COVID-19, Capital Flows and Sustainable Development in Sub-Saharan Africa

A thesis

submitted in fulfillment

of the requirements for the degree

of

Doctor of Philosophy in Economics

at

The University of Waikato

by

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Year of submission

2025

Abstract

The Sub-Saharan Africa (SSA) region suffered severe economic impacts from COVID-19, despite experiencing some of the lowest numbers of cases and deaths from the pandemic. The attainment of sustainable development in the region was significantly affected partly because of the region's huge reliance on industrialised economies who were most hit by the pandemic. The SSA countries covered 33 of the 45 countries listed by the United Nations Conference on Trade and Development (UNCTAD) as least developed countries (LDCs) requiring significant assistance. Moreover, the countries in the region experience some of the lowest inflows of foreign direct investment (FDI), both in comparison to other regions and to the flow of other foreign capitals into SSA. Again, as these countries were more vulnerable to economic shocks because of their lower resilience capacities, the attainment of sustainable development was significantly threatened when COVID-19 resulted in reduced economic activity, foreign investment and deteriorating socio-economic inequalities. Although earlier studies have concentrated on the impact of various cross-border capital flows on economic growth and some development indicators, those studies have not empirically evaluated how this global shock has impacted the inflows of foreign capital and their effects on sustainable development. In view of these, this thesis provides three empirical studies, using data from SSA countries over the period 2000 – 2022.

The first paper evaluated the impact of COVID-19 on the nexus between remittances and sustainable development. Relying on both static and dynamic estimation techniques, the study found that remittance is positively associated with sustainable development, both before and after the threshold, subject to the absorptive capacity of the SSA economies. In effect, there is a minimum level of institutional quality and financial development, below which their effects

on sustainable development would be negative; at which the stimulating effect of remittances may be reversed. In addition, COVID-19 was observed to reduce the progress towards sustainable development, directly and when interacted with remittances.

In the second paper, the impact of the pandemic was estimated in the nexus between FDI and sustainable development. The empirical estimates showed that FDI does not exert a significant impact on sustainable development. When the effect of FDI was further analysed on economic growth, the environment, and human development, the estimates remained consistent. While COVID-19 was found to reduce the levels of economic growth, the environment, human development, and sustainable development, the interaction effect showed that FDI reduces the negative effect of COVID-19 on economic growth and sustainable development.

The third paper measured the impact of COVID-19 on the aid – sustainable development nexus. The findings revealed that foreign aid facilitates the attainment of sustainable development and many of its goals. Even though the pandemic was found to exert a diminishing effect, foreign aid was not only found to reduce the negative effect of the pandemic but to also enhance the complementary roles of financial and institutional infrastructures on the attainment of sustainable development.

Keyword: remittances, foreign direct investment, foreign aid, sustainable development, coronavirus disease, panel data analysis, Sub-Saharan Africa

JEL Classification: C26, C33, F21, F24, F35, G01, Q01

Notes on Publications

Each of the papers that forms the basis of this thesis has been presented at different conferences and workshop. They have also been published by the University of Waikato Working Papers in Economics and are currently under consideration for journal publications.

Paper 1: COVID-19 and the Role of Remittances on Sustainable Development: Insights from Sub-Saharan Africa

- **Paper Presented** at the 63rd Annual Conference of the New Zealand Association of Economists (NZAE), Auckland University of Technology, Auckland, New Zealand (28-30 June 2023).
- **Working Paper:** Shittu, W. O., Hassan, G. M., & Scrimgeour, F. G. (2023). *COVID-19 and the Role of Remittances on Sustainable Development: Insights from Sub-Saharan Africa* (No. 23/05): University of Waikato.

Paper 2: The Impact of COVID-19 on the Relationship between Foreign Direct Investment and Sustainable Development in Sub-Saharan Africa

- **Paper Presented** at the Australian Conference of Economists (Hosted by Economic Society of Australia), Adelaide, Australia (9-12 July 2024).
- **Working Paper:** Shittu, W. O., Hassan, G. M., & Scrimgeour, F. G. (2023). *The Impact of COVID-19 on the Relationship between Foreign Direct Investment and Sustainable Development* (No. 23/08): University of Waikato
- **Under Consideration** by Research in Economics

Paper 3: Foreign Aid, COVID-19, and Sustainable Development in Sub-Saharan Africa

- **Presented** at the 2024 NZAE PhD Student Workshop at The Treasury (co-hosted with Reserve Bank of New Zealand), Wellington, New Zealand (2 July 2024).
- **Under Consideration** by Journal of International Development.

Acknowledgement

Thanks to almighty Allaah with whose mercy good things are completed. My gratitude is to Allaah, who has always guided my affairs, sometimes away from what I might have planned for myself. I extend my prayers to my parents (Alhaji and Alhaja Shittu Arowojeka), with whom I began my life and academic sojourn but by the will of their creator, they could not stay long enough to witness this day. I pray Allaah grant them the best of the hereafter. Aameen. In the same way, I extend my prayers to Dr Maa'ruf Gbiyanju Hussain, who was the main brain behind my desire to progress through the doctoral level. He not only inspired and supported me, but also provided the finances for both my master's and other preparatory programmes that led me to The University of Waikato. May Allaah grant him the best of the hereafter and look after everyone and everything he has left behind. Aameen.

I would like to express my sincere gratitude to my chief supervisor, Professor Frank Scrimgeour. Frank (as he would like to be called) is not just an advisor, but also other things I needed to settle well as an international student. He provided the support I needed to complete the programme on time and enriched my CV for a post-PhD life. He is, by many standards, everything anyone would need in a successful doctoral programme. A whole page acknowledgement would never be enough to describe how much I appreciate you. I thank you most sincerely and wish you all the best you want in life. I also thank and appreciate the guidance and support given by Dr Gazi Hassan, with whom I started the journey in 2021 through to the production of the first and second papers. I appreciate the times spent together and wish him the best of life.

Likewise, I would like to sincerely appreciate The University of Waikato Doctoral Scholarships and the School of Accounting, Finance and Economics (SAFE) for their generous fundings,

which made this research hassle-free. These financial supports greatly relieved my financial stress and allowed me to concentrate fully on my study. Also, I appreciate the various supports from members of staff of Waikato Management School and SAFE, including but not limited to Maria Neal, Denise Martin and Amanda Sircombe; Professors Les Oxley, Kathryn Pavlovich and Michael Cameron; Dr Mary Low and Dr Umesh Sharma.

Importantly, I would like to appreciate the patience of my beautiful and loving wife, Saidat Lawal, and our loving children whom I have left behind for too long to concentrate on this study. I also appreciate all my siblings – brothers, sisters, and their families – who have always been supportive and proud of me at each stage of my endeavours. Likewise, I appreciate the supports of my in-laws, with whom my family members have been comfortable while I concentrate on my research. Lots of thanks to Dr Titilope OlaDejo and his family, Dr Hammed Musibau, Dr Yusuf Agboola, Dr Muhammed Ojuolape, Dr Olabode John, Ann Wamwea and my other Nigerian friends, as well as my PhD colleagues (Sandamali, Jahan, and Noushad).

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Glossary of Terms

ANSG	Adjusted Net Savings (% of GDP)
CO_2	Carbon dioxide
CE&B	Central Europe & the Baltics
COVID-19	Coronavirus Disease
DAC	Development Assistance Committee
EA&P	East Asia & Pacific
EKC	Environmental Kuznets Curve
E&CA	Europe & Central Asia
EIU	Economist Intelligence Unit
FD	Financial Development
FE	Fixed Effects
FA	Foreign Aid
FAVOLT	Volatility of Foreign Aid
FDI	Foreign Direct Investment
FFEC	Fossil Fuel Energy Consumption (% of total)
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
GE	Government Effectiveness
GMM	Generalised Method of Moments
GFC	Global Financial Crises
GHG	Greenhouse Gases
HDI	Human Development Index
IV	Instrumental Variable
ILO	International Labour Organisation
LA&C	Latin America & the Caribbean
LDCs	Least Developed Countries
LEB	Life Expectancy (at birth)
MNE	Multinational Enterprises
ODA	Official Development Assistance
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Square
PCSE	Panel Corrected Standard Error
PSAV	Political Stability and Absence of Violence
REM	Remittances
ROL	Rule of Law
SSA	Sub-Saharan Africa
SD	Sustainable Development
SDG	Sustainable Development Goals
2SLS	Two-Stage Least Squares
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department for Economic and Social Affairs
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Association
UNGA	United Nations General Assembly
WDI	World Development Indicators
WGI	World Governance Indicators
WHO	World Health Organisation

Chapter One: General Introduction

1.0 Introduction

Africa has the world's youngest population, with abundant natural resources, increasing urbanisation and robust entrepreneurial spirit (World Bank, 2024a). Prior to the COVID-19 pandemic, the continent had been recording significant progress in various development indicators (United Nations, 2021). Nonetheless, the pandemic has worsened several recurrent challenges, including extended food crises, conflicts and security, political instability, and the loss of biodiversity. In addition, the quest for inclusive growth has been impaired by governance and inequality challenges, with rising population exerting greater pressure on natural resources and the labour market, leaving about 400 million people below the poverty line and lack access to basic services (European Commission, 2024). Out of the forty-five (45) countries currently listed by the United Nations as least developed, and requiring special technical assistance alongside other concessions, thirty-three (33) are in Africa (UNCTAD, 2024).

Sub-Saharan Africa (SSA)[1] is a very diverse region. According to World Bank (2023), SSA is rich in natural resources and has the largest free trade area in the world. Moreover, it has the potential to shape a new direction of economic development, harnessing the potential of its people and resources. Nevertheless, the region faces numerous development challenges, including mounting conflict and violence that inhibit economic activities, with climate shocks worsening this fragility, all of which threaten the attainment of sustainable development in the region (United Nations, 2021). The COVID-19 pandemic has disrupted supply chains and the

[1] A map of Africa showing the locations of the SSA countries is shown in Figure 8.

globalized systems, engulfed the health systems, and undermined development gains in several countries. Although the SSA region managed to avoid a devastating health effect, it continues to face scratching economic impacts. This is in addition to rising commodity prices and food insecurity, alongside supply chain constraints triggered by the war in Ukraine, that are impediments to the growth of the region (World Bank, 2023). The growth in SSA decelerated to an estimated 2.9% in 2023, a 0.3 percentage point lower than projected (World Bank, 2024b).

Similarly, political instability deepens the challenges in SSA, as it dampens growth via declining investor confidence and rising policy uncertainty. With increasing climate risks, labour productivity and agricultural yields further face adverse consequences (IMF, 2024). More so, the region has the least access to clean cooking and electrification rates globally. By historical estimates, it has the lowest contribution to global greenhouse gas emissions, yet it suffers its worst impacts. These call for drastic changes in the financing and policy landscape to support Africa's rising energy demands and meet the SDG targets (UNDP, 2024).

Given this context, this PhD study seeks to evaluate the impact of the COVID-19 pandemic on cross-border capital flows and the attainment of sustainable development in SSA. However, before commencing the study, it is essential to lay down the philosophical foundations.

2.0 Research Philosophy

Philosophical foundations underpinning research need to be identified as they influence the practice of research. At the planning stage of a research, there is a need to think through the philosophical perspectives that are brought to the study, including the method of inquiry and the techniques of research which translate the approach into practice (Creswell, 2009). In Easterby-Smith et al. (2002), it is suggested that three reasons exist for understanding the philosophical issues. First, it helps in the clarification of research designs by considering the form of evidence needed and how it is to be collected and interpreted. Second, the knowledge of philosophy assists researchers in identifying the designs that work best. Finally, the knowledge of philosophy assists in identifying as well as adapting research designs based on the limits of knowledge structures or different subject.

Hence, research philosophy defines the advancement of research assumptions, as well as its knowledge and nature (Saunders et al., 2007). The four major philosophical approaches discussed in this section are the positivist, interpretivist, pragmatist, and realistic research philosophy.

2.1 The Positivist Philosophy

Positivism is an objective philosophical approach, which examines theories and establishes scientific laws with a view to establishing causes and effects (Walliman, 2006). This philosophical idea assumes an objective view in the conduct of research and is separated from those participating in the study. In other words, the philosophy of the positivists asserts that the

social world can be understood in an objective way, wherein the researcher works independently and distances himself from personal values. Even though the critics of this approach may argue that interesting insights may be lost, the analysis of observations will be quantitative, as a result the reliability of positivist research results will be high because of its highly structured approach (see Wilson, 2014). More so, the positivists assume a deterministic philosophy whereby the cause determines the effect or outcome. Hence, the problems studied by this perspective suggest the necessity of the identification and assessment of the causes that drive the outcomes. Thus, the knowledge developed from this philosophical standpoint relies on careful observation and measurement of the objective realities (Creswell, 2009).

2.2 The Interpretivist Philosophy

In this approach, researchers actively engage in their research via high levels of participation and/or interaction, which may involve observations that are subjective and qualitative in nature (Wilson, 2014). Viewed as an approach to qualitative research, the interpretivist philosophy holds the assumptions that individuals seek understanding of the world by examining the subjective implications of their experiences. These meanings are multiple and diverse, prompting the researcher to look for the density of perspectives rather than restricting meanings into a few categories or ideas (Creswell, 2009). While this seeks to provide interesting yet novel understandings of a certain context, interpretivism does not concentrate on the issue of reliability and measurement. Since such studies are largely qualitative, they hardly adopt specific measurement techniques (Wilson, 2014).

2.3 The Pragmatist Philosophy

Pragmatism is not particularly devoted to any single reality and philosophical system. Rather it applies mixed methods of research. This is because the inquirers draw freely from both qualitative and quantitative ideas and the data that work to give the most useful answer to the research problem. Using this approach, each researcher is free to determine both the technique and method, as well as the research procedure that best satisfies the requirements of the study. This implies that pragmatism permits different perspectives and assumptions, multiple methodologies, and diverse forms of data collection and analysis for the mixed method researchers (Creswell, 2009). In effect, the Pragmatist philosophical perspective approves the usage of such methods that are considered most relevant in obtaining the most essential insights, since it places the research questions and problems at the centre of the research (Wilson, 2014).

2.4 The Realist Philosophy

Finally, the realist research philosophy supposes that structures underlie social events and discourses. Since these are only not directly observable, however, they need to be stated in theoretical terms, which make them likely to be provisional in nature (Walliman, 2006). Thus, the realistic approach relies on suppositions that are essential for the perception of subjective nature of the human (see Moon & Blackman, 2014). Realists recognise that numbers utilised may not be measuring what one thinks they are measuring, so it is appropriate to be cautious and indeed sceptical about data that are truly satisfying.

2.5 Choice of Research Philosophy

Given the panel nature of the data, the choice of appropriate technique(s) is largely based on the research problems and the objectives to be achieved. Hence this research is undertaken from a positivist base because the objective of the analysis is measurable and quantifiable; the researcher is separated from the research to make objective observations; and the relationships explored are quantifiable and analysed using statistical methods. This research also leans towards the pragmatic research philosophy. The pragmatic philosophy favours mixed methods.

In conclusion this study takes place within a positivist framework. It is influenced by critical realism as proper care is taken with variable definitions and measurements. It is equally influenced by intepretism as the empirical results are interpreted in the light of other studies – both positivist and non-positivist. Further, it is informed by pragmatism since the research design and practice allow for new opportunities that enhance the usefulness of the results.

3.0 Critical Constructs and Variables

In pursuing this study, numerous choices must be made as to what variables and data should be used in the analysis. These critical issues are how Sustainable Development is defined, what COVID-19 data should be utilised, and how to measure institutional quality.

3.1 Sustainable Development

Throughout this study, Sustainable Development is defined, in line with the United Nations General Assembly (UNGA, 1987, p. 43), as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". While no single measure is perfect, measuring sustainable development by adjusted net savings fits the UNGA definition adopted in this study, as it provides a measure of a country's sustainability through the change in comprehensive wealth during a specified period. By providing a test to check the extent to which today's rents from a number of natural resources and changes in human capital are balanced by net saving, adjusted net savings also provides a comprehensive measure of a country's true wealth by considering not just traditional economic factors, like financial savings, but also the depletion of natural resources, investments in human capital, and environmental damage – essentially indicating whether a nation is saving enough to maintain its wealth for future generations and thus developing sustainably (refer to Qasim & Grimes, 2018).

Nonetheless, in some situations, Sustainable Development is also measured by the human development index and real GDP per capita – with a provision for environmental quality. This is in order to capture the overall impacts – social, economic, human development, and environmental impacts.

3.2 COVID-19 Measurement

The COVID-19 measure employed in this thesis is a part of 'uncertainty' which Ahir et al. (2018) started tracking since 1996; the variable was extracted from the uncertainty data – being a form of uncertainty itself. This explains why, even though the entire dataset by Ahir et al. (2018) started in 1996, the COVID-19 data only covered 2019 – 2022. Using an alternative, the dummy variable option was not appropriate, given that it does not adequately record the variability of the impacts of the pandemic. A more acceptable alternative would have been the Oxford COVID-19 Government Response Tracker (OxCGRT). Nonetheless, the OxCGRT only tracked and compared various governments' policy responses to the pandemic – including school and workplace closures, travel bans – (see Hale et al., 2021) and does not directly measure the magnitude and direction of the pandemic, which are the focus of the thesis.

3.3 Institutional Quality

There are a range of measures of institutional quality utilised in the Worldwide Governance Indicators (WGI). A core of governance/institutional quality is the rule of law; it provides a foundation for the attainment of sustainable development and encapsulates many other indicators. According to the UN (2023), "the rule of law is a principle of governance in which all persons, institutions and entities, public and private, including the State itself, are accountable to laws that are publicly promulgated, equally enforced and independently adjudicated, and which are consistent with international human rights norms and standards. It requires measures to ensure adherence to the principles of supremacy of the law, equality before the law, accountability to the law, fairness in the application of the law, separation of

powers, participation in decision-making, legal certainty, avoidance of arbitrariness, and procedural and legal transparency.

The rule of law is fundamental to international peace and security and political stability; to achieve economic and social progress and development; and to protect people's rights and fundamental freedoms. It is foundational to people's access to public services, curbing corruption, restraining the abuse of power, and to establishing the social contract between people and the state. Rule of law and development are strongly interlinked, and strengthened rule of law-based society should be considered as an outcome of the 2030 Agenda and Sustainable Development Goals (SDGs)."

Nonetheless, additional measures are used for some analyses, including government effectiveness (GE) and political stability and absence of violence (PSAV).

In conclusion, during the course of the doctoral study, many other construct, variable and data issues would be resolved. These decisions, to the extent necessary, are discussed in the following chapters.

4.0 Structure of Research

This thesis is written in a hybrid model 'PhD with Publication' and is organised in five chapters. Chapter One presents the general introduction covering the overview of Africa and some of her economic and institutional environments. The choice of research philosophy is also discussed in this chapter. The first paper is presented in Chapter Two. This paper evaluated the impact of COVID-19 on the relationship between remittances and sustainable development in SSA. The second paper is presented in Chapter Three. This paper examined the role of the pandemic on the nexus between foreign direct investment and sustainable development. In Chapter Four, the impact of COVID-19 on the interaction of foreign aid with sustainable development is presented, which is the third paper component of the thesis. Finally, Chapter Five presents the general conclusion, summary of contributions, policy implications and potential for future research.

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Chapter Two: COVID-19, Remittances and Sustainable development: Insights from Sub-Saharan Africa

2.0 Introduction

The macroeconomic impacts of remittances have been extensively discussed in recent years. Being a significant source of development finance, the flows of private remittances have generally increased more than foreign direct investment (FDI) and, in the last two decades[2], their flows have exceeded that of official development assistance (ODA) (Sobiech, 2019). While not all migrant workers' job aspirations are met, neither does every migrant worker remit money back home, governments generally encourage international employment as an active labour market strategy given that the growth of remittances is one of the main sources of income to households (Wagle & Devkota, 2018). Regional comparisons (going by the trends in Figure 1) show that the Sub-Saharan African (SSA) region appears to have benefitted a lot from inward remittances, second only to South Asia. In other words, inward remittances to the region exceed the global average and the flows to Latin America & the Caribbean (LA&C), Europe & Central Asia (E&CA), East Asia & Pacific (EA&P) as well as Central Europe & the Baltics (CE&B). It indicates a significant rise from 2004 through 2018, until it slightly falls in 2019 and 2020 when the pandemic began.

