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Ofori, Isaac K. and Figari, Francesco and Ojong, Nathanael

University of Insubria, The University of Eastern Piedmont, York University

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Isaac K. Ofori*
Department of Economics, University of Insubria,
Via Monte Generoso, 71, 21100, Varese, Italy.
E-mail: ikofori@outlook.com
*Corresponding author

Francesco Figari
Department of Economics and Business, University of Eastern Piedmont,
Via Perrone, 18 – 28100, Novara, Italy.
E-mail: francesco.figari@uniupo.it

Nathanael Ojong
Department of Social Science, York University,
4700 Keele Street, Toronto, On M3J 1P3, Canada
E-mail: nojong@yorku.ca

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Abstract

This study contributes to the environmental and socioeconomic sustainability literature by examining three important issues. First, the study examines the effects of foreign direct investment (FDI) and economic freedom on inclusive green growth (IGG) in sub-Saharan Africa (SSA). Second, we investigate whether economic freedom interacts with FDI to promote IGG. Third, we identify minimum thresholds required for economic freedom to cause FDI to foster IGG. The findings are based on macro data for 20 SSA countries. Evidence, based on instrumental variable regression, show that, unconditionally, FDI is not statistically significant for promoting IGG. Second, the study finds that SSA's '*Mostly unfree*' economic architecture conditions FDI to reduce IGG. Third, results from our threshold regression reveal that the minimum threshold required for economic freedom to cause FDI to foster IGG is 66.2% (Moderately free). The study sheds new light on investments necessary for SSA's economic architecture to form relevant synergies with FDI to promote IGG.

Keywords: Economic Freedom; FDI; Government Integrity; Inclusive Green Growth; Sustainable Development; sub-Saharan Africa

JEL Codes: F21; F6; H1; P1; O55; Q01; Q56

1. Introduction

Policymakers at the national level have stepped up efforts aimed at achieving multidimensional sustainability. These efforts are in line with the Sustainable Development Goals (SDGs), which seek to foster socioeconomic and environmental progress (Intergovernmental Panel on Climate Change [IPCC], 2022; Sarkodie, 2022; Sachs, 2021; United Nations [UN], 2020). Additionally, African leaders are charting a long-term multidimensional sustainability agenda of their own[1], with the aim of addressing the continent's complex challenges of poverty, income inequality, environmental degradation, and institutional frailties (African Union [AU], 2015). This brings to the fore the concept of *Inclusive Green Growth* (hereafter, IGG), which essentially signifies building societies that are socially inclusive and environmentally sustainable, such that natural capital continues to deliver the resources and environmental services that are essential for life (Green Growth Knowledge Program [GGKP], 2016, 2013; Fay, 2012). It is an ambitious but crucial development agenda for settings like sub-Saharan Africa (SSA), where the progress towards shared prosperity has generally been slow and even suffered a major setback following the emergence of the coronavirus pandemic (Sachs et al. 2021; International Monetary Fund [IMF], 2020; International Labour Organization [ILO], 2020).

Achieving IGG in SSA is particularly important since economic growth that is achieved at the expense of environmental quality (also known as 'dirty growth') could worsen the region's already dire situation concerning food security, water stress, biodiversity loss, and pollution-related mortalities. An increase in finance and the diffusion of environmentally-friendly industries, technologies and practices in developing countries is essential to addressing these pertinent issues (Organization for Economic Cooperation and Development [OECD], 2017). This stems from the concern that although developing countries host vital ecosystems, their share of greenhouse gas emissions has been rising in the past two decades, yet resources for engineering environmental sustainability and climate change adaption/mitigation are limited (Sarkodie & Strezov, 2019; United Nations Office for Disaster Risk Reduction [UNISDR], 2011). It is in this regard that this study interrogates whether the inflow of resources, in the form of foreign direct investment (FDI), to SSA matters for promoting IGG across the region. Our focus on FDI is against the backdrop that both the OECD and the United Nations Framework Convention on Climate Change (UNFCCC) consider it as a key driver of sustainable growth. In particular, whereas the OECD (2017) identifies it as a key component

[1] This is referred to as The Africa We Want (Agenda 2063)

of the 'Green Economic Opportunities' toolkit, the UNFCCC (2015) consider it as part of the 'Clean Development Mechanism'.

Concerning environmental sustainability, for instance, FDI can promote sustainable innovation and green growth (Amendolagine et al., 2021; Melane-Lavado et al., 2018; Kardos, 2014), which can reduce pollution-related mortalities and welfare cost associated with dirty growth. Moreover, the diffusion of clean energy technologies, which are associated with efficiency-seeking and market-seeking FDI can promote environmentally-sustainable production and consumption practices in a region where informality is high (Buchner et al., 2011; United Nations Conference on Trade and Development [UNCTAD], 2011). Also, there is evidence that the flow of FDI into sectors such as telecommunication and hospitality promote coastal redevelopment and environmental conservation (Falk, 2016; Osinubi et al., 2022). However, some studies also argue that FDI can trigger substantial ecological footprint and the acceleration of (i) ozone precursor gasses (e.g., hydrofluorocarbons and nitrogen oxides), (ii) acidifying gasses (e.g., ammonia and sulphur oxides) and (iii) air pollutants (e.g., Ambient PM2.5 and black carbon) (Doytch 2020).

With respect to socioeconomic sustainability, studies have shown that FDI can boost growth by raising innovation, total factor productivity, private sector competition and efficient use of resources (UNCTAD, 2014; Feldstein, 2000). Moreover, FDI can accelerate poverty alleviation and facilitate a reduction in income inequality by enhancing economic complexity, upstream and downstream inter-firm linkages, global value chain participation, and durable growth and employment (Xu et al., 2021; Anetor et al., 2020; Opoku et al., 2019). However, some studies also contend that FDI can hamper social progress in developing countries by deepening income inequality, capital flight, the crowding-out of domestic firms, and the vulnerability to global economic and financial shocks (Ndikumana & Sarr, 2019; Pavcnik, 2017).

Consequently, we argue that the effectiveness of FDI in propelling SSA towards a resilient IGG path could be contingent on economic freedom. Put differently, this study argues that, in the presence of market openness, regulatory efficiency and the rule of law, FDI could promote IGG. These plausible contingency effects stem from the economic liberalism argument that, in economically-free societies, governments do not only allow free movement of labour, capital, and goods, but also refrain from burdensome regulations that impede innovation, firm performance and long-term planning (Miller et al. 2022; Apergis & Cooray, 2017; Williamson & Mathers, 2011). Additionally, in countries where economic freedom is high, the tax codes are business-friendly, markets are efficient, and governments offer investors innovative support and financial opportunities (Kouton, 2019; Miller et al., 2010). Additional gains linked to economic freedom are procedural fairness, protection of property rights, cleaner environment, and human capital development, which are vital for attracting and sustaining foreign investors (Miller et al., 2022; Nikolaev & Bennett, 2016).

Despite these shared growth and environmentally sustainable effects of FDI and economic freedom, there remains an empirical research gap regarding whether the latter conditions the effect of the former on IGG. Although across the socioeconomic and environmental sustainability perspective of IGG, several studies have assessed the effects of FDI on economic/inclusive growth (see e.g., Ofori & Asongu, 2021; Opoku et al., 2019), income inequality (Xu et al., 2021; Song et al., 2021; Herzer et al., 2014), poverty (Teixeira & Loureiro, 2019) or the environment (see e.g., Chen et al. 2022; Opoku & Boachie, 2020; Khan et al., 2020; Tiba & Belaid, 2020; Bokpin, 2017; Hakimi & Hamdi, 2016), such contributions are hard to find when the scope is broadened to IGG. Moreover, although empirical contributions concerning the direct effects of economic freedom on greenhouse gas emissions (see e.g., Mahmood et al., 2022; Alola et al., 2022; Shahnazi & Shabani, 2021; Joshi & Beck, 2018; Adesina & Mwamba, 2019; Williamson & Mathers, 2011), clean water, sanitation and clean energy (Aust et al., 2020) or economic/inclusive growth (see e.g., Huynh, 2022; Malanski & Póvoa, 2021; Kouton, 2019; Whajah et al., 2019; Graafland & Lous, 2018; Apergis & Cooray, 2017; Apergis et al., 2014; Doucouliagos & Ulubasoglu, 2006) can be mentioned, empirical evidence on whether it interacts with FDI to foster IGG are conspicuously missing in the sustainable development literature. Further, previous studies have not explored minimum thresholds essential for economic freedom (including the subcomponents of business freedom, government integrity, government spending and investment freedom) to cause FDI to promote IGG. This study seeks to address these pertinent gaps in the scholarly literature by using macro data for 20 SSA countries. Specifically, this study seeks to:

1. Estimate the unconditional effects of FDI and economic freedom on IGG in SSA.
2. Investigate the contingency effects of economic freedom in the FDI-IGG relationship.
3. Compute minimum threshold required for economic freedom to form relevant synergies with FDI to promote IGG.

In addressing these important gaps in the literature, this study contributes to knowledge and the policy discourse on sustainable development on several fronts. First, this study deepens the understanding on the implications of capital flows for multidimensional sustainability in SSA.

We do so by pointing out whether unconditionally FDI is relevant for promoting greener and more inclusive growth in SSA. This study is thus timely as SSA leaders are mapping out strategies to attract foreign investors to realise Aspiration 1 of AU's Agenda 2063, which seeks to build a prosperous Africa based on inclusive growth and sustainable development. Second, this study contributes to knowledge by scrutinizing and gauging the impact of economic freedom on IGG in SSA. Crucially, we inform SSA governments and their development partners on the extent to which the region's 'Mostly unfree' economic architecture, as Miller et al. (2022) point out, conditions the effect of FDI on IGG. Neglecting the empirical perspective of this classification could cost SSA governments. This is because although FDI inflows to the region is expected to rise following the implementation of the African Continental Free Trade Area (AfCFTA), repressed economic freedom could nullify or dampen potential IGG gains. Moreover, the disaggregation of economic freedom into government integrity, investment freedom, government spending, and business freedom is novel and imperative for policy-specific recommendations. Third, this study provides a practical approach for tracking the progress of developing countries towards sustainable development. For SSA governments, the AU, and the UN, this study provides insights and lessons on the progress of the region towards Agenda 2030 and Agenda 2063. Finally, this study contributes to policymaking in SSA by pointing out the level of investments required for economic freedom to form relevant synergies with FDI to promote IGG. We reckon that evidence-based recommendation in this regard will enable SSA governments and policymakers interested in the region's sustainable development agenda to channel resources judiciously towards the region's IGG pursuit.

We structure the remainder of the study as follows: the next section provides a theoretical framework linking FDI and economic freedom to IGG, while Section 3 sheds light on the research methodology. We present and discuss our empirical findings in Section 4, and provide concluding remarks and policy recommendations in Section 5.

2. Literature review

In this section, we present some theories on the linkages between FDI and IGG on the one hand, and economic freedom and IGG on the other hand. It is imperative to point out that these theoretical linkages are appreciated from two perspectives: (i) theories on socioeconomic progress and (ii) theories on environmental sustainability.

2.1 Theoretical and empirical literature on the link between FDI and IGG

2.1.1 Theoretical linkages between FDI and socioeconomic sustainability

The theoretical relationship between FDI and IGG can be analysed from the lenses of the economic modernisation (i.e., the neoclassical growth and endogenous growth) theories and the dependency theory. First, the neoclassical growth theory pioneered by Swan (1956) and Solow (1956) identifies FDI as a major driver of economic growth. The neoclassical growth theory emphasises that FDI promotes economic growth in host countries through capital accumulation and the acquisition of new inputs and foreign technologies. The theory considers technological progress as exogenous, and that the marginal returns to capital diminishes in the long-run, thereby limiting its long-run growth effect. However, if FDI triggers substantial technological progress, it can promote labour productivity and the overall efficiency of investments in host countries to drive sustained economic growth even in the long-run (Herzer et al., 2008; Barro & Sala-I-Martin, 1995).

In the remit of the endogenous growth theory, FDI promotes rapid economic growth in host countries by augmenting the stock of human capital and technological progress (Rivera-Batiz & Romer, 1991; Grossman & Helpman, 1990, 1991; Krueger, 1998). The theory treats technological progress as endogenous, stressing its role in increasing returns to scale and growth rate in the long-run. Proponents of this theory argue that FDI can trigger perpetual increase in the growth rate of host country via technology transfer, diffusion, and spillover effects (Borensztein et al., 1998; de Mello, 1999). In this regard, FDI can engender knowledge expansion, the acquisition of new skills, and the introduction of contemporary management methods and organizational mechanisms. This, in turn, can improve the production efficiency of the private sector to enhance growth and employment creation (Sylwester, 2005). Empirical evidence concerning the shared growth effect of FDI have been reported in the literature (see e.g., Lee et al., 2022; Heimberger, 2020; Teixeira & Loureiro, 2019; Xu et al., 2021; Gui-Diby, 2014; Aizenman et al., 2013), although Adams and Klobodu (2017) and Agbloyor et al. (2014) report contrary effects.

In contrast, the dependency theory stresses that although the injection of capital and technologies by foreign investors can stimulate industrialisation and growth in host countries, it can also heighten unemployment and income inequality (Girling, 1973). According to Girling (1973), this happens at least in the short run as the adoption of new production techniques and innovation fuel skill set mismatch and job losses. Stiglitz (2002) and Ndikumana and Sarr (2019) also contend that the increase in the ownership of assets/resources by multinational companies in host countries can lead to the floundering of domestic firms, capital flight, and macroeconomic instability. Empirical studies highlighting the harmful effects of FDI on inclusive growth in both developing and advanced countries have been reported in the literature (see e.g., Song et al., 2021; Ravallion, 2018; Pavcnik, 2017; Herzer et al., 2014; Feenstra & Hanson, 1997).

2.1.2 Theoretical linkages between FDI and environmental sustainability

The theoretical relationship between FDI and environmental sustainability can be situated in the pollution halo (PH) and pollution haven hypotheses (PHH). According to the PH hypothesis, FDI triggers significant green technological shocks that developing countries can leverage to support sustainable production (Zarsky, 1999). Golub et al. (2011) argue that eco-friendly technological transfers for carbon abatement and energy conservation support green growth and the environmental quality of life. Several empirical contributions across the world confirm this hypothesis (Chen et al. 2022; Jiang et al., 2018; Hakimi & Hamdi, 2016; Khan et al., 2020; Bokpin, 2017). Nonetheless, some concerns have been raised that FDI undermines environmental progress. This is captured in the PHH, which suggests that FDI provides the impetus for pollution-intensive industries in developed countries that are constrained by stringent environmental regulations[2] to relocate to developing countries (McGuire,1982; Mani & Wheeler, 1998; Keller & Levinson, 2002). According to Opoku and Boachie (2020), this is also fuelled by policymakers in developing countries lowering environmental standards to attract foreign investors.

2.2 Theoretical and empirical literature on the link between economic freedom and IGG

2.2.1 Theoretical linkages between economic freedom and socioeconomic sustainability

The relationship between economic freedom and socioeconomic sustainability is situated in the *economic liberalism* and *economic federalism* arguments of economic systems. The former relates to economic agents' freedom to control their own labour and property, invest or spend in free markets (Miller et al., 2010; Acemoglu et al., 2005; Sen, 2000). Economic liberalism thus signifies free enterprise and property rights, which indicates that shared wealth and prosperity is created when firms run freely and capital flows to ventures where it yields the highest rate of return (Justesen, 2008; Doucouliagos & Ulubasoglu, 2006). It is widely argued

[2] For example, the European Union has increased its emission cost/penalty for firms in the automobile, aviation, and hospitality (European Union, 2019).

that economic liberalism fosters sustainable investment, production and economic growth by reducing transaction costs and protecting intellectual property (Gwartney & Lawson, 2003; North, 1998).

Economic federalism also emphasises control and support by policymakers over the production and consumption practices of economic agents through taxation and regulations (Acemoglu & Robinson, 2008; Sharma, 2007; North, 1990). Under economic federalism, governments allow labour, capital, and goods to move freely, and refrain from coercive regulations (Bronfenbrenner, 1955). Additionally, economic federalism denotes the setting up of business-friendly tax codes and support for innovation and entrepreneurship by central governments to promote private sector growth and fairer income growth and distribution (Mason, 2011). Studies conducted in the OECD countries (Graafland & Lous, 2018), Asian economies (Huynh, 2022), North America (Apergis et al., 2014), Africa (Whajah et al., 2019), and Latin America and Pacific Asia (Malanski & Póvoa, 2021) provide evidence that economic freedom promotes inclusive growth.

