a unit root	Data is stationary
GDPR	136.91	0.000***	P<0.05; the data does not have a unit root	Data is stationary

The results of the Granger causality test are reported in table 7. Only the significant and meaningful results are reported in this section. Table 7 shows that there is a uni-directional causality between the EPI and SDG3 variables. This indicates that a change in economic policy causes a change in the level of good health and well-being. There is also a uni-directional causality between the MP2 and SDG3 variables. This indicates that a change in money supply causes a change in the level of good health and well-being. There is also a uni-directional causality between the MP2 and SDG7 variables. This indicates that a change in money supply causes a change in the provision of affordable and clean energy. Similarly, there is a uni-directional causality between the ISI and SDG7 variables. This indicates that a change in regulatory policy causes a change in the provision of affordable and clean energy. Furthermore, there is a uni-directional causality between the GDPR and SDG7 variables. This indicates that a change in economic growth causes a change in the provision of affordable and clean energy. There is bi-directional causality between the GDPR and SDG3 variables. This indicates that a change in economic growth causes a change in the level of good health and wellbeing, and a change in the level of good health and well-being causes a change in economic growth.

Table 7. Pairwise Granger Causality Tests

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.	Causality Decision
EPI does not Granger Cause SDG3	101	5.0473	0.0082	Prob<5%; there is granger causality
SDG3 does not Granger Cause EPI		0.0447	0.9563	Prob>5%; No granger causality
MP2 does not Granger Cause SDG3	132	4.0734	0.0193	Prob<5%; there is granger causality
SDG3 does not Granger Cause MP2		0.6757	0.5106	Prob>5%; No granger causality
MP3 does not Granger Cause SDG3	122	3.0143	0.0529	Prob>5%; No granger causality
SDG3 does not Granger Cause MP3		0.3534	0.7030	Prob>5%; No granger causality
ZSCORE does not Granger Cause SDG3	132	0.5598	0.5727	Prob>5%; No granger causality
SDG3 does not Granger Cause ZSCORE		3.2555	0.0418	Prob<5%; there is granger causality
GDPR does not Granger Cause SDG3	132	11.3175	0.00003	Prob<5%; there is granger causality
SDG3 does not Granger Cause GDPR		12.4455	0.00001	Prob<5%; there is granger causality
GDPR does not Granger Cause D(SDG6)	75	0.0608	0.9410	Prob>5%; No granger causality
D(SDG6) does not Granger Cause GDPR		2.3073	0.1070	Prob>5%; No granger causality
EPI does not Granger Cause D(SDG7)	84	2.5307	0.0860	Prob>5%; No granger causality
D(SDG7) does not Granger Cause EPI		3.4589	0.0363	Prob<5%; there is granger causality
D(FP2) does not Granger Cause D(SDG7)	105	1.0785	0.3440	Prob>5%; No granger causality
D(SDG7) does not Granger Cause D(FP2)		5.7187	0.0045	Prob<5%; there is granger causality
MP2 does not Granger Cause D(SDG7)	110	3.6557	0.0292	Prob<5%; there is granger causality
D(SDG7) does not Granger Cause MP2		0.3351	0.7160	Prob>5%; No granger causality
MP3 does not Granger Cause D(SDG7)	101	0.4866	0.6162	Prob>5%; No granger causality
D(SDG7) does not Granger Cause MP3		4.9933	0.0086	Prob<5%; there is granger causality
D(ISI) does not Granger Cause D(SDG7)	110	4.4570	0.0139	Prob<5%; there is granger causality
D(SDG7) does not Granger Cause D(ISI)		0.7532	0.4733	Prob>5%; No granger causality
GDPR does not Granger Cause D(SDG7)	110	9.6360	0.0001	Prob<5%; there is granger causality
D(SDG7) does not Granger Cause GDPR		0.0918	0.9123	Prob>5%; No granger causality