[2] See Figure 2 for the trends of Remittance, FDI and Foreign Aid in SSA

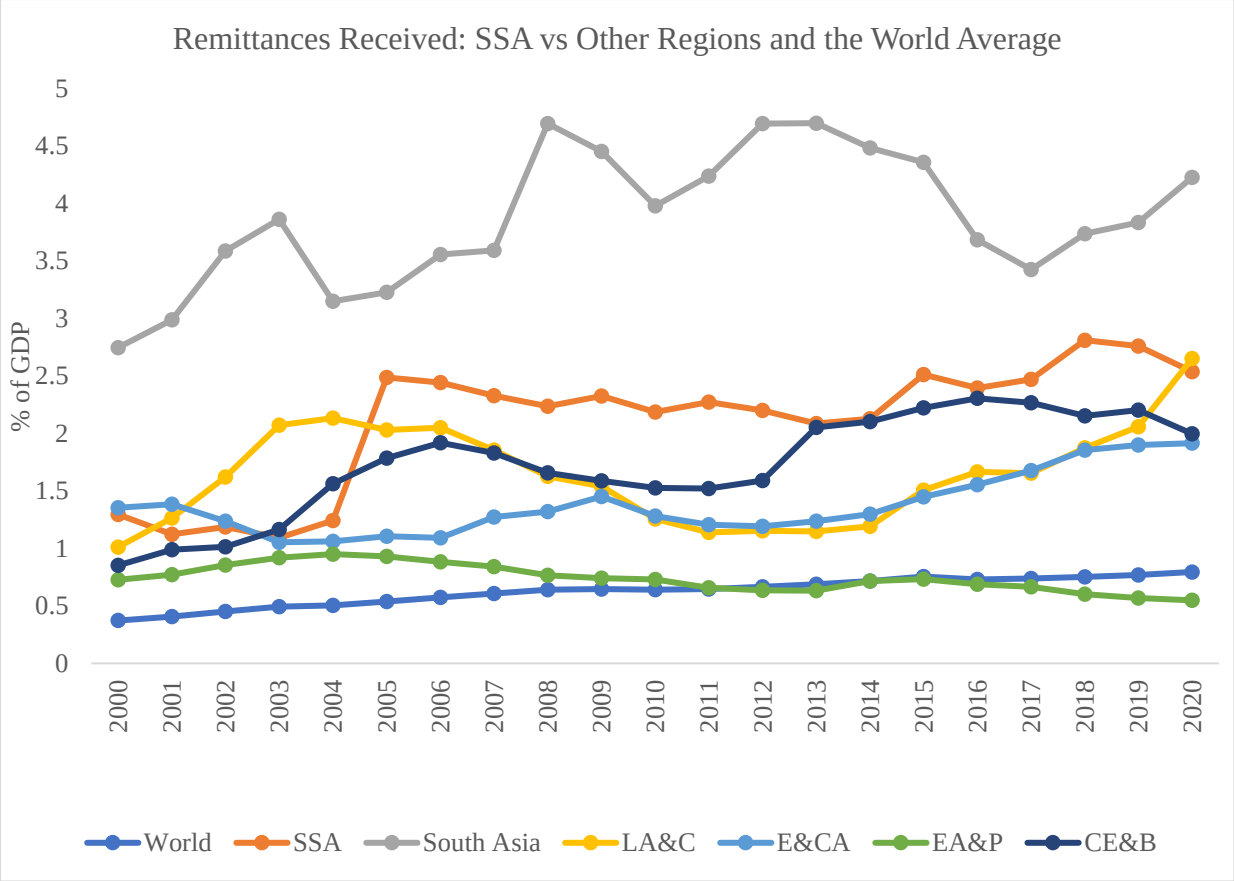


Figure 1: Remittance received in SSA in relation to some other regions' receipts

Source: Authors' computation from the World Bank dataset

As in other financial flows, remittance may positively or negatively affect the general economy. For instance, remittance reduces the likelihood of violence, especially against women, thus promoting social cohesion, gender balance, and harmonious relationship (Mitra et al., 2021). It also raises investment expenditure, enhances households' economic well-being, reduces poverty level (Adams Jr & Cuecuecha, 2013; Wagle & Devkota, 2018), and aids the efficiency of the financial sector by reducing net interest margins and overhead costs (Kacou et al., 2021). Although the migration of parents tends to exert a negative effect on children's education, partly due to absence of parental control in critical areas of their upbringings, the resulting remittance inflow lessens the income constraints to human capital development, especially when it is channelled into (human) investment (Salas, 2014). Similarly, the inflow of foreign

remittance supports industrialisation through enhanced market-oriented production and transfer of skills and technology (see Efobi et al., 2019).

In the same vein, remittance drives macroeconomic growth by enhancing investment; it facilitates the development of human capital and promotes financial system stability. Beyond this argument, Sobiech (2019) contends that remittance promotes economic growth, but that the magnitude of the growth-impact of remittance is constrained by the efficiency of financial sector. This position contends that the impact of remittance on economic growth is less in a more financially developed economy and there could be output losses in the long-run if such an economy simultaneously achieves increasing remittance inflows and high levels of financial development. Hence, remittance is considered especially useful where access to domestic credit markets is either limited or not well developed (Bahadir et al., 2018).

Notwithstanding these potential benefits, it is evident in many other studies that remittance reduces the incentives to work due to a high dependence on migrants' transfers and may hamper the economy in the long-run through the tradable sector because of real exchange rate appreciation (Abdih et al., 2012; Catrinescu et al., 2009). Furthermore, as much as remittance promotes household welfare and general economic development, it may also worsen it due to its weakening effect on the quality of institutions. This argument partly relies on the work of Abdih et al. (2012), which provides evidence that it may be easier for the government to divert public resources for private uses when remittance inflows afford households access to public commodities instead of depending on the government, thus reducing the incentives to demand public accountability. Besides, even though remittances are less expensive when compared to some other development loans – such as ODA which attracts interest rates – the government tends to lose a massive return should migrants fail to return to their home countries, since they

may have benefitted from government investments in education, which are generally costly (Abduvaliev & Bustillo, 2020; Isomatov, 2010).

More so, as much as it may be interesting to households benefiting from these remittances, the brain drain associated with the emigration of highly skilled workers is worrisome and does more harms in view of its net negative impact on productivity and growth of developing economies (Sharipov, 2012). Again, as explained in Acheampong et al. (2021), the inflow of foreign remittances could further deteriorate the level of poverty by enhancing income inequalities in remittance-receiving economies, if it is tilted to benefit more wealthy households' income. Besides, the families left behind tend to experience poorer mental and physical health, which the financial benefits from inward remittances may not offset (see Tachibana et al., 2019). In the same way, the social cost of family disruptions could result in lesser investments in human capital of, especially, children left behind. This hinders the long-run development prospects via human capital formation in the left-behind children (Murakami, 2021).

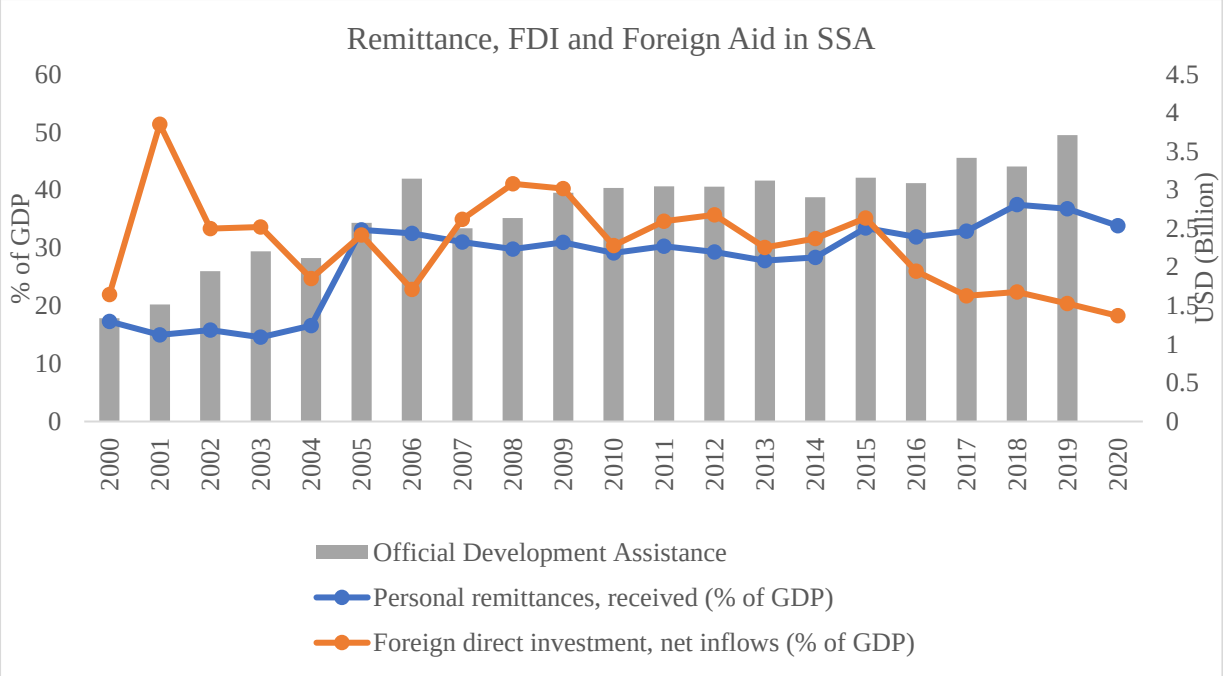


Figure 2: Remittances, FDI and Foreign aid (all inwards) in SSA

Source: Authors' computation from the World Bank dataset

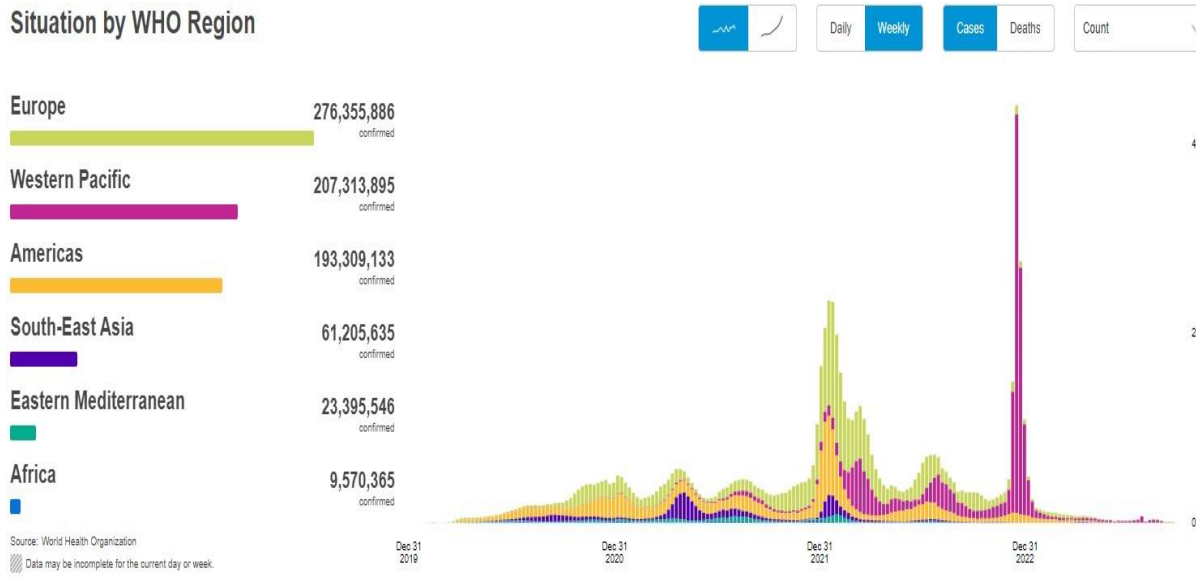
While remittances may serve as an alternative to debts accumulation in some respects, consistent and high government borrowings have seen the debt level grow in SSA. Notwithstanding the region's endowment of human and natural resources, the income levels are very low, coupled with widespread current account and fiscal deficits. Besides, many countries in SSA have been listed among those with the highest working poverty rates[3], hence they have paid close attention to the flow of foreign remittances to support fiscal sustainability (ILO, 2022; Adams & Klobodu, 2016).

To the disbelief of many international organisations, who had predicted a colossal decline in remittances to developing economies when the COVID-19 lockdown measures began in March 2020, remittances were rather stable and even grew higher in many countries than in the pre-pandemic periods (Dinarte-Diaz et al., 2022; Ahsan et al., 2022). In other words, as the COVID-

[3] Working poverty rate defines the proportion of employed persons living in households with per-capita consumption or income that falls below the international poverty line of US$1.90 a day (ILO, 2022).

19 pandemic continues to bite harder, even with recurring variants, private remittance flows surprisingly suggest a lower decline in 2020 even below that experienced during the GFC. This is as the World Bank (2021a) reports that remittances to low- and middle-income economies are expected to have reached $589 billion in 2021, representing a strong growth of 7.3%. When compared to 2009 when remittances to developing countries are estimated to have fallen by 6.1% because of the GFC (see Mohapatra & Ratha, 2012), the flow of remittances is reported to be more robust than earlier estimates. It also aligns with the resilience of flows in 2020 when the flow of remittances fell by just 1.7% even with a severe COVID-19 – induced global recession. This resilience may not be unconnected to the transition from informal to formal channels and from cash to digital payment platforms (World Bank, 2021b); some governments' fees remediation and cash incentives for inward remittances through appropriate financial systems (Ahsan et al., 2022); as well as some of the policies of some host countries that allowed migrants the same vaccinations and welfare supports as the natives, thereby supporting them to continue working (Mbiba & Mupfumira, 2022).

Cases of COVID-19 By Regions



Deaths from COVID-19 By Regions

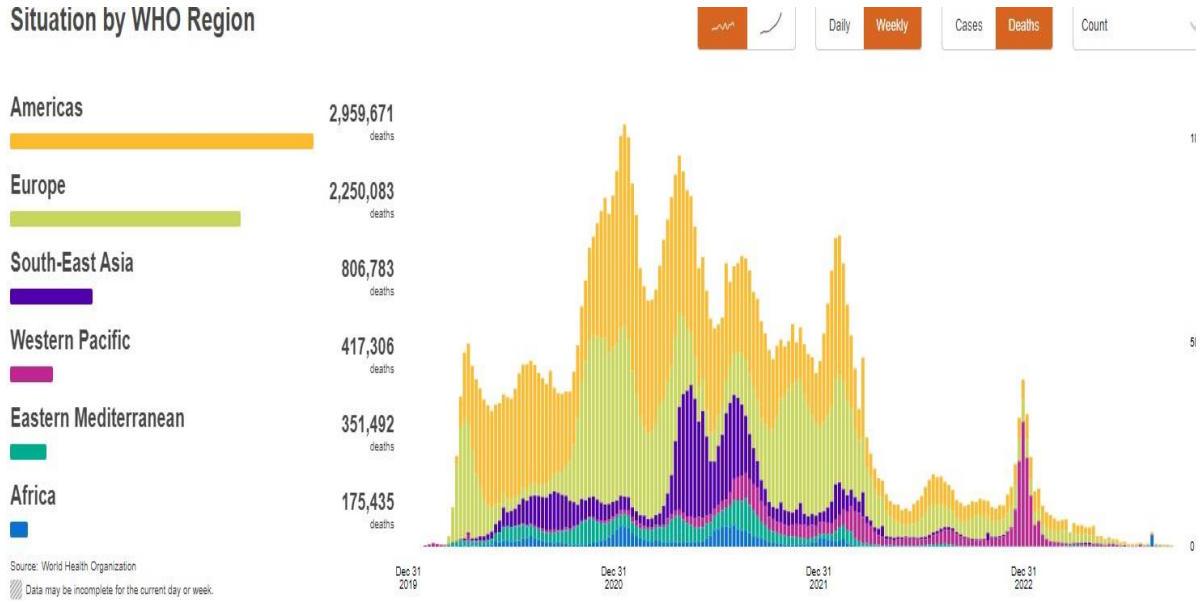


Figure 3: Weekly confirmed cases and deaths from COVID-19, as of 04 October 2023

Source: World Health Organisation (2023).

In addition, remittances act differently from other capital flows, such that their flows increase even when financial markets decline, particularly in times of economic downturn, natural disasters, civil and political unrests. This is because migrants living abroad send more money in response to the

rising needs of their families back home, especially when investors and donors may have pulled out. Thus, remittances may thwart unexpected current account reversal and curb investor panic during crisis (Ratha, 2013). This is more so as this form of financial flows is targeted at households, and not the governments, which may provide a form of social safety nets in trying times. This is because they are relatively stable when compared to many other inflows (Feeny et al., 2014), which further explains the resilience of flows and the strong growth recorded even as the pandemic rages.

It is further suggested that pandemics generally define a significant shift in capital from the more affected economies to the less affected ones (see McKibbin & Sidorenko, 2006). This is more so as remittance inflows to SSA returned to growth in 2021, rising by 6.2% (to USD 45 billion from USD 42 billion in the preceding year) and are further projected to grow by 5.5% in 2022 because of recoveries in Europe and the United States. However, the cost of sending remittances to SSA is most costly – at 8% in the first quarter of 2021, far more than the SDG target of 3% by 2030. This is partly due to both the utilisation of black-market exchange rates and small quantities of formal flows (World Bank, 2021a), as a result of which a significant share of these remittances is lost in intermediation (see Mbiba & Mupfumira, 2022). Again, this high cost of sending remittances has significantly underestimated the actual flows thereby prompting migrants to utilise informal channels, while a number of developing countries do not even report remittances in their balance of payments (El Hamma, 2019).

Part of the motivation for this study is the contention that attaining sustainable development and stamping out poverty in SSA (and other developing economies) entails not just economic growth but also other economic factors that lead to structural changes, chief of which include the inflow of foreign remittances (Acheampong et al., 2021). However, previous studies on the

role of remittances in economic development have largely been insignificant in the context of SSA countries, as studies have focused on other regions, such as Asia and Latin America (Adams Jr & Cuecuecha, 2013). Most significantly, COVID-19 has assumed a huge shock on the global and regional economies, thus estimating its impact is expected to provide important policy directions both for SSA and for other regions.

This overview, therefore, highlights the following.

- Even though the SSA region has witnessed successive economic growth, the attainment of sustainable development requires more painstaking efforts.
- The COVID-19 pandemic has worsened the economic conditions of the region and its prospect towards sustainable development.
- Remittances play an essential role in the attainment of sustainment development in SSA.

To this extent, this research attempts to address the following important questions in relation to the SSA region: (1) why is sustainable development, as opposed to growth and other development indicators, considered to be more relevant? (2) why is COVID-19 important to the nexus between remittances and sustainable development? (3) what is the nature of the relationship between remittances and sustainable development?

In the next section, the review of relevant literature is logically presented; Section Three discusses the methodology, and the empirical analysis are presented in Section Four. Section Five concludes.

2.1 Review of Relevant Literature

This section reviews the earlier studies conducted on the impacts of remittances on economic growth other development indicators. It covers extensive reviews on earlier studies in both the SSA region and globally. The conclusion from this section is expected to better situate the current studies in the extant literature.

Friedman's (1957) permanent income hypothesis postulates that while a transitory income increase may be spread over a lifetime through savings and investment, a rise in permanent income only raises the current level of consumption. This hypothesis largely explains the direction of migrant remittance in relation to economic growth based on self-interest or altruistic behaviour. While the former allows migrants to send more money for investment, the latter suggests such money is sent to support households in economic difficulties back home (Lim & Basnet, 2017). Hence, that the household's use of remittances income is important in examining its impact on economic growth and development. Moreover, the investment impact is further reinforced by the arguments that remittances may both substitute financial development in the short-run (substitutability hypothesis) and may complement it in the long-run (financialisation of remittance markets hypothesis) (see, e.g., Kacou et al., 2021).

The linkage between remittances and economic growth and/or development is empirically contradictory. Some studies have contended that a positive connection exists between the variables. For example, amongst the post-Soviet states, Abduvaliev and Bustillo (2020) investigated the impact of private remittances on growth and poverty level. The authors found that remittances raise the rate of economic growth; it equally drives a decline in poverty severity via rising income and the level of consumption. Employing the GMM technique on a

panel data for 136 countries, including 25 small islands developing countries (SIDS), for the period 1971 – 2010, Feeny et al. (2014) studied the role of remittances on economic growth. Their empirical analysis suggested a positive effect of remittances on the growth of SIDS, but not in other developing countries considered. These findings, however, depicted that the results are heterogeneous among different groups of SIDS. Similarly, Ofori and Grechyna (2021) examined the joint effects of remittances and natural resource rent on economic growth in 43 SSA countries. Using the traditional panel and GMM estimation techniques on the data obtained between 1990 and 2017, the authors affirmed that the positive impact of remittances mitigates the negative effect of oil rent on economic growth below a threshold point, and that the unconditional effect of remittances on growth is positive. In addition to these, Lim and Simmons (2015) measured the economic significance of remittances to the Caribbean Community and Common Market (CARI-COM) economy in the long-run. Relying on Westerlund and Pedroni cointegration techniques on the data covering 1975 to 2010, the researchers advanced no evidence for the long-run association between migrant remittances and the per capita real GDP, though some empirical proofs of the long-run linkage were found between remittances and real consumption per capita. Their finding, thus, concluded that the inflow of remittances into the region largely finances consumption needs.

Away from their effects on economic growth, some other researchers have examined the nexus between remittances and economic development and some development indicators. For instance, Askarov and Doucouliagos (2020) measured the effect of remittances on education, with meta-regression analysis covering 30 countries. Their empirical findings suggested that the effect of remittances on education expenditure increases over time, without gender-based differences in the effects. Also, both internal and international remittances increased but the latter had a larger effect. While assuming that the nature of the school attended defines the

quality of education obtained, Salas (2014) measured the impact of foreign remittances on the choice of public or private schools for children, based on the Peruvian data spanning 2007 – 2010. The author observed that international remittances induce the likelihood to send children to private schools. Similar to these estimates, Murakami (2021) investigated the effect of cross-country migration and foreign remittances on school enrolment of children left behind in Tajikistan. Applying the switching probit model on the data obtained from the 2013 Tajikistan Jobs, Skills, and Migration Survey, the researcher confirmed that the migration of parents exerts a higher adverse effect on the school enrolment of children and that, even with their remittances back home, the compensating effect is less significant than that of the migration of other members of the household.

In line with the gender aspect of development, Mitra et al. (2021) investigated the role of remittance access on women acceptance of domestic violence. Using data from the Punjab province in Pakistan in 2014, the researchers observed that, in relative terms, women with remittance access are less likely to accept domestic violence. In a different aspect of development, Tachibana et al. (2019) estimated the impacts of remittances on the mental health of the victims of the 2015 earthquake (EQ) in Nepal, based on the data from 335 individuals in 6 villages in the Western part of the country. The investigators observed a decline in psychological distress due to the rise in remittances sent to households; however, the increased remittance did not assuage mental disorder. On its impact on the environment, Wijayarathne et al. (2022) employed the IV mediation analysis on the data from three waves of Sri Lankan Households' Income and Expenditure Survey (2009, 2012, and 2016). Their findings suggested that inward remittances raise household wealth, thereby enhancing the transition from solid fuel to clean, modern fuel usage.

Furthermore, some researchers opined that remittances are not efficient in promoting economic growth and development when there are inefficient domestic institutions. In respect of this, Catrinescu et al. (2009) stated that remittances enhance economic growth, but institutions play a crucial role, as they allow remittances to be efficiently channelled. Similar to this is the work of Zghidi et al. (2018), who confirmed that institutional quality moderates the nexus between remittances and economic growth. Using the system GMM technique on the panel data from four North African countries, from 1980 to 2012, the researchers observed evidence of a positive linkage between remittances and economic growth and that economic freedom complements the relationship. Still extolling the role of institutions, Williams (2018) asserted that with efficient democratic institutions, remittance recipients largely invest those foreign inflows into entrepreneurial activities and human capital development. Relying on the panel data from 109 developing economies, between 1975 and 2014, the author observed that remittances exert a negative impact on economic growth in those countries with deficient democratic institutions while the effect turns positive as democratic institutions improve. Another related study by Adams and Klobodu (2016) sought to investigate the roles of remittances and regime durability on the growth of thirty-three (33) SSA countries, based on data covering 1970 – 2012. Applying the GMM procedure, their empirical estimates confirmed that the growth effect of remittances is stimulated in the presence of a democratic and stable government.