2.2.2 Theoretical linkages between economic freedom and environmental sustainability

The theoretical link between economic freedom and environmental progress is anchored in the theory of pollution policy or the positive theory of environmental regulation. The theory points to feasible ways of achieving the socially optimal level of pollution, or reducing the social costs associated with unsustainable production and consumption practices (Coase, 1960; Helfand et al., 2003). The theory, thus, indicates the internalisation of external costs of production by (i) setting pollution taxes equal to marginal social damage or (ii) introducing a tradable emission permit that restricts aggregate pollution to the efficient level (Levinson & Taylor, 2008; Carlsson & Lundström, 2003).

The theory of pollution policy has been advanced by Lundström and Carlsson (2003) in a series of hypotheses. The first is referred to as the *efficiency effect*, which is the notion that economic freedom creates market efficiency and competition, which can reduce CO_2 emissions in the long-run (Lundström & Carlsson, 2003). This arises since firms seek to minimise the cost of production. Accordingly, in freer environments, firms device innovative ways of reducing resource and energy intensity. The second is the *trade regulation effect*, which comes in two forms. On the one hand, lax regulations fuel inefficient resource allocation and the creation of pollution havens, which harms environmental quality (Levinson & Taylor, 2008). On the other hand, the Porter hypothesis suggests that stringent regulatory frameworks foster environmental quality. For example, the introduction of carbon taxes incentivizes producers to favour green innovations and more energy-efficient investments, which could count for reducing carbon intensity and environmental degradation (Porter & van der Linde, 1995). Several empirical studies (see e.g., Joshi & Beck, 2018; Shahnazi & Shabani, 2021; Alola et al., 2022; Adesina & Mwamba, 2019; Mahmood et al., 2022) corroborate these theoretical arguments.

Despite these clear theoretical relationship between FDI, economic freedom and IGG, empirical studies providing evidence-based recommendations to guide policy formulation are hard to find. Notably, the theoretical perspectives above suggest that whether FDI would be a 'boon or bane' for regions like SSA is determined, to an extent, by the level of economic freedom. Empirical contributions in this direction are missing in the literature and this study contributes to knowledge in this regard.

2.3 IGG analytical framework

In this section, we build on the IGG framework of Ofori et al. (2022a), where we introduce an analytical framework that provides a basis for our empirical contribution (see Figure 1). The crux of this framework is anchored in the argument by Acosta et al. (2019a) and Fay (2012) that building inclusive and greener societies is rooted in two spheres of sustainable development: (i) socioeconomic sustainability, and (ii) environmental progress. Specifically, Figure 1 indicates that for IGG to be attained, efforts should be made to promote social progress, which according to the Partnership for Action on Green Economy [PAGE] (2017) and the OECD (2011) is achieved by improving access to education, water and sanitation, and equitable distributions of incomes. Moreover, the framework highlights the essence of environmental sustainability, which is attained by protecting natural capital, creating green economic opportunities, and developing efficient resource production schemes (GGKP, 2016; OECD, 2017). Finally, in line with the aforementioned theories linking capital flows and economic systems to inclusive growth and environmental quality, we incorporate FDI and economic freedom into the framework.

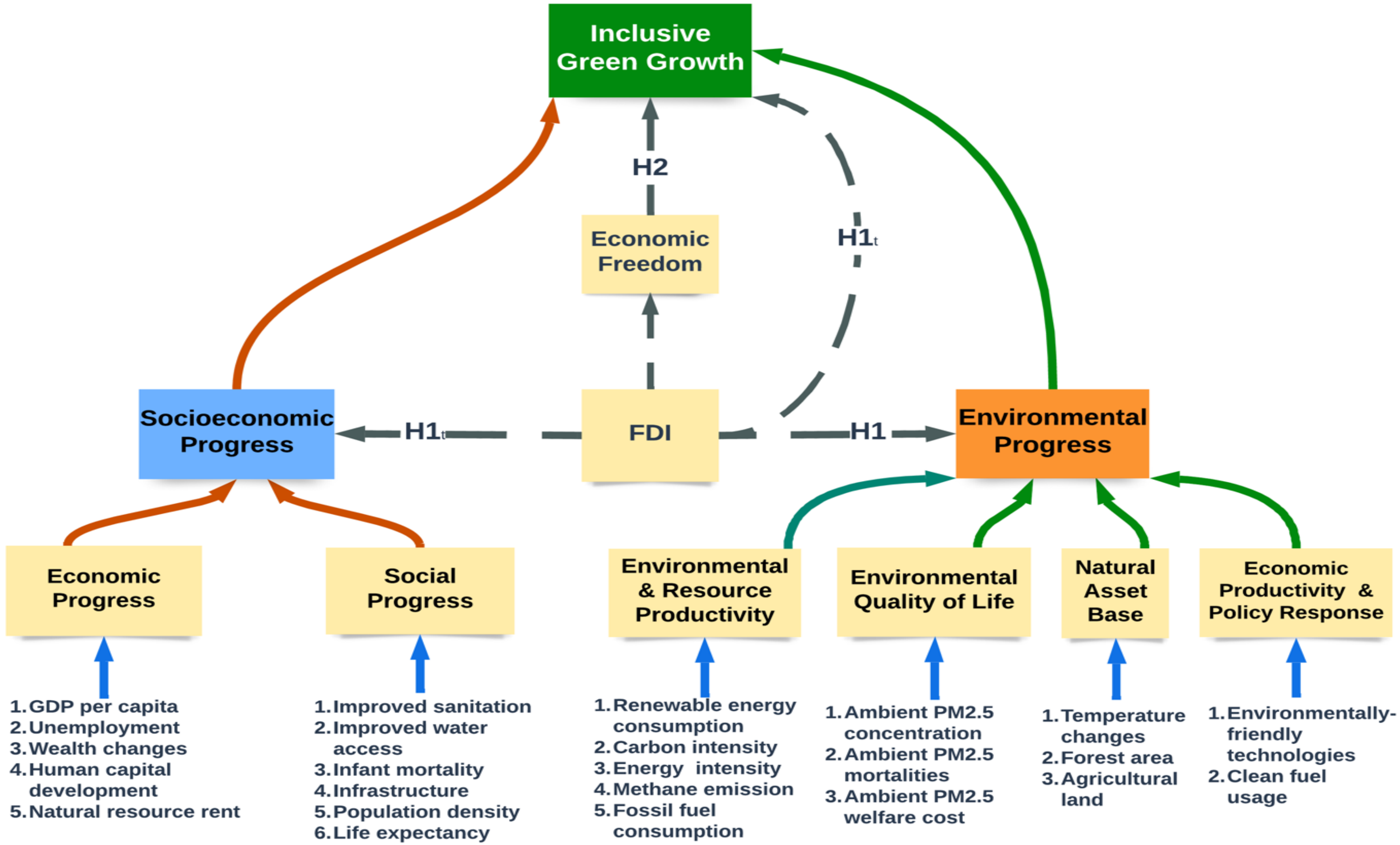

Figure 1: Analytical framework for inclusive green growth
Source: Authors' design

3. Methodology

3.1 Data and justification for the inclusion of variables

The study employs macro data spanning 2002 – 2020 for 20 SSA countries for the analysis (see Table A.1). The choice of the study period and the sampled countries is informed by data availability. For instance, data on wealth changes, environmentally-friendly technologies, and the welfare cost of air pollution are conspicuously missing or scanty for countries such as South Sudan, Somalia, Eritrea, Eswatini, Mauritania, Seychelles, The Gambia, Chad, Guinea, Zimbabwe, Djibouti, Comoros, Guinea Bissau, and Madagascar. The main outcome variable in this study is inclusive green growth (IGG) – a sustainable development indicator generated via the principal component analysis (PCA). Further, to inform policy as to how the FDI-economic freedom interaction impacts the two main spheres of IGG, we disaggregate IGG into (i) socioeconomic sustainability (proxied by inclusive growth), and (ii) environmental sustainability (proxied by greenhouse gas emissions). While the latter is sourced from the World Development Indicators (WDI), the former is calculated following the Anand et al. (2013) approach. We find the Anand et al. (2013) approach appropriate, as it integrates income growth and income distribution in a unified manner based on the social opportunity and welfare function. This approach, thus, adjust income growth across the entire population equitably. A detailed procedure on how the inclusive growth index was calculated is provided as a supplementary material (see SM1 in the Appendices Section). Also, we opt for greenhouse gas emissions (percentage change since 1990) other than CO_2 emissions, as the former goes beyond carbon emissions including biomass burning and all anthropogenic methane sources, nitrous oxide sources and fluorinated gases.

The main independent variable in this study is foreign direct investment and is defined as net inflow as a share of gross domestic product (GDP). The moderator in this study is economic freedom– an index for the rule of law, regulatory efficiency, market openness, and government size. To inform policy as to which component of economic freedom interacts with FDI to yield the highest IGG net effect, we disaggregate economic freedom into: (1) business freedom, (2) government integrity, (3) investment freedom and (4) government spending. This disaggregation is prudent to enable us to provide policy specific recommendations. This is possible because business freedom and government integrity are major components of regulatory efficiency and the rule of law, respectively, while government spending and investment freedom are under the umbrella of government size and market openness, respectively. The choice of these economic freedom variables is also on grounds of data availability as data on other components such fiscal health, monetary freedom, labour freedom, tax burden and financial freedom are available for only a short period. The data for economic freedom are taken from the Heritage Foundation, and those related to FDI from the WDI.

Additionally, we control for some variables in line with scientific standards for generating sound multiple regression estimates. The reasons informing the choice of these variables are captured in what follows. First, the essence of financial development for IGG is deeply rooted in the argument that an efficient financial sector redistributes resources effectively to support private sector performance, economic growth and poverty alleviation (Peprah et al., 2019). Also, concerning environmental sustainability, while a strand of the literature show that financial development promotes the environmental quality of life through eco-friendly innovations and the acquisition of green technologies (Salahuddin et al., 2015; Shahbaz et al. 2013), others also report harmful effects arising due to the income and materialisation effect (e.g., the acquisition of slightly-used fringes, air-conditioners, printers) (Zhang, 2011; Sadorsky, 2010).

The essence of trade openness for IGG is anchored in empirical evidence that trade can be a catalyst for sustainable growth through knowledge transfer, innovation, wider markets and durable employment creation (Opoku et al., 2019). However, concerns have been raised that trade openness can also be a drawback to shared prosperity by heightening income inequality and the collapse of local firms (Pavcnik, 2017). From the environmental progress angle, while some studies find that trade openness triggers ecological setbacks through excessive resource exploitation and greenhouse gas emissions (see e.g., Wang & Zhang, 2021; Al-Mulali et al., 2015), others report favourable effects (see e.g., Khan et al., 2022; Tiba & Belaid, 2020). Further, we consider development assistance, in line with recent evidence that in Africa, foreign aid contributes to investments in socioeconomic overheads, which are essential for building the capacity of the masses to take advantage of opportunities, withstand socioeconomic shocks, and contribute to economic development (Kruckenberg, 2015). Also, foreign aid is instrumental in cushioning developing countries to manage health crisis and climate change (Overseas Development Institute [ODI], 2020; Development Assistance Committee [DAC] & OECD, 2020).

Finally, we consider internet access based on prior empirical contributions that internet access contributes to environmental quality by reducing precarity, and energy intensity (Asongu, 2018; Shahnazi & Shabani, 2019). In the area of socioeconomic progress, some studies also show that internet access broadens access to information, wider markets, and economic opportunities (Ofori & Asongu, 2021; Adeleye et al., 2021). Table 1 presents a summary of the definition of all the variables used in this study. The pairwise correlations between the variables are also reported in Table A.2.

Table 1: Variable description and data sources

Variables	Symbol	Descriptions	Sources
Dependent variable			
Inclusive green growth	*igg*	Sustainable development indicator generated using the PCA	Authors
Inclusive growth index	*igrow*	Shared growth index generated following the approach of Anand et al. (2013)	Authors
Greenhouse gas emissions	*ghg*	Total greenhouse gas emissions (% change from 1990)	WDI
Main independent variable			
Foreign direct investment	*fdi*	Foreign direct investment, net inflow (% GDP)	WDI
Moderating variables			
Economic freedom	*efs*	An index obtained by averaging four factors: government size, rule of law, regulatory quality and open markets (Highest = 1; Lowest = 0)	HF
Government integrity	*govint*	An index obtained by averaging equally the score for three factors: risk of bribery, control of corruption, and perception of corruption (Highest = 1; Lowest = 0).	HF
Business freedom	*busf*	An index calculated by averaging equally the score for four factors: access to electricity, business environment risk, regulatory quality, and women's economic inclusion (Highest = 1; Lowest = 0).	HF
Investment freedom	*invtf*	An index computed by averaging equally the score for seven factors: foreign investment code, restrictions on land ownership, national treatment of foreign investment, sectoral investment restrictions, capital controls, foreign exchange controls, and expropriation of investments without fair compensation (Highest = 1; Lowest = 0).	HF
Government spending	*govs*	An index computed as 100 minus a constant variation of the square of all government expenditure in a fiscal year (Highest = 1; Lowest = 0).	HF
Control variables			
Trade openness	*trade*	Sum of imports and exports (% GDP)	WDI
Foreign aid	*faid*	Inflow of official development assistance (% GNI)	WDI
Internet access	*int*	Individuals using the Internet (% of population)	WDI
Financial development	*findex*	Financial development index	FINDEX

Note: WDI is World Development Indicators; FINDEX is IMF's Financial Development Index; HF is Heritage Foundation

3.2 Construction of inclusive green growth index

This section provides information on how the IGG index is generated. We begin by pointing out that 24 variables, which cut across the environmental and socioeconomic perspectives of IGG, are employed for the computation. These variables were selected by drawing on works that emphasise variables crucial for sustainable development (see Acosta, 2019a, 2019b; PAGE, 2017; OECD, 2017, 2011; GGKP, 2016, UNICEF, 2016; UNEP, 2012; Fay, 2012; UNISDR, 2011). For instance, following the recommendations of UNICEF (2016) and Fay (2012), we consider social progress variables such as human capital, transport infrastructure, healthcare, unemployment, and access to clean water and sanitation. In the same way, following global efforts in building climate change resilience and improving the environmental quality of life, we consider variables such as energy intensity, carbon intensity, green technologies, agricultural land, temperature changes and ambient particulate matter of 2.5 microns (OECD, 2017; UNISDR, 2011). The definitions and sources of the 24 variables are shown in Table 2. The summary statistics for these variables are also reported in Table A.3 in the Appendices section.

The computation of our IGG index is based on the PCA. The appropriateness of the PCA in yielding sound index depends on several requirements, which we pay attention to. First, we evaluate whether, (i) the 24 variables form adequate sample, and (ii) there is strong correlation between the variables is significant. In assessing the adequacy of our sample, we employ the Kaiser-Meyer-Olkin (KMO). Additionally, in evaluating whether the overall correlation, and interrelations among the 24 variables are strong enough, we employ the Bartlett test of variable intercorrelations, and the pairwise correlation test, for the assessment.

The attendant results suggest that the PCA can be applied. First, per the KMO test statistic of 0.743, the sample adequacy condition is satisfied. Second, according to the results in Table A.4, there is evidence of strong pairwise correlations between our IGG variables. This evidence of strong correlation is reinforced by the Bartlett (X^2) statistic of 6891.67, which is statistically significant at 1%. This implies that, overall, the correlation among the variables in the data is strong enough, justifying the application of the PCA.