4.2.4. Regional interaction effect of economic policy on sustainable development

Next, we conduct some regional interaction analyses using binary variables. We argue that regional differences may affect the relationship between economic policy and the level of sustainable development because most regions have a regional economic bloc, and the bloc often adopts a common economic policy framework (Moore and Rhodes, 1976). The common economic policy framework used in one region will differ from the economic policy framework used in other regions, thereby, leading to regional differences in economic policymaking. Therefore, we examine whether regional differences affect the relationship between economic policy and sustainable development. We introduce the AFF, ASS, ERR, NAFF, ASS and NERR binary variables into the model. The AFF binary variable takes the value of one if the country is an African country and zero otherwise. The ASS binary variable takes the value of one if the country is an Asian country and zero otherwise. The ERR binary variable takes the value of one if the country is a European country and zero otherwise. The NAFF binary variable takes the value of one if the country is a non-African country and zero otherwise. The NASS binary variable takes the value of one if the country is a non-Asian country and zero otherwise. The NERR binary variable takes the value of one if the country is a non-European country and zero otherwise. The six regional binary variables are interacted with the SDGI variable to determine their joint effect on the level of sustainable development in the six regions. The result is reported in table 8. Of all the interaction results, only the ERR*EPI and the NERR*EPI variables are statistically significant in both the 2SLS and quantile regression estimations. This indicates that the result is robust. The significant negative sign on the ERR*EPI coefficient in columns 1 and 2 implies that sound economic policy has a significant negative impact on the level of sustainable development in the European countries. Meanwhile, the significant positive sign on the NERR*EPI coefficient in columns 3 and 4 implies that sound economic policy has a significant positive impact on the level of sustainable development in the non-European countries in the sample. The result for the AFF*EPI, NAFF*EPI, ASS*EPI and NASS*EPI interaction variables are not robust as they show different coefficient signs in the 2SLS and quantile regression estimations.

Table 8. Regional effect of economic policy on sustainable development: 2SLS and quantile regression estimations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variable	2SLS	QR	2SLS	QR	2SLS	QR	2SLS	QR	2SLS	QR	2SLS	QR
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
C	-0.464*** (0.00)	-0.012 (0.97)	0.422*** (0.00)	0.761*** (0.00)	0.196 (0.22)	0.166 (0.52)	-0.458 (0.41)	-1.487*** (0.00)	0.109 (0.51)	0.049 (0.86)	-0.390 (0.15)	-0.346 (0.51)
EPI	0.651*** (0.00)	0.632*** (0.00)	0.207*** (0.00)		0.434*** (0.00)	0.439*** (0.00)	0.527** (0.02)	0.009 (0.96)	0.563*** (0.00)	0.572*** (0.00)	0.726*** (0.00)	0.735*** (0.00)
ERR	0.886*** (0.00)	0.773*** (0.00)										
ERR*EPI	-0.444*** (0.00)	-0.399*** (0.00)										
NERR			-0.886*** (0.00)	-0.773*** (0.00)								
NERR*EPI			0.444*** (0.00)	0.399*** (0.00)								
AFF					-0.655 (0.19)	-1.653*** (0.00)						
AFF*EPI					0.093 (0.68)	-0.431** (0.04)						
NAFF							0.655 (0.19)	1.653*** (0.00)				
NAFF*EPI							-0.093 (0.68)	0.431** (0.03)				
ASS									-0.500** (0.01)	-0.395 (0.18)		
ASS*EPI									0.163 (0.15)	0.162 (0.19)		
NASS											0.500** (0.01)	0.395 (0.19)
NASS*EPI											-0.163 (0.15)	-0.162 (0.19)
ZSCORE	0.052*** (0.00)	0.034 (0.12)	0.052*** (0.00)	0.035 (0.12)	0.030*** (0.00)	0.019 (0.25)	0.030*** (0.00)	0.019 (0.25)	0.034*** (0.00)	0.029 (0.14)	0.034*** (0.00)	0.029 (0.15)
GDPR	-0.139*** (0.00)	-0.186*** (0.00)	-0.139*** (0.00)	-0.186*** (0.00)	-0.128*** (0.00)	-0.105** (0.02)	-0.128*** (0.00)	-0.105** (0.02)	-0.145*** (0.00)	-0.136*** (0.00)	-0.145*** (0.00)	-0.135*** (0.00)
Adjusted R^2	90.05		90.05		82.81		82.81		80.84		80.84	
F-statistic	169.38		169.38		90.58		90.58		79.49		79.49	
Pseudi-R^2		68.89		68.89		60.98		60.98		60.82		60.82
Quasi-LR statistic		265.99		265.98		224.08		224.08		277.93		277.93

P-values are reported in parenthesis. ***, ** represent statistical significance at the 1%, and 5% levels. The 2SLS instruments are the lagged independent variables.