Building on these studies, some other researchers obtained that it takes the efficiency of financial sector, alongside institutional effectiveness, for remittances to exert the desired impacts on economic growth and development. In this respect, Fromentin (2017) studied the dynamic impact of remittances on financial development, and whether the impact differs by income group, using developing economies' data spanning 1974 – 2014. Based on the Pooled

Mean Group (PMG) technique, the researcher observed that, except for low-income countries, a positive relationship exists between the two variables in both the long-run and the short-run, as a result of which remittances complement financial development. In addition, based on a panel of 49 African countries, spanning 1980 – 2014, Efobi et al. (2019) considered if remittances indirectly (via financial development) and directly relate with industrialisation. Relying on the instrumental fixed effects, GMM, and instrumental quantile regressions (QR) estimates, the researchers observed that for particular early levels of industrialisation, remittances promote industrialisation via financial sector development.

Furthermore, Acheampong et al. (2021) investigated the roles of financial development and remittance on poverty alleviation in 44 SSA countries, based on data covering 2010 to 2019. Relying on the IV-GMM and Two-Stage Least Squares (2SLS) techniques, the researchers obtained that foreign remittance raises the level of poverty (in both female and male), while financial development reduces it. In contrast to these findings, Kacou et al. (2021) analysed the dynamic interactions between remittances and financial development in a panel of 22 SSA countries, using a panel vector autoregression (PVAR) model over the period 2004–2017. Their empirical estimates suggested that migrant remittances are detrimental to the overall financial institutions, but financial institution positively influences remittances inflows. Also, the relationship between the two variables changes with the dimensions of financial institution.

Confirming financial development and institutional effectiveness as conduits via which remittances stimulate economic growth, El Hamma (2019) estimated the conditional impacts of remittances on economic growth in 14 Middle East and North Africa (MENA) countries. Relying on the Two-Stage Least Squares instrumental variables (2SLS/IV) technique, based on data spanning 1982 – 2016, the author obtained that remittances only promote economic

growth in the presence of efficient institutional environments and developed financial systems. Along the same line, Dastidar (2017) investigated the role of openness in the connection between remittances and economic growth for a sample of 62 developing economies, for the period 1990 – 2014. The finding suggested that remittances stimulate growth only in more open economies – where there are lower incidences of corruption, better financial markets and legal systems that can subject remittances to viable investments.

In a major deviation from the earlier findings, Ruiz et al. (2009) opined that a nonlinearity exists in the remittances – economic growth nexus. Using a semiparametric model to measure the nonlinear linkage, based on data covering 1978 – 2001, the researchers found that there are no measurable effects when nonlinearities are considered, neither do institutions reinforce the role of remittances on growth. Again, while most of the studies have focused on the direct impacts of remittances on economic growth and development, Das and Chowdhury (2019) observed that the potential for reverse flows – proportion of remittances that is not locally absorbed but used to finance accumulated reserves, debt obligations, and capital flights – have been ignored. Based on the ARDL technique on Bangladeshi data covering 1976 to 2015, the authors, therefore, estimated that between 13 and 14% of the remittances received are used for external purposes. In a more recent study, Ahsan et al. (2022) studied the impact of COVID-19 on electric power consumption and the economy of Bangladesh. Based on the ARDL procedure, the empirical findings suggested that, during partial lockdowns, a negative long-run connection between power consumption and COVID-19 cases exists.

The above review shows that earlier studies have:

- measured the impact of remittances on economic growth and some other development indicators.
- examined the mediating roles of financial development and institutional quality on the relationship between remittances and growth.
- while some of these studies were country-specific, some others were carried out on a panel of countries.

Given contradictory findings in earlier studies, policy makers have generally contended that results from studies carried out in other regions may be less relevant in Africa (Asiedu, 2014). This justifies the concentration of this study on SSA, where the countries have shared development characteristics, so that the findings could be more useful to their attainments of sustainable development. In view of new realities to trade and the general economy occasioned by COVID-19, it is necessary to consider the role played by the pandemic in the impact of remittances on sustainable development. Even as the global economy recovers from the pandemic-induced recessions, available studies have not researched into why COVID-19 is important to further discussions on this cause-effect scenario and why it may be important to directly study its role in the linkage between the two variables. Although there has been some theoretical discussion on the subject-matter – which has been largely contradictory – it is difficult for governments and policymakers to formulate sound policies geared towards sustainable development without empirically measuring the role of the COVID-19 pandemic on this relationship, a gap this study intends to cover. This is necessary because, even though COVID-19 may be a one-off event, its economic impacts may linger for years – like that of the global financial crises.

Besides, several studies have measured the impact of remittances on economic growth (see, e.g., Feeny et al., 2014; Zghidi et al., 2018), level of poverty (see Abduvaliev & Bustillo, 2020; Acheampong et al., 2021), financial development (see Fromentin, 2017; Kacou et al., 2021), education (see Salas, 2014; Askarov & Doucouliagos, 2020), institutional quality (see, e.g., Berdiev et al., 2013; Ajide & Olayiwola, 2021), gender violence (see Mitra et al., 2021), exchange rate (see, e.g., Hassan & Holmes, 2013), food insecurity (see, e.g., Mora-Rivera & Gameren, 2021); and many other aspects of economic development. None of these studies has, nevertheless, been expanded into sustainable development. Sustainable development, according to the United Nations General Assembly (UNGA, 1987, p. 43), explains "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Given the global outcry on climate change and the environment, sustainable development is a much better measure as it raises the national income per capita while maintaining a reasonable limit to environmental degradation.

Finally, very few studies have examined a nonlinear relationship between remittances and economic growth (see, e.g., Ruiz et al., 2009), while a large body of recent literature assumes a linear economic relationship between the two variables. Along this line, Hassan et al. (2016) proposed a different standpoint on remittances – growth nexus and concluded that there is a U-shaped relationship between the variables in the long-run: the growth effects of remittances are at first negative but later turn positive. The use of a quadratic term to measure the nonlinear effect may, however, result in misleading conclusions and specification bias because of the arbitrary introduction of this functional form. To the extent that remittances may make or mar economic progress, establishing an extreme point beyond which remittances may be linked with financial crisis is necessary. In addition, previous studies have not considered the threshold values of financial development and institutional quality at which the impact of

remittances on sustainable development changes. Again, these important gaps in the SSA literature are intended to be covered in this study.

2.2 Method and Data

2.2.1 Hypotheses

In line with the identified areas of improvement to earlier studies, the following hypotheses were formulated to achieve the objectives of this research.

H1: COVID-19 impacts sustainable development, directly and through inward remittances.

H2: Other variables (such as governance and financial development) moderate the nexus between remittances and sustainable development.

H3: Remittances impact both the economic and environmental components of sustainable development.

H4: The impact of remittances on sustainable development changes at a particular level of the absorptive capacity.

2.2.2 Model Specification

Given the identified areas of improvements to prior studies, the following equations are constructed to achieve the objectives of this research. These equations are modelled after the works of several researchers, such as Das & Chowdhury (2019) and Kacou et al. (2021).

$$SD_{it} = \gamma_0 + \gamma_1 REM_{it} + \gamma_2 COVID19_{it} + \gamma_3 X_{it} + v_{it} \quad [1]$$

$$SD_{it} = \gamma_0 + \gamma_1 REM_{it} + \gamma_2 COVID19_{it} + \gamma_3 ROL_{it} + \gamma_4 FD_{it} + \gamma_5 (REM * COVID19)_{it} + \gamma_5 (REM * ROL)_{it} + \gamma_6 (REM * FD)_{it} + \gamma_7 X_{it} + v_{it} \quad [2]$$

$$SD_{it} = \begin{cases} \mu_i + \propto_1 X_{i,t} + \beta_1 (REM_{i,t}, FD_{i,t}, ROL_{i,t}) + \varepsilon_{i,t}, (REM, FD, ROL)_i < \gamma \\ \mu_i + \propto_2 X_{i,t} + \beta_2 (REM_{i,t}, FD_{i,t}, ROL_{i,t}) + \varepsilon_{i,t}, (REM, FD, ROL)_i \geq \gamma \end{cases}$$

[3]

Equation [1] models the impacts of COVID-19 and remittances on sustainable development, while equation [2] examines the moderating roles of COVID-19, institutional quality and financial development on the nexus between remittances and sustainable development. Furthermore, equation [3] is constructed to measure a potential nonlinearity in remittances – sustainable development relations; where *SD* is the dependent variable; *X* is the vector of independent variables; *FD, and ROL*[4] are threshold variables; *i* and *t* denote country and time, respectively; $\beta_1 \; and \; \beta_2$ and $\propto_1 \; and \; \propto_2$ are, respectively, the coefficients of the threshold and independent variables; γ is the threshold value; μ_i denotes the fixed effects; and $\varepsilon_{i,t}$ is the error term with constant variance, zero mean, and independently and identically distributed (see, e.g., Liu et al., 2020).

As presented in equations [1] and [2], X represents a set of other explanatory variables, based on extant literature and parsimony, included in order to avoid any possible specification bias. These variables include financial development (FD) and institutional quality (ROL)[5], natural resource endowment (NRR), FDI, and foreign aid (FA). Population growth rate (POPGR) is also included to account for the dynamics of population in long-run growth, since a higher population growth lowers capital per worker and results in slower long-run growth (Mankiw

[4] The threshold variables are set in line with Hypothesis 4 on page 26. The values of these variables at the reversal points would be estimated both by FE threshold estimates, and by manually estimating the first- and second-order derivatives. In each case, the results are expected to be quite similar.
[5] FD and ROL have been separately included in equation [2]

et al, 1992; Solow, 1956; Barro, 1991); government expenditure (SIZE) is to account for the role of stabilisation policy. γ_i (i = 0,1,2,...,38) denotes the representative parameters for the intercept and slope coefficients; v_{it} is the disturbance term; i represents the cross-section (countries); t is the time-series (in years).

These equations are estimated using the instrumental variable regression[6] (with FE and 2SLS options). This method is useful where the distribution of error cannot be said to be independent of the distribution of the explanatory variables. It equally generates consistent estimates of the standard errors and efficient estimates of the coefficients (Baum, et al., 2003). Furthermore, equation [3] is constructed to measure a possible nonlinearity in the impact of remittances on sustainable development. In order to identify the values of the absorptive capacity at which the impact of the former on the latter changes, the fixed effects panel threshold regression technique (Hansen, 1999) is employed.

2.2.3 Source of Data

This research is based on a panel of thirty-eight (38) countries[7] in SSA, with data covering the period from 2000 to 2021. The choice of temporal and geographical scopes is dependent upon

[6] The first lag of the regressors is used as instruments, alongside the average crude price (taken as an external instrument). Given that it is difficult to identify the "best" instruments, the use of the lag of regressors can be good because they satisfy the conditions of temporal precedence (not correlated with error terms), and relevance. Besides, the lag of explanatory variables as instruments certifies that the instruments have a strong correlation with the endogenous variables (see Wooldridge, 2010; Boateng et al., 2021).

[7] The list of these countries is provided in Table 7

contingencies in data availability. The measurement of each variable and data source are presented in Table 1.

Table 1: Variable Description and Data Sources for Paper 1

Variable	Measurement	Data Source	Expected Sign
Coronavirus Disease 2019 (COVID19)	It is calculated by counting the percent of the word "uncertain" (or its variant) in the EIU reports; multiplied by 1,000,000	World Pandemic Uncertainty Index (WPUI)	-ve
Remittances (REM)	It is composed of all current transfers (in kind or cash) received by resident households from non-resident households.	World Development Indicators (WDI)	–
Institutions (ROL)	Rule of Law; percentile rank	World Governance Indicators (WGI)	+ve
Sustainable Development (SD)	Adjusted net savings, excluding particulate emission damage (percentage of GNI)		–
Foreign Direct Investment (FDI)	Foreign direct investment, net inflows (% of GDP)		+ve
Population (POPGR)	Growth rate of population (annual %)		–
Economic Growth (GDPPC / RGDPPC / GDPPCGR)	GDP per capita (current US$) / GDP per capita (constant 2015 US$) / GDP per capita growth (annual %)		+ve
Foreign Aid (FA)	Net official development assistance and official aid received (constant 2020 US$)	WDI	+ve/-ve/Neutral
Natural Resources (NRR)	Total natural resources rents (% of GDP)		+ve/-ve
Size of Government (SIZE)	General government final consumption expenditure (% GDP)		+ve
Financial Development (FD)	Domestic credit to private sector by Banks (% of GDP)		+ve

2.3 Results and Discussion

This section presents the empirical results, which incorporate eight (8) estimations as shown in Tables 4, 5, and 6. Models 1, 2, 3, and 4 detail the estimates of the IV regression (with fixed effects and 2SLS options), including the interaction of remittances with COVID-19, financial development and institutional quality. To account for country heterogeneity, the fixed effects estimates (with country cluster) are presented in Model 2. Moreover, the fixed effects threshold regression results, from which the values of remittances, institutional quality, and financial development at the reversal points are obtained, are presented in Table 5. In each of these models, the dependent variable is sustainable development. Further, the preliminary estimations are discussed in Tables 2 and 3.

Table 2 presents the results of the descriptive statistics, which suggest that sustainable development has an average value of 2.661%; this is higher than the average growth rate of population at 2.404%.

Table 2: Descriptive Statistics for Paper 1

	SD	REM	COVID-19	FDI	FD	SIZE	ROL	FA ($million)	POPGR	NRR
Mean	2.661	3.593	5.205	3.816	19.346	14.963	32.489	8.51	2.404	10.678
Maximum	38.977	53.826	68.915	57.877	106.260	43.484	82.587	12200	5.605	58.688
Minimum	-50.010	0.000	0.000	-18.918	0.000	0.952	0.478	-18.4	-2.629	0.001
Std. Dev.	13.591	6.092	16.830	5.587	17.501	6.453	20.187	1020	0.902	10.573
Skewness	-0.570	4.164	3.069	3.378	2.228	1.348	0.346	3.393	-1.155	1.910
Kurtosis	4.059	26.434	10.863	23.443	8.408	5.956	2.218	26.391	4.976	6.988
Jarque-Bera (JB)	68.158	19662.92	3465.761	15412.73	1579.512	511.973	36.242	19648.91	321.793	1013.957
Probability (of JB)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observation	675	763	836	798	772	768	798	795	836	798

Also, the average private sector credit from Banks is relatively higher than remittances received since their mean values are, respectively, 19.346% and 3.593%. While FDI inflow is observed to have a comparatively lower mean than what the proportion of natural resources is to the GDP, the inflow of foreign aid has been high, at an average of US$ 8.51E+08 (at constant 2020 US$) between 2000 and 2021. Furthermore, the governments of the SSA region, in the periods under study, have expended an average of 14.963% of their GDP, given the large size of government in the region. While the rule of law ranks is low – which is consistent with low quality of institutions – the average effect of COVID-19 is comparatively low.

In Table 3, the results of the correlation analysis suggest that each of remittances, FDI, financial development, government size, institutional quality, foreign aid, population growth, and natural resource endowment is positively correlated with sustainable development, while a negative correlation exists between COVID-19 and sustainable development.

Table 3: Correlation Analysis for Paper 1

	SD	REM	COVID-19	FDI	FD	SIZE	ROL	FA	POPGR	NRR
SD	1.000									
REM	0.589	1.000								
	(0.000)									
COVID-19	-0.358	-0.302	1.000							
	(0.000)	(0.000)								
FDI	0.395	0.599	-0.513	1.000						
	(0.000)	(0.000)	(0.000)							
FD	0.420	0.570	-0.454	0.671	1.000					
	(0.000)	(0.000)	(0.000)	(0.000)						
SIZE	0.489	0.152	-0.094	0.166	0.165	1.000				
	(0.000)	(0.000)	(0.007)	(0.000)	(0.000)					
ROL	0.103	0.128	-0.009	0.116	0.046	0.030	1.000			
	(0.004)	(0.000)	(0.800)	(0.001)	(0.198)	(0.399)				
FA	0.407	0.409	-0.962	0.642	0.559	0.132	-0.010	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.775)			
POPGR	0.063	-0.004	-0.027	0.020	-0.007	0.115	-0.437	0.046	1.000	
	(0.070)	(0.901)	(0.438)	(0.573)	(0.831)	(0.001)	(0.000)	(0.185)		
NRR	0.316	0.484	-0.410	0.696	0.576	0.151	-0.129	0.543	0.172	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

Probability values are presented in parenthesis ()

In Table 4, the efficiency of the regression estimates is confirmed by relatively high values of R-squared and significant values of F-statistic. This is especially reliable given that the IV regression addresses the biases from a possible reverse causality and the measurement problem arising from unrecorded remittances. Moreover, the instruments used, the lagged values of the explanatory variables, tend to reduce biases due to omitted variables and reverse causality associated with remittances and economic growth / development (see, e.g., Adams & Klobodu, 2016). Again, the result of the Friedman's cross-section dependence (CD) test fails to reject the null hypothesis that the countries are cross-sectionally independent.

Table 4: Estimation of Coefficients for the Baseline Model for Paper 1

Dependent Variable = SD	Model 1 (IV-2SLS)	Model 2 (FE)	Model 3 (IV-FE)	Model 4 (IV-2SLS)
L.SD	0.226***	–	–	0.199***
	(0.061)			(0.059)
REM	1.935***	2.169***	2.848***	2.952***
	(0.176)	(0.503)	(0.274)	(0.466)
COVID-19	-63.724**	55.170	85.459	80.580
	(24.906)	(67.664)	(64.342)	(60.681)
FDI	-1.122***	0.610	-0.026	-1.122**
	(0.385)	(1.026)	(0.613)	(0.473)
FD	0.041	-0.014	-0.096	0.701***
	(0.070)	(0.199)	(0.098)	(0.229)
SIZE	0.335***	0.438***	0.436***	0.358***
	(0.037)	(0.101)	(0.033)	(0.037)
ROL	10.043*	75.087	60.266***	-55.936***[8]
	(5.832)	(49.722)	(18.541)	(21.833)
FA	-0.001	-0.036	-0.001	0.041
	(0.162)	(0.117)	(0.192)	(0.171)
POPGR	210.447*	699.114*	1329.293***	181.787
	(125.220)	(378.355)	(338.798)	(126.658)
NRR	0.077	1.048	1.200*	0.184
	(0.419)	(0.999)	(0.630)	(0.450)
REM*COVID-19	–	-0.026*	-0.033***	-0.031***
		(0.014)	(0.011)	(0.011)
REM*ROL	–	–	–	0.016***
				(0.005)
REM*FD	–	–	–	-0.0002***
				(0.0001)
_cons	-3083.2**	-11563.782***	-13846.58***	-7718.68***
	(1346.311)	(4001.186)	(3043.005)	(2819.095)
Instrument	Regressors and the lags of regressors			
Friedman's CD Test (Probability)		15.031 (0.999)		
Adjusted R^2	0.681	0.569	0.534	0.682
Wald Chi2 / F-Stat	1337.12***	85.977***	4.19***	1364.20***
Observation	722	798	722	722
Country Dummy		YES		

Note: ***, ** & * denote significance at 1%, 5% & 10%, respectively; standard errors are included in parenthesis
Source: Authors' computation

Sustainable development appears to be influenced by its previous value, as the coefficient of its lagged value is positive. Given a significant coefficient, at 1% level, of the lagged value in Models 1 and 4, the estimate contends that sustainable development is persistent. The coefficient of remittances is found to be significant and positive across all estimates, such that,

[8] The change in the direction of the effect could be due to 'Suppression Effect', where the inclusion of one variable (REM*FD) unexpectedly alters the predictive power of another variable (see, e.g., Allison, 2022).

on the average, remittance raises sustainable development by 2.4%. Even when the value of remittances at the reversal point is observed (see Model 5, Table 5), the finding upholds that remittances stimulate sustainable development before and after the first threshold. This finding relates with the empirical findings of Ofori and Grechyna (2021), Askarov and Doucouliagos (2020), and Wijayarathne et al. (2022) who observe a positive connection between remittances and economic growth, education, and environmental quality, respectively.

This stimulating effect, however, relies on the absorptive capacity of the SSA economies, including financial development and institutional quality. In line with this, the minimum level of the region's rank on the rule of law is 32.2% (see Model 6, Table 5), below which the impact of institutional quality would be negative, and the stimulating effect of remittances may be reversed. Similarly, Model 5 suggests that financial development is positively connected with sustainable development before the threshold and negatively connected after the threshold. This argues that as much as remittances promote sustainable development, which is good for the SSA economies, it tends to hurt development in the absence of efficient financial and governance systems. This explains why, despite a huge inflow of remittances over the years, the SSA region is still among the worst regions in nearly all development indicators. A case in point is poor access to education and health care that has persistently impeded the region's development prospects, as well as poor financial system to assist the disadvantaged and low-income families (Bare et al., 2022). Similarly, the region has lost a sizeable proportion of its labour force to industrialised countries; while this may have resulted in increased inward remittances, there have been reduced productivities and the average standard of living has consistently declined. Besides, the national cost of investment in their education constitutes a huge loss to the governments, which remittances may not immediately compensate for, especially when the migrants fail to return to their home countries.

The sign of the coefficient of COVID-19 is inconsistent across all models; its negative impact is, however, statistically validated and the magnitudes show a severe impact. As expected, based on theoretical expositions, the COVID-19 pandemic has adversely affected nearly all economic activities and brought untold hardships to many economies. The SSA region is not an exception as the ravaging pandemic has affected both developed and developing economies. Even with some of the lowest cases and deaths from COVID-19[9], the region has witnessed some of its worst economic impacts arising from slower growth and first recession in more than two decades (World Bank, 2020), while the progress towards the attainment of SDGs has been slow in the region and globally (Tonne, 2021). Although the industrialised economies also suffer some severe economic impacts, that of SSA (and other developing economies) may be particularly disturbing because of unprecedented fall in some commodity prices – which is a premise of their annual budgets – and the foreign financial inflows, upon which many of the countries in this region rely, may have been less appealing as various economies seek to restore and deal with domestic issues before looking elsewhere (Franz, 2021; Fenner & Cernev, 2021).

The interaction effect of remittances with COVID-19 is statistically significant and negative, with a magnitude ranging between 0.026 and 0.033% (as apparent in Models 2 to 4). Although with a lesser magnitude, this estimate suggests that COVID-19 reduces the positive effect of remittances on sustainable development by (an average of) 0.03%. This is possible, given that majority of remittances that accrue to the region during the pandemic are largely targeted at softening the impacts of the pandemic on households left behind, not to directly enhance economic growth and development. In other words, the remittances inward during COVID-19

[9] Refer to Figure 3

may have mostly been directed at cushioning the effect of job losses, slower economic activities and inadequate reliefs from the governments of the region.