Table 2: Definition of variables in IGG index

Variable	Symbol	Variable description	Data source
A. Socioeconomic sustainability			
(i) Social context			
Sanitation	*sanit*	Population with access to improved sanitation, % total population	GGKP Data
Population density	*pop*	Population density, inhabitants per km2	OECD Statistics
Potable water	*powat*	Population with access to improved drinking water sources, % total population	GGKP Data
Infant mortality	*infmort*	Mortality rate, infant (per 1,000 live births)	WDI Data
Life expectancy	*lifexp*	Life expectancy at birth, total (years)	OECD Statistics
Transport infrastructure	*trans*	Composite index for road, air, maritime, and railway transport infrastructure	AIKP
(ii) Economic context			
Changes in wealth	*cwea*	Changes in wealth per capita (US$)	GGKP Data
Income growth	*incgro*	GDP per capita, PPP (constant 2017 international $)	GGKP Data
Income inequality	*ineq*	Gini index (0=Lowest; 1=Highest)	GGKP Data
Human capital index	*hci*	Human capital index, based on years of schooling and returns to education	PWT
Unemployment	*unemp*	Unemployment, total (% of total labour force)	GGKP Data
B. Environmental sustainability			
(i) Natural asset base			
Agricultural land	*agric*	Agricultural land (% of land area)	GGKP Data
Forest cover	*forest*	Forest area (% of land area)	OECD Statistics
Temperature changes	*temp*	Annual surface temperature, change since 1951-1980	OECD Statistics
(ii) Environmental quality of life			
Exposure to ambient PM.2.5	*amb*	Mean population exposure to PM2.5	OECD Statistics
Ambient PM.2.5 mortalities	*ambmort*	Mortality from exposure to ambient PM2.5	OECD Statistics
Ambient PM.2.5 welfare cost	*ambcost*	Welfare costs of premature mortalities from exposure to ambient PM2.5, GDP equivalent	OECD Statistics
(iii) Environmental & resource productivity			
Methane emission	*metha*	Agricultural methane emissions (thousand metric tons of CO_2 equivalent)	GGKP Data
Natural resources rent	*natres*	Total natural resources rents (% of GDP)	GGKP Data
Renewable energy	*renener*	Renewable energy consumption (% of total final energy consumption)	WDI Data
Carbon intensity	*carint*	CO_2 intensity level, primary energy	WDI Data
Fossil fuel consumption	*fosiful*	Fossil fuel energy consumption (% of total)	OECD Statistics
(iv) Economic opportunities & policy response			
Clean fuel usage	*cleanfuel*	Access to clean fuels and technologies for cooking (% of population)	WDI Data
Environmentally friendly technologies	*envtech*	Development of environment-related technologies, % all technologies	OECD Statistics

Note: Source: Authors' construct, 2022

We proceed, therefore, to generate the IGG index. It is worth noting that, since the 24 variables are measured on different scales, we first normalise all the variables before generating the index for each country. We then invoke the '*pca*' command in Stata to generate the IGG series for each country. Following Jolliffe (2002), we generate our IGG index based on the first 6 principal components[3], which cumulatively account for 83% of variation in the dataset. As we show in Table A.5 and Figure A.1, these 6 components meet the Kaiser rule of paying attention to components with eigenvalues of at least 1.

3.3. Theoretical and empirical model specifications

In this section, we shed light on the theoretical and empirical models underpinning our empirical analysis. First, we focus on the specification of the theoretical models, which are based on our analytical framework in Section 2.3. Accordingly, we specify a functional form as apparent in Equation (1), where IGG is driving chiefly by FDI and economic freedom.

$$igg = f(fdi,\ efs,\ trade; int; faid; findex), \qquad (1)$$

where $\boldsymbol{igg}$ is inclusive green growth; $\boldsymbol{fdi}$ is foreign direct investment; $\boldsymbol{int}$ is internet access; $\boldsymbol{findex}$ is financial development; $\boldsymbol{faid}$ is foreign aid; and $\boldsymbol{efs}$ denotes economic freedom and its subcomponents: government integrity (***govint***); business freedom (***busf***); investment freedom (***invtf***); and government spending (***gov***). Next, following the functional form specifications of Whajah et al. (2019), the theoretical linkages between FDI, economic freedom and socioeconomic sustainability is presented as:

$$igrow = f(fdi,\ efs,\ trade; int; faid; findex), \qquad (2)$$

where $\boldsymbol{igrow}$ denotes inclusive growth. Finally, we proceed by following the approach of Bekun et al. (2019) where we specify a functional form for environmental sustainability as seen in Equation 3:

$$ghg = f(fdi,\ efs,\ trade; int; faid; findex), \qquad (3)$$

[3] The eigenvectors of all the principal are disclosed in Table A.6 in Appendices section.

where $\boldsymbol{ghg}$ denotes greenhouse gas emission, while the definitions of all other symbols remain as aforementioned.

Subsequently, we transform Equations 1 – 3 into standard empirical econometric models. In doing so, we first examine the effects of our control variables. This leads to the specification of Equations 4 – 6 for our inclusive green growth, inclusive growth and greenhouse gas emission models, respectively.

$$igg_{it} = \alpha_0 + \delta_1 igg_{it-1} + \delta_2 trade_{it} + \delta_3 int_{it} + \delta_4 faid_{it} + \delta_5 findex_{it} + \mu_i + \rho_t + \varepsilon_{it} \quad (4)$$

$$igrow_{it} = \emptyset_0 + \beta_1 igrow_{it-1} + \beta_2 trade_{it} + \beta_3 int_{it} + \beta_4 faid_{it} + \beta_5 findex_{it} + \mu_i + \rho_t + \varepsilon_{it} \quad (5)$$

$$ghg_{it} = \varphi_0 + \omega_1 ghg_{it-1} + \omega_2 trade_{it} + \omega_3 int_{it} + \omega_4 faid_{it} + \omega_5 findex_{it} + \mu_i + \rho_t + \varepsilon_{it} \quad (6)$$

where $\boldsymbol{igg_{it}}$ denotes inclusive green growth in country $\boldsymbol{i}$ at time $\boldsymbol{t}$ and $\boldsymbol{igg_{it-1}}$ is the first lag of inclusive green growth, used to denote the initial sustainable development condition. Also, we use $\boldsymbol{ghg_{it}}$ and $\boldsymbol{ghg_{it-1}}$ to signify greenhouse gas emissions and its first lag. Similarly, we use $\boldsymbol{igrow_{it}}$ and $\boldsymbol{igrow_{it-1}}$ to represent inclusive growth and its first lag, while $\boldsymbol{\mu_i}$ denotes the country-specific effects, with $\boldsymbol{\varepsilon_{it}}$ signifying the idiosyncratic error term.

We build on this foundation by specifying our full models, where we introduce the conditional and unconditional effect of FDI into Equations 4 – 6 to obtain:

$$igg_{it} = \alpha_0 + \delta_1 igg_{it-1} + \delta_2 trade_{it} + \delta_3 int_{it} + \delta_4 faid_{it} + \delta_5 findex_{it} + \delta_6 fdi_{it} + \delta_7 efs_{it} + \delta_8 (fdi_{it} \times efs_{it}) + \mu_i + \rho_t + \varepsilon_{it} \quad (7)$$

$$igrow_{it} = \emptyset_0 + \beta_1 igrow_{it-1} + \beta_2 trade_{it} + \beta_3 int_{it} + \beta_4 faid_{it} + \beta_5 findex_{it} + \delta_6 fdi_{it} + + \delta_7 efs_{it} + \delta_8 (fdi_{it} \times efs_{it}) + \mu_i + \rho_t + \varepsilon_{it} \quad (8)$$

$$ghg_{it} = \alpha_0 + \omega_1 ghg_{it-1} + \omega_2 trade_{it} + \omega_3 int_{it} + \omega_4 faid_{it} + \omega_5 findex_{it} + \omega_6 fdi_{it} + \omega_7 efs_{it} + \omega_8 (fdi_{it} \times efs_{it}) + \mu_i + \rho_t + \varepsilon_{it} \quad (9)$$

In estimating Equations 4 – 9, although we reckon that competing estimation techniques such as the pooled least squares, the random effect, and the fixed effect can be applied, the attendant estimates will not be reliable. This is due to some endogeneity concerns inherent in these Equations. As Obeng et al. (2022) argue, the introduction of the lags of the outcomes, which captures initial growth conditions, introduces endogeneity in our models. For instance, in

Equation 7, the endogeneity concern arises since $\boldsymbol{igg_{it-1}}$ depends on $\boldsymbol{\epsilon_{it-1}}$, which this also a function on the country-specific impact $\boldsymbol{\mu_i}$. The second endogeneity suspicion has to do with the potential bi-causal relationship between inclusive growth and financial development as espoused in the supply-leading and growth-led hypotheses. In view of this, we resort to the instrumental variable regression approach of Blundell and Bond (1998). The choice of this estimation procedure is discussed below. First, the sampled countries in this study exceed the time span under consideration (i., N=20 > T=19). Second, the Blundell and Bond (1998) technique addresses misspecification bias by accounting for initial conditions in models 7 – 9. Third, vis-à-vis the first difference GMM estimator, the two-step estimation of Blundell and Bond (1998) is more efficient as it yields asymptotically consistent and reliable (see Windmeijer, 2005; Bond et al., 2001). Another caveat for employing the two-step system GMM estimator other than the first-difference GMM estimator is that it addresses possible instrument proliferation and overfitting better. This, according to Mehrhoff (2009), is imperative for yielding reliable coefficients and confidence intervals. Accordingly, this study follows the approach of Blundell and Bond by instrumenting the level equation with the lagged first-differenced covariates and that of the first-differenced estimation with the lagged level variables.

With all these econometric requirements for sound regression taken care of, we proceed to specify the two-step system GMM model. In doing so, we first transform our IGG model in Equation 7 into a standard GMM model, as shown in Equation 10.

$$igg_{it} - igg_{it-\tau} = \delta_0 + \delta_1(igg_{it-\tau} - igg_{it-2\tau}) + \delta_2(trade_{it} - trade_{it-\tau}) + \delta_3(int_{it} - int_{it-\tau}) + \delta_4(faid_{it} - faid_{it-\tau}) + \delta_5(findex_{it} - findex_{it-\tau}) + \delta_6(fdi_{it} - fdi_{it-\tau}) + \delta_7(efs_{it} - efs_{it-\tau}) + \delta_8(fdi_{it} \times efs_{it} - fdi_{it-\tau} \times efs_{it-\tau}) + (\mu_t - \mu_{it-\tau}) + (\varepsilon_{it} - \varepsilon_{it-\tau}) \quad (10)$$

Likewise, we specify the dynamic GMM models for inclusive growth and environmental sustainability as shown in Equations 11 and 12, respectively.

$$igrow_{it} - igrow_{it-\tau} = \beta_0 + \beta_1(igrow_{it-\tau} - igrow_{it-2\tau}) + \beta_2(trade_{it} - trade_{it-\tau}) + \beta_3(int_{it} - int_{it-\tau}) + \beta_4(faid_{it} - faid_{it-\tau}) + \beta_5(findex_{it} - findex_{it-\tau}) + \beta_6(fdi_{it} - fdi_{it-\tau}) + \beta_7(efs_{it} - efs_{it-\tau}) + \beta_8(fdi_{it} \times efs_{it} - fdi_{it-\tau} \times efs_{it-\tau}) + (\mu_t - \mu_{it-\tau}) + (\varepsilon_{it} - \varepsilon_{it-\tau}) \quad (11)$$

$$ghg_{it} - ghg_{it-\tau} = \omega_0 + \omega_1(ghg_{it-\tau} - ghg_{it-2\tau}) + \omega_2(trade_{it} - trade_{it-\tau}) + \omega_3(int_{it} - int_{it-\tau}) + \omega_4(faid_{it} - faid_{it-\tau}) + \omega_5(findex_{it} - findex_{it-\tau}) + \omega_6(fdi_{it} -$$

$fdi_{it-\tau}) + \omega_7(efs_{it} - efs_{it-\tau}) + \omega_8(fdi_{it} \times efs_{it} - fdi_{it-\tau} \times efs_{it-\tau}) + (\mu_t - \mu_{it-\tau}) + (\varepsilon_{it} - \varepsilon_{it-\tau})$

(12)

Finally, to capture the net effects of our FDI and economic freedom interaction terms in Equations 10 – 12, Equations 13 – 15 are presented.

$$\frac{\partial(igg_{it})}{\partial(fdi_{it})} = \delta_6 + \delta_8\overline{(efs_{it})} \tag{13}$$

$$\frac{\partial(igrow_{it})}{\partial(fdi_{it})} = \beta_6 + \beta_8\overline{(efs_{it})} \tag{14}$$

$$\frac{\partial(ghg_{it})}{\partial(fdi_{it})} = \omega_6 + \omega_8\overline{(efs_{it})} \tag{15}$$

where $\overline{\boldsymbol{efs}}$ is the mean value of each of our economic freedom variable. We point out that the marginal effects are computed by invoking the '***lincom***' command in Stata in order to produce standard errors and test statistics essential for assessing their significance levels. Also, it is worth noting that in all our models, the economic freedom variables and their respective interaction terms are introduced stepwisely to avoid multicollinearity.

Following the standard procedure concerning instrumental variable regression, we subject our estimates to several post-estimation tests. First, although we recognise that the Hansen and Sargan tests can be used to ascertain the appropriateness of our instruments, we pay attention to the former. This is because the latter has been shown to be less effective (see Asongu & Odhiambo, 2020b). The Hansen over-identification test is evaluated against the null hypothesis that there is no correlation between the set of identified instruments and the residuals (Hansen, 1982). Besides, post-estimation tests pertaining to the absence of second-order serial correlation in the residuals, the significance of the interaction terms, and the full models are based on the Fisher test.

3.4 Panel threshold regression

To inform policy concerning thresholds necessary and sufficient for economic freedom to moderate FDI to foster IGG, we employ the Hansen (1999) panel threshold estimator for the analysis. The Hansen estimator computes asymmetric effects of the exogenous variable (in our case, FDI) when the threshold variable (i.e., economic freedom) is below/above a particular value. In other words, the panel threshold regression enables us to identify the value of economic freedom (including the subcomponents of *government integrity, business freedom, investment freedom and government spending*) below/above which the relationship between FDI and inclusive green growth changes. Following the Hansen (1999) specification, the threshold model is specified in Equation (16) as:

$$igg_{it} = \alpha_0 + n_i Z_{it} + X_{it}(q_{it} < \gamma)\beta_1 + X_{it}(q_{it} \geq \gamma)\beta_2 + \eta_{it} + \varepsilon_{it} \qquad (16),$$

where $\boldsymbol{igg_{it}}$ represents inclusive green growth, $\boldsymbol{\alpha_0}$ the constant term, $\boldsymbol{Z_{it}}$ is a vector of control variable and $\boldsymbol{n_i}$ is a vector of coefficients for the control variables. Also, $\boldsymbol{X_{it}}$ is a vector of regime dependent variables (i.e., FDI), $\boldsymbol{q_{it}}$ is the threshold variable (in our case, economic freedom) and $\boldsymbol{\gamma}$ is the threshold parameter that splits the equation into two regimes with coefficients $\boldsymbol{\beta_1}$and $\boldsymbol{\beta_2}$.

4. Results and discussion

This section is divided into two parts. The first part (i.e., Section 4.1 – 4.2) focuses on the summary statistics and the IGG scores. The second part (i.e., Section 4.3 – 4.7) also deals with the presentation and discussion of the main regression results.

4.1. Summary statistics

The descriptive statistics of the variables are presented in Table 3. For IGG, we observe a mean value of -0.157, suggesting that over the study period, growth in SSA has neither been inclusive nor green. This becomes glaring when we consider the average inclusive growth and greenhouse gas emission values of 0.143 and 136.42, respectively. Compared to the case of perfect inclusiveness (i.e., inclusive growth index = 1), the mean value of 0.143 for inclusive growth suggests that, over the study period, growth in SSA has not been inclusive. The latter also shows that the carbon footprint of the region is rising. Also, the mean FDI and economic freedom over the study period are 4.085% and 55.6%, respectively. Per Miller et al. (2022) classification, the latter suggests that SSA's economic architecture is 'Mostly unfree'.

Table 3: Summary statistics, 2002 -2020

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum
Outcome variables					
Inclusive green growth	380	-0.157	0.934	-1.424	1.398
Inclusive growth	380	0.143	0.157	0.050	1.000
Greenhouse gas emission	380	136.421	208.761	-85.277	828.871
Main independent variable					
Foreign direct investment	380	4.085	5.960	-6.370	39.760
Control variables					
Trade openness	380	70.242	27.517	20.723	156.862
Foreign aid	380	5.130	6.002	-0.251	62.187
Internet access	380	13.770	16.066	0.072	68.200
Financial development	380	0.180	0.144	0.029	0.646
Moderating variables					
Economic freedom	380	0.556	0.084	0.243	0.770
Government integrity	380	0.307	0.123	0.100	0.640
Business freedom	380	0.551	0.117	0.268	0.850
Investment freedom	380	0.480	0.165	0.100	0.900
Government spending	380	0.770	0.145	0.000	0.965

Source: Authors' construct.

Based on a further analysis, as apparent in Figure A.2 we find that although countries such as Mauritius (72.57%), South Africa (62.84%), Botswana (69.47%), and Namibia (61.72%) have made remarkable strides in building freer economic environments, challenges are conspicuous in Angola (42.75%), Democratic Republic of Congo (41.55%), Congo Republic (43.56%) and Togo (49.31%). Also, the data shows that while government spending in SSA is high, investment freedom is 'Repressed' and business freedom is 'Mostly unfree'.