4.2.5. Classification according to developed, developing or emerging market country status

Finally, we perform some interaction analyses based on the level of development of the countries in the sample. These analyses are important because differences in the level of development may influence the relationship between economic policy and the level of sustainable development. To capture this effect, we introduce the DC, NDC, EME and NEME binary variables into the model. The DC binary variable takes the value of one if the country is a developed country and zero otherwise. The NDC binary variable takes the value of one if the country is a developing country and zero otherwise. The EME binary variable takes the value of one if the country is an emerging market country and zero otherwise. The NEME binary variable takes the value of one if the country is a non-emerging market country and zero otherwise. The four binary variables are interacted with the SDGI variable to examine their joint effect on the level of sustainable development. The result is reported in table 9. Of all the interaction results, only the DC*EPI and the NDC*EPI variables are statistically significant in both the 2SLS and quantile regression estimations. This indicates that the result is robust. The significant negative sign on the DC*EPI coefficient in columns 1 and 2 implies that sound economic policy has a significant negative impact on the level of sustainable development in developed countries. Meanwhile, the significant positive sign on the NDC*EPI coefficient in columns 3 and 4 implies that sound economic policy has a significant positive impact on the level of sustainable development in developing countries. The result for the EME*EPI and NEME*EPI interaction variables are not robust as they show different coefficient signs in the 2SLS and the quantile regression estimations.

Table 9. Further interaction analysis based on level of development: 2SLS and quantile regression estimations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variable	2SLS	QR	2SLS	QR	2SLS	QR	2SLS	QR
	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)	Coefficient (p-value)
C	0.603*** (0.00)	0.384 (0.13)	2.441*** (0.00)	1.435*** (0.00)	-0.125 (0.51)	0.147 (0.60)	-0.002 (0.99)	0.169 (0.63)
EPI	0.587*** (0.00)	0.571*** (0.00)	-0.182 (0.19)	0.107 (0.32)	0.613*** (0.00)	0.571*** (0.00)	0.305*** (0.00)	0.487*** (0.00)
DC	1.837*** (0.00)	1.051*** (0.00)						
DC*EPI	-0.769*** (0.00)	-0.464*** (0.00)						
NDC			-1.837*** (0.00)	-1.051*** (0.00)				
NDC*EPI			0.769*** (0.00)	0.465*** (0.00)				
EME					0.124 (0.30)	0.022 (0.91)		
EME*EPI					-0.308*** (0.00)	-0.084 (0.53)		
NEME							-0.124 (0.30)	-0.022 (0.91)
NEME*EPI							0.308*** (0.00)	0.084 (0.53)
ZSCORE	-0.002 (0.86)	0.013 (0.40)	-0.002 (0.86)	0.013 (0.40)	0.034*** (0.00)	0.023 (0.31)	0.034*** (0.00)	0.023 (0.31)
GDPR	-0.161*** (0.00)	-0.179*** (0.00)	-0.161*** (0.00)	-0.179*** (0.00)	-0.131*** (0.00)	-0.145** (0.04)	-0.131*** (0.00)	-0.145** (0.04)
Adjusted R^2	84.58		84.58		81.35		81.35	
F-statistic	103.04		103.04		82.14		82.13	
Pseudi-R^2		64.70		64.70		58.86		58.86
Quasi-LR Statistic		271.58		271.58		207.63		207.63

P-values are reported in parenthesis. ***, ** represent statistical significance at the 1% and 5% levels. The 2SLS instruments are the lagged independent variables.

5. Economy policy strategies for achieving the sustainable development goals

Having established a significant positive relationship between economic policy and sustainable development in section 4, the next question that arises is how economic policy can contribute to sustainable development. In this section, we proffer some economic policy strategies that can be used to achieve the sustainable development goals. The strategies highlighted in this section are the strategies we find to be particularly important, and the strategies are applicable to many countries.

5.1. Monetary policy strategies for achieving the sustainable development goals

Existing studies such as Lagoarde-Segot (2020), Kharas et al (2014) and Schmidt et al (2019) show that monetary policy tools can support the realization of the sustainable development goals. Monetary policy involves using monetary policy tools to influence the terms of credit and the flow of money in the economy (Woodford, 2008). Policymakers may consider the following monetary policy strategies to accelerate the realization of the sustainable development goals.