Going forward, the role of financial development is observed with conflicting signs but only statistically significant where the effect appears positive. This suggests that sustainable development rises by 0.70% with an improved financial system. While this positive effect turns negative after the threshold, the interaction effect of remittances and financial development is negative, thereby upholding the 'substitutability hypothesis'. This proposition is further evident from the positive impact of each of the variables and a negative interaction effect involving the two variables. This contends, following El Hamma (2019), that in an atmosphere of a developed financial system, sufficient credits can be raised for investment without significantly depending on remittances. In other words, remittances tend to substitute inefficient credit markets by giving domestic entrepreneurs another credit source capable of bypassing high lending rate and/or lack of collateral facilities.

Table 5: Estimation of Threshold Values for Paper 1

Dependent Variable = SD	Model 5	Model 6
	(Fixed Effects Threshold Regression)	
COVID-19	-415.959***	-346.690***
	(117.228)	(115.651)
FDI	-1.064**	-0.488
	(0.499)	(0.471)
SIZE	0.421***	0.440***
	(0.032)	(0.032)
FA	-0.271	-0.215
	(0.192)	(0.190)
POPGR	863.292***	582.506*
	(305.007)	(304.16)
NRR	-0.313	0.170
	(0.577)	(0.558)
(Threshold Level) ROL		
0	73.172***	-57.025**
	(17.131)	(26.638)
1		34.840*
		(18.125)
(Threshold Level)REM		
0	0.584*	2.126***
	(0.325)	(0.140)
1	3.042***	
	(0.292)	
(Threshold Level)FD		
0	0.386***	-0.077
	(0.139)	(0.089)
1	-0.360***	
	(0.110)	
_cons	-3949.912**	-2556.001
	(1706.465)	(1732.689)
Observation	798	798
R-Squared	0.509	0.542
F-Stat	96.05***	107.22***

Note: Standard errors are in parenthesis; ***, ** & * imply significance at 1%, 5% & 10% level
Note: While the threshold value of rule of law is 32.212% and it is significant at 1%; the threshold effect test is significant at 5% level.
Note: The signs of the coefficients are the same whether the sum or average of the COVID-19 index is used.

The coefficient of institutional quality is conflicting (with both positive and negative signs), though the positive effect dominates. Besides, institutional quality adversely affects sustainable development before the threshold and stimulates it after the threshold. Each of these findings argues in support of Rodrik and Subramanian (2003), who propose that an improved institutional environment promotes economic development. More so, those economies with high quality of institutions are more likely to experience higher growth and greater

development than those with low quality of institutions (see, e.g., Musibau et al., 2022). Furthermore, the interaction effect of institutional quality on remittance – sustainable development nexus confirms that institutional quality stimulates the impact of remittances on sustainable development (see Model 4, Table 4). This follows the finding of Zghidi et al. (2018) and reiterates that institutional quality and remittances exert a complementary effect on sustainable development. Hence, remittances are largely efficient in enhancing a sustainable development where there are improved institutional environments.

Furthermore, the coefficient of FDI is inconsistent across all models; it is, however, negative where it is significantly connected to sustainable development. This maintains that a percentage increase in FDI reduces sustainable development by 1.12%. While this is not a common finding in the extant literature, a possible justification is that FDI may both crowd-out domestic investments and many of these inflows may have been directed at the natural resources sector. In the case of the former, local firms may be technically pushed out of the market as international investors may have deprived them of credits when they borrow heavily from local financial markets. In the latter case, the inflows of FDI into natural resources sector may adversely affect economic growth and sustainable development since the sector has little linkages with the local economy (see, e.g., Agbloyor et al. 2014). Being the major driver of the region's economy, however, the rent from natural resources is found to positively affect sustainable development and the effect is significant at the 10% level.

More so, each of population growth and government size is found to propel the wheel of sustainable development, while the coefficient of foreign aid is not found to be statistically significant across all models. The insignificant foreign aid – sustainable development nexus upholds the empirical finding by Babalola and Shittu (2020), who assert that foreign aids may

rather be channelled towards enhancing welfare and social services; to mitigate the effects of disasters; and / or for humanitarian and other non-economic reasons as opposed to directly stimulating economic growth and development.

As a robustness check and to further confirm the validity and efficiency of the estimates, the role of COVID-19 on the nexus between remittances and some sustainable development goals (SDGs) – such as forest area, carbon dioxide and methane emissions – is estimated and the results are presented in Table 6. While environmental degradation is measured by both carbon dioxide and methane emissions, the inclusion of forest area is premised on the submission that deforestation is among the main environmental issues in respect of biodiversity and climate change (Afawubo & Noglo, 2019). This provides further opportunity to evaluate the impacts of remittances on SDGs 15 (Life on Land) and 13 (Climate Action). While the former seeks to "Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss", the latter seeks to "Take urgent action to combat climate change and its impacts".

Table 6: Effect of Remittances on Sustainable Development Indicators

The Impact of Remittances on:	Model 7: Environmental Degradation (IV-2SLS)		Model 8: Forest Area
	DV = CH_4	DV = CO_2	DV = FASQ
REM	-0.208***	-0.002	0.086***
	(0.038)	(0.040)	(0.027)
COVID-19	-6.729***	-7.842***	-1.723***
	(1.091)	(0.654)	(0.442)
FDI	0.062**	0.054***	0.091***
	(0.025)	(0.017)	(0.012)
FA	0.020	-0.008	0.028***
	(0.024)	(0.016)	(0.010)
RGDPPC	-0.031***	0.016	-0.006
	(0.008)	(0.022)	(0.005)
RGDPPCSQ	2.43e-06***	-1.58e-06*	–
	(5.50e-07)	(9.59e-07)	
URB	3.147***	5.203***	-4.653***
	(0.504)	(1.469)	(0.905)
ROL	0.836**	-2.765***	-0.396
	(0.407)	(0.599)	(0.393)
REC	-0.131***	–	–
	(0.039)		
FFEC	0.126*	–	–
	(0.067)		
REM_COVID-19	0.005***	0.004***	0.005***
	(0.002)	(0.001)	(0.001)
_cons	193.764***	203.348***	373.062***
	(59.050)	(65.180)	(44.145)
Adjusted R^2	0.401	0.658	0.597
Wald Chi^2 / F-Stat	487.87***	43.82***	181.04***
Observation	722	722	722
Instrument	Regressors and the lags of regressors		

Note: ***, ** & * denote significance at 1%, 5% & 10%, respectively; standard errors are included in parenthesis
Source: Authors' computation. The definitions and data on the following variables are available on the World Development Indicators of the World Bank.

I. CH_4 defines methane emissions, which is measured by methane emissions (kt of CO_2 equivalent)
II. CO_2 defines carbon dioxide emissions, which is measured by CO_2 emissions (kg per 2015 US$ of GDP)
III. RGDPPC defines real economic growth by deflating it with the size of population (GDP per capita, constant 2015 US$)
IV. FFEC defines non-renewable energy consumption, and it is measured by Fossil fuel energy consumption (% of total)
V. REC defines renewable energy consumption, and it is measured by Renewable energy consumption (% of total final energy consumption)
VI. URB measures the rate of urbanisation in the SSA region (i.e Urban population as a % of total population)
VII. FASQ defines forest area, which is measured by Forest area (% of land area)

In what could be regarded as a disaggregated effect of remittances on sustainable development, the relationships obtained appear to be similar in most cases to those of the baseline models. For example, the signs of the coefficients suggest that remittance is positively connected to forest areas and negatively associated with environmental degradation. These findings uphold

the baseline estimates, since remittance reduces environmental degradation even as it enhances the preservation and regeneration of forest areas in the SSA region. These results align with that of Afawubo and Noglo (2019), who obtain that inward remittance tends to alleviate poverty, lowers deforestation – since it enables households to transit towards clean energy – and fosters the spread of low-carbon technologies. They are equally in line with that of Sharma et al. (2019), who infer that remittances may be directed at promoting environmentally friendly consumption, and the proportion of remittances invested in better technologies, health and education could reduce emission intensity and expand energy efficiency. This, in turns, lessens heat-related deaths, particularly among the elderly, that are common under a high-emissions scenario.

Similarly, these estimates suggest that COVID-19 reduces environmental degradation. This is reasonable given that the major manufacturing (and other emitting) activities were almost non-existent during the pandemic, thus reducing both carbon dioxide and methane emissions. In a mild deviation from this, COVID-19 is observed to reduce forest areas. This is expected given that considerable reductions in manufacturing (and other economic) activities may have largely degraded people's economic and social conditions, as a result of which many (mainly the rural areas residents) may have remained in the forests and revert to deforestation for their energy needs. The interaction effect of COVID-19 and remittance, however, suggests that remittance inward during COVID-19 reduces the negative effect of the pandemic on forest area. This is possible given that inward remittances to the SSA region during the pandemic may have relieved the financial burdens on people and encourage environmental preservation. This is important given that forest protection and conservation is important to avoid climate catastrophe and tends to limit global heating, thereby promoting ecological stability.

Likewise, the reduction effect of FDI on sustainable development obtained in the baseline model may be connected with its tendency to raise environmental degradation through both carbon dioxide and methane emissions, as observed in Model 7. It is equally observed that the effects of renewable energy and non-renewable energy on methane emissions are negative and positive, respectively. This suggests that renewable energy reduces environmental degradation, while non-renewable energy worsens it.

Other interesting findings in Table 6 are the coefficients of institutional quality. The empirical findings in Model 7 suggest that the institutional quality raises methane emissions but reduces carbon dioxide emissions. According to the International Energy Agency (IEA, 2021), agriculture is the leading source of methane emission. Hence, the positive coefficient obtained for institutional quality may point to various policies directed at improving agriculture and food supply, with little attention paid to its environmental consequences because of its urgent need in SSA. On the contrary, greater attention is paid to the reduction of carbon emission, which majorly stems from the energy sector – burning of fossil fuel for power generation or to fuel vehicles and machines (IEA). This receives greater attention from policymakers in the region, thereby explaining the negative relationship between institutional quality and carbon dioxide emission.

2.4 Conclusion

In view of increasing international labour migration, discussion on the economic impact of remittances is ever relevant. It has become more desirable because of the impact of COVID-19 on the global economy, especially Africa which has been severely impacted. This research is, therefore, important to get the region's economy back on track and to better prepare it against any similar shocks in the future. Again, the debate on sustainable development is premised on

the fact that for any development to be sustainable, sufficient and adequate resources need to be efficiently mobilised, not just for economic but also for environmental sustainability. In the light of the foregoing, this study examined the role of COVID-19 on the relationship between remittances and sustainable development in the SSA region. Relying on the permanent income hypothesis and other theoretical propositions, studies have contended that due to a temporary increase in income, the families left behind by migrants tend to consume a part of the remitted money and invest others, thereby stimulating economic growth and development. Drawing insights from these previous studies, however, a uniqueness of this study is in the estimation of the role of COVID-19 on the relationship between these important economic variables.

The empirical findings from the instrumental variable regression and the threshold estimates suggest that remittances are positively connected with sustainable development, both before and after the threshold, based on the absorptive capacities of the SSA economies. In effect, there is a minimum level of institutional quality and financial development, below which their effects on sustainable development would be negative; at which the stimulating effect of remittances may be reversed. In addition, COVID-19 is observed to adversely affect sustainable development, both directly and when it is interacted with remittances. Among the other variables considered, the coefficient of financial development upholds that sustainable development rises with an improved financial system. While this positive effect turns negative after the threshold, the interaction effect of remittances and financial development is negative, thereby upholding the 'substitutability hypotheses'. Again, foreign direct investment is observed to retard sustainable development. Finally, the quality of institutions adversely impacts sustainable development before the threshold and stimulates it after the threshold, while its moderating role on remittances – sustainable development is positive.

These empirical findings have implications, both for the SSA governments in the pursuit of sustainable development, and for others. Given the threshold values obtained, it is important for the SSA region to improve both financial and governance infrastructures in order to promote sustainable development. Specifically, SSA governments should prioritise the development of governance infrastructures by promoting the rule of law. While providing these necessary environments for remittances inflows to benefit sustainable development and some of its goals, a more developed financial system could also be a driving force for higher remittances, from which the region greatly benefits in the long-run. The COVID-19 pandemic has reinforced the need to develop the region's financial system as an endogenous variable should there be any other global shocks that tend to de-globalise trade, in which the SSA region may be severely impacted.

Moreover, friendships that promote complementary inflows of foreign capital (such as remittances, FDI, and foreign aid) between SSA and the rest of the world should be strengthened, as they tend to reduce the burden of COVID-19. There should, however, be a reduced reliance and the region's economy should be better developed so that the primary sector does not, again, fall victim should there be any similar global shock in the future. This is especially important given that a relatively small interaction effect of remittances and COVID-19 further recommends that the SSA region target other development drivers beyond remittances if it aims at attaining sustainability. Likewise, policies targeting the inflow of foreign direct investment should be pursued but not at the expense of domestic industries. As much as appropriate credits are made available to foreign investments, local firms should also be encouraged with credits availability; while foreign investments should be better linked to the local economy. Finally, the use of emission-reduction technology in manufacturing

activities is necessary to reduce environmental degradation, thereby promoting sustainable development.

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Appendices

Table 7: List of Countries Considered for Paper 1

Benin	Congo, Dem. Rep.	Guinea	Senegal
Botswana	Congo, Rep.	Guinea-Bissau	Seychelles
Burkina Faso	Cote d'Ivoire	Kenya	Sierra Leone
Burundi	Eswatini	Lesotho	South Africa
Cabo Verde	Ethiopia	Madagascar	Tanzania
Cameroon	Gabon	Mali	
Comoros	Gambia, The	Mauritania	
Togo	Ghana	Mauritius	
Uganda	Angola	Mozambique	
Zambia	Namibia	Nigeria	
Zimbabwe	Niger	Rwanda	

Chapter Three: The Impact of COVID-19 on the Relationship Between Foreign Direct Investment and Sustainable Development in Sub-Saharan Africa

3.0 Introduction

The coronavirus disease (COVID-19) caused the largest shock the global economy has suffered in decades; it impacted all parts of the world, including Africa (World Bank, 2020). In a general sense, pandemics inflict harm on both the demand and supply sides of the economy. Unsurprisingly, COVID-19 triggered severe demand-side and supply-side contractions, leading to lower investment, erosion of human capital, worsening poverty and job losses (Millard, 2020). As a result, prospects for the global economy and development were adversely affected. Also, the progress towards the sustainable development goals (SDGs) ante COVID-19 had been slow, and the pandemic generated even more hindrances as inequalities have intensified, the quality of education impaired, and the global economy contracted (Tonne, 2021). As a result, there have been income losses to vulnerable families and households in low-income economies, which may mean further spikes in poverty and reduced healthcare access even far beyond the COVID-19 pandemic (Evans & Over, 2020).

As the global economy moved closer to the achievement of SDGs, output growth was projected to decline to 1.9% in 2023 (from an estimated 3% in 2022), making it one of the lowest growth rates recorded in recent decades. Nonetheless, the waves of COVID-19 continued to reverberate, while the climate shocks persistently subject many countries to massive

humanitarian crises and economic damages caused by wildfires, heat waves, hurricanes and floods (United Nations, 2023). Despite surveillance, testing, sequencing and vaccination gaps still left opportunities for a new variant to emerge, especially as more countries reduced the pandemic-related restrictions (WHO, 2022b). Apart from the direct health and economic costs of COVID-19, several developing economies are now confronted with unprecedented reduction in some commodity prices, unexpected stops and reverse of capital inflows, as well as drastic devaluation of local currencies. While, in the short-run, the increased difficulty of access to foreign finances substantially limited government mitigation of the abrupt health and economic consequences of the pandemic, the interconnected shocks created the risk of severe balance of payments crises, at least in the medium term (Franz, 2021).

These financial imbalances may extend the period of economic recovery from the pandemic as periods of extended lockdowns have raised both corporate and government debts, while foreign investment declines sharply (Wang & Huang, 2021; Donthu & Gustafsson, 2020). Similarly, the global pandemic is reversing economic globalisation due to both demand and supply shocks caused by containment measures; hence, the global production networks witnessed an unprecedented disruption. This has severely impacted multinational enterprises (MNEs) globally as the prevailing global value chains relied upon by the bulk of MNEs was majorly disrupted, while several supply and demand shocks threaten the capability of numerous businesses (Nawo & Njangang, 2021).

Africa has experienced the adverse events described above (see EIU, 2022). This is not surprising given that the majority of the region's economies are dependent on primary products, with high revenue volatility. Thus, economic diversification – arguably the most feasible approach to sustaining their prosperity and survival when faced with uncertainties and

vulnerabilities – was already compromised by the volatility in commodity prices and the negative effects of shocks, such as global financial crisis (GFC) and COVID-19, leading to disruptions in international trade (see UNCTAD, 2022b). Africa was estimated to be hard hit, with the largest level of contraction (OECD, 2020a). Even with some of the lowest confirmed cases and deaths relative to other regions[10], the region was at a high risk because of its relatively low capacity to manage health emergencies. The economic effect of the pandemic on the region was significant because of its high reliance on advanced economies that have been severely affected by the pandemic (see Lone & Ahmad, 2020). In corroborating this, the United Nations Economic Commission for Africa (UNECA, 2024) reports that intra-African trade as a proportion of world trade fell to 13.7% in 2022 (from 14.5% in 2021). Within the same period, intra-African exports as a share of total exports fell from 18.22% to 17.89%, while intra-African imports fell from 12.81% to 12.09%. These indicate that the countries in Africa maintain greater trade relations with the rest of the world than among themselves. More so, many countries in Sub-Saharan Africa (SSA) had existing political and social challenges, which have exacerbated the severe impacts of COVID-19 (Fagbemi, 2021).

Because of the underdeveloped healthcare facilities in Africa and the diversion of health system resources to the pandemic response, COVID-19 caused serious disruption to health services (WHO, 2022a). The inequality of vaccines was another major concern; the level of (full) vaccination in the continent is still far below other regions. Again, repeated and severe climate shocks have raised socioeconomic costs and eroded real incomes; the resulting economic slowdown increased the proportion of Africans living below the extreme poverty level to 17.2% in 2020. Furthermore, the economy was projected to stay subdued, given the uncertain and

[10] See Figure 3

volatile global environment compounding domestic challenges, and output growth was expected to decline from 4.1% in 2022 to 3.8% in 2023 (United Nations, 2023).

Given FDI is a significant proportion of the overall capital flows, it can be regarded as the herald of economic development because it is a propelling force in bridging the domestic saving – investment gap. This argument is based on the assertion that FDI triggers both demand-side effects – by increasing human capital accumulation via technology transfers, spillovers, and physical capital investments – and supply-side effects – by promoting the level of education via change in employment and wage structures (see, e.g., Fagbemi & Osinubi, 2020). Besides, with advanced technologies, managerial and marketing expertise, improved financial resources and quality of local institutions, as well as its spillover effects on local firms, FDI enhances economic development in the host country (Long et al., 2015). It also enhances the productivity of local firms and boosts their integration into international markets (Qiang et al., 2021).

The COVID-19 pandemic has, however, turned around the global patterns of trade and investment by reversing the recent pattern of globalisation. This has impacted all forms of economic globalisation and the inflow of foreign capital, thus altering fundamental projections for the international economy. Although FDI rose to $1.58 trillion in 2021, the global FDI flow in 2020 was below $1 trillion and SDG investment was significantly affected, with double-digit reductions in almost all the sectors (UNCTAD, 2022a). Developing countries are more vulnerable to economic shocks and, therefore, more affected by the pandemic than the developed ones because of their lower resilience capacities. As such, they faced difficulties in meeting their financial needs as COVID-19 manifested in reduced economic activity, reduced foreign investment, and worsening socio-economic inequalities. While mobility restrictions

may have enhanced the attainment of SDGs 12 (responsible consumption and production) and 13 (climate action), other goals have been adversely affected (e.g., SDG1: no poverty; SDG2: zero hunger; SDG3: good health and wellbeing; SDG8: decent work and economic growth; and SDG10: reduced inequalities) (see Joshi et al., 2021).

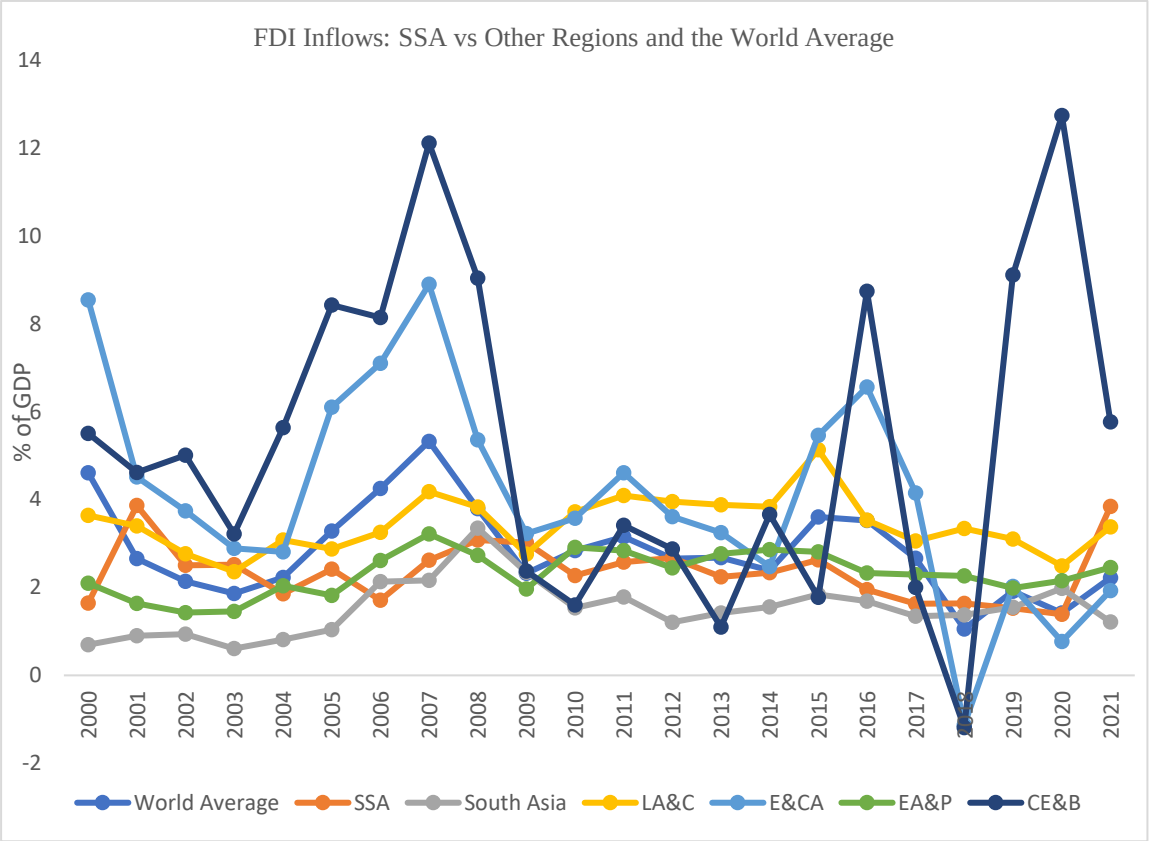

Figure 4:FDI inwards in SSA in relation to some other regions' receipts

Source: Authors' computation from the World Bank dataset

The flow of FDI to Africa hit a record $83 billion in 2021, which is more than double that reported in the previous year when COVID-19 weighed deeply on investment flows to the region. Notwithstanding the strong growth, this flow of investment to the region is only 5.2% of the global FDI – a rise from 4.1% in 2020. Besides, the aggregate Greenfield investments[11] stayed depressed,

[11] Greenfield investment defines both new projects and expansions by individual overseas investors

at $39 billion, with only a modest recovery from the low of $32 billion in 2020 (a downward trend from $77 billion in 2019). In terms of the sub-regions, West Africa, Southern Africa, and East Africa recorded increases in investment flows, while the flows to Central Africa remained flat and North Africa registered a decline (UNCTAD, 2022a). Also, as much as this form of capital flow promotes investments and finances deficits in an economy's current account, it may equally reduce her competitiveness, thus hampering growth and sustainable development (Naceur et al., 2012). This perverse economic effect tends to create a stalemate for governments and policymakers in the management of such inflows.