Besides, the graphical relationship between FDI, economic freedom and IGG as shown in Figure 2 provides some interesting perspectives, which we subject to rigorous empirical analysis in Section 4.4. For instance, Figure 2 shows that higher levels of FDI and government spending are associated with lower levels of IGG, while business freedom, investment freedom and government integrity show otherwise. Clearly, it is relevant to investigate how these perspectives pan out for IGG, including identifying minimum thresholds necessary and sufficient for economic freedom to cause FDI to promote IGG in SSA

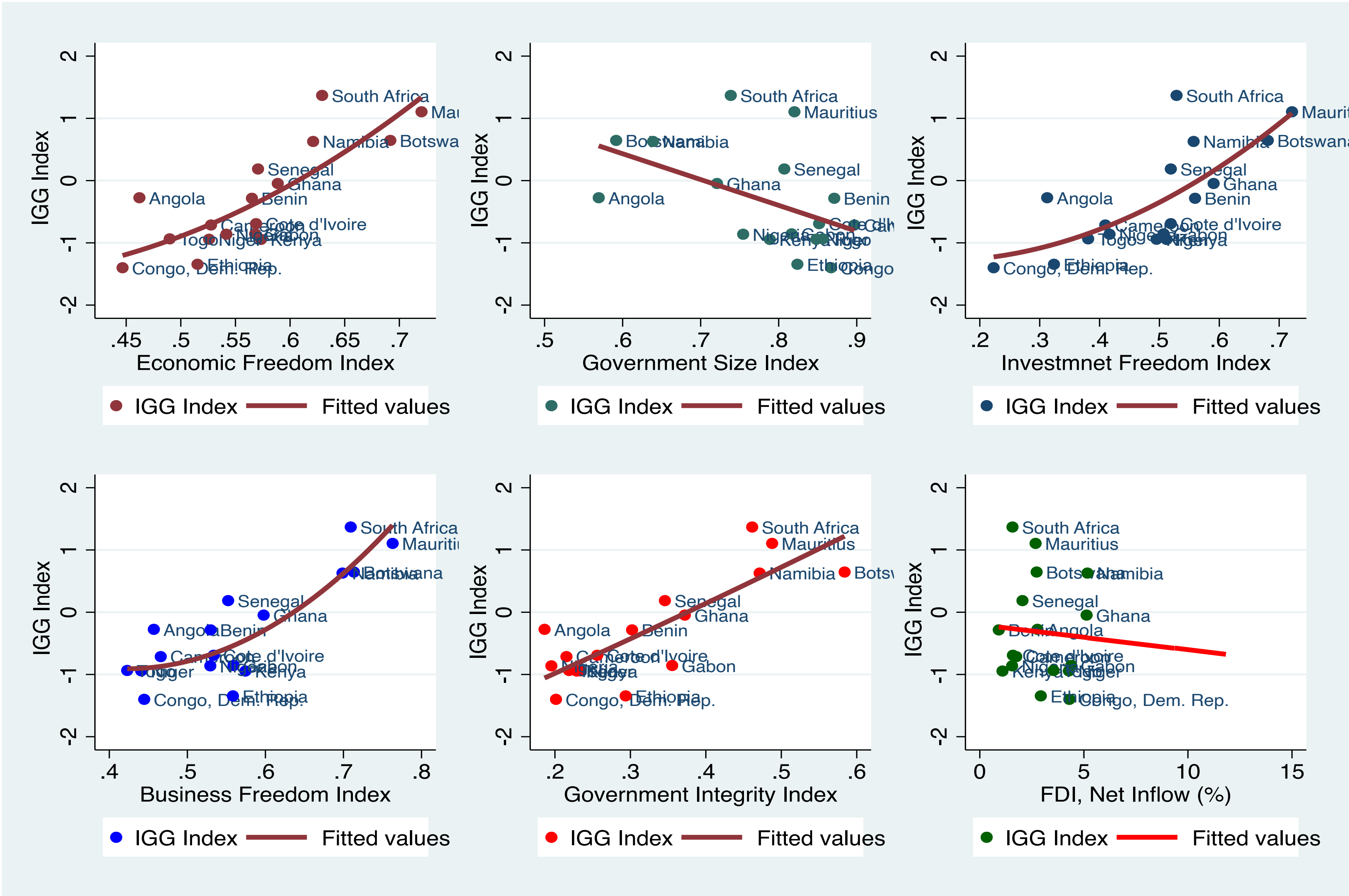

Figure 2: Relationship between FDI, economic freedom and inclusive green growth.
Note: Data used are taken from the WDI and the Heritage Foundation Data Center.

4.2 Overview of socioeconomic and environmental progress in SSA

In this section, we shed light on the developments regarding socioeconomic and environmental sustainability in SSA by way of graphical analysis. It is imperative to point out the analysis is based entirely on the region's progress toward sustainable development over the study period. Regarding the former, information gleaned from Figure 3 gives an indication that growth in SSA has not been inclusive. This is against the backdrop that all the sampled countries report inclusive growth values less than 0.2. This is more so considering the high unemployment and infant mortality rates in the sampled countries. Indeed, Figure 3 shows that unemployment is high in countries such as Botswana, Gabon, Nigeria, Namibia, Senegal, Congo Republic, Mauritius, and South Africa. Also, the high infant mortality rate in countries covered in our study suggests some weaknesses in the quality of healthcare delivery in SSA.

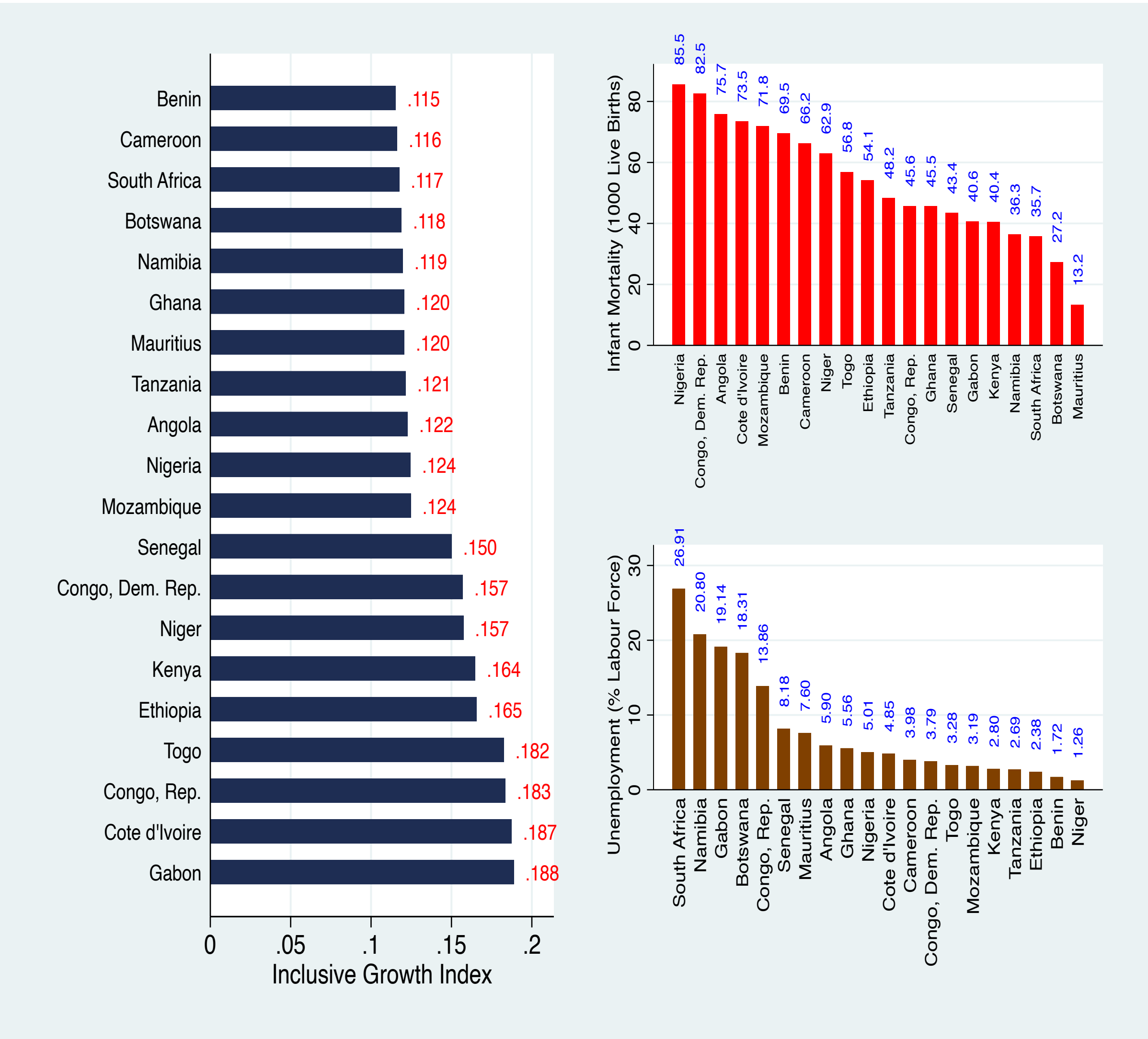

Figure 3: In-country major social progress indicators (average) in SSA, 2002 – 2020.
Note: Data used are taken from the OECD Statistics, WDI, and the Green Growth Knowledge Program.

On the environmental sustainability front, Figure 4 shows that greenhouse gas emission in most SSA countries has risen significantly over the study period. Except for Angola, Benin, Cote d'Ivoire, Congo Republic, and Democratic Republic of Congo, it is evident that since 1990, all the sampled countries have seen an increase in carbon emissions. This is clearly visible in the high fossil fuel consumption (as a share of primary energy consumption), although renewable energy consumption (as a share of primary energy consumption) is also high. The environmental quality of life associated concerns associated with greenhouse gas emissions is apparent in the rising levels of ozone depletion mortalities.

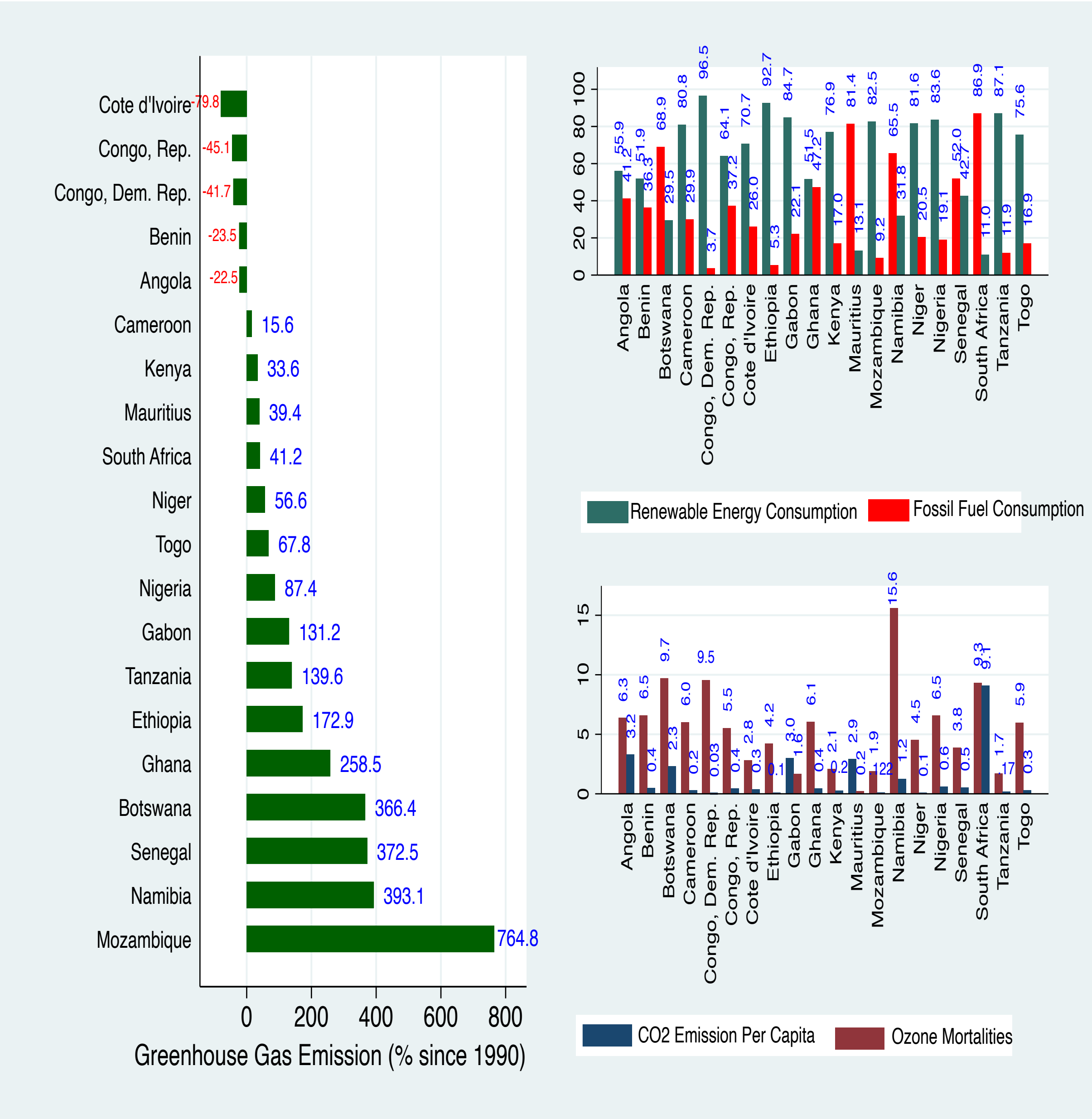

Figure 4: In-country major environmental progress indicators (average) in Africa, 2002 – 2020. **Note**: Data used are taken from the OECD Green Growth Statistics and the WDI.

4.3 Inclusive green growth performance in SSA countries

In this section, we analyse the PCA results for our IGG index. In doing so, we assess whether the growth trajectory of each country in our sample is socially and environmentally sustainable or not. Consequently, Figure 5 is presented to show the overview of the growth trajectory of countries covered in our study. Here, we deepen an understanding of our IGG index by pointing out that a negative (positive) IGG score depends on a country's progress regarding social and environmental perspectives of sustainable development. The import of this is that although a country could be experiencing progress in the area of environmental sustainability, it could be worse off from the social progress side, culminating into an overall negative IGG. The other scenario is that a country could be better off (worse off) across the two domains of sustainable development.

Compelling evidence from Figure 6 indicates that, out of the 20 countries sampled, only 6 report growth trajectory that is both inclusive and green. These countries are Botswana, Namibia, Mauritius, South Africa, Mozambique, and Tanzania. Arguably, this implies that the growth path of the rest of the countries can be described as 'porous' and/or 'dirty'. Figure 5 shows that this concern is striking in countries such as the Democratic Republic of Congo, Ethiopia, Kenya, Togo, Niger, Nigeria, Gabon and Cameroon.