5.1.1. Reduce the central bank interest rate

Existing studies such as Schmidt et al (2019) and Sims and Wu (2021) show that interest rate is the classic tool used by a monetary authority to influence the level of credit and money supply in the economy. The monetary authority can reduce interest rate to stimulate lending to various sectors of the economy (Sims and Wu, 2021). Reducing interest rate will make credit cheaper. It will encourage borrowing by individuals and entities involved in SDG activities and projects (Schmidt et al, 2019). The borrowed funds will be used to improve SDG outcomes, thereby accelerating the realization of the SDGs. A reduction in interest rate can encourage financial institutions to lend to individuals and entities involved in SDG activities and projects (Schmidt et al, 2019).

5.1.2. Use moral suasion to elicit commitment to the SDGs

The monetary authorities can use moral suasion to elicit commitment to the SDGs. Moral suasion involves the monetary authority persuading regulated financial institutions through

appeals to behave in a certain way or to take some actions that support the monetary policy objectives of the monetary authority (Dumitriu and Stefanescu, 2022). The monetary authority can persuade regulated financial institutions through appeals to support the realization of the SDGs. Under moral suasion, the monetary authority will inform financial institutions about the benefits that they will gain if they contribute to making the world a better place by spending some of their profit on SDG activities and projects. The monetary authority will also inform financial institutions about the consequence on the environment if they fail to contribute to making the world a better place by refusing to spend any money or invest in SDG activities. Through the appeals of the monetary authority, financial institutions may agree to support the attainment of the SDGs by providing loans for SDG-related activities or through other means.

5.1.3. Use differentiated cash reserve ratio as an incentive

If moral suasion fails, the monetary authority should consider adopting a differentiated cash reserve ratio as an incentive. A cash reserve ratio (CRR) is the minimum amount of deposits which banks must hold as reserves either in cash or as deposits with the central bank (Calomiris, 2012). A high CRR means that banks will have little money available for lending to individuals and businesses while a low CRR means that banks will have more money available for lending to individuals and businesses (Alper et al, 2018). A differentiated CRR means that each bank will have dissimilar CRR. The monetary authority should use the differentiated CRR to stimulate banks' interest in the sustainable development agenda. Banks that show significant commitment to the SDGs and can provide evidence to prove their commitment to the SDGs should be required to keep a lower CRR as a reward for supporting the sustainable development agenda. The low CRR should be lower than the stipulated regulatory minimum CRR. In contrast, banks that show little or no commitment to the SDGs should not be given a low differentiated CRR; rather, they should keep the stipulated regulatory minimum CRR requirement as specified by prudential regulations. Banks will be motivated to commit to the SDGs and support its realization when they become aware that the monetary authority will reward banks that support the SDG agenda with a differentiated CRR that is lower than the regulatory minimum CRR.

5.1.4. Offer special SDG-linked financing programs

The monetary authority should also consider providing long-term financing to banks and other financial institutions involved in SDG activities and projects (Lagoarde-Segot, 2020). The monetary authority should offer financial institutions SDG-linked long-term funding at a low interest rate, e.g., at 1 percent, so that financial institutions can reduce the interest rates they charge to borrowers involved in SDG activities and projects. This will increase the availability of credit to the SDG sector and encourage bank lending to individuals and business entities involved in SDG activities and projects (Kharas et al, 2014). The monetary authority should also consider providing more funding to financial institutions that increase lending to individuals and business entities involved in SDG activities and projects.

5.1.5. Use forward guidance to create a positive outlook for the SDGs

Forward guidance, also known as open mouth operation, is simply a communication by the monetary authority about how it expects the economy and monetary policy to evolve in the near future (Bernanke, 2020). The monetary authority can use forward guidance to communicate its monetary policy projections and how it will support the realization of the sustainable development goals. The monetary authority can also use forward guidance to give a promise or commitment that it will use specific policy tools to support the realization of the SDGs in the present and in the future. Such forward guidance will help the public to understand the monetary authority's outlook about the SDGs. If the outlook is positive, it can make banks willing to lend to SDG activities and projects and it will raise optimism among SDG-linked borrowers and investors.