Africa's slow recovery from the health and economic effects of the pandemic has been costly, given that global demand and rising oil prices enhanced her macroeconomic fundamentals. As a result of the COVID-19 pandemic, some 30 million Africans transitioned into extreme poverty while about 22 million jobs were lost in 2021, the trend of which was projected to persist through 2023 (African Development Bank, 2022). While FDI is essential to prompt economic recovery from the effects of COVID-19, its inflow into the region and participation in global value chains remains comparatively low. This underlies the need for more external investment in export-oriented and employment-intensive sectors (Qiang et al., 2021). Furthermore, the inflow of FDI into SSA has, for most periods, been comparatively low relative to other regions and the world average but recorded a sharp increase in 2021 even in the middle of COVID-19 (refer to Figure 4). Despite the benefits from new investments, unless clean technologies are applied in production, this increased FDI inflow may deepen environmental degradation and worsen the level of poverty, thus hampering sustainable development (see Akinlo & Dada, 2021). Again, besides the year 2021, the ratio of inward of FDI falls short of other forms of capital inflow, including remittances and foreign aid[12]. While this may be

[12] Refer to Figure 5

attributed to many factors as evident in previous studies, such as dearth of infrastructure (Asongu & Odhiambo 2020), and inefficient institutions (Arogundade et al., 2021), it is more pertinent to examine the empirical role of the COVID-19 pandemic on the relationship between FDI and sustainable development, hence this study is novel.

In summary, this overview highlights the following:

- Though FDI to SSA showed a significant increase in 2021, its inflow prior to the pandemic had been low relative to other regions; it also fell short of other forms of capital inflow.
- With some of the largest contractions, disruption to foreign trade and reduced investment in the region, COVID-19 has slowed down the prospects of progress towards sustainable development.
- Even though the SSA economy has witnessed continuing economic growth, the attainment of sustainable development requires the overcoming of other constraints.

The superiority of sustainable development indicators vis-à-vis other development measures used in the extant literature is premised on its concerns for development now and in the future. In the words of Kevin Urama[13], the Vice President and Acting Chief Economist of The African Development Bank: "Finding policies that address climate adaptation and mitigation of greenhouse gas emissions while ensuring social and economic development is one of the most enduring policy challenges of our time". This is because climate risks may affect international investment behaviours, since it is a serious financial risk for external investors (Fagbemi & Oke, 2024).

[13] See African Development Bank (2022)

The term “sustainable development” is particularly relevant in African literature, since the current growth in the region was achieved at the cost of environmental quality, including the loss of biodiversity, reduced food security, and pollution-related mortalities (see Ofori et al., 2023). As evidenced in Lone and Ahmad (2020), China, United States and the European Union, India, and Russia are some of the largest CO_2 emitters in the world. While Africa contributes the least (given her relatively low CO_2 emissions per capita), the continent suffers significantly from climate-related adversities, ranging from infectious diseases to economic growth and sustainable development. As such, Africa is excessively affected by climate change to which she loses 5% - 15% of her GDP (see African Development Bank, 2022).

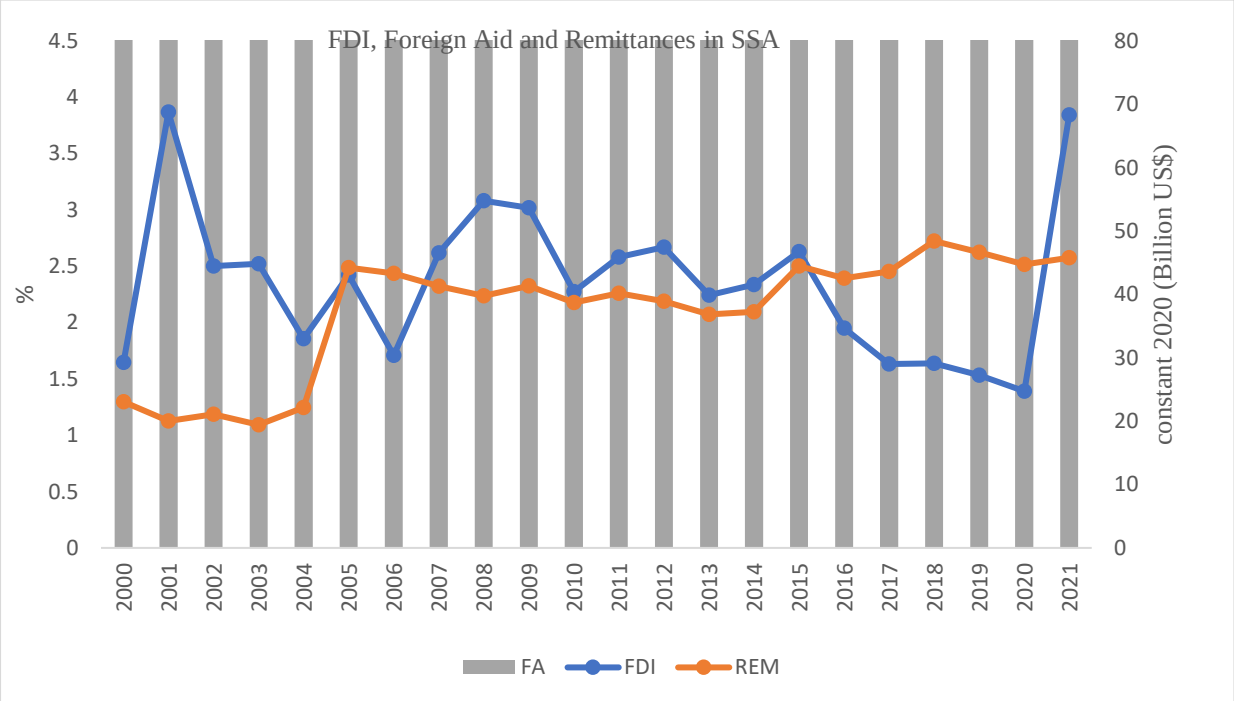

Figure 5: FDI, Foreign aid and Remittances (all inwards) in SSA

Source: Authors’ computation from the World Bank dataset

In the light of the above, this research attempts to empirically address the following questions in relation to the SSA region: (1) why is sustainable development considered to be more

relevant than growth and other development indicators? (2) how did COVID-19 impact the nexus between FDI and sustainable development? (3) what is the role of SSA's absorptive capacity in the connection between FDI and sustainable development?

The answers to these questions are expected to inform important policy directions, not just for the SSA but also for other regions, given that COVID-19 was a huge shock to the global and regional economies. Moreover, the concern for the environment that defines 'sustainable development' also infers the relevance of this study in aiding appropriate decisions on environmental quality, both in the SSA region and globally.

Following this introduction, this paper has another four sections. The review of relevant literature is presented in Section 2. While the methodology and empirical results are, respectively, presented in the third and fourth sections, the conclusion of the study appears in section five.

3.1 Review of Relevant Literature

This section reviews earlier studies addressing the impacts of FDI on economic growth and other development indicators. It covers extensive reviews on earlier studies in both the SSA region and globally. The conclusion from this section is expected to better situate the current study in the extant literature.

In defining the theoretical connection between FDI and economic growth, some researchers (see, e.g., Sunde, 2017) explained that FDI may enhance economic growth when it is linked with such factors as human capital and technology transfers (FDI-led growth hypothesis). The

latter may also stimulate the former due to potentially higher profitability from increased aggregate demand and (foreign) investment (growth-led FDI hypothesis). The feedback hypothesis proposes an interdependence between the two variables, as improved economic growth tends to promote FDI inflows (and vice-versa). As much as this theoretical exposition holds, some researchers believe FDI may not produce the desired effects on growth and development without adequate host economy absorptive capacity. For example, Long et al. (2015), and Nejati and Bahmani (2020) supposed that the extent of FDI spillovers relies on the absorptive capacity of the host economy to promote technology transfers, among other spillovers. Therefore, there may be negative impacts on the economy if the inflow of FDI lacks productivity spillovers. Furthermore, Singh (2021) relied on neo-classical and endogenous growth theories to explain the conditions necessary for FDI to improve economic growth. While the former (advanced by Solow, 1956; Swan, 1956) contend that FDI promotes long-run economic growth by expanding the level of technology, the latter (see Romer, 1993; Borensztein et al., 1998) discuss the need for supportive domestic environments to sustain the growth process. Hence, FDI can both widen the host countries' capital (through the accumulation of more capital for investment) as well as improve their productivities via human capital development, technology transfer, and linkages of local firms with foreign networks – capital deepening (see, e.g., Cao et al., 2017).

Given the role of policy (un)certainty in the attractiveness of FDI, Nguyen and Lee (2021) measured the effects of financial development and uncertainty on FDI in 116 economies, between 1996 and 2017. Their estimates suggested that even though improved financial development raises FDI inflow, policy uncertainty reduces it. In relation to the business cycle, Doytch (2021) estimated the behavioural patterns of sectoral FDI in 19 Eastern European and Central Asian economies, for the period 1993–2011. The author found that besides the services

FDI inflows that rise during economic contractions and fall during expansions (countercyclical), other FDI inflows do not change in relation to the business cycle.

With the recent pandemic, Nawo and Njangang (2021) observed the impact of COVID-19 outbreaks on FDI and how Sovereign Wealth Funds (SWFs) affected the relationship in 79 developing and developed economies. Based on the estimates from a cross-sectional OLS analysis, the researchers claimed that both the total cases and the total number of deaths are inversely correlated with FDI. Besides, COVID-19 is found to significantly reduce FDI in countries without SWFs, but the effect is non-significant in countries with SWFs. Similarly, Nwosa (2021) measured the effects of COVID-19 on stock market performance, exchange rate, oil price, and its implications for FDI inflow in Nigeria. Based on daily data spanning 1 December 2019 to 31 May 2020, the researcher observed that COVID-19 negatively affects each of the variables, even more than the 2009 and 2016 global recessions, thus having implications for FDI inflow into the country.

In other empirical estimates, Sunde (2017) measured the impact of FDI and exports on the growth of the South African economy and found that FDI stimulates economic growth. A unidirectional causality running from FDI through economic growth was established. In another aspect of development, Fagbemi and Osinubi (2020) observed the connection between FDI inflow to Nigeria and human capital development. Their estimates revealed that the effect of FDI on human capital development was significant in the short-run, but not in the long-run. While unidirectional causality running from human capital through FDI was obtained, the asymmetric effects suggested that a long-run increase in FDI inflows to a certain rate may well raise the level of human capital development in Nigeria. Likewise, Ofori et al. (2023) evaluated the impacts of FDI and economic freedom on inclusive green growth (IGG) in 20 SSA

countries. The researchers obtained that, unconditionally, FDI does not exert a significant effect on growth, and that inadequate economic freedom in SSA causes FDI to reduce inclusive green growth.

Exploring another dimension, Akinlo and Dada (2021) examined the role of FDI on the link between environmental degradation and poverty reduction using a panel of 39 SSA countries. They found that FDI contributes to poverty reduction. Besides, the interaction effect of FDI and environmental degradation mainly depended on the measures adopted. It failed to stimulate poverty reduction when poverty was measured by household final consumption expenditure. But when the human development index (HDI) was used as a measure of poverty, the interaction effect enhanced poverty reduction, and was harmful to poverty reduction when poverty was measured by life expectancy. Also, Asongu et al. (2019) explored the relevance of external flows on inclusive human development in a panel of 48 SSA countries and established that stimulating FDI has a net negative effect on inclusive development, and a threshold value of 33.3 (% of GDP) is required for FDI to turn to a positive net effect on inclusive human development.

Looking forward, Dhrifi et al. (2020) observed the connection between FDI, CO_2 emissions, and poverty for a panel of 98 developing economies (covering Africa, Asia, and Latin America), spanning 1995 – 2017. Their empirical findings suggested a significant negative nexus between FDI and poverty for other regions, except Africa; a negative relation between FDI and CO_2 emission in Africa; an inverted U-shaped nexus between FDI and CO_2 emissions in Asia; and a positive connection between FDI and environmental quality in Latin America. Also, their global estimates suggested reverse causality between FDI and poverty, and between CO_2 emissions and poverty; but a unidirectional causality running from FDI through CO_2

emissions. More so, Waqih et al. (2019) studied the contributions of FDI, economic growth, and energy consumption on CO_2 in South Asia. Among their major findings, the researchers observed that FDI raises CO_2 emissions in the short-run but reduces it in the long-run. Moreover, Sung et al. (2018) observed the impact of FDI on CO_2 emissions in 28 Chinese manufacturing subsectors, from 2002–2015, based on System GMM estimators. Their empirical findings upheld the view that FDI stimulates environmental quality by advancing environmental-friendly technologies, thereby providing real benefits to the host economy.

Udemba and Yalçıntaş (2021) also investigated the role of FDI and natural resources on environmental performance in Algeria. Based on data spanning 1970 – 2018, the researchers showed evidence of negative effects of economic growth and excessive fossil fuels use, though FDI was confirmed to positively impact the environment. Moreover, Deng et al. (2022) evaluated the effects of FDI, social globalisation, and finance on environmental pollution in 107 economies, based on threshold regression. Their empirical estimates indicated that FDI raised and reduced air pollution after and before the threshold level in the overall panel, the upper-middle-income and the low-income sub-panels; it raised environmental pollution before and after the threshold in lower-middle-income economies. Also, financial development raised and reduced environmental pollution, respectively, before and after the threshold levels.

In contrast to these, Singh (2021) evaluated the long-run connection of trade and FDI to economic growth in India (from 1991 to 2019) and observed that while FDI is adversely linked to economic growth, both the long-run and the short-run unidirectional causality exists from economic growth through FDI. Similarly, Cao et al. (2017) explored the impact of FDI on inequality-adjusted human development index in 23 Asian countries, covering 2013 – 2015. Their empirical estimates revealed that the effect of FDI on human development was not

significant and FDI was observed to promote income inequality even though it reduces inequality in education. Further, Shahbaz et al. (2018) explored the roles of FDI, economic growth, financial development, energy research innovations, and energy consumption on CO_2 emissions using French data spanning 1955 – 2016. Their empirical findings upheld the view that a positive relationship exists between FDI and CO_2 emissions. Energy research innovations and financial development exert a negative effect on CO_2 emissions; while consumption of energy is positively connected with CO_2 emissions.

Some other studies were of the opinion that the benefits of FDI to economic growth and/or development do not occur automatically, but through the absorptive capacity of the host country(ies). Among these studies, Arogundade et al. (2021) examined the role of absorptive capacity on the nexus between FDI and inclusive human development in 28 SSA countries, from 1996 to 2018. Employing a panel smooth transition regression (PSTR) model, the authors ascertained that the impact of FDI is nonlinear and that it is only positive on a threshold level of institutional quality and infrastructure. Similarly, Asongu and Odhiambo (2020) investigated the moderating role of information and communication technology (ICT) on the nexus between FDI and economic growth dynamics in 25 SSA countries. Applying the GMM estimator on the data for the period 1980–2014, their study found that both the mobile phone and the internet penetrations stimulate the impact of FDI on the overall positive net effects of the dynamics of economic growth. In a similar sense, Aziz (2018) observed that institutional quality exerts a positive impact on economic growth. Applying a system GMM technique on 16 Arab countries, between 1984 and 2012, while measuring the impact of institutional quality on the inflows of FDI, the empirical findings supported that the ease of doing business, economic freedom, and the international country risk guide (ICRG) measures have a significant and positive linkage with FDI.

Based on the reviewed literature above, it is evident that earlier studies have:

- investigated the role of FDI on economic growth and various development indicators;
- estimated the roles of institutional quality and other mediating factors on the FDI – economic growth nexus; and
- carried out these studies in different countries (and a panel of countries).

As much as it is evident that COVID-19 has affected the global health and economic well-being, its mediating role on the nexus between FDI and sustainable development has not been discussed in the public space. Even though there have been empirical studies on the effect of the pandemic on FDI (see, for instance, Nawo & Njangang, 2021; Nwosa, 2021), and on economic growth (see, for example, Inegbedion, 2021), there is a need to establish an empirical channel through which economic development is impacted, as a result of which this study is novel. With respect to SSA and other developing economies, Wang and Huang (2021) supported that even though the scope of research on COVID-19 is extensive, the depth of research on the subject is inadequate as it is more focused on advanced economies, whereas the effect of the pandemic on sustainable development was more critical in developing countries. Hence, this research is important for development policy in SSA as the region is among the least developed, with poor welfare distribution. Besides, it has suffered some of the worst environmental challenges and related adversity, especially with the complications of the COVID-19 pandemic. As part of this novelty, therefore, the index of COVID-19 is extracted from the World Uncertainty Index database (WUI) by Ahir et al. (2020) for the empirical estimation.

Besides, there have been insufficient studies, to date, that measured the impact of this important capital flow on sustainable development utilising a panel of SSA countries. Again, the case for sustainable development is based on its consideration of environmental quality, even as improved economic welfare is pursued. The only studies close to what is researched in this study are those of Cao et al. (2017) and Arogundade et al. (2021) who, however, only concentrate on the human aspect of development, while ignoring other vital aspects – including concern for the environment. Also, the latter study only considers twenty-eight (28) SSA countries, which may not be a good representation, especially concerning the flows of FDI into the SSA region. This research, therefore, goes a step further by examining this important relationship that is robust to various economic and environmental indicators.

This study considers economic growth alongside other factors moderating the FDI – sustainable development nexus. This is in support of a theoretical explanation (refer to Asongu & Odhiambo, 2020) that economic prosperity is important for economic development since the former aids consumption and investment, employment, and other paths that promote the general wellbeing. Finally, the study argues that a mere establishment of the nexus between FDI and development is not very informative for policymakers, unless the value of FDI at the threshold point is established. This is because an economy would be assumed to benefit from FDI at the same rate over time should the nexus be linear, thus ignoring a likely threshold after which the impact of FDI on economic growth/development may diminish or disappear. This approach, however, departs from that of Asongu et al. (2019) in their use of a quadratic term to measure the nonlinear effect.

3.2 Method and Data

3.2.1 Hypotheses

Given the opportunities to improve on prior studies, as earlier identified, the following hypotheses were formulated to achieve the objectives of this research.

H1: COVID-19 impacts sustainable development, directly and through the inflows of FDI.

H2: in addition to **H1**, other economic variables (such as growth and financial development) moderate the nexus between FDI and sustainable development.

H3: There is a threshold below (or beyond) which the initial impacts of FDI on economic growth and sustainable development change.

3.2.2 Model Specification

Following the neo-classical and endogenous growth theories, and some earlier studies, the following models are specified to study the relevance of COVID-19 in the relationship between FDI and sustainable development in the SSA.

$$SD_{it} = \gamma_0 + \gamma_1 FDI_{it} + \gamma_2 COVID19_{it} + \gamma_3 X_{it} + v_{it} \quad [1]$$

$$SD_{it} = \gamma_0 + \gamma_1 FDI_{it} + \gamma_2 COVID19_{it} + \gamma_3 GDPPC_{it} + \gamma_4 FD_{it} + \gamma_5 (FDI * COVID19)_{it} + \gamma_5 (FDI * GDPPC)_{it} + \gamma_6 (FDI * FD)_{it} + \gamma_7 X_{it} + v_{it} \quad [2]$$

In equation [1], the relationship between FDI, COVID-19 and sustainable development (SD) is examined in a panel of 38 SSA countries. Equation [2] is specified to examine the moderating role of COVID-19 on the nexus between FDI and sustainable development. The other interactive roles observed in equation [2] are those of economic growth (GDPPC) and financial development (FD). Other important drivers of sustainable development are captured by X. These include some social variables (school enrolment (NSER), electricity (PAEL), life expectancy (LEB), urbanisation (URB), health (DGGHE)), economic, monetary and financial variables (government size (SIZEG), interest rate (LIR), natural resources (NRR), foreign aid (FA), household consumption expenditure (HFCEG)). γ_i (i = 0,1,2,...,38) denotes the representative parameters for the intercept and slope coefficients; v_{it} is a residual term, which captures the impacts of other variables that are not included in the model; *i* represents the cross-section (countries); *t* is the time-series (in years).

These equations are estimated using the instrumental variable regression (with OLS and GMM options). This method is useful where the distribution of error cannot be said to be independent of the distribution of the explanatory variables. While the IV regression generates efficient estimates of the coefficients as well as consistent estimates of the standard errors, the GMM option better controls for heteroscedasticity of unknown forms (Baum, et al., 2003 Hansen, 1982).