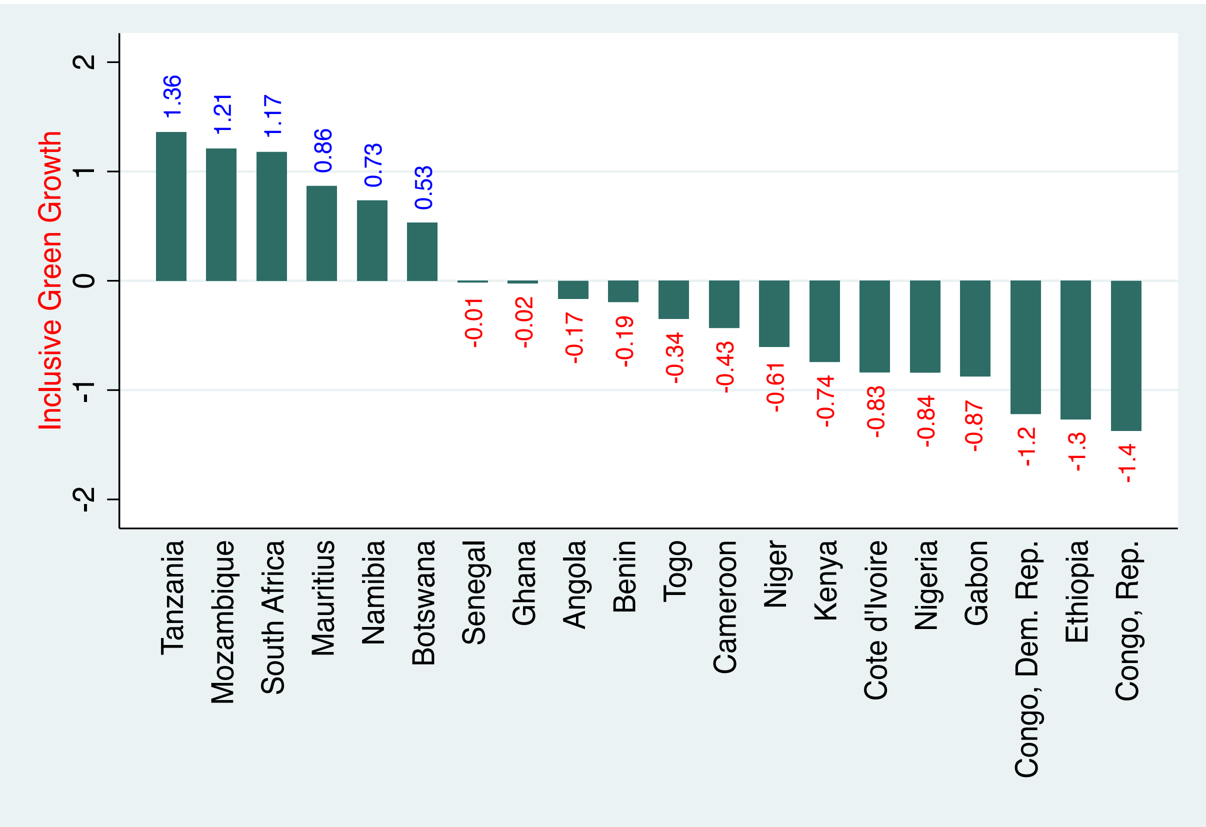

Figure 5: In-country inclusive green growth in SSA, 2002 – 2020

4.4. Effects of FDI and economic freedom on inclusive green growth

We begin the presentation of the main results by first paying attention to the conditional and unconditional effects of FDI on IGG. For the first objective, the results in Table 4 indicate that although FDI is positively related to IGG, the effect is not statistically significant (see Column 2). This is not farfetched because although FDI flows to the region has been effective in promoting equitable income growth and distribution (see Ofori & Asongu, 2021; Xu et al., 2021), the evidence by Opoku and Boachie (2020) that it hampers environmental quality mean that it could fall short in promoting IGG. Still on Objective 1, we find strong evidence at 1% level of significance that economic freedom promotes IGG (Column 3). With a coefficient of 0.35, the result suggests that for every 1% improvement in economic freedom, the IGG score of SSA is enhanced by 0.35. The study provides empirical evidence in support of the argument by Miller et al. (2022) that by improving market openness, government integrity and regulatory efficiency, countries can build a conducive setting for innovation and investment. In SSA, this could contribute to IGG through entrepreneurship, private sector growth, and environmental consciousness.

At the disaggregated level of economic freedom (Columns 4 – 7), we find some interesting findings as well. We find that, with the exception of business freedom, all the other aspects of economic freedom are statistically significant in spurring IGG. First, the evidence in Column 5 suggests that a 1% increase in government integrity boosts IGG by 0.47 points. Our evidence suggests that the effectiveness of governments in building structures and frameworks that address corruption, informality and informal markets can help the private sector to actively support IGG through innovation, durable growth and green innovation diffusion (Miller et al., 2022; Amendolagine et al., 2021; Melane-Lavado et al., 2018). Also, the study finds that the IGG score of SSA increases by 0.24 points for every 1% improvement in investment freedom (Column 6). The result suggests that eliminating burdensome and reductant government regulations can enable the private sector to participate actively in market systems in a manner that is socially and environmentally progressive. From another angle, the result mean that transparency and equity in investment regulation, effective support for all firms, and the easing of restrictions on capital flows can cushion SSA countries to build greener and more inclusive growth trajectories.

Table 4: Effects of FDI and economic freedom on inclusive green growth (Dependent variable: inclusive green growth)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Inclusive green growth (-1)	0.9635***	0.9396***	0.8941***	0.9095***	0.9010***	0.8773***	0.9621***	0.8855***	0.9058***	0.9009***	0.8622***	0.9230***
	(0.0289)	(0.0166)	(0.0260)	(0.0378)	(0.0335)	(0.0360)	(0.0198)	(0.0361)	(0.0391)	(0.0309)	(0.0379)	(0.0208)
Trade openness	-0.0007	0.0069	0.0325*	0.0380	0.0482*	0.0955***	0.1011***	0.0420**	0.0465	0.0500*	0.1016***	0.0332*
	(0.0169)	(0.0228)	(0.0183)	(0.0268)	(0.0250)	(0.0227)	(0.0112)	(0.0185)	(0.0295)	(0.0250)	(0.0254)	(0.0179)
Internet access	-0.0015***	-0.0008	-0.0001	-0.0002	-0.0003	-0.0004	-0.0013*	-0.0007	-0.0002	-0.0004	-0.0004	0.0001
	(0.0002)	(0.0006)	(0.0005)	(0.0005)	(0.0006)	(0.0005)	(0.0006)	(0.0005)	(0.0004)	(0.0006)	(0.0005)	(0.0005)
Foreign aid	-0.0021*	0.0022	0.0019	-0.0004	0.0043	0.0060**	-0.0052***	0.0030*	0.0033	0.0043	0.0061**	0.0025
	(0.0010)	(0.0021)	(0.0018)	(0.0023)	(0.0026)	(0.0023)	(0.0015)	(0.0015)	(0.0029)	(0.0027)	(0.0021)	(0.0015)
Financial development	0.2377	0.5073***	0.4388***	0.4505***	0.2686**	0.4729***	0.3741***	0.3675***	0.3788***	0.2980***	0.5478***	0.3341***
	(0.2036)	(0.1630)	(0.1016)	(0.1016)	(0.1088)	(0.1087)	(0.1147)	(0.1275)	(0.1030)	(0.1010)	(0.1144)	(0.0705)
Foreign direct investment (FDI)		0.0001	0.0006	-0.0006	-0.0001	-0.0020***	0.0026***	0.0062	0.0034*	-0.0034	-0.0095*	0.0061*
		(0.0003)	(0.0006)	(0.0005)	(0.0009)	(0.0007)	(0.0009)	(0.0087)	(0.0019)	(0.0046)	(0.0046)	(0.0034)
Economic freedom			0.3546**					0.8273***				
			(0.1323)					(0.1720)				
Business freedom				0.1029					0.2935**			
				(0.1209)					(0.1366)			
Government integrity					0.4731***					0.4396***		
					(0.0727)					(0.0779)		
Investment freedom						0.2492***					0.2202***	
						(0.0592)					(0.0588)	
Government spending							0.5604***					0.0234
							(0.1021)					(0.0335)
Economic freedom × FDI								-0.0098				
								(0.0163)				
Business freedom × FDI									-0.0098**			
									(0.0041)			
Government integrity × FDI										0.0121		
										h(0.0157)		
Investment freedom × FDI											0.0146	
											(0.0086)	
Government spending × FDI												-0.0110*
												(0.0054)
Constant	-0.0278	-0.1206	-0.4463***	-0.3125	-0.4212***	-0.6312***	-0.8918***	-0.7228***	-0.4433**	-0.4212***	-0.6610***	-0.2245**
	(0.0766)	(0.0999)	(0.1330)	(0.1884)	(0.1415)	(0.1406)	(0.1073)	(0.1665)	(0.2049)	(0.1376)	(0.1534)	(0.0930)
Observations	380	380	380	380	380	380	380	380	380	380	380	380
Net Effect	na	na	na	na	na	na	na	0.0007	-0.0019**	0.0003	-0.0025***	-0.0023***
								(0.0009)	(0.0007)	(0.0010)	0.0007	0.0008
Joint Sig. Statistic [p-value]	na	na	na	na	na	na	na	0.81 [0.429]	-2.50 [0.022]	0.29 [0.775]	-3.32 [0.004]	-2.90 [0.009]
Countries/Instruments	20/17	20/17	20/19	20/19	20/19	20/19	20/20	20/20	20/19	20/19	20/19	20/19
Wald Statistic	4199***	8677***	6638***	8594***	4318***	1337***	22108***	10149***	29569***	6005***	1198***	205644***
Wald P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen P-Value	0.341	0.527	0.244	0.207	0.571	0.520	0.622	0.161	0.336	0.512	0.461	0.678
AR(1)	0.005	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.004	0.005	0.004	0.004
AR(2)	0.120	0.248	0.227	0.161	0.223	0.287	0.217	0.257	0.253	0.189	0.181	0.147

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The estimates in Column 7 also indicate that government spending boosts IGG in SSA by 0.56 points. In low-income countries like SSA, productive government spending in broadening access to socioeconomic overheads (e.g., healthcare, telecommunication, sanitation, schools, roads, potable water) and cash transfers can promote IGG through equitable growth and sustainable consumption.

We now turn our attention to the results concerning Objective 2, where we interrogate whether economic freedom interacts with FDI to promote IGG. A major finding from this study is that, out of the 5 economic freedom modules considered, only business freedom (Column 9) investment freedom (Column 11) and government spending (Column 12) are statistically significant for conditioning the effect of FDI on IGG. The marginal effect for the FDI-business freedom interaction term is, however, negative (-0.0019), obtained by engaging the unconditional effect of FDI (0.0034), the indirect effect of FDI (-0.0098), and the average business freedom score of 0.551. Following similar computations, we report net effects of -0.0025 and -0.0023 for the FDI-investment freedom, and FDI-government spending pathways, respectively. These findings are unique and revealing. We provide strong empirical evidence that Africa's economic architecture, which Miller et al. (2022) classify as '*Mostly unfree*', hurts the region's IGG pursuit. This means that although FDI inflow to SSA is expected to rise following the implementation of the AfCFTA (UNCTAD, 2021), potential IGG gains could prove elusive due to the region's mostly unfree economic freedom. For instance, burdensome investment regulations, lack of productive support for firms, and state control on capital flows, which are prevalent in unfree economies could hamper or lessen potential shared growth and environmentally sustainable gains of FDI. Moreover, unfree business environments, in the form of long contact hours for registering a business, unreliable energy supply, and complicated tax compliance procedures could lessen potential IGG effects of FDI. This could manifest in several ways especially as FDI inflow to SSA have been concentrated in the extractive, fishing, retail and telecommunication industries. For example, market-seeking foreign investors could opt for strong ties with foreign counterparts other than local firms, impeding forward and backward linkages, and growth in the host countries. Further, in unfree economic settings, resource-seeking, and strategic asset-seeking foreign investors might shy away from committing enormous resources into green technology investments. It could also provide the impetus for foreign investors to engage in capital flight as they become apprehensive about returns to investments.

The ancillary findings also provide some interesting perspectives. First, the evidence shows that while financial development promotes IGG in SSA, internet access shows otherwise. Precisely, we find that financial development promotes IGG, irrespective of model specification. This result suggests that in developing countries, access to finance could spur greener and more inclusive growth, possibly due to its effectiveness in supporting innovation, and entrepreneurship (Demirgüç-Kunt & Singer, 2017). Also, the result feeds into the argument that financial development can cushion economic agents to acquire products/services that support environmentally sustainable production and consumption practices (Adams & Koblodu., 2018; Shahbaz et al., 2018). Further, the study finds that internet access harms IGG. This harmful effect can also be explained by the fact the disparity in the access across to internet services across the rural-urban divide in SSA is high. This, in effect, can deepen inequalities in access to socioeconomic opportunities. Additionally, internet usage has also been found to degrade the environment since it requires high energy consumption to power data centres and ICT gadgets (see, Salahuddin & Alam, 2016). In SSA, where non-renewable energy is high, this can intensify carbon emissions). Both trade openness and foreign aid also appear to hinder IGG in SSA, although the effects are quite sensitive to model specification. The harmful effect of trade openness is not surprising per evidence that it can intensify income inequality, energy intensity, and ecological footprint in regions where informality is high and the energy systems are in their nascent stages of development (IEA, 2019; Erkul & Külünk, 2022).

4.5 Effects of FDI and economic freedom on environmental sustainability

Table 5 presents the findings for the conditional and unconditional effects of FDI on environmental sustainability. For Objective 1, the study reveals that FDI degrades the environment, with the magnitude of the coefficient indicating that greenhouse gas emissions increase by 0.02% for every 1% increase capital flows to SSA. The study, therefore, confirms the case of the pollution haven hypothesis in SSA. This is plausible, considering evidence by Ofori & Figari (2023) that the region's institutional fabric is weak.

Table 5: Effects of FDI and economic freedom on environmental sustainability (Dependent variable: Greenhouse gas emission)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Greenhouse gas emission (-1)	0.6684***	0.6443***	0.6498***	0.7103***	0.6714***	0.6629***	0.8284***	0.6536***	0.7247***	0.5719***	0.6087***	0.5760***
	(0.0156)	(0.0246)	(0.0237)	(0.0240)	(0.0653)	(0.0340)	(0.0333)	(0.0400)	(0.0276)	(0.0639)	(0.0808)	(0.0599)
Trade openness	0.0399	0.1598**	0.0572	0.2407***	0.0364	0.2339***	0.3624***	0.2529**	0.1650*	-0.0525	0.1550**	-0.2180
	(0.0508)	(0.0622)	(0.0919)	(0.0611)	(0.0955)	(0.0769)	(0.0456)	(0.1114)	(0.0893)	(0.1549)	(0.0700)	(0.2007)
Internet access	-0.0006	0.0060***	0.0051***	0.0028**	0.0019	0.0024***	0.0013	0.0029**	0.0015	0.0018	0.0036**	0.0065***
	(0.0011)	(0.0020)	(0.0012)	(0.0012)	(0.0019)	(0.0008)	(0.0017)	(0.0012)	(0.0010)	(0.0038)	(0.0017)	(0.0022)
Foreign aid	-0.0002	0.0353***	0.0354***	0.0280***	0.0288**	0.0396***	0.0207*	0.0504***	0.0256**	0.0476**	0.0419***	0.0264
	(0.0029)	(0.0112)	(0.0114)	(0.0090)	(0.0123)	(0.0121)	(0.0113)	(0.0093)	(0.0111)	(0.0174)	(0.0113)	(0.0162)
Financial development	2.7898*	0.9397	1.2185*	0.0740	-0.1517	0.9739	1.2019*	-0.0147	0.1358	-0.5134	0.5741	1.0525
	(1.3765)	(1.1634)	(0.6592)	(0.4050)	(0.6726)	(0.6241)	(0.5744)	(0.5801)	(0.5268)	(1.0901)	(0.7747)	(0.7252)
Foreign direct investment (FDI)		0.0221***	0.0318***	-0.0089**	0.0084	0.0054	0.0303***	0.2781***	0.0570***	0.2219***	0.0834**	-0.0965***
		(0.0041)	(0.0064)	(0.0033)	(0.0105)	(0.0059)	(0.0064)	(0.0367)	(0.0140)	(0.0439)	(0.0369)	(0.0271)
Economic freedom			-0.8285***					5.3291***				
			(0.2548)					(0.9521)				
Business freedom				1.4522***					1.6634***			
				(0.3841)					(0.4720)			
Government integrity					2.3840***					4.4587***		
					(0.4126)					(1.2820)		
Investment freedom						1.1375***					1.7222***	
						(0.1417)					(0.4714)	
Government spending							2.6651***					-1.6780***
							(0.3720)					(0.4420)
Economic freedom × FDI								-0.4933***				
								(0.0617)				
Business freedom × FDI									-0.1103***			
									(0.0224)			
Government integrity × FDI										-0.6780***		
										(0.1612)		
Investment freedom × FDI											-0.1308**	
											(0.0516)	
Government spending × FDI												0.2002***
												(0.0456)
Constant	-0.1710	-0.7629**	0.0546	-1.6370***	-0.7363	-1.5466***	-3.8486***	-3.9589***	-1.4701**	-0.9516	-1.4635***	2.0746**
	(0.4148)	(0.3272)	(0.5064)	(0.4016)	(0.4828)	(0.4069)	(0.3134)	(0.7969)	(0.5638)	(0.7944)	(0.5032)	(0.8979)
Observations	380	380	380	380	380	380	380	380	380	380	380	380
Net Effect	na	na	na	na	na	na	na	0.0038	-0.0037	0.0137	0.0206	0.0576***
								(0.0034)	(0.0044)	(0.0089)	(0.0138)	(0.0143)
Joint Sig. statistic [p-value]	na	na	na	na	na	na	na	1.12 [0.276]	-0.85 [0.404]	1.53 [0.142]	1.49 [0.153]	4.02 [0.001]
Countries/Instruments	20/17	20/17	20/19	20/19	20/19	20/19	20/20	20/20	20/19	20/19	20/19	20/19
Wald Statistic	3939***	12191***	25145***	1760***	76055***	19137***	2.578e+06***	15594***	12042***	18464***	3334***	18779***
Wald P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen P-Value	0.522	0.262	0.409	0.670	0.622	0.228	0.332	0.512	0.684	0.532	0.309	0.678
AR(1)	0.054	0.044	0.039	0.050	0.044	0.046	0.049	0.034	0.048	0.036	0.042	0.047
AR(2)	0.087	0.076	0.068	0.085	0.076	0.080	0.081	0.082	0.082	0.100	0.077	0.082

Standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

In such contexts, Bokpin (2017) argues that foreign investors may not commit to environmental obligations/standards, noting that firms could adopt technologies that only achieve the goals of extraction or manufacturing at the expense of environmental progress. Additionally, the intense competition among African countries to lure foreign investors in recent times could lead to policymakers lowering environmental standards for foreign firms (including energy-intensive or polluting foreign firms).

Still on Objective 1, the evidence in Column 3 suggests that, overall, economic freedom promotes environmental quality. However, at the disaggregated level, some interested findings are evident. Specifically, we find that unfree business freedom, government integrity, investment freedom, and government spending intensify greenhouse gas emission by 1.45% (Column 4), 2.38% (Column 5), 1.13% (Column 6), and 2.66% (Column 7), respectively. Several reasons explain these environmentally-deteriorating effects. First, in economically unfree societies, widespread state interference and weak regulatory frameworks impede private sector innovation, performance, and entrepreneurship. This, in effect, can incentivize foreign firms to favour environmentally unsustainable means of production especially in a region where corruption control is weak. Furthermore, in unfree business environment, foreign firms may find it tough mapping out a clear long-term production plan due to regulatory uncertainties and performance-impeding demands from corrupt bureaucrats. Second, in jurisdictions where government integrity is weak as clearly depicted in Figure A.2, efficient operation of free markets is hampered. This can work out to the advantage of polluting or resource-seeking foreign firms, who for purposes of profits, can offer bribes to circumvent environmental sustainability obligations. Finally, poor investment freedom can also hurt environmental progress as it may lead to inefficient allocation of capital in a setting where the energy system is already in its nascent stages. This is more so per host country-foreign investor disputes in countries such as Tanzania, Mozambique, Benin, and Congo (Adarkwah, 2021; p.201), which may (i) cause already established firms not to investment in green technologies, or (ii) be a disincentive to 'clean' foreign investors who are wary of undue political takeovers.

Having said that, we now turn attention to our second objective, where we examine whether economic freedom moderates FDI to foster environmental progress. With the exception of government spending, the evidence indicates that all our economic freedom indicators are not effective for regulating the impact of FDI on environmental sustainability. Precisely, the FDI-government spending interaction term yields a marginal effect of 0.0576, which is computed by taking into account the direct effect of FDI on greenhouse gas emissions (−0.0965), the coefficient of the FDI-government spending interaction term (−1.6780), and the mean government spending score (0.770). This result can be explained in many ways. First, in a bid to build the absorptive capacity of their economies to deepen forward and backward linkages with foreign firms, governments invest in infrastructure (e.g., roads, energy systems, airports, telecommunication, etc), which have been shown to degrade the environment through carbon emissions (see Nchofoung & Asongu, 2022). Second, governments in SSA spend highly on fossil fuel and agricultural subsidies, which can heighten energy intensity and high greenhouse gas emissions (IEA, 2021; Jayne & Rashid, 2013).

For our control variables, the results in Column 1 of Table 5 show that both financial development and trade openness increase greenhouse gas emissions in SSA. For financial development, the study reveals a remarkable 2.78% effect. This finding aligns with empirical evidence that, in developing countries, financial development can exacerbate greenhouse gas emissions through the income and technology effect (Lahiani, 2020; Al-Mulali et al., 2015). This is possible in settings like SSA where access to funds cushions households and firms to acquire to acquire energy-consuming technologies or engage in petty trading (e.g., restaurant services, air conditioners, cement production, shoe-making, etc).

4.6 Effects of FDI and economic freedom on socioeconomic sustainability

In this section, we present our results for the direct and indirect effects of FDI on inclusive growth. For Objective 1, the results in Columns 1 and 2 of Table 6 shows that both FDI and economic freedom are negatively related to inclusive growth, albeit statistically insignificant. Unconditionally, FDI may fall short of spurring shared prosperity in SSA per the observation by UNCTAD (2021) that capital flows largely into sectors that generate fewer jobs (e.g., in fuels, extractive, cement and finance industries). Also, unfree economic environments can hinder inclusive growth by retarding innovation, entrepreneurship and private sector performance.

Table 6: Effects of FDI and economic freedom on socioeconomic sustainability (Dependent variable: Inclusive growth)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Inclusive growth (-1)	0.8141***	1.0576***	0.8901***	0.9888***	0.9980***	0.8766***	0.8881***	0.7794***	0.8928***	0.9000***	0.8598***	0.8726***
	(0.0689)	(0.1809)	(0.0739)	(0.0557)	(0.0596)	(0.0839)	(0.0526)	(0.0544)	(0.0641)	(0.1001)	(0.0768)	(0.1113)
Trade openness	-0.0129	-0.0048	-0.0100	0.0069	-0.0017	-0.0030	-0.0235**	-0.0155*	-0.0134	-0.0063	-0.0019	0.0003
	(0.0092)	(0.0284)	(0.0078)	(0.0129)	(0.0118)	(0.0118)	(0.0088)	(0.0080)	(0.0086)	(0.0125)	(0.0102)	(0.0140)
Internet access	0.0000	0.0006*	0.0003**	0.0005*	0.0006***	0.0006**	0.0003**	-0.0002	0.0002	0.0003	0.0005**	0.0004
	(0.0002)	(0.0003)	(0.0001)	(0.0003)	(0.0002)	(0.0002)	(0.0001)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0004)
Foreign aid	-0.0056***	-0.0047***	-0.0042**	-0.0051***	-0.0053***	-0.0040***	-0.0036***	-0.0034**	-0.0041***	-0.0040**	-0.0039***	-0.0029**
	(0.0014)	(0.0010)	(0.0016)	(0.0012)	(0.0011)	(0.0011)	(0.0013)	(0.0014)	(0.0014)	(0.0015)	(0.0012)	(0.0014)
Financial development	-0.2131*	-0.0958	-0.0737*	-0.1083***	-0.1111***	-0.0999***	-0.1274***	-0.1186***	-0.1188***	-0.1291***	-0.0986***	-0.1048**
	(0.1194)	(0.1705)	(0.0355)	(0.0290)	(0.0161)	(0.0178)	(0.0246)	(0.0197)	(0.0192)	(0.0386)	(0.0223)	(0.0384)
Foreign direct investment (FDI)		-0.0001	0.0020***	-0.0021	-0.0006	0.0002	0.0017***	0.0367***	0.0144*	0.0197**	0.0105***	0.0127
		(0.0032)	(0.0005)	(0.0020)	(0.0013)	(0.0013)	(0.0005)	(0.0057)	(0.0070)	(0.0071)	(0.0032)	(0.0100)
Economic freedom			-0.1075					0.2971***				
			(0.0825)					(0.0681)				
Business freedom				-0.0807*					0.0944			
				(0.0428)					(0.0616)			
Government integrity					-0.1132***					0.1866		
					(0.0341)					(0.1080)		
Investment freedom						-0.1056***					-0.0227	
						(0.0301)					(0.0431)	
Government spending							-0.1039**					0.1061
							(0.0402)					(0.1067)
Economic freedom × FDI								-0.0710***				
								(0.0125)				
Business freedom × FDI									-0.0234*			
									(0.0131)			
Government integrity × FDI										-0.0742**		
										(0.0289)		
Investment freedom × FDI											-0.0234**	
											(0.0083)	
Government spending × FDI												-0.0202
												(0.0145)
Constant	0.1350***	0.0289	0.1270*	0.0486	0.0707	0.0985**	0.2106***	-0.0348	0.0377	0.0195	0.0581	-0.0422
	(0.0467)	(0.0561)	(0.0621)	(0.0360)	(0.0458)	(0.0431)	(0.0586)	(0.0627)	(0.0340)	(0.0551)	(0.0487)	(0.1141)
Observations	380	380	380	380	380	380	380	380	380	380	380	380
Net effect	na	na	na	na	na	na	na	-0.0027*	0.0015	-0.0030	-0.0007	-0.0028
								(0.0014)	(0.0013)	(0.0028)	(0.0017)	(0.0029)
Joint Sig. statistic [p-value]	na	na	na	na	na	na	na	-1.88 [0.076]	1.13 [0.273]	-1.07 [0.296]	-0.40 [0.695]	-0.97 [0.344]
Countries/Instruments	20/17	20/17	20/19	20/19	20/19	20/19	20/20	20/20	20/19	20/19	20/19	20/19
Wald Statistic	385.9***	3462***	991***	1458***	504.6***	1949***	2532***	37595***	1327***	1393***	5675***	4898***
Wald P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Hansen P-Value	0.234	0.305	0.276	0.256	0.235	0.381	0.276	0.140	0.292	0.192	0.199	0.366
AR(1)	0.006	0.005	0.006	0.006	0.005	0.006	0.005	0.005	0.007	0.007	0.006	0.008
AR(2)	0.988	0.993	0.995	0.977	0.981	0.995	0.962	0.997	0.954	0.893	0.992	0.983

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

This can, in effect, keep/push the masses into precarious jobs, which according to Ofori et al. (2022b) hinder inclusive growth. Also, at the disaggregated level of economic freedom, we find strong evidence that business freedom, government integrity, investment freedom and government spending reduce inclusive growth. Notably, the evidence suggests that, in SSA, low government integrity and repressed investment freedom hurt inclusive growth the most. Specifically, we show that SSA's unfree business freedom, government integrity, and investment freedom reduce inclusive growth by 0.081 (Column 4), 0.113 (Column 5), and 0.105 (Column 6) points, respectively.

The finding concerning the second objective of this study is equalling compelling. Specifically, the results show that economic freedom nullifies the positive effects of FDI (0.0367) to yield a net effect of -0.0027 (Column 8). We compute this marginal effect as:

$$\frac{\partial(igrow_{it})}{\partial(fdi_{it})} = [(0.0367) + [(-0.0710) \times (0.556)] = -0.0027,$$

For our control variables, the evidence in Column 1 of Table 6 suggests that although internet access is positively related to inclusive growth as Adeleye et al. (2021) argue, the effect is not statistically significant. Furthermore, the study finds that foreign aid drags down inclusive growth by 0.005 points. The deleterious effect is in line with the concern raised by Babalola and Shittu (2020) that the inflow of aid to sectors such as health, education, and water and sanitation have not been complemented with durable shared growth modules that bridge rural-urban disparities in terms of opportunities, income growth and wealth. Finally, the negative effect of financial development (-0.213) is also in line with evidence by Ofori et al. (2022c) that the glaring disparities in access to finance and inefficiency of Africa's financial institutions impede inclusive growth in Africa.

Overall, it is evident that our findings are appropriate for policymaking. First, the estimates are efficient per the Hansen p-values, which indicate the absence of instrument proliferation. Second, the AR(2) statistics confirm the absence of second-order serial correlations in the residuals and hence the appropriateness of the estimates. Third, all the Fisher statistics are significant, suggesting that the models are appropriate for inference and policy recommendations. Fourth, we produce test statistics and standard errors to back the marginal effects reported for all the FDI-economic freedom interactions.

4.7 Threshold regression results for economic freedom dynamics

In this section, we present a key contribution from this study, which has to do with informing policy on minimum thresholds required for our economic freedom dynamics to form relevant synergies with FDI to foster IGG. We do so by drawing from the results which show that economic freedom dynamics are either not statistically significant in conditioning FDI to foster IGG or dampen/nullify the effects of FDI on environmental/socioeconomic sustainability. This contribution is imperative to guide policymakers as to the level of investments required for our various economic freedom dynamics to condition FDI to foster IGG in SSA.

The attendant results, which are based on threshold regression are novel and revealing. First, the results in Table 7 show that for economic freedom (overall) to form relevant synergy with FDI to foster IGG, a minimum threshold of 66.2% (Column 1) is required. Indeed, below the threshold of 66.2%, economic freedom is ineffective in interacting with FDI to promote greener and more inclusive growth, which confirms our finding in Column 8 of Table 4. The result suggests that by improving the current level of economic freedom in Africa (i.e., 55.4%), which is regarded as 'Mostly unfree' by Miller et al. (2022) to 66.2% (Moderately free), FDI can spur IGG. At the disaggregated level, the study finds that minimum thresholds of 70%, 31.3% and 60% are required for business freedom, government integrity, and investment freedom, respectively. Overall, evidence indicates that whereas achieving a 'Moderately *free*' investment freedom is necessary and sufficient to cause FDI to promote IGG, greater efforts are needed to ensure that business freedom is at least in the 'Mostly free' bracket before FDI can foster IGG.

Table 7: Economic freedom threshold results for inclusive green growth

Variable	(1)	(2)	(3)	(4)	(5)
Trade openness	-0.0767	-0.0888	-0.1311	-0.0953	-0.0786
	(0.0915)	(0.0924)	(0.0897)	(0.0925)	(0.0919)
Internet access	0.0045***	0.0042***	0.0039***	0.0044***	0.0036**
	(0.0015)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
Foreign aid	0.0020	0.0022	-0.0002	0.0020	0.0029
	(0.0039)	(0.0039)	(0.0038)	(0.0039)	(0.0039)
Financial development	-0.5361	-0.3794	-0.0893	-0.3780	-0.2190
	(0.5415)	(0.5424)	(0.5294)	(0.5400)	(0.5444)
Economic freedom	-0.1289				
	(0.4858)				
Business freedom		0.1990			
		(0.2631)			
Government integrity			-1.5443***		
			(0.3137)		
Investment freedom				-0.2817	
				(0.1801)	
Government size					0.2167
					(0.1785)
< Threshold x FDI	0.0002	0.0008	0.0012	0.0011	0.0023
	(0.0037)	(0.0037)	(0.0037)	(0.0036)	(0.0039)
> Threshold x FDI	0.0877***	0.0236	0.0261***	0.0291**	0.0235*
	(0.0303)	(0.0159)	(0.0097)	(0.0143)	(0.0132)
Constant	0.2350	0.0926	0.7903**	0.3528	-0.0397
	(0.4837)	(0.4340)	(0.3997)	(0.4067)	(0.4281)
Observations	380	380	380	380	380
R-squared	0.0577	0.0447	0.1026	0.0479	0.0501
Threshold variable	*efs*	*busf*	*govint*	*invtf*	*gov*
Threshold statistic	0.6620	0.7000	0.3130	0.6000	0.8880
Fisher statistic	3.09***	2.36**	5.76***	2.54**	2.66**
Fisher p-value	0.003	0.023	0.000	0.014	0.011
Countries	20	20	20	20	20
Sigma E	0.295	0.297	0.288	0.297	0.296
Sigma U	0.924	0.910	1.015	0.943	0.934
Rho	0.907	0.904	0.926	0.910	0.909

*Note: efs is Economic Freedom; busf is Business Freedom; govint is Government Freedom; invtf is Investment Freedom; gov is Government Freedom; Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*

The results concerning the environmental and socioeconomic sustainability domains of IGG are compelling as well. First, the study finds that while a 64.8% threshold is required for economic freedom (overall) to moderate FDI to promote environmental sustainability, 69.5%, 48%, and 65% are required for business freedom, government integrity, and investment freedom, respectively. The threshold result for government spending (56.9%) should be interpreted with caution. This is because beyond this threshold, FDI degrades the environment by 0.018. This means that for capital flows to promote environmental sustainability in SSA, government spending should not exceed 56.9%. This finding is particularly revealing as SSA governments seek to scale up investments in infrastructure and security to attract foreign investors to support green growth. In all, we provide convincing evidence that while a 'Satisfactory' government integrity, and 'Moderately high' government expenditure are necessary and sufficient to cause FDI to foster environmental progress, investment freedom and business freedom need to be 'Moderately free' in order for FDI to enhance environmental quality.