5.2. Fiscal policy strategies for achieving the sustainable development goals

Existing studies such as Wood (2011) and Zhang and Song (2022) show that fiscal policy tools can support the realization of the sustainable development goals. Fiscal policy involves using taxes and government revenue to influence the level of spending in the economy (Candelon and Lieb, 2013). Policymakers may consider the following fiscal policy strategies to accelerate the realization of the sustainable development goals.

5.2.1. Use grants to stimulate corporate spending towards the SDGs

Grants are an effective way to stimulate spending for a particular cause (Ferede, 2014). The fiscal authorities should allocate SDG-linked grants to startups, SMEs and large corporations

that have proven capabilities to accelerate the attainment of the SDGs in the business environment they operate in. The fiscal authorities should require the beneficiaries of the grant to use the grant for training and capacity building towards achieving the SDGs. The grants should also be spent on high-impact SDG-related research and innovation projects. The resulting corporate spending will increase demand for SDG related services, and it will attract domestic and foreign investment to the SDG sector.

5.2.2. Provide climate loss and damage funding during unfavorable climate change event

In times of climate change induced disasters, the fiscal authorities should provide immediate liquidity support to affected businesses, and income support to affected individuals, households and informal workers through direct cash or digital transfers as quickly as possible and through social protection benefits (Wood, 2011). This will provide financial support to mostly informal workers and households who lost their means of livelihood due to unfavorable climate change events (Agrawal et al, 2020).

5.2.3. Use SDG-linked tax rebate schemes to gain re-commitment and new commitment to the SDGs

The fiscal authorities should identify SDG-intensive businesses or businesses that undertake a significant SDG activity. Such businesses should be eligible for a tax rebate. The purpose of the tax rebate is to encourage such businesses to sustain their commitment to the sustainable development goals (Zhang and Song, 2022). The presence of a tax rebate will motivate businesses across several industries to commit to the SDGs by undertaking one or more SDG activities alongside their normal operations. The tax rebate will ensure a re-commitment to the SDGs from SDG-intensive businesses, and it will attract new commitment to the SDGs from businesses that want to start undertaking some SDG activities so that they can participate in the tax rebate scheme of the fiscal authorities. The tax rebate scheme can stimulate spending and investment in SDG activities and projects.

5.3. Regulatory policy strategies for achieving the sustainable development goals

Existing studies such as Levitsky and Murillo (2013) and Siegel and Johnson (1993) show that regulatory policy can support the realization of the sustainable development goals. Regulatory policy involves using institutional regulations to influence the behaviour of

economic agents to act in ways that are pro-sustainability. Policymakers may consider the following regulatory policy strategies to accelerate the realization of the sustainable development goals.

5.3.1. Strengthen institutions

Regulatory policies are often issued by institutions (Spiller and Tommasi, 2005). Therefore, institutions must be strengthened for regulations to be effective. Policymakers and lawmakers should work together to build strong public institutions that have appropriate legal monitoring and enforcement powers (Levitsky and Murillo, 2013). Such institutions should also receive regular training on acceptable and unacceptable SDGs activities and practices. They should have sufficient financial resources to develop personnel, plan and build mechanisms to monitor and correct inappropriate practices or activities that are averse to the realization of the sustainable development goals (Roy and Tisdell, 1998).

5.3.2. Identify clearly the environmentally desirable activities and the environmentally undesirable activities

The regulatory authorities should develop a regulatory compendium or a list of all environmentally desirable and environmentally undesirable activities and communicate such information to the public (Siegel and Johnson, 1993). Such information will guide individuals and businesses in knowing the activities which the regulatory authorities believe are helpful for achieving the sustainable development goals and the activities which the regulatory authorities believe are harmful for sustainable development. With this information, law-abiding individuals and businesses can choose from the list of the environmentally desirable activities, the activity they would like to participate in, and the environmentally undesirable activities they would like to avoid. This will help to guide the behaviour of economic agents towards sustainability.

5.3.3. Impose a fine or financial penalty for engaging in environmentally undesirable activities

The regulatory authorities and policymakers in the central government should influence the local authorities to impose financial penalties on individuals and businesses that engage in environmentally undesirable activities or activities that are harmful to the environment (Høiberg Olsen et al, 2021). The imposed fines or financial penalty should not be too high so

that it will not be opposed or resisted by the public. The fines or financial penalty should not be too low, as it may encourage repeated violation. Rather, the fine or financial penalty should be set at a level that is affordable and it should be substantial enough to discourage repeated involvement in environmentally undesirable activities by individuals and businesses.