Furthermore, equation [3] is constructed to measure a possible nonlinearity in FDI – SD relations. In order to identify the values of FDI for which its relationship with economic growth and sustainable development changes, a non-linear term of FDI is incorporated, in addition to the employment of fixed effects panel threshold regression technique – developed by Hansen

(1999). In each of these cases, the values of FDI at the reversal points are estimated, thereby allowing for more-efficient decisions.

$$SD_{it} = \begin{cases} \mu_i + \propto_1 X_{i,t} + \beta_1 FDI_{i,t} + \varepsilon_{i,t}, FDI_i < \gamma \\ \mu_i + \propto_2 X_{i,t} + \beta_2 FDI_{i,t} + \varepsilon_{i,t}, FDI_i \geq \gamma \end{cases} \quad [3]$$

where *SD* is the dependent variable; *X* is the vector of independent variables; *FDI* is the threshold variable; *i* and *t* denote country and time, respectively; $\beta_1 \; and \; \beta_2$ and $\propto_1 \; and \; \propto_2$ are, respectively, the coefficients of the threshold and independent variables; γ is the threshold value; μ_i denotes the fixed effects; and $\varepsilon_{i,t}$ is the error term with constant variance, zero mean, and independently and identically distributed (see, e.g., Liu et al., 2020).

Finally, equation [1] is disaggregated into economic growth (RGDPPC), environment (GHG; CO_2), and human development (HDI) – as a robustness check – as a result of which equations [4] and [5] are constructed.

$$\begin{cases} HDI= \\ RGDPPC= \end{cases} \quad \gamma_0 + \gamma_1 FDI_{it} + \gamma_2 COVID19_{it} + \gamma_3 X_{it} + v_{it} \quad [4]$$

$$\begin{cases} GHG= \\ \\ CO2= \end{cases} \quad \gamma_0 + \gamma_1 FDI_{it} + \gamma_2 COVID19_{it} + \gamma_3 GDPPCGR_{it} + \gamma_4 GDPPCGRSQ_{it} + \gamma_3 X_{it} + v_{it} \quad [5]$$

3.2.3 Source of Data

A panel of 38[14] SSA economies represent the sample of the analysis, covering 2000 – 2022, subject to data availability. The measurement of each variable and data source are presented in Table 8.

[14] The list of countries is presented in Table 15

Table 8: Variable Descriptions and Data Sources for Paper 2

Variable	Measurement	Data Source	Expected Sign
Coronavirus Disease 2019 (COVID19)	It is calculated by counting the percent of the word "uncertain" (or its variant) in the EIU reports; multiplied by 1,000,000	World Pandemic Uncertainty Index (WPUI)	-ve
Human Development (HDI)	Human Development Index; ranges between **zero** and **one**	UNDP; Our World in Data (see Herre & Arriagada, 2023)	–
Institutions (ROL)	Rule of Law; percentile rank	World Governance Indicators (WGI)	+ve
Sustainable Development (SD)	Adjusted net savings, excluding particulate emission damage (current US$)		–
Foreign Direct Investment (FDI)	Foreign direct investment, net inflows (% of GDP)		+ve
Greenhouse Gases Emissions (GHG)	Total greenhouse gas emissions (kt of CO2 equivalent)		–
Carbon dioxide Emissions (CO_2)	CO2 emissions (kt)		–
Economic Growth (GDPPC / RGDPPC / GDPPCGR)	GDP per capita (current US$) / GDP per capita (constant 2015 US$) / GDP per capita growth (annual %)		+ve
Foreign Aid (FA)	Net official development assistance and official aid received (constant 2020 US$)		+ve/-ve/Neutral
Household Consumption Expenditure (HFCEG)	Households and NPISHs final consumption expenditure (% of GDP)		+ve
Natural Resources (NRR)	Total natural resources rents (% of GDP)		+ve/-ve
Size of Government (SIZEG)	General government final consumption expenditure (annual % growth)	World Development Indicators (WDI)	+ve
Interest Rate (LIR)	Lending Interest Rate		+ve

Financial Development (FD)	Domestic credit to private sector (% of GDP)	+ve
Health (DGGHE)	Domestic general government health expenditure (% of GDP)	+ve
School enrolment (NSER)	School enrollment, secondary (% net)	+ve
Electricity (PAEL)	Access to electricity (% of population)	+ve
Life Expectancy (LEB)	Life expectancy at birth, total (years)	+ve
Urbanisation (URB)	Urban population (% of total population)	+ve
Fossil Fuel (FFEC)	Fossil fuel energy consumption (% of total)	–
Renewable Energy (REC)	Renewable energy consumption (% of total final energy consumption)	+ve

3.3 Results and Discussion

3.3.1 Introduction

This section presents the empirical results, which incorporate fifteen (15) estimations as shown in Tables 11, 12, 13, and 14. The results of the IV regressions (with OLS and GMM options) are presented in Table 11, where the empirical relationship between FDI, COVID-19 and sustainable development is obtained. These estimates are robust to, and efficient for, arbitrary autocorrelation and heteroscedasticity. Besides, instruments validity and relevance are important questions in this estimation method. While controlling for the country heterogeneity in each of the estimates, the coefficients of Kleibergen-Paap rk LM statistic and Hansen J Statistic respectively confirm that the models are neither under-identified (through the rejection of the null hypothesis) nor over-identified. The efficiency of these estimates is further confirmed by relatively high values of R-squared; significant values of F-statistics; and AR(2) statistics, which validates the absence of second-order serial correlations in the residuals.

Table 9: Pairwise correlations for Paper 2

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) ANSG	1.000									
(2) FDI	0.323*	1.000								
(3) COVID19_A	-0.347*	-0.059*	1.000							
(4) LEB	0.395*	0.832*	-0.038	1.000						
(5) NSER	0.154*	0.141*	-0.215*	0.140*	1.000					
(6) FD	0.161*	0.169*	-0.043	0.214*	0.071*	1.000				
(7) GDPPC	0.083*	-0.005	0.032	-0.022	0.023	-0.080*	1.000			
(8) SIZEG	0.321*	0.032	0.022	0.103*	0.036	0.118*	0.143*	1.000		
(9) NRR	0.388*	0.836*	-0.053	0.987*	0.140*	0.215*	-0.066*	0.097*	1.000	
(10) DGGHE	0.598*	0.549*	-0.373*	0.633*	0.199*	0.175*	-0.001	0.171*	0.640*	1.000

**** p<0.01, ** p<0.05, * p<0.1*

As presented in Table 9, except for COVID-19 that shows a negative degree of relation with sustainable development, the results of the correlation analysis suggest that each of FDI, life expectancy, school enrolment rate, financial development, economic growth, government size, natural resources, and health is positively correlated with sustainable development.

In Table 10, the measures of variability and central tendency are evaluated using the values of minimum, maximum, mean, and standard deviation. The outcome shows that the average value of sustainable development for every economy ranges from 1 to 5390; that of COVID-19 ranges from 0 to 17.23; while that of FDI varies from 1 to 6907. More so, the values of the standard deviation explain that school enrolment rate deviates farthest away from the mean, while COVID-19 fluctuates least away from the mean. Similarly, the normality conditions of the variables are explained by the kurtosis and the skewness values[15]. Showing the lopsided distribution of the data points, the skewness values imply that urbanisation, economic growth, school enrolment rate, and COVID-19 are positively skewed – implying the asymmetry of the distribution, while the other variables are negatively skewed. Finally, apart from interest rate, school enrolment rate, and sustainable development whose kurtosis values are less than 3 (thus, exhibiting platykurtic), the other variables exhibit leptokurtic behaviour (peaked, having kurtosis values greater than 3).

[15] The detailed Descriptive Statistics and Correlation Estimates are included as Tables 17 and 16, respectively.

Table 10: Descriptive Statistics for Paper 2

Variable		Mean	Std. dev.	Min	Max	Observations	
ANSG	overall	3902.716	2126.636	1	5390	N =	874
	between		811.9299	2010.217	4755.87	n =	38
	within		1969.762	-852.1533	7093.499	T =	23
FDI	overall	6257.911	1205.92	1	6907	N =	874
	between		224.1046	5620.217	6724.783	n =	38
	within		1185.448	-140.1327	7395.693	T =	23
COVID1~A	overall	1.350872	4.119903	0	17.22881	N =	874
	between		0	1.350872	1.350872	n =	38
	within		4.119903	0	17.22881	T =	23
LEB	overall	19138.56	4127.761	1	20498	N =	874
	between		203.3133	18726.13	19575	n =	38
	within		4122.878	-435.4416	20679.78	T =	23
NSER	overall	4758.818	7275.93	1	16003	N =	874
	between		3796.804	1	11710.04	n =	38
	within		6235.922	-6950.225	20050.73	T =	23
FD	overall	7155.164	2653.274	1	8516	N =	874
	between		1648.911	2809.261	8391.957	n =	38
	within		2095.107	-764.0973	12790.9	T =	23
GDPPC	overall	2089.871	2740.631	110.4609	16851.12	N =	874
	between		2626.075	201.1423	12562.78	n =	38
	within		888.0205	-2409.256	6378.209	T =	23
SIZEG	overall	2461.737	900.1044	1	3160	N =	874
	between		589.022	1	2906.913	n =	38
	within		687.011	-235.4805	4388.911	T =	23
NRR	overall	16930.96	3619.259	1	18118	N =	874
	between		158.8102	16542.35	17167.7	n =	38
	within		3615.861	-235.7391	18259.43	T =	23
DGGHE	overall	8717.236	2889.23	1	10062	N =	874
	between		701.2703	4656.348	9152.391	n =	38
	within		2805.042	-434.1556	13975.89	T =	23

3.3.2 Baseline Estimates

The empirical results in Table 11 supports that sustainable development is influenced by its previous value. Given a positive and significant coefficient, at 1% level, the estimate establishes that sustainable development is persistent. Defying the a priori expectation, the coefficient of FDI does not exert a statistically significant relationship with sustainable

development. This result holds even when the lagged effect of FDI[16] (Model 2), as opposed to the contemporaneous effect (Model 1), was estimated on sustainable development. It remains consistent with an alternative estimation technique (Model 3). This finding aligns with that of Ofori et al. (2023); it explains that Africa's sustainable development agenda has not really benefitted from the inflow of FDI into the region, possibly because of a relatively low level of FDI inflows into the region. While Europe, Latin America and the Caribbean, East Asia and the Pacific, and North Africa had FDI inflows of 30.34%, 13.25%, 26.45%, and 17.33%, respectively, between 2010 and 2016, the SSA region only had 1.87% of the world net FDI. With the COVID-19 pandemic, FDI inflows to the SSA region declined by 12%, while the investment flows to entire Africa was only 5.2% of the world FDI in 2020 (see, e.g., Adegboye & Okorie, 2023; UNCTAD, 2022a).

[16] The model is further tested for higher lags (lags 2 & 3) and the impact turns significant, suggesting that it takes a longer time for FDI to stimulate sustainable development (Results in 'Further Appendices' on page 155 – 160)

Table 11: Estimation of Coefficient for Paper 2

DV = SD	Model 1	Model 2	Model 3	Model 8
	IV-OLS		IV 2-Step GMM	
L.SD	0.585***	0.585***	0.479***	0.593***
	(0.025)	(0.025)	(0.082)	(0.106)
FDI / lagFDI	0.007	-0.082	-0.242	-0.327
	(0.055)	(0.119)	(0.197)	(0.229)
COVID-19	-95.579***	-95.538***	-1504.549**	-117.873***
	(10.106)	(10.099)	(766.535)	(38.114)
LEB	0.086	0.087	1.073**	0.149*
	(0.057)	(0.057)	(0.532)	(0.091)
URB	21.061	21.096	29.723	-39.876
	(13.045)	(13.026)	(29.173)	(66.757)
NSER	0.005	0.005	0.003	0.023
	(0.006)	(0.006)	(0.008)	(0.015)
FD	-0.005	-0.005	-0.129*	-0.005
	(0.017)	(0.017)	(0.070)	(0.071)
GDPPC	0.027	0.029	0.159*	0.284
	(0.045)	(0.045)	(0.082)	(0.294)
SIZEG	-0.134**	-0.134**	-0.423**	0.069
	(0.060)	(0.060)	(0.177)	(0.292)
NRR	0.009	0.008	-1.856**	-8.617
	(0.078)	(0.077)	(0.841)	(5.792)
DGGHE	0.247***	0.248***	0.598***	0.096
	(0.020)	(0.020)	(0.156)	(0.223)
HFCEG	0.053***	0.053***	0.073***	0.037
	(0.008)	(0.008)	(0.024)	(0.032)
LIR	0.019**	0.020**	0.026	-0.003
	(0.009)	(0.009)	(0.021)	(0.036)
FA	-0.024	-0.023	0.284	-0.040
	(0.027)	(0.027)	(0.183)	(0.062)
PAEL	-0.537***	-0.538***	–	
	(0.147)	(0.147)		
ROL	–	–	–	18.286
				(13.333)
FDI_GDPPC	–	–	–	-0.00003
				(0.0001)
FDI_COVID-19	–	–	0.229*	–
			(0.123)	
Observation	836	836	836	760
F-Stats	58.08***	58.20***	37.14***	11.20***
Country Effect	YES	YES	YES	YES
R-Squared	0.951	0.951	0.903	0.833
Kleibergen-Paap rk LM statistic	–	–	12.989***	2.838*
Hansen J Statistic	–	–	Identified	Identified
AR(2): Prob.	–	–	0.427	0.183

Note: Standard errors are in parenthesis; ***, ** & * imply significance at 1%, 5% & 10% level

Furthermore, COVID-19 follows the a priori expectation as the sign of the coefficient suggests that it is negatively connected to sustainable development. This finding is consistent with

Adegboye and Okorie (2023), whose COVID-19 dummy shows a negative nexus with human development. This is expected, given that the pandemic has adversely affected nearly all economic activities, including those of SSA region. Although SSA recorded some of the lowest cases and deaths from COVID-19[17], the region has witnessed some of its worst economic impacts arising from slower growth and the first recession in more than two decades (World Bank, 2020), while the progress towards the attainment of SDGs has been slow in the region and globally (Tonne, 2021). This is also in tandem with Nguyen and Lee (2021), who infer that policy uncertainty reduces FDI inflows, thus hampering sustainable development. A positive effect with a statistical significance is, however, obtained when FDI is interacted with COVID-19 (Model 3). This supposes that even though FDI does not directly promote development in SSA, its inflows tend to reduce the negative effect of COVID-19 on sustainable development. Specifically, FDI is found to reduce the negative impact of COVID-19 on sustainable development by 0.229%.

While each of foreign aid, level of education, and urbanisation does not exert a significant impact, financial development is observed to retard the progress towards sustainable development in SSA. Nonetheless, each of the coefficients of health expenditure, household consumption expenditure, interest rate, economic growth, and life expectancy is significant and positively affects the level of sustainable development. On the contrary, an increase in government size adversely affects the level of sustainable development. The coefficient of natural resources endowment is also negative, thus signaling a Dutch disease syndrome in the SSA region.

[17] Refer to Figure 3

3.3.3 Extended Results and Robustness Tests

For the robustness tests of the results in Table 11, the estimate is repeated for each of the sub-regions in the entire sample considered (Southern Africa, Eastern Africa, and West Africa), as presented in Table 13. Further, to empirically capture the UNGA's definition of sustainable development adopted in this research, the model is repeated for economic growth, human development, and the environment and the estimates are presented in Table 12. Finally, the rule of law (a measure of institutional quality) is incorporated into the model (Table 11, Model 8), while the relationship is further examined for the non-linear effects (Table 12, Model 7).

In Table 12, the estimates in Models 4, 5, and 6 confirm the main findings of the baseline estimates. Specifically, FDI does not exert a significant relationship with economic growth, human development, and the environment. In Model 7 (where the threshold effects of FDI on economic growth is presented), the coefficient of FDI after the second threshold also validates that FDI does not exert a significant relationship with economic growth. The coefficient of COVID-19, however, depicts that it reduces each of economic growth and human development by 9.564% and 0.0002%, respectively; it also reduces the emission of greenhouse gases by 805.167%%.

Table 12 :Estimation of Coefficients with Disaggregated Measures of Sustainable Development

DV =	Model 4	Model 5	Model 6	Model 7
	RGDPPC	GHG	HDI	RGDPPC
		IV 2-Step GMM		FE-Threshold
FD	-0.007	-0.170	-6.51e-07***	-0.011
	(0.006)	(0.493)	(1.87e-07)	(0.010)
GDPPC	–	–	1.17e-06***	–
			(4.67e-07)	
SIZEG	0.034*	2.329*	6.57e-08	0.004
	(0.019)	(1.279)	(9.34e-07)	(0.027)
NRR	0.074	-70.579**	-0.00002	0.011
	(0.080)	(32.289)	(0.00002)	(0.030)
DGGHE	-0.008	–	1.61e-06***	-0.002
	(0.014)		(6.31e-07)	(0.009)
HFCEG	-0.001	–	3.98e-08	0.009***
	(0.001)		(7.53e-08)	(0.003)
LIR	0.0002	-0.259	-6.77e-08	0.002
	(0.002)	(0.245)	(1.21e-07)	(0.004)
L.DV	0.949***	32.207**	0.937***	–
	(0.047)	(14.415)	(0.013)	
FDI	-0.009	0.200	2.00e-07	-0.014
	(0.013)	(0.735)	(7.04e-07)	(0.028)
COVID-19	-9.564**	-805.167***	-0.0002*	-3.872
	(4.185)	(185.072)	(0.0001)	(4.525)
LEB	-0.050		-2.71e-07	-0.007
	(0.043)		(2.97e-07)	(0.025)
URB	4.501	-499.440**	0.0004**	43.320***
	(3.469)	(253.830)	(0.0002)	(5.254)
NSER	-0.001	0.165*	-3.16e-08	-0.009***
	(0.001)	(0.093)	(4.86e-08)	(0.003)
FA	0.006	0.140	4.97e-07***	–
	(0.021)	(0.401)	(1.37e-07)	
PAEL	-0.087	1.759	3.11e-07	–
	(0.070)	(1.840)	(1.25e-06)	
GDPPCGR		5.797**		–
		(2.741)		
GDPPCGRSQ		-0.0002**		–
		(0.0001)		
FFEC		0.039		–
		(0.069)		
REC		0.459***		–
		(0.097)		
Observation	836	836	790	874
F-Stats	3435.29***	162.11***	8836.05***	497.18***
Country Effect	YES	YES	YES	–
R-Squared	0.998	0.855	0.99	
Kleibergen-Paap rk LM statistic	10.309***	5.603**	3.573*	
Hansen J Statistic	Identified	Identified	Identified	
AR(2): Prob.	0.147		0.110	

Note: Standard errors are in parenthesis; ***, ** & * imply significance at 1%, 5% & 10% level
Note: The threshold effect test is only significant for the Double Threshold, thus the second threshold coefficients are those presented for FDI and FD in Model 7, based on FE-Threshold results. The coefficients of FDI and FD turned **insignificant** after the second threshold (full results in 'Further Appendices' on page 161 – 162).

While the reductions in the rates of economic growth and human development confirm the projections of earlier researchers and various international organisations at the start of the pandemic (see, e.g., OECD, 2020a; Lone & Ahmad, 2020; Fagbemi, 2021), the environment effect may be attributed to a significant reduction in manufacturing (and other emitting) activities during the pandemic. In addition, the size of government stimulates economic growth, but raises the level of greenhouse gases emission, thus reducing the level of sustainable development. This is evident in Tables 12 (Models 4 & 5) and 11 (Models 1, 2 & 3), respectively. While this positive growth-effect may be attributed to government expenditure on cash transfers and access to socioeconomic overheads, the negative environment-effect may be that a large proportion of those spending have been on environmentally degrading goods and services. Moreover, the EKC hypothesis is validated, as the linear and non-linear terms of economic growth are, respectively, positive and negative (see Model 4 of Table 12). One other interesting finding is the coefficients of urbanisation in Table 12 (Models 5, 6 & 7), which provides that urbanisation raises economic growth, reduces environmental degradation, and improves the level of human development in the SSA region. This reinforces that promoting sustainable cities and communities (SDG 11) is necessary for the overall attainment of sustainable development in SSA.

These key findings equally hold in Table 13, where the empirical model is estimated on the sub-regions. In each of Southern Africa, Eastern Africa, and West Africa, FDI does not exert any significant influence on sustainable development. On the contrary, COVID-19 reduces the levels of sustainable development by 31.79%, 7.72%, and 28.73%, respectively.

In Model 8 (Table 11), both the institutional quality indicator and the interaction effect of FDI and economic growth are incorporated into the regression estimates. The empirical findings are consistent with the baseline estimates: FDI exerts no significant effect, while COVID-19 remains negative. Further, each of the coefficients of the institutional indicator and the moderating effect of economic growth produces no significant result.

Table 13: Estimation of Coefficient for the Sub-Regions for Paper 2, with Panel OLS

DV = SD	Southern Africa	Eastern Africa	West Africa
L.SD	0.484***	0.400***	0.541***
	(0.045)	(0.064)	(0.043)
FDI	-0.270	0.056	-0.088
	(0.393)	(0.147)	(0.093)
COVID-19	-31.790***	-7.721***	-28.733***
	(7.643)	(2.515)	(3.476)
LEB	0.014	1.647***	-0.602**
	(0.034)	(0.428)	(0.263)
URB	6.986	-26.023***	11.514**
	(9.597)	(7.180)	(5.808)
NSER	0.024	-0.001	0.003
	(0.030)	(0.003)	(0.002)
FD	0.036	-0.012	0.0005
	(0.032)	(0.034)	(0.032)
GDPPC	0.007	0.014	0.077*
	(0.025)	(0.011)	(0.042)
SIZEG	-0.150***	-0.072	-0.008
	(0.026)	(0.047)	(0.015)
NRR	-0.369	-0.045	-0.052
	(0.578)	(0.064)	(0.101)
DGGHE	0.555***	0.064***	0.042***
	(0.039)	(0.011)	(0.008)
HFCEG	0.234***	0.072***	0.008
	(0.031)	(0.017)	(0.007)
LIR	-0.109	-0.002	0.006***
	(0.125)	(0.006)	(0.002)
FA	-0.147***	-0.054*	0.098
	(0.053)	(0.031)	(0.089)
PAEL	-0.022	-0.008	-0.0004
	(0.050)	(0.006)	(0.004)
Observation	242	176	330
F-Stats	67.36***	26.17***	42.69***
Country Effect	YES	YES	YES
R-Squared	0.8746	0.7730	0.7847

Note: Standard errors are in parenthesis; ***, ** & * imply significance at 1%, 5% & 10% level

3.4 Discussion

Even though FDI was expected to stimulate economic growth and development in the SSA region, each of its observed effects on economic growth, the environment, and human development was found to be statistically insignificant. These confirm that variations in FDI do not explain the variations in economic growth, environment, and human development in the SSA region. When this effect test was applied on sustainable development, FDI was still observed to exert no significant relationship with sustainable development in SSA – even when institutions variable was incorporated into the model. There are a few reasons why this finding may hold in Africa. First, foreign firms tend to take a larger share and drive domestic firms out of the market when they are fully integrated into the system. This is because of their greater access to superior technologies and the fact that they are able to attract the best workers with higher wages than the domestic firms. This may afford foreign investors some monopoly powers to raise their prices, leading to a long-run negative impact on sustainable development.

Similar to this is the resource-seeking nature of FDI inflows into the region, as a large proportion is directed towards the oil and gas sector; a sector that is usually seen as weak in terms of both backward and forward linkages with the rest of the economy (Adeniyi et al., 2012; Ehigiamusoe & Lean, 2019). Moreover, FDI stimulates growth and development when there is optimal capacity utilisation in the host economies, such as efficient governance and financial institutions. Unfortunately, the SSA region is characterised by institutional challenges; a case in point is the ravaging disruption of democratic systems witnessed in many countries in the region in the last few years. The loss of confidence from these often hampers the performance

of FDI inflows. This is because the SSA region's operating environment is attributed to weak legal framework and bureaucratic bottlenecks (see, e.g., Fagbemi & Osinubi, 2020; Nyuur et al., 2014).

In addition, natural resources endowment was observed to have no significant effect and, where it was significant, negative relationship with economic growth and sustainable development. Because the natural resources sector is one of the major drivers of the SSA economy, however, both the direct and interactive roles of financial development were found to be largely insignificant and, where they were significant, negative. This equally explains why the interactive role of economic growth on FDI – sustainable development was insignificant, even though economic growth was observed to stimulate both human and sustainable development indicators. While explaining the insignificant moderating role of financial development on FDI – sustainable development nexus, this finding contends that providing domestic private sectors with more financial resources might not produce the expected impact on growth and sustainable development because of their minimal involvements in the growth and development process (see Adeniyi et al., 2012).

Even though the index of COVID-19 was found to exert a significant and negative relationship with economic growth, human development, the environment, and sustainable development, further empirical finding revealed that FDI reduces the negative effect of the pandemic on sustainable development. This evidence shows that, among the countries in SSA, those with increased FDI inflows tended to experience some relief from the negative impact of COVID-19. In general, Africa recorded the largest increases in FDI flows, having benefitted from six out of the top fifteen Greenfield megaprojects in 2022. Thus, the value of Greenfield projects nearly quadrupled (from $52 billion in 2021 to $195 billion in 2022), with the largest project

increases in the construction, extractive, as well as energy and gas supply sectors (UNCTAD, 2023). This report further shows that FDI to Southern Africa returned to the pre-pandemic level, at $6.7 billion after the peak in 2021; FDI to East Africa increased by 3% (to $8.7 billion), while the flows to Central Africa declined by 7% (to $6 billion). This interaction effect may, therefore, be explained in relation to business cycle. As reported earlier, the pandemic caused the SSA region to witness some of its worst economic impacts arising from slower growth and first recession in decades. This supposes that the increase in FDI inflows may be attributed to the fact that the domestic assets are less expensive and more attractive to foreign investors (Doytch, 2021), thereby reducing the negative effect of COVID-19 on sustainable development.

3.5 Conclusion

This research investigated the impact of COVID-19 on the relationship between FDI and sustainable development in SSA. The empirical analysis relied on a panel data from 38 SSA countries, covering 2000 – 2022. Further, this study estimated the threshold values at which the patterns of the relationship between FDI and economic growth, on the one hand, and FDI and sustainable development, on the other hand, changed. Besides, the interactive roles of COVID-19 and other important economic variables were measured in these empirical associations.

The estimates from the instrumental variable regressions (with OLS and GMM options) revealed that FDI does not exert the expected effect on economic growth and development. Specifically, FDI does not have a significant impact on sustainable development even when an institutions variable was incorporated into the model. When the effect of FDI was further analysed on economic growth, the environment, and human development, the estimates

remained consistent. While COVID-19 reduces the levels of economic growth, the environment, human development, and sustainable development, the moderating effect showed that FDI reduces the negative effect of COVID-19 on economic growth and sustainable development. Other important findings suggested that urbanisation promotes economic growth and human development, and reduces environmental degradation; government size increases the rates of growth and environmental degradation, thereby reducing sustainable development. Even though economic growth raises the levels of human and sustainable development, natural resources rent adversely affects sustainable development – thus, confirming the Dutch disease syndrome. Finally, it was observed that the effect of institutional indicator does not significantly promote sustainable development; financial development does not exert a significant connection with sustainable development, and negatively affects economic growth and human development, yet the interaction effects of economic growth and FDI on sustainable development was statistically insignificant.

In view of these findings, appropriate economic environments that entrench the rule of law – devoid of nepotism, cronyism, and other institutional deficiencies – should be provided. This would not only enhance innovation, healthy competition, and environmental consciousness, but would also encourage both the existing and new foreign investments. While doing this, the SSA countries should promote environmentally sustainable and technology-intensive FDI inflows (in such areas as green technologies) in order foster economic growth, environmental quality, and sustainable development. As much as foreign investments are targeted, it should be in such a way that the domestic investments are allowed their rights of place in the SSA economy through credible market access and stabilisation policies. The resulting economic prosperity from these actions ultimately promotes the environment, as validated by the EKC hypothesis, especially with sustainable strategies as green investments. Finally, the region

should strive to significantly increase intra-Africa trade. This would reduce dependence on advanced economies and accelerate the process towards productive and sustainable development.

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Appendices

Table 14: List of Countries Considered for Paper 2

Angola	Cabo Verde	Congo, Dem. Rep.	Ethiopia	Guinea-Bissau	Uganda	Namibia	Senegal
Benin	Cameroon	Congo, Rep.	Gabon	Kenya	Mali	Niger	Seychelles
Botswana	Zambia	Cote d'Ivoire	Gambia, The	Lesotho	Mauritania	Nigeria	Sierra Leone
Burkina Faso	Zimbabwe	Tanzania	Ghana	Togo	Mauritius	Rwanda	
Burundi	Comoros	Eswatini	Guinea	Madagascar	Mozambique	South Africa	

Table 15: Full Correlation Analysis for Paper 2

	ANSG	FDI	COVID1~A	LEB	NSER	FD	GDPPC
ANSG	1.0000						
FDI	0.3230*	1.0000					
COVID19_A	-0.3470*	-0.0586*	1.0000				
LEB	0.3948*	0.8317*	-0.0378	1.0000			
NSER	0.1543*	0.1407*	-0.2146*	0.1396*	1.0000		
FD	0.1613*	0.1687*	-0.0429	0.2138*	0.0707*	1.0000	
GDPPC	0.0826*	-0.0045	0.0324	-0.0223	0.0227	-0.0802*	1.0000
SIZEG	0.3206*	0.0324	0.0222	0.1028*	0.0364	0.1182*	0.1427*
NRR	0.3877*	0.8364*	-0.0534	0.9865*	0.1400*	0.2154*	-0.0663*
DGGHE	0.5977*	0.5491*	-0.3735*	0.6334*	0.1989*	0.1755*	-0.0006
HFCE	0.3623*	0.0593*	0.0148	0.1270*	0.0369	0.1218*	0.1532*
LIR	0.2278*	0.1663*	-0.0714*	0.1232*	0.0958*	0.0531	0.1021*
URB	0.0081	-0.0037	0.0921*	-0.0561*	-0.1703*	-0.0250	0.5279*
FA	0.3692*	0.8024*	-0.0723*	0.9474*	0.1351*	0.2510*	-0.1225*
PAEL	0.3630*	0.7865*	-0.0148	0.9331*	0.1183*	0.2227*	0.0597*

	SIZEG	NRR	DGGHE	HFCE	LIR	URB	FA
SIZEG	1.0000						
NRR	0.0970*	1.0000					
DGGHE	0.1708*	0.6398*	1.0000				
HFCE	0.9152*	0.1190*	0.1860*	1.0000			
LIR	0.1498*	0.1198*	0.2056*	0.1475*	1.0000		
URB	0.0294	-0.0746*	-0.0740*	0.0485	-0.2432*	1.0000	
FA	0.0856*	0.9597*	0.6130*	0.1084*	0.1144*	-0.0865*	1.0000
PAEL	0.1262*	0.9346*	0.5916*	0.1305*	0.1058*	0.0338	0.9076*

	PAEL
PAEL	1.0000

Table 16: Full Descriptive Analysis for Paper 2

ANSG

Percentiles		Smallest		
1%	1	1		
5%	1	1		
10%	1	1	Obs	874
25%	4735	1	Sum of wgt.	874
50%	4953.5		Mean	3902.716
		Largest	Std. dev.	2126.636
75%	5172	5387		
90%	5303	5388	Variance	4522579
95%	5347	5389	Skewness	-1.275594
99%	5382	5390	Kurtosis	2.663513

FDI

Percentiles		Smallest		
1%	1	1		
5%	6077	1		
10%	6121	1	Obs	874
25%	6252	1	Sum of wgt.	874
50%	6470.5		Mean	6257.911
		Largest	Std. dev.	1205.92
75%	6689	6904		
90%	6820	6905	Variance	1454243
95%	6864	6906	Skewness	-4.710908
99%	6899	6907	Kurtosis	24.41059

COVID19_A

Percentiles		Smallest		
1%	0	0		
5%	0	0		
10%	0	0	Obs	874
25%	0	0	Sum of wgt.	874
50%	0		Mean	1.350872
		Largest	Std. dev.	4.119903
75%	0	17.22881		
90%	2.381298	17.22881	Variance	16.9736
95%	11.37577	17.22881	Skewness	3.090819
99%	17.22881	17.22881	Kurtosis	11.15164

LEB

Percentiles		Smallest		
1%	1	1		
5%	18256	1		
10%	19726	1	Obs	874
25%	19856	1	Sum of wgt.	874
50%	20071.5		Mean	19138.56
		Largest	Std. dev.	4127.761
75%	20285	20495		
90%	20414	20496	Variance	1.70e+07
95%	20455	20497	Skewness	-4.340998
99%	20490	20498	Kurtosis	20.15802

NSER

Percentiles		Smallest		
1%	1	1		
5%	1	1		
10%	1	1	Obs	874
25%	1	1	Sum of wgt.	874
50%	1		Mean	4758.818
		Largest	Std. dev.	7275.93
75%	15785	16000		
90%	15916	16001	Variance	5.29e+07
95%	15960	16002	Skewness	.8741671
99%	15995	16003	Kurtosis	1.764323

FD

Percentiles		Smallest		
1%	1	1		
5%	1	1		
10%	1	1	Obs	874
25%	7861	1	Sum of wgt.	874
50%	8079.5		Mean	7155.164
		Largest	Std. dev.	2653.274
75%	8298	8513		
90%	8429	8514	Variance	7039862
95%	8473	8515	Skewness	-2.308345
99%	8508	8516	Kurtosis	6.386023

GDPPC

Percentiles		Smallest		
1%	135.6065	110.4609		
5%	244.1454	114.367		
10%	326.9667	117.8602	Obs	874
25%	529.5243	119.2619	Sum of wgt.	874
50%	975.3523		Mean	2089.871
		Largest	Std. dev.	2740.631
75%	2167.925	15874.54		
90%	5869.738	15961.24	Variance	7511061
95%	8153.299	16409.47	Skewness	2.528558
99%	12963.06	16851.12	Kurtosis	9.982007

SIZEG

Percentiles		Smallest		
1%	1	1		
5%	1	1		
10%	1	1	Obs	874
25%	2505	1	Sum of wgt.	874
50%	2723.5		Mean	2461.737
		Largest	Std. dev.	900.1044
75%	2942	3157		
90%	3073	3158	Variance	810187.9
95%	3117	3159	Skewness	-2.201313
99%	3152	3160	Kurtosis	6.335877

NRR

Percentiles		Smallest		
1%	1	1		
5%	17288	1		
10%	17332	1	Obs	874
25%	17463	1	Sum of wgt.	874
50%	17681.5		Mean	16930.96
		Largest	Std. dev.	3619.259

75%	17900	18115		
90%	18031	18116	Variance	1.31e+07
95%	18075	18117	Skewness	-4.445934
99%	18110	18118	Kurtosis	20.86781

DGGHE

	Percentiles	Smallest		
1%	1	1		
5%	1	1		
10%	9276	1	Obs	874
25%	9407	1	Sum of wgt.	874
50%	9625.5		Mean	8717.236
		Largest	Std. dev.	2889.23
75%	9844	10059		
90%	9975	10060	Variance	8347649
95%	10019	10061	Skewness	-2.668521
99%	10054	10062	Kurtosis	8.183326

HFCE

	Percentiles	Smallest		
1%	1	1		
5%	1	1		
10%	1	1	Obs	874
25%	32589	1	Sum of wgt.	874
50%	32807.5		Mean	29543.9
		Largest	Std. dev.	9893.151
75%	33026	33241		
90%	33157	33242	Variance	9.79e+07
95%	33201	33243	Skewness	-2.651651
99%	33236	33244	Kurtosis	8.036479

LIR

	Percentiles	Smallest		
1%	1	1		
5%	1	1		
10%	1	1	Obs	874
25%	1	1	Sum of wgt.	874
50%	12545.5		Mean	8813.181
		Largest	Std. dev.	5697.577
75%	12747	12864		
90%	12792	12865	Variance	3.25e+07
95%	12825	12866	Skewness	-.8368039
99%	12859	12867	Kurtosis	1.747217

URB

	Percentiles	Smallest		
1%	10.118	8.246		
5%	16.225	8.461		
10%	17.735	8.682	Obs	874
25%	28.08	8.908	Sum of wgt.	874
50%	39.588		Mean	40.19982
		Largest	Std. dev.	16.40384
75%	51.123	89.741		
90%	62.218	90.092	Variance	269.086
95%	66.856	90.423	Skewness	.4534505
99%	87.651	90.735	Kurtosis	3.038456

FA

	Percentiles	Smallest

1%	1	1		
5%	22112	1		
10%	22156	1	Obs	874
25%	22287	1	Sum of wgt.	874
50%	22504.5		Mean	21468.55
		Largest	Std. dev.	4771.179
75%	22723	22937		
90%	22854	22938	Variance	2.28e+07
95%	22898	22939	Skewness	-4.268464
99%	22932	22940	Kurtosis	19.27355

PAEL

Percentiles		Smallest		
1%	1	1		
5%	3947	1		
10%	3980	1	Obs	874
25%	4096	1	Sum of wgt.	874
50%	4301.5		Mean	4119.847
		Largest	Std. dev.	936.1357
75%	4506	4712		
90%	4634	4713	Variance	876350.1
95%	4674	4714	Skewness	-3.890276
99%	4708	4715	Kurtosis	17.28926

Table 17:Estimations with Lag (1) of FDI


```
OLS estimation
--------------

Estimates efficient for homoskedasticity only
Statistics robust to autocorrelation
  kernel=Quadratic Spectral; bandwidth=3
  time variable (t):  Year
  group variable (i): Country

                                                Number of obs =       836
                                                F( 52,   783) =     58.20
                                                Prob > F      =    0.0000
Total (centered) SS     =   3703750446          Centered R2   =    0.7775
Total (uncentered) SS   =  1.66558e+10          Uncentered R2 =    0.9505
Residual SS             =  824041168.2          Root MSE      =     992.8

------------------------------------------------------------------------------
        ANSG | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
        ANSG |
          L1. |   .5848233   .0252512    23.16   0.000      .535332    .6343147
             |
      lagFDI |  -.0818409   .1190385    -0.69   0.492    -.3151521    .1514703
   COVID19_A |   -95.5379   10.09939    -9.46   0.000    -115.3323   -75.74345
         LEB |   .0871235   .0573462     1.52   0.129     -.025273     .19952
         URB |   21.09567   13.02626     1.62   0.105    -4.435329    46.62668
        NSER |   .0052798   .0057744     0.91   0.361    -.0060379    .0165974
          FD |   -.005032   .0171663    -0.29   0.769    -.0386774    .0286134
       GDPPC |   .0287793   .0447773     0.64   0.520    -.0589826    .1165412
       SIZEG |  -.1339393   .0595326    -2.25   0.024     -.250621   -.0172576
         NRR |   .0079318   .0767669     0.10   0.918    -.1425287    .1583922
       DGGHE |   .2483841   .0198555    12.51   0.000      .209468    .2873001
       HFCEG |   .0530569    .007611     6.97   0.000     .0381396    .0679741
         LIR |   .0199896   .0091579     2.18   0.029     .0020404    .0379388
          FA |  -.0230401   .0272949    -0.84   0.399    -.0765373     .030457
        PAEL |  -.5378017   .1467072    -3.67   0.000    -.8253424   -.2502609
        dum1 |  -471.8275   455.9927    -1.03   0.301    -1365.557    421.9017
        dum2 |  -65.29401   312.0429    -0.21   0.834    -676.8868    546.2988
        dum3 |  -483.3833   462.1217    -1.05   0.296    -1389.125    422.3586
        dum4 |   93.24354   300.8933     0.31   0.757    -496.4964    682.9835
        dum5 |   351.2232   416.5854     0.84   0.399    -465.2691    1167.716
        dum6 |  -508.8147   453.4878    -1.12   0.262    -1397.634    380.0051
        dum7 |   107.9741   384.7624     0.28   0.779    -646.1463    862.0945
        dum8 |   283.1272   312.4382     0.91   0.365    -329.2405    895.4948
        dum9 |  -220.0302    304.077    -0.72   0.469    -816.0101    375.9497
       dum10 |  -591.8089   483.8543    -1.22   0.221    -1540.146     356.528
       dum11 |    647.407   370.2456     1.75   0.080    -78.26102    1373.075
       dum13 |   274.8297   355.2095     0.77   0.439    -421.3682    971.0276
       dum14 |  -1226.515   701.4869    -1.75   0.080    -2601.404    148.3737
       dum15 |  -326.3611   418.0599    -0.78   0.435    -1145.743    493.0212
       dum16 |   13.33817   379.0813     0.04   0.972    -729.6475    756.3238
       dum17 |   233.3024   301.3436     0.77   0.439    -357.3201    823.9249
       dum18 |   45.52098   303.5343     0.15   0.881    -549.3954    640.4373
       dum19 |   219.0505     317.31     0.69   0.490    -402.8656    840.9667
       dum20 |   180.8458   309.6607     0.58   0.559     -426.078    787.7696
       dum22 |   94.25915   290.1271     0.32   0.745    -474.3795    662.8978
       dum23 |  -917.6482   350.0115    -2.62   0.009    -1603.658   -231.6382
       dum24 |  -37.16526   438.6784    -0.08   0.932    -896.9591    822.6286
       dum25 |   -209.509   282.6442    -0.74   0.459    -763.4813    344.4634
       dum26 |  -137.2904   348.0845    -0.39   0.693    -819.5235    544.9427
       dum27 |    523.627   359.2725     1.46   0.145    -180.5343    1227.788
       dum28 |   165.2805   317.7044     0.52   0.603    -457.4087    787.9698
```

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       dum29 |  -332.3829   354.2233    -0.94   0.348    -1026.648     361.882
       dum30 |  -22.06827   314.6196    -0.07   0.944    -638.7114    594.5749
       dum31 |   -885.669   581.2533    -1.52   0.128    -2024.905    253.5665
       dum32 |  -71.04376   294.3245    -0.24   0.809    -647.9092    505.8216
       dum33 |  -543.1405   465.7805    -1.17   0.244    -1456.053    369.7724
       dum34 |   141.7815   287.1065     0.49   0.621    -420.9369    704.4998
       dum35 |   146.8936   292.4498     0.50   0.615    -426.2976    720.0848
       dum36 |   480.1398   333.3344     1.44   0.150    -173.1837    1133.463
       dum37 |  -401.8192   351.0391    -1.14   0.252    -1089.843    286.2049
       dum38 |   494.6705   301.5482     1.64   0.101     -96.3532    1085.694
       dum12 |   371.2827   366.3731     1.01   0.311    -346.7954    1089.361
       dum21 |          0  (omitted)
       _cons |  -1025.964   951.4166    -1.08   0.281    -2890.706    838.7784
------------------------------------------------------------------------------
Included instruments: L.ANSG lagFDI COVID19_A LEB URB NSER FD GDPPC SIZEG NRR
                      DGGHE HFCEG LIR FA PAEL dum1 dum2 dum3 dum4 dum5 dum6 dum7
                      dum8 dum9 dum10 dum11 dum13 dum14 dum15 dum16 dum17 dum18
                      dum19 dum20 dum22 dum23 dum24 dum25 dum26 dum27 dum28
                      dum29 dum30 dum31 dum32 dum33 dum34 dum35 dum36 dum37
                      dum38 dum12
Dropped collinear:    dum21
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Chapter Four: Foreign Aid, COVID-19, and Sustainable Development in Sub-Saharan Africa

4.0 Introduction

In order to lessen the impacts of global shocks on developing economies, stimulate economic growth and sustainable development, several external aid arrangements have emerged. These have taken different forms, including budget supports (e.g., institutional improvements and public finances), technical assistance (e.g., effective macroeconomic management), humanitarian assistance (e.g., to enhance human capital and save lives), and development finance (e.g., infrastructure, thus stimulating both human and physical capital). Essentially, by shifting an economy's aggregate supply curve, this development assistance can reduce production costs and stimulate growth, thus reversing the Dutch Disease syndrome when directed towards the tradable sectors (see, e.g., Addison & Baliamoune-Lutz, 2017).

COVID-19 was a major threat to the objectives of sustainable economies and the achievement of sustainable development goals (SDGs), particularly in developing countries where it has threatened progress because of a dearth of expertise and the resources necessary to deal with the related economic and social problems. This pandemic, coupled with the Russia – Ukraine conflict, has further plunged the SSA region and developing countries into an energy crisis by reversing the progress towards promoting universal access to modern energy (Li, 2023). At the heart of globalisation is the rising connection between developing and developed economies, from which the latter has been increasingly vulnerable to the challenges of the former (and vice-versa). This illustrates why, even with greater concern for domestic situations at the height

of COVID-19, donor countries sustained their supports to poor countries, not just to facilitate significant investment in energy infrastructures and mitigate the global impacts, but also to reduce the potential effects on the donors (see Kobayashi et al., 2021; Li, 2023).

Further, the impact of COVID-19 on the SDGs financing gap in developing economies is distressing; resources are under stress, poverty levels are on the increase, and development financing is at the risk of collapse. Prior to the pandemic, there was a USD 2.5 trillion SDGs unattained annual financing needs. This has, however, been amplified by COVID-19, with USD 1 trillion supplementary needs for COVID-19 expenditure and a USD 700 billion fall in foreign private resources in 2020 alone, even as the financing gap was projected to increase to USD 4.2 trillion (OECD, 2020). While domestic resources remained under intense pressure and some other financial flows to developing countries (FDI and trade) declined during the pandemic, the rising flow of foreign aid saw some USD 12 billion – composed of both new spending and those redirected from other development programmes to food security, humanitarian aid, and health systems – expended on COVID-19 related activities by the Development Assistance Committee (DAC) of the OECD in 2020. As a result of this, external aid from official donors increased, in real terms, by 3.5% in 2019 to a record high of USD 161.2 billion in 2020 (OECD, 2021). In particular, the SSA region received its highest inflow of foreign aid in decades between 2020 and 2021 (see Figure 6).

Foreign aid is volatile, and its volatility grows with the intensity of aid reliance, which has implications for macroeconomic stability. For instance, where the proportion of aid in national budgets is quite high, an increased reliance may create a disincentive for efficient institutions and the adoption of good policies (see Crivelli & Gupta, 2017). It can also be a deterrent to wealth building, hinder governments' motivations for revenue generation, and distort economic

growth and development when capital formation is hampered (Asiedu et al., 2020). COVID-19 and consequent distortions in global supply chains have had a deteriorating effect, particularly for developing countries, whose inefficient financial and institutional infrastructures exacerbated the effects of the pandemic (see Pradhan et al., 2023b). For instance, the accomplishments of SDGs in African countries, that lagged behind in SDGs targets, have been further threatened, as COVID-19 has adversely affected public health and nearly all other aspects of life (see, e.g., Marzouk et al., 2022).

In (Sub-Saharan) Africa, this form of external flows may displace savings and exacerbate the dependency problems. Besides, its volatility could subvert the region's economy by lessening its welfare gains, constraining its fiscal planning, and worsening its soft budget constraints (Boateng et al., 2021). In line with the aid diversion theory, external aid flows to developing economies hampers economic development by encouraging less-efficient government and distorting domestic income distribution. This connotes that foreign aid may create a disincentive to private sector investments in manufacturing and other sectors. This slows down progress towards sustainable development in SSA (Nguea et al., 2022).

External aid mostly come with specified conditions that recipients may need to comply with, sometimes even above national interests (Atitianti et al., 2023). Multilateral aid is more targeted towards economic development and welfare considerations and are less inclined to political interference. Conversely, bilateral assistance may be allocated along political goals, colonial lines, and strategic alliances (see Ram, 2003; Mahembe & Odhiambo, 2021). This explains why foreign aid may be harmful to African economies, as it tends to perpetuate corruption, distort incentives, and support dysfunctional political elites (Minasyan, 2016). Equally, aid may be used as an important strategic tool of the recipient countries in supporting

the implementation of regulations and policies that are more conducive to the donors' outward investments (Liu et al., 2021), from which the recipient countries may become havens for carbon emissions and pollution (Wang et al., 2021). Little wonder, despite benefiting from significant external aid over the years[18], even far above other regions of the world (refer to Figure 7), the *SSA* region remains the poorest in major human development indicators (World Bank, 2023). In addition, foreign aid not only fails to stimulate economic growth and development in Africa, but also engenders worse perceptions of governance, thus weakening the relationship between the governments and the citizens *(*Atitianti et al., 2023). This echoes Pradhan et al. (2023b), who argue that international aid may promote rent-seeking behaviour and conceal ineffective government policies, thus preserving inefficient institutions that hinder economic growth. While this reduces the effectiveness with which aids are utilised, it may also create a disincentive for external donors. These arguments are further corroborated by the trends in Figure 6, where, for the most periods, an increase in foreign aid inflow is associated with declining economic growth and sustainable development (and vice versa).

[18] In real terms, foreign aid received by SSA countries has significantly increased in recent years, from US$ 26.58 billion in 1990 to US$ 58.80 billion in 2021 (World Bank, 2023b).

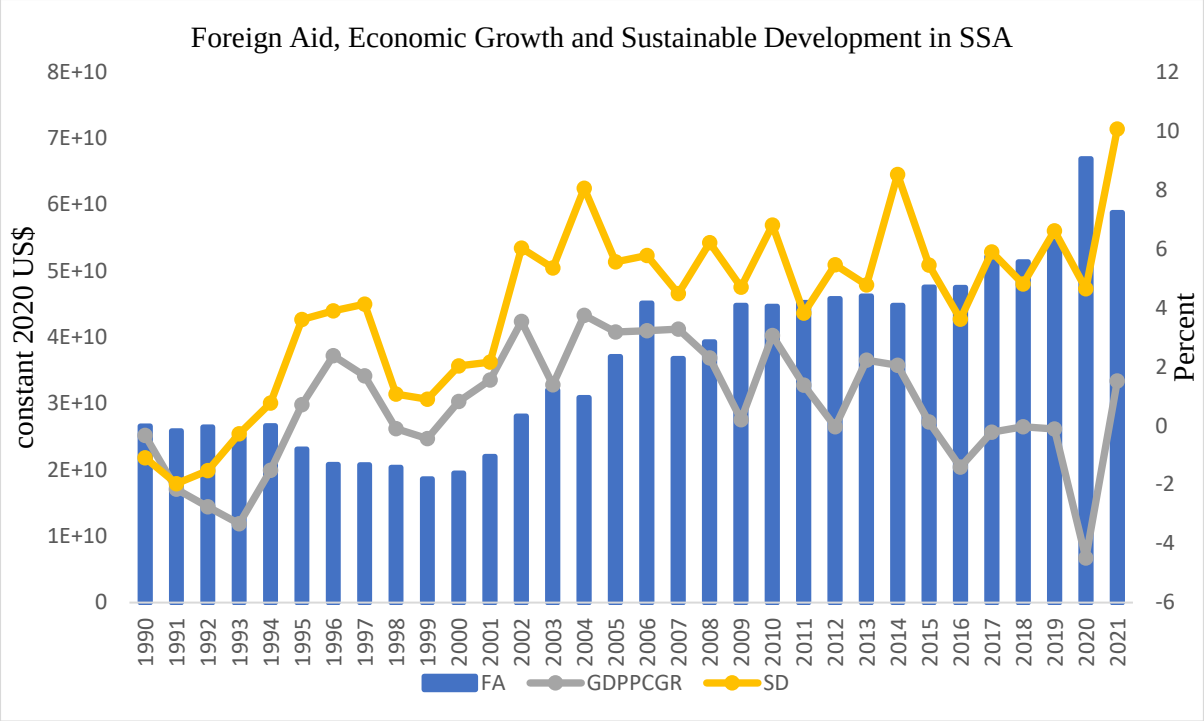

Figure 6: Foreign aid, Economic Growth and Sustainable Development in SSA
Source: Authors' computation from the World Bank dataset

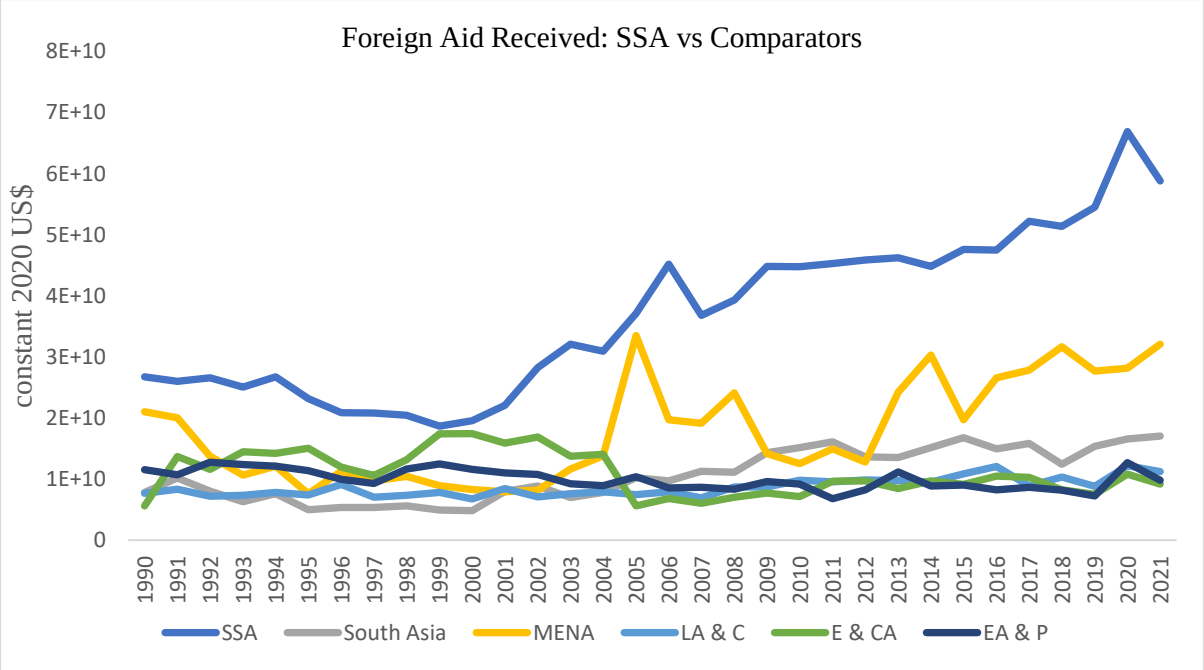

Figure 7:Foreign aid received in SSA in comparison with other regions
Source: Authors' computation from the World Bank dataset

As in other financial flows, as identified earlier, foreign aid may fall short of achieving its developmental objectives, especially when those objectives conflict with one another.

Nonetheless, such international assistance may stimulate sustainable development, particularly with efficient absorptive capacity of the host economies. Huong and Ha (2023) argue that donors evaluate the recipients' debt obligations and institutional framework that are essential for economic stability, income generation, and sustainable development. They further argue that if a cause of environmental degradation, for example, relates to growing dependence on fossil fuels, financial assistance may be targeted at energy upgrades, thus assuaging ecological pressure. In addition, external aid supports the industrial sectors through active investments in research and development (R & D) activities. This is because of its positive spill overs vis-à-vis government incentives for the issuance of subsidies, knowledge transfers, and funds disbursement to stimulate R & D projects (Farooq, 2023). Moreover, efficient institutions support allocative efficiency in foreign aid, thereby facilitating technology transfers, raising productivity, improving affordability and accessibility to clean energy, and promoting sustainable development. They also widen trade opportunities, market access, and access to natural resources for donor countries (Pradhan et al., 2023a; Li, 2023).

Foreign aid may encourage further inflow of FDI to the recipients by facilitating supportive business environments and easing their macroeconomic challenges. This is achieved by directing aid to enhance more public utilities and infrastructures, thereby reducing the cost of production (see, e.g., Liu et al., 2021). As a prospective intervention that reduces energy poverty through access to dependable, affordable, sustainable, and modern energy services, foreign aid tends to promote sustainable development (especially) when it is targeted towards sustainable energy. As documented in Munyanyi and Churchill (2022), energy poverty, arising from the use of traditional energy sources, can result in air pollution which undermines health, wellbeing and efforts to reduce mortality rates. Nonetheless, by stimulating investments in clean and renewable energy sources, foreign aid bridges financial constraints to health and

education infrastructure and the usage of environmentally friendly sources of energy (Sharma et al., 2019).

As the SSA economy largely relies on climate-sensitive sectors and struggles to keep up with the multiple ecological challenges, the impact of climate change weakens her development gains and raises her level of poverty. It also hampers food security and jeopardizes the livelihoods (and lives) of many people because of the significant increase in global atmospheric concentrations of methane, nitro, and carbon oxide emissions caused by human activities. Hence, foreign aid may be directed in support of ecological quality and reduced carbon emissions by lowering the budgetary constraints of recipient governments, providing necessary carbon-reduction equipment, and driving investments in carbon reduction (see Li et al., 2022; Wu et al., 2021). Further, with a continuous surge in the number of Africans emigrating the continent in the last two decades (Africa Center for Strategic Studies, 2023), foreign aid tends to reduce excessive migration flows by enhancing the provision of public services in the recipient countries (Lanati & Thiele, 2018).

In summary, this overview highlights the following:

- Even though the SSA economy has witnessed continuing economic growth, the attainment of sustainable development requires the overcoming of other constraints.
- Foreign aid plays a significant role in the attainment of sustainment development in SSA.
- Though foreign assistance to SSA has increased in recent years, COVID-19 pandemic has worsened the economic conditions of the region and its prospects of progress towards sustainable development.

In the light of the above, this research attempts to address the following important questions in relation to the SSA region: (1) why is sustainable development considered to be more relevant than growth and other development indicators? (2) how did COVID-19 impact the nexus between foreign aid and sustainable development? (3) what is the role of SSA's absorptive capacity in the connection between foreign aid and sustainable development?

The answers to these questions are expected to inform important policy directions, not just for the SSA but also for other regions, given that COVID-19 was a huge shock to the global and regional economies. Moreover, the concern for the environment that defines 'sustainable development' also infers the relevance of this study in aiding appropriate decisions on environmental quality, both in the SSA region and globally.

Following this introduction, this paper has another four sections. The review of relevant literature is presented in Section 2. While the methodology and empirical results are, respectively, presented in the third and fourth sections, the conclusion of the study appears in section five.

4.1 Prior Studies

This section reviews the earlier studies of foreign aid impacts on economic growth and other development indicators. It covers extensive reviews on earlier studies in both the SSA region and globally. The conclusion from this section is expected to better situate the current study in the extant literature.

In emphasising the supportive role of foreign aid in the financial resources of developing economies, a number of researchers have investigated the impact of this external assistance on economic growth and development in different countries and regions. While this facilitates aid policies and outcomes being tailored to the needs of each region, the extant literature has produced contradictory results.

Covering the role of ODA on energy, the environment and climate change, Li (2023) evaluated the role of Chinese external aid in energy poverty in 11 SSA countries, over 2000 – 2014. The empirical findings showed that Chinese aid to these countries promoted their access to clean cooking fuels. Consistent with this, Munyanyi and Churchill (2022) explored the impact of external aid effectiveness on energy poverty in Senegal and observed that foreign aid reduced the prospect of energy poverty. Similarly, Wu et al. (2021) explored the heterogeneous impacts of climate-targeted aid on carbon emissions on a panel of 77 recipient-countries, spanning 1980 – 2016. While their estimates are sensitive to the levels of aid, emissions, and income because of aid utilisation and funding gaps in different countries, the researchers contended that climate aid reduced carbon emissions in the recipient countries. In a similar vein, Sharma et al. (2019) contended that other factors may have been responsible for the worsening environmental

quality in Nepal, as external aid was found to reduce CO_2 emissions, based on their empirical analysis of data covering 1971 – 2013.

Other empirical studies have observed the role of external aid on other macroeconomic variables. For example, Addison and Baliamoune-Lutz (2017) investigated the comparative nexus between foreign aid and the exchange rate between Tunisia and Morocco. Based on the data covering 1980 – 2009, the authors established evidence of aid-induced Dutch Disease in Morocco, but not in Tunisia. In relation to this, Crivelli and Gupta (2017) investigated if the IMF conditionality offsets the potential adverse impact of aid on tax revenues, based on panel data spanning 1993 – 2012 for 111 low- and middle-income economies. The findings revealed that low-income economies' increased adoption of revenue conditionality partly compensates for the depressing impact of foreign aid on tax revenue. In a similar vein, based on the 2003 – 2014 data on 51 Chinese aid-receiving countries, Liu et al. (2021) employed a Poisson pseudo-maximum-likelihood (PPML) to study the effects of China's aid on its outward FDI to the recipient economies. The researchers found that Chinese aid facilitate her outwards FDI flows to aid-recipient countries.

Using data from 50 recipient countries, covering 1980 – 2016, Abbas et al. (2021) studied the nexus between foreign aid and remittances, and established a negative association between the two variables. Their empirical findings also revealed that, by increasing human capital via access to education, foreign aid raises the inflow of remittances. More so, Farooq (2023) investigated the role of external financial assistance on R & D investments in Bangladesh, India, and Pakistan (spanning 2006 – 2019) and the empirical analysis suggested that foreign aid enhances corporate R & D investments. Furthermore, by empirically analysing data on 70

developing countries, covering 1980 – 2016, Maruta (2019) confirmed that external aid facilitates financial development.

Some other studies have considered the absorptive capacities of the recipient countries on the impacts that foreign aid may exert on economic growth and development. For example, Boateng et al. (2021) estimated the impact of institutions on the association between aid volatility and economic growth. By empirically analysing data from 45 SSA countries, the researchers demonstrated that foreign aid inhibits growth and that, even though the quality of institutions stimulates economic growth, it fails to subside the negative effect of aid volatility on economic growth. In addition, the models of development introduced to the aid-recipient economies scarcely adjusts for cultural differences. In the light of this, Minasyan (2016) measured the role of cultural differences on the connection between foreign aid and economic growth on data spanning 1961 – 2010 for 66 countries. The author empirically found that, where the cultural differences between the donors and recipients are not taken into consideration, development assistance may engender an adverse effect on economic growth.

Going forward, Bila et al. (2023) explored the impact of Official Development Assistance (ODA) on the growth of 24 SSA countries. Their empirical estimates established that ODA has a stimulating impact in countries with high levels of economic growth, and institutional quality reinforces the positive effects. Based on two-step system GMM and fixed effect panel quantile approaches on data (covering 2002 – 2017) from 38 African countries, Dinh Su and Nguyen (2022) investigated the role of human capital on the association between foreign financial flows and economic growth. Among the findings from their empirical estimates are that while ODA exerts a negative coefficient, human capital reduces the adverse effect of ODA on economic growth. In the same vein, Pradhan et al. (2023b) examined the connection between financial

development, institutional quality and foreign aid in resource-rich economies. Using a range of panel estimation techniques on time-series data spanning 2005 – 2020, the researchers established that improved financial and institutional infrastructures are necessary for foreign aid that set the countries on the path to sustainable development.

Similarly, Ouedraogo et al. (2021) analysed the role of institutions on the nexus between external aid and economic growth by grouping their sample of 25 SSA countries into three different classes in order to identify any possible heterogeneity in this relationship. Applying a finite mixture model on data spanning 1970 – 2015, the authors contended that external aid retards economic growth in the first two classes and stimulates it in the third class. The researchers also highlight that for the SSA region to benefit from foreign aid, there is a need for enhanced quality of institutions. Moreover, Chuke Nwude et al. (2023) explored the role of external aid on the growth of 40 SSA countries¸ grouped according to income-level and colonial history. Their empirical estimates suggested that aggregate aid exerts no significant impact on the growth of the region. While bilateral aid is found to enhance economic growth in the long-run, multilateral aid retards it. Further findings revealed that bilateral aid stimulates growth in low-income- and lower-middle-income countries in the long-term, and better favours the Francophone countries; multilateral aid is unfavourable to the Anglophone countries. At a disaggregated level, Maruta et al. (2020) explored the role of institutions on the connection between external aid and economic growth in 74 developing economies from Africa, South America, and Asia spanning 1980 – 2016. The authors claimed that education aid is more significant for economic growth when augmented by institutional quality. In regional contexts, their empirical evidence shows that education aid is more effective in South America; agriculture aid is more effective in Africa; and health aid is more effective in Asia.

A number of other researchers have estimated the impact of this important financial flow on numerous indicators of sustainable development. For example, Asongu and Nwachukwu (2018) have investigated whether growing external aid supports inclusive human development in disaggregated estimates. Based on the dynamic panel system estimation approach on data from 53 African countries, covering 2005 –2012, the researchers uncovered evidence of interaction effects from 'aid to the productive sector' and a positive net effect from 'programme assistance', albeit adverse net impacts from 'aid to social infrastructure' and humanitarian assistance. In a similar sense and using the system GMM approach on data covering 2000 – 2016 for 47 SSA countries, Akinbode and Bolarinwa (2020) estimated that external aid does not have a significant impact on human development, neither do the moderating impacts of corruption and government effectiveness produce significant estimates. In a more recent study, Andaish and Assadi (2024) analysed the role of external aid on human development in Afghanistan, by applying the Vector Error Correction Model (VECM) on the data spanning 1990 – 2019. The empirical findings suggested that, while foreign aid promotes human development, improvement on the latter also enhances the inflow of the former.

Going forward, Wang et al. (2021) examined the effects of ODA on the development of renewable energy in 34 SSA countries. They showed evidence of a non-linear nexus between the variables. The researchers observed that ODA stimulates renewable energy at the initial stages of structural change and technical progress and the effect turns negative after the established threshold values. Also, Mahembe and Odhiambo (2021) explored the role of foreign aid on extreme poverty based on the system GMM approach on SSA data spanning 1981–2013. Their empirical findings confirmed the poverty-reduction role of foreign aid, and that democracy stimulates the effect in SSA.

In relation to the pandemic, Kobayashi, Heinrich and Bryant (2021) explored the means by which COVID-19 may alter the flows of foreign aid, based on 887 respondents from the U.S. in 2020. The outcomes from the experiment revealed a reduction in foreign aid support because of concerns about the effect of the pandemic on the country's financial situation.

In contrast to the studies reviewed above, Huong and Ha (2023) investigated the role of institutional quality on the association of foreign aid with energy security in emerging economies. Their empirical findings, based on data spanning 2002 – 2018, provided evidence of an inverted U-shaped nexus between aid and energy security, such that a high reliance on foreign aid at the initial stage of development hampers energy sustainability. This effect, however, turns positive after a certain threshold, as well as when institutional quality is included in the model. In a related study, Askarov and Doucouliagos (2015) investigated the role of development aid on governance and democratic institutions in 32 transitional economies. The authors estimated that aid stimulates democracy up to a threshold and this appears to be more pronounced in stable and open economies. Nonetheless, aid exerts no or adverse effects on governance. This has a resemblance with the findings of Dzhumashev and Hailemariam (2021), who observed a positive nexus between foreign aid and the quality of economic institutions in developing countries.

It is evident from the earlier studies that efforts have been made to:

- evaluate