Table 8: Economic freedom threshold results for environmental sustainability

Variable	(1)	(2)	(3)	(4)	(5)
Trade openness	0.5072***	0.5989***	0.5273***	0.5280***	0.5681***
	(0.1532)	(0.1624)	(0.1585)	(0.1542)	(0.1712)
Internet access	0.0136***	0.0143***	0.0140***	0.0165***	0.0150***
	(0.0026)	(0.0027)	(0.0026)	(0.0025)	(0.0027)
Foreign aid	-0.0076	-0.0081	-0.0082	-0.0055	-0.0078
	(0.0065)	(0.0068)	(0.0067)	(0.0064)	(0.0069)
Financial development	0.0788	-0.4578	-0.0592	-0.0676	0.7025
	(0.8997)	(0.9646)	(0.9297)	(0.9022)	(0.9828)
Economic freedom	-0.1111				
	(0.8061)				
Business freedom		0.0729			
		(0.4617)			
Government integrity			-0.1115		
			(0.5635)		
Investment freedom				0.2513	
				(0.2970)	
Government size					0.1786
					(0.3367)
< Threshold x FDI	0.0137**	0.0129**	0.0120*	0.0073	-0.0056
	(0.0062)	(0.0065)	(0.0062)	(0.0060)	(0.0101)
> Threshold x FDI	-0.3561***	-0.1246***	-0.2403***	-0.2022***	0.0187**
	(0.0443)	(0.0283)	(0.0397)	(0.0278)	(0.0078)
Constant	-0.8003	-1.2381	-0.9224	-1.0769	-1.4982*
	(0.8066)	(0.7592)	(0.7052)	(0.6784)	(0.8155)
Observations	380	380	380	380	380
R-squared	0.2963	0.2100	0.2520	0.2908	0.1739
Threshold variable	*efs*	*busf*	*govint*	*invtf*	*govs*
Threshold value	0.643	0.695	0.480	0.650	0.569
Fisher statistic	21.24***	13.41***	16.99***	20.67***	10.61***
Fisher p-value	0.000	0.000	0.000	0.000	0.000
Countries	20	20	20	20	20
Sigma E	0.493	0.522	0.508	0.495	0.534
Sigma U	2.079	2.065	2.076	2.083	2.020
Rho	0.947	0.940	0.943	0.947	0.935

*Note: efs is Economic Freedom; busf is Business Freedom; govint is Government Freedom; invtf is Investment Freedom; gov is Government Freedom; Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*

Concerning socioeconomic sustainability, the result in Table A.7 reveals threshold values of 42.8%, for economic freedom (overall), 56.2% for government size, 30% for investment freedom, compared to 23% and 48.6% for government integrity and business freedom, respectively. The results, thus far, suggest that vis-à-vis socioeconomic sustainability, greater effort is required to improve the various economic freedom modules to levels that can interact with FDI to foster environmental sustainability. In all, we find that these threshold estimates are achievable and statistically reliable since all the Fisher statistics are significant.

5. Conclusion and policy implications

This study contributes to the policy discourse aimed at realising sustainable development in the light of Agenda 2030 and the African Union's Agenda 2063. We do so by investigating whether economic freedom (including the subcomponents of business freedom, investment, government integrity and government spending) matters for interacting with FDI to promote IGG in Africa. The empirical analysis is based on macro data for 20 SSA countries for the period 2002 - 2020. Additionally, the study computes minimum thresholds required for our various economic freedom modules to form relevant synergies with FDI to foster IGG in SSA. On the theoretical front, this study provides a clear analytical framework that can be relied upon by researchers to examine how capital flows and economic freedom feed into multidimensional sustainability. More importantly, the framework can be employed researchers and policymakers alike to track the progress of regions/territories towards IGG.

The results, which are based on the dynamic system GMM estimator and threshold regression reveal the following. First, FDI is not statistically significant for promoting IGG. Second, the study finds that Africa's 'Mostly unfree' economic architecture completely nullifies the marginal positive effect of FDI to yield an overall negative effect. Third, results from our threshold regression reveal that the minimum threshold required for economic freedom to condition FDI to foster IGG is 66.2%. At the disaggregated level, also, we find minimum thresholds of 70% for business freedom, 60% for investment freedom and 31.3% for government integrity.

For FDI to foster IGG as envisioned in Agenda 2030 and Agenda 2063, we recommend that African countries prioritise environmentally sustainable capital flows and investments especially in the areas of recycling and green technologies. Second, African countries should prioritise investments aimed at enhancing regulatory efficiency, market openness and government integrity. This can be enhanced if development partners like the African Development Bank and the World Bank support African countries to create a fair and transparent investment and business environment that supports both large and small businesses, promotes innovation and competition. Third, policymakers must ensure the free flow of capital in the light of the implementation AfCFTA, by discarding redundant regulations and implementing financial and technical support schemes to cushion investors to contribute to IGG. Finally, governments should also design mechanisms to address issues such as bribery, nepotism and cronyism that affect countries' investment climate. This could go a long way to consolidate and attract new foreign investors, which could contribute to Africa's IGG pursuit.

The main limitations of this study are two. First, we do not explore how the FDI-economic freedom linkages impact IGG across the major sub-regional blocs of SSA. Second, we do not take into account whether the two main sources of capital flows to Africa (i.e., the Europe and Asia) have any differing impacts on IGG in SSA. These issues are worth exploring and can be considered by other researchers with interest in contributing to the sustainable development literature.

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Table A.1: List of Countries

Angola	Kenya
Benin	Mauritius
Botswana	Mozambique
Cameroon	Namibia
Democratic Republic of Congo	Niger
Republic of Congo	Nigeria
Cote d'Ivoire	Senegal
Ethiopia	South Africa
Gabon	Tanzania
Ghana	Togo

Table A.2: Pairwise correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Inclusive green growth	1												
(2) Inclusive growth	0.0459	1											
(3) Greenhouse gas emission	0.459^{***}	-0.0328	1										
(4) Trade openness	0.0541	0.254^{***}	0.114^{*}	1									
(5) Foreign direct investment	0.0165	0.00851	0.298^{***}	0.386^{***}	1								
(6) Foreign aid	-0.0349	-0.249^{***}	0.255^{***}	-0.158^{**}	0.168^{***}	1							
(7) Internet access	0.261^{***}	-0.00245	0.0751	-0.00594	-0.100^{*}	-0.388^{***}	1						
(8) Financial development	0.509^{***}	0.247^{***}	0.133^{**}	0.189^{***}	-0.106^{*}	-0.398^{***}	0.501^{***}	1					
(9) Economic freedom	0.510^{***}	0.221^{***}	0.277^{***}	0.00512	-0.232^{***}	-0.293^{***}	0.428^{***}	0.592^{***}	1				
(10) Government integrity	0.436^{***}	0.323^{***}	0.337^{***}	0.219^{***}	-0.0370	-0.301^{***}	0.411^{***}	0.666^{***}	0.792^{***}	1			
(11) Investment freedom	0.459^{***}	0.164^{***}	0.245^{***}	0.0209	-0.0793	-0.227^{***}	0.388^{***}	0.401^{***}	0.768^{***}	0.642^{***}	1		
(12) Business freedom	0.47^{***}	0.304^{***}	0.275^{***}	0.159^{**}	-0.130^{**}	-0.207^{***}	0.351^{***}	0.664^{***}	0.708^{***}	0.668^{***}	0.506^{***}	1	
(13) Government size	-0.114^{*}	-0.144^{**}	-0.179^{***}	-0.435^{***}	-0.313^{***}	0.181^{***}	-0.0345	-0.252^{***}	0.171^{***}	-0.175^{***}	-0.0845	-0.0772	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.3: Summary statistics of IGG variables

Variables	N	Mean	Std. Dev.	Minimum	Maximum
Clean fuel usage	391	33.708	34.727	0.340	99.100
Agricultural land	437	44.888	19.502	8.022	80.888
Life expectancy	460	60.322	7.848	46.267	76.880
Forest cover	483	30.889	23.621	0.663	91.978
Fossil fuel consumption	345	40.944	30.13	1.640	99.978
Economic growth	483	5996.051	4955.111	630.702	22870.29
Renewable energy	437	56.944	30.394	0.059	98.343
Exposure to Ambient PM.2.5	299	6.661	2.365	1.130	15.200
Unemployment	483	8.772	7.392	0.320	33.29
Sanitation	423	30.846	24.102	2.000	93.200
Potable water	368	73.000	17.158	28.900	99.900
Wealth changes	287	-94.743	620.182	-3281.8	1867.6
Temperature changes	483	1.007	0.420	-0.562	2.291
Population density	483	78.127	121.545	2.180	626.486
Carbon intensity	444	0.150	0.126	0.024	0.738
Ambient PM.2.5 mortalities	460	283.848	162.144	47.066	742.247
Ambient PM.2.5 welfare cost	460	3.187	1.909	0.474	8.621
Transport infrastructure	414	8.746	8.774	1.255	37.649
Income inequality	327	46.213	8.622	32.900	66.900
Human capital index	460	1.869	0.455	1.118	2.939
Methane emission	437	11414.7	13434.02	20.000	68350
Natural resources rent	460	11.726	12.439	0.001	58.65
Environmentally friendly technologies	393	10.806	16.667	0.000	100.00
Infant mortality	460	52.18	24.283	12.500	121.200

Note: N = Observations; Std. Dev denotes Standard Deviation.

Table A.4: Pairwise correlation matrix for IGG index variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
(1) Cleanfuel	1																							
(2) agric	0.127	1																						
(3) enerint	-0.504***	-0.236**	1																					
(4) forest	-0.151*	-0.439***	0.125	1																				
(5) fosful	0.866***	0.317***	-0.597***	-0.396***	1																			
(6) gpc	0.795***	0.0410	-0.499***	0.0456	0.667***	1																		
(7) renener	-0.840***	-0.325***	0.576***	0.398***	-0.991***	-0.657***	1																	
(8) amb	-0.290***	-0.0262	0.309***	0.205**	-0.213**	-0.458***	0.235**	1																
(9) unemp	0.631***	0.195**	-0.322***	-0.0673	0.647***	0.732***	-0.624***	-0.242**	1															
(10) sanit	0.630***	0.119	-0.437***	0.130	0.474***	0.717***	-0.482***	-0.376***	0.389***	1														
(11) powat	0.797***	0.227**	-0.726***	0.0297	0.782***	0.842***	-0.781***	-0.300***	0.656***	0.701***	1													
(12) cwea	0.164*	0.263***	-0.188*	-0.475***	0.412***	0.0983	-0.452***	-0.164*	0.230**	0.189*	0.227**	1												
(13) temp	0.143	0.0688	-0.0247	-0.249***	0.155*	-0.197**	-0.126	0.162*	-0.156*	-0.211**	-0.103	-0.0746	1											
(14) pop	0.223**	0.178*	-0.122	-0.115	0.175*	0.285***	-0.200**	-0.467***	-0.165*	0.384***	0.218**	-0.0003	-0.0054	1										
(15) carint	0.512***	0.468***	-0.104	-0.289***	0.647***	0.452***	-0.651***	-0.120	0.678***	0.308***	0.430***	0.177*	0.0286	0.0189	1									
(16) ambmort	0.862***	0.320***	-0.556***	-0.211**	0.820***	0.692***	-0.761***	-0.116	0.644***	0.436***	0.750***	0.102	0.178*	0.157*	0.540***	1								
(17) ambcost	0.852***	0.323***	-0.559***	-0.209**	0.811***	0.662***	-0.749***	-0.0986	0.629***	0.437***	0.741***	0.122	0.183*	0.136	0.523***	0.992***	1							
(18) trans	0.563***	0.141	-0.430***	-0.325***	0.646***	0.732***	-0.669***	-0.523***	0.513***	0.511***	0.648***	0.470***	-0.198**	0.558***	0.325***	0.500***	0.475***	1						
(19) ineq	-0.0129	0.340***	-0.210**	-0.0248	0.166*	0.267***	-0.187*	-0.0500	0.560***	0.253***	0.351***	0.398***	-0.421***	-0.290***	0.382***	0.0683	0.0780	0.303***	1					
(20) hc	0.525***	0.167*	-0.390***	-0.0021	0.515***	0.780***	-0.507***	-0.330***	0.648***	0.461***	0.674***	0.170*	-0.257***	0.233**	0.409***	0.625***	0.598***	0.665***	0.347***	1				
(21) methane	-0.403***	0.0402	0.538***	-0.105	-0.428***	-0.342***	0.442***	0.122	-0.277***	-0.206**	-0.595***	-0.0883	-0.0008	-0.0914	-0.117	-0.439***	-0.428***	-0.365***	-0.180*	-0.378***	1			
(22) natres	-0.0285	-0.453***	0.265***	0.527***	-0.277***	0.0348	0.290***	0.322***	-0.112	0.0344	-0.110	-0.459***	-0.0849	-0.272***	-0.240**	-0.210**	-0.209**	-0.378***	-0.253***	-0.209**	0.252***	1		
(23) envtech	0.118	-0.0487	0.0912	-0.0168	0.0656	0.0656	-0.0561	-0.0429	-0.00239	0.0057	-0.0305	-0.009	0.0245	0.142	-0.003	0.0824	0.0809	0.0780	-0.189*	0.0642	0.107	0.00995	1	
(24) infmort	-0.760***	-0.164*	0.441***	0.372***	-0.766***	-0.674***	0.767***	0.507***	-0.578***	-0.353***	-0.628***	-0.337***	-0.0765	-0.283***	-0.425***	-0.695***	-0.680***	-0.675***	0.009	-0.699***	0.366***	0.367***	-0.126	1

* *p < 0.1,* ** *p < 0.05,* *** *p < 0.001*

Table A.5: Principal components and eigenvalues for inclusive green growth

Component	Eigenvalue	Difference	Proportion	Cumulative	KMO Statistic
Comp 1	**10.051**	**7.532**	**0.419**	**0.419**	**0.826**
Comp 2	**2.519**	**0.370**	**0.105**	**0.524**	**0.363**
Comp 3	**2.149**	**0.113**	**0.089**	**0.613**	**0.744**
Comp 4	**2.036**	**0.659**	**0.085**	**0.698**	**0.579**
Comp 5	**1.376**	**0.320**	**0.057**	**0.755**	**0.800**
Comp 6	**1.057**	**0.146**	**0.044**	**0.799**	**0.831**
Comp 7	0.911	0.055	0.038	0.837	0.776
Comp 8	0.855	0.228	0.036	0.873	0.684
Comp 9	0.627	0.071	0.026	0.899	0.844
Comp 10	0.556	0.105	0.023	0.922	0.742
Comp 11	0.451	0.096	0.019	0.941	0.876
Comp 12	0.355	0.062	0.015	0.956	0.610
Comp 13	0.293	0.071	0.012	0.968	0.850
Comp 14	0.222	0.016	0.009	0.977	0.296
Comp 15	0.206	0.086	0.009	0.986	0.708
Comp 16	0.120	0.054	0.005	0.991	0.758
Comp 17	0.066	0.019	0.003	0.994	0.821
Comp 18	0.047	0.005	0.002	0.996	0.655
Comp 19	0.042	0.015	0.002	0.997	0.391
Comp 20	0.028	0.010	0.001	0.999	0.746
Comp 21	0.017	0.006	0.001	0.999	0.669
Comp 22	0.011	0.008	0.001	1.000	0.558
Comp 23	0.004	0.002	0.000	1.000	0.569
Comp 24	0.002	0.000	0.000	1.000	0.749
Overall	–	–	–	–	**0.720**

Note: KMO is Kaiser-Meyer-Olkin; Comp is Principal Component
Source: Authors' construct, 2023

Table A.6: Eigenvectors of IGG components

Variable	Comp1	Comp2	Comp3	Comp4	Comp5	Comp6	Comp7	Comp8	Comp9	Comp10	Comp11	Comp12	Comp13	Comp14	Comp15	Comp16	Comp17	Comp18
cleanfuel	0.276	0.117	-0.227	0.033	0.080	-0.030	0.179	0.005	-0.014	0.040	-0.067	-0.180	0.109	0.220	0.045	-0.218	0.063	-0.059
agric	0.105	-0.358	0.090	0.136	0.058	0.579	-0.147	0.177	-0.130	-0.141	-0.021	-0.035	-0.407	0.342	0.113	-0.119	-0.080	0.110
enerint	-0.205	-0.034	0.016	0.022	0.471	-0.080	-0.037	-0.177	0.497	0.144	0.113	-0.199	0.052	0.399	-0.035	-0.212	0.267	-0.026
forest	-0.087	0.518	0.069	0.053	-0.085	0.104	-0.145	0.111	0.113	0.237	0.240	-0.312	-0.254	-0.210	0.488	0.064	0.038	-0.139
fosful	0.288	-0.094	-0.135	0.101	0.000	-0.081	0.168	0.077	0.076	0.055	-0.198	0.052	-0.075	-0.212	0.099	-0.026	0.001	-0.186
incgro	0.268	0.260	0.062	-0.076	0.140	0.004	0.054	-0.093	-0.058	-0.059	0.102	0.205	0.020	0.008	-0.024	-0.045	0.273	0.542
renener	-0.285	0.106	0.101	-0.075	0.004	0.088	-0.196	-0.086	-0.124	-0.113	0.229	-0.055	0.197	0.211	-0.060	0.120	-0.054	0.111
amb	-0.130	0.020	-0.139	0.457	-0.046	0.028	-0.039	0.364	0.512	-0.278	0.071	0.124	0.056	-0.241	-0.079	-0.278	-0.162	0.165
unemp	0.237	0.085	0.175	0.260	0.210	-0.146	-0.083	-0.206	-0.119	0.115	0.099	0.090	0.095	0.104	0.368	-0.110	-0.569	0.249
sanit	0.199	0.227	0.114	-0.146	0.056	0.298	0.372	0.233	-0.047	0.139	0.208	-0.297	0.232	-0.036	-0.440	-0.161	-0.302	-0.004
powat	0.282	0.175	0.042	0.036	-0.168	0.084	0.062	0.136	-0.032	0.033	0.010	0.067	-0.161	0.041	0.058	-0.178	0.510	0.178
cwea	0.115	-0.337	0.248	-0.032	-0.054	-0.350	0.362	0.296	0.161	-0.075	0.264	-0.299	-0.151	0.136	0.141	0.400	0.002	0.159
temp	-0.006	-0.203	-0.498	0.103	-0.112	0.028	0.104	-0.124	-0.077	0.339	0.664	0.279	-0.119	0.018	-0.064	0.013	0.003	-0.034
pop	0.091	-0.036	-0.093	-0.551	0.048	0.390	-0.052	0.059	0.361	0.063	-0.005	0.148	0.009	-0.015	0.201	0.084	-0.154	-0.102
carint	0.195	-0.132	0.055	0.269	0.341	0.198	-0.031	-0.185	0.153	0.433	-0.230	-0.043	-0.054	-0.271	-0.180	0.372	0.049	0.066
ambmort	0.271	0.031	-0.225	0.150	0.001	0.083	-0.166	-0.001	0.007	-0.215	0.044	-0.106	0.298	0.123	0.088	0.226	0.079	-0.013
ambcost	0.267	0.025	-0.225	0.162	-0.011	0.082	-0.148	0.028	-0.011	-0.225	0.065	-0.155	0.333	0.141	0.104	0.248	0.086	-0.277
trans	0.246	-0.043	0.155	-0.291	0.029	-0.125	0.034	0.011	0.275	-0.075	0.063	0.442	0.153	0.024	0.177	-0.029	-0.052	-0.080
ineq	0.097	-0.048	0.556	0.259	-0.038	0.030	-0.053	0.105	-0.077	0.157	0.184	0.261	0.141	0.092	-0.060	-0.147	0.167	-0.503
hc	0.236	0.138	0.155	-0.055	0.092	-0.051	-0.359	-0.133	0.129	-0.322	0.306	0.008	-0.298	-0.182	-0.405	0.213	-0.033	-0.048
methane	-0.158	-0.114	0.014	-0.021	0.551	0.156	0.293	-0.033	-0.266	-0.363	0.207	0.009	0.069	-0.413	0.252	-0.066	0.174	-0.108
natres	-0.104	0.442	-0.124	0.148	0.205	-0.013	0.363	0.049	-0.007	-0.163	-0.144	0.321	-0.347	0.358	-0.087	0.285	-0.141	-0.224
envtech	0.016	0.010	-0.172	-0.157	0.411	-0.274	-0.386	0.654	-0.250	0.218	-0.024	0.085	-0.011	0.025	-0.069	0.004	-0.003	0.009
infmort	-0.261	0.070	0.115	0.138	-0.073	0.259	0.089	0.232	0.037	0.148	-0.014	0.255	0.348	0.028	0.062	0.392	0.124	0.248

Variable	Comp19	Comp20	Comp21	Comp22	Comp23	Comp24
cleanfuel	-0.320	0.007	0.652	0.353	-0.103	0.005
agric	-0.199	-0.104	-0.122	0.066	-0.053	0.059
enerint	0.107	-0.240	-0.139	-0.076	-0.003	0.032
forest	-0.233	-0.028	-0.109	0.050	0.012	0.021
fosful	0.026	-0.384	-0.006	-0.256	0.054	0.690
incgro	-0.378	0.100	-0.030	-0.480	-0.069	0.019
renener	0.034	0.352	0.117	0.128	0.074	0.691
amb	-0.022	0.229	0.075	-0.017	-0.004	0.012
unemp	0.329	-0.082	0.077	-0.012	-0.041	-0.045
sanit	0.051	-0.075	-0.247	0.019	0.026	0.016
powat	0.617	0.127	-0.034	0.256	0.016	0.056
cwea	0.009	0.128	0.096	-0.057	0.023	-0.005
temp	-0.011	-0.004	-0.019	0.006	0.002	-0.002
pop	0.231	0.163	0.333	-0.284	0.065	-0.068
carint	-0.050	0.349	-0.022	0.180	0.006	0.039
ambmort	-0.035	-0.082	-0.103	0.011	0.745	-0.124
ambcost	0.095	0.135	-0.200	-0.167	-0.600	-0.030
trans	-0.264	0.028	-0.373	0.496	-0.053	0.086
ineq	-0.076	0.121	0.192	-0.231	0.123	-0.055
hc	0.066	-0.329	0.236	0.128	-0.088	-0.011
methane	0.071	0.005	0.048	0.085	0.019	-0.033
natres	0.053	0.105	-0.045	-0.030	0.062	-0.014
envtech	0.018	0.021	-0.012	0.001	0.006	-0.000
infmort	0.023	-0.494	0.182	0.127	-0.144	-0.032

Note: Comp is principal components

Table A.7: Economic freedom threshold results for inclusive growth

Variables	(1)	(2)	(3)	(4)	(5)
Trade openness	-0.0815*	-0.0855*	-0.1245***	-0.1066**	-0.0437
	(0.0456)	(0.0466)	(0.0452)	(0.0459)	(0.0458)
Internet access	-0.0023***	-0.0025***	-0.0027***	-0.0026***	-0.0023***
	(0.0007)	(0.0007)	(0.0007)	(0.0008)	(0.0007)
Foreign aid	0.0050***	0.0057***	0.0057***	0.0064***	0.0060***
	(0.0019)	(0.0019)	(0.0019)	(0.0019)	(0.0019)
Financial development	-0.8326***	-0.7711***	-0.6792**	-0.7404***	-0.7963***
	(0.2665)	(0.2703)	(0.2657)	(0.2698)	(0.2628)
Economic freedom	-0.3629				
	(0.2402)				
Business freedom		0.0810			
		(0.1385)			
Government integrity			-0.5685***		
			(0.1571)		
Investment freedom				-0.1003	
				(0.0822)	
Government size					0.1949**
					(0.0900)
< Threshold x FDI	0.0079***	0.0073***	-0.0024	-0.0025	0.0144***
	(0.0023)	(0.0022)	(0.0029)	(0.0028)	(0.0027)
> Threshold x FDI	-0.0026	-0.0015	0.0062***	0.0056***	-0.0020
	(0.0023)	(0.0024)	(0.0019)	(0.0020)	(0.0021)
Constant	0.8435***	0.5965***	0.9504***	0.7579***	0.3169
	(0.2438)	(0.2221)	(0.2017)	(0.2020)	(0.2180)
Observations	380	380	380	380	380
R-squared	0.1914	0.1672	0.1876	0.1638	0.2147
Threshold variable	***efs***	***busf***	***govint***	***invtf***	***gov***
Threshold statistic	**0.4280**	**0.4340**	**0.2300**	**0.3000**	**0.5690**
Fisher statistic	14.53*	9.05	8.90	7.60	32.00***
Fisher p-value	0.063	0.143	0.273	0.116	0.010
Countries	20	20	20	20	20
Sigma E	0.145	0.147	0.145	0.147	0.143
Sigma U	0.175	0.146	0.198	0.161	0.151
Rho	0.593	0.496	0.650	0.543	0.527

*Note: efs is Economic Freedom; busf is Business Freedom; govint is Government Freedom; invtf is Investment Freedom; gov is Government Freedom; Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*

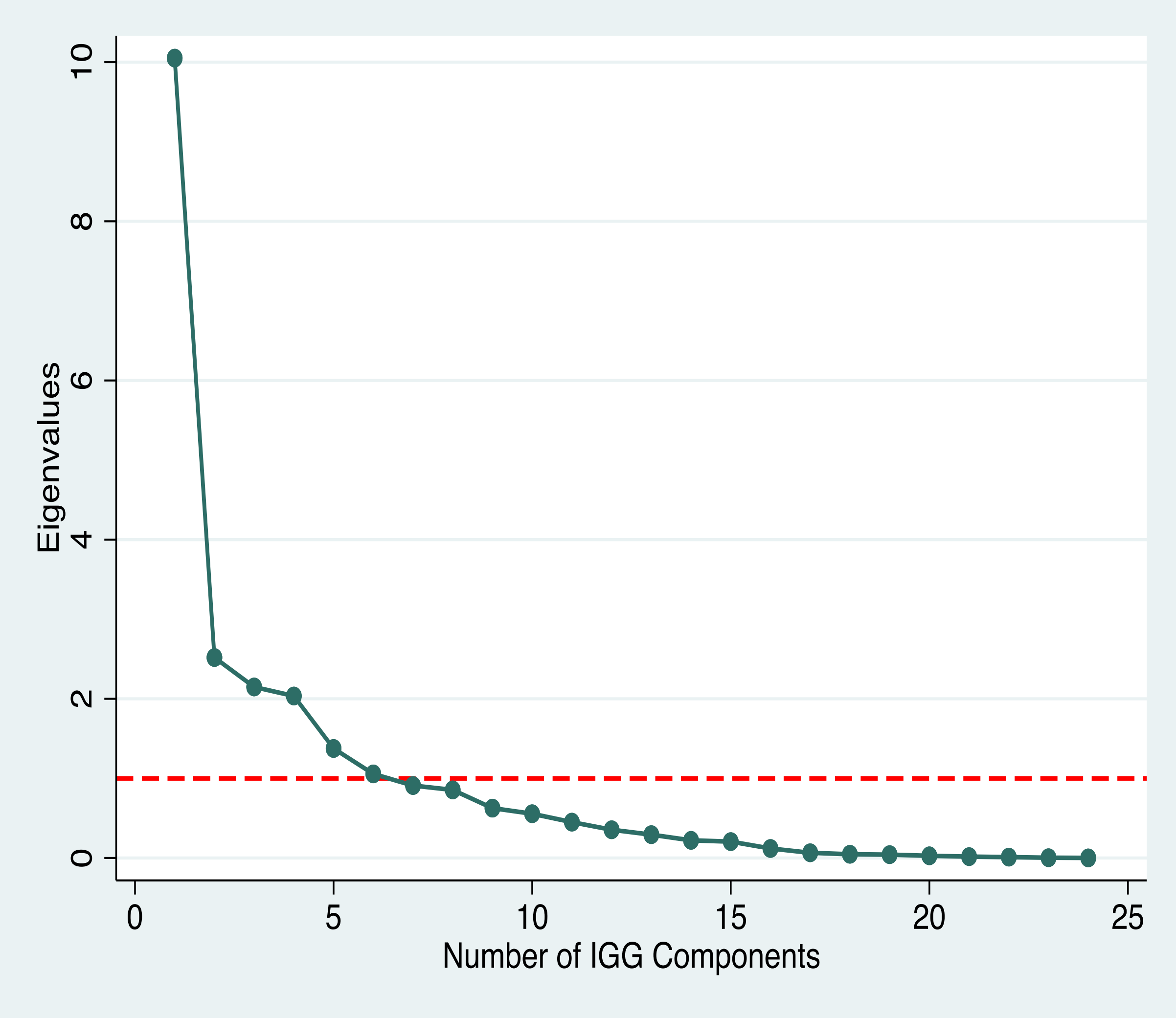

Figure A.1: Screeplot of IGG Components

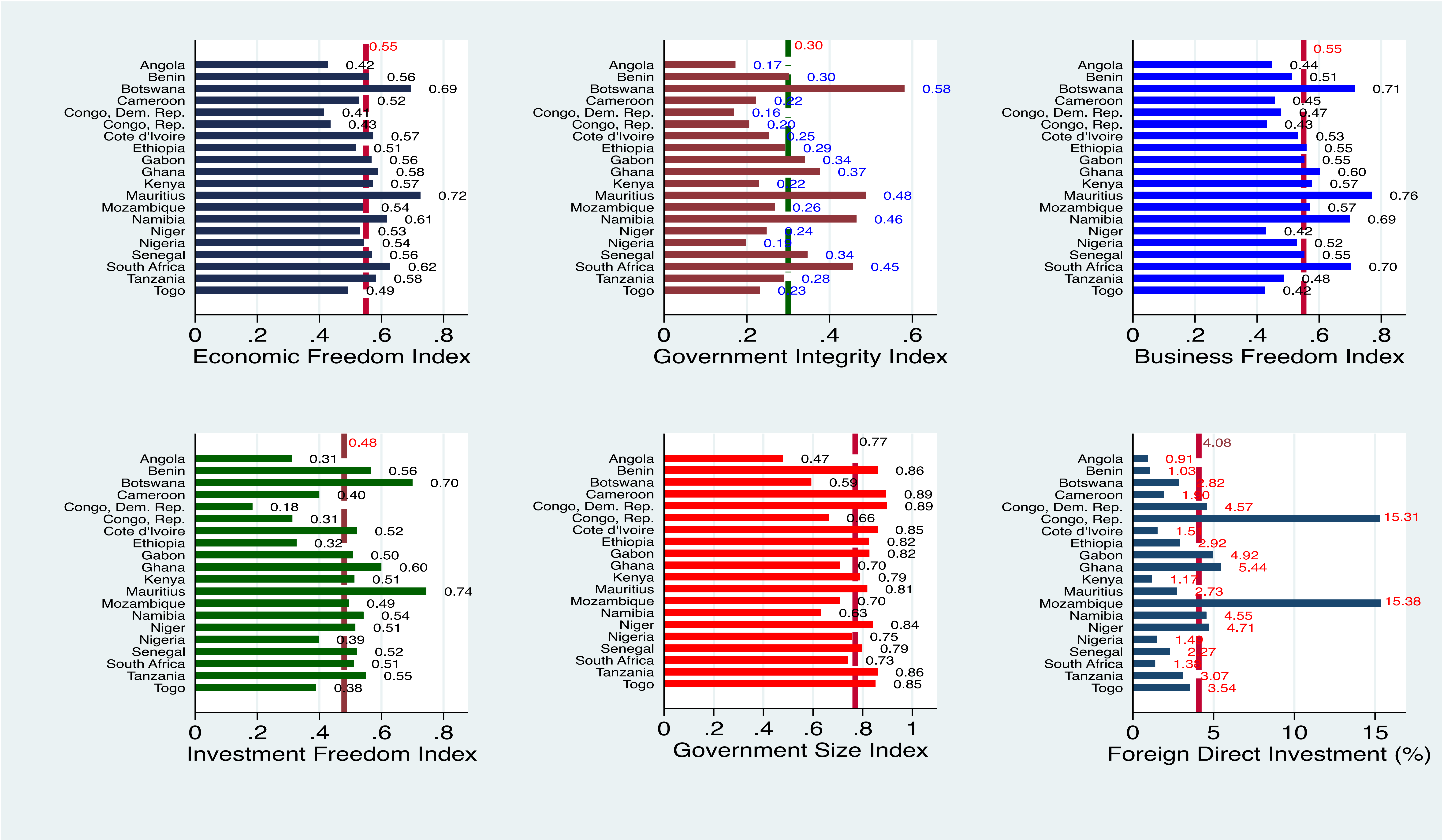

Figure A.2: In-country average economic freedom indicators and FDI in SSA, 2002 – 2020. Note: The dotted vertical lines are the averages of each indicator, and the source of the data is the Heritage Foundation; 0 is Lowest and 1 is Highest.