5.3.4. Collected fines or financial penalties should be used as donations to specific SDG activities

After fines have been imposed and collected by the local authorities, the local authorities should be required to release a large amount of the fines as donations to the public agencies and non-governmental organizations (NGOs) that are actively involved in SDG activities and projects that yield huge benefits to members of the public (Wu et al, 2021). The donations can serve as capital injection into the SDG-linked entities. This will ensure that the fines collected by the local authorities are re-invested back into activities and projects that accelerate the realization of the sustainable development goals (Scataglini and Ventresca, 2019).

5.3.5. Continuous evaluation of emerging activities to determine whether they support or hinder sustainable development

The regulatory authorities should continuously evaluate emerging activities to determine whether emerging activities are beneficial or detrimental to the environment and society. If emerging activities are beneficial to the environment, they should be added to the list of environmentally desirable activities (Siegel and Johnson, 1993). But if the activities are considered to be detrimental to the environment, they should be added to the list of environmentally undesirable activities

6. Conclusion

This study examined the effect of economic policy on the level of sustainable development. The study analyzed twenty-two countries using annual data from 2011 to 2018. It was argued that sound economic policy will provide an enabling economic environment and incentives for economic agents to support the attainment of the sustainable development goals. This

study extend the literature by linking economic policy to sustainable development using composite-level indicators. The study assessed the empirical relationship between economic policy indicators and sustainable development indicators using the two-stage least squares regression method, the quantile regression method, and the granger causality test.

The findings showed that the economic policy index has a significant positive effect on the sustainable development index particularly in non-European countries and in developing countries. Changes in monetary policy, fiscal policy and regulatory policy have a significant impact on the level of sustainable development. Expansionary monetary policy via increase in broad money to GDP ratio, increases the attainment of SDG6 while contractionary monetary policy via increase in central bank interest rate increases the attainment of SDG7. Expansionary fiscal policy via increase in consumer spending leads to the attainment of SDG3 and SDG7 but it adversely affects the attainment of SDG6. It was also found that a stable banking sector is a significant determinant of the level of sustainable development particularly SDG3. Positive economic growth leads to the attainment of SDG7, but it lowers the attainment of SDG3 and SDG6. There is uni-directional causality between economic policy and sustainable development. Monetary policy and regulatory policy also have a uni-directional relationship with the level of sustainable development, implying that changes in monetary and regulatory policies cause a change in the level of sustainable development.

These results call on economic policymakers to develop sound economic policies, particularly monetary, fiscal, and regulatory policies, that will positively affect the level of sustainable development. It is recommended that policymakers in developing countries and in non-European countries should improve their regulatory policies by strengthening institutions and increasing their enforcement powers. The monetary authorities should use potent monetary policy tools, such as central bank interest rate and broad money to GDP ratio, to support the realization of the SDGs. Fiscal policymakers should also find innovative ways to stimulate consumer spending towards SDG expenditures. The findings of this study contribute to the ongoing debate about the role of economics in the realization of the sustainable development goals. The findings of the study adds to this debate by showing that the macroeconomic policies can have a significant impact on the level of sustainable development. The findings are also important to investors who want to invest in sustainable development activities. They want an enabling policy environment that is conducive for investment and is guided by sound

economic policymaking. Deploying sound economic policy will encourage investors to bring in their funds to invest in sustainable development projects and activities.

The study has some limitations. One, the study relied on composite measures of economic policy and sustainable development. Using individual measures of economic policy and sustainable development may offer additional insights. A second limitation of the study relates to the selection of the SDG proxy variables. A third limitation is that the SDG index used in this study may not capture the complex nature of the sustainable development goals as each SDG has multiple targets and it is possible that each economic policy indicator may affect each target differently. Finally, we suggest some areas for future research. Future research studies should investigate the impact of economic policy on the multiple targets of each SDG. Another area for future research inquiry is to investigate the effect of economic policy uncertainty on efforts to achieve the sustainable development goals. Future research can also consider extending the present study by exploring other countries and additional measures of economic policy and sustainable development that may offer additional insights to this line of research. Future studies can also use multiple econometric techniques or qualitative methods to gain a deeper understanding of the ways in which economic policy might influence sustainable development.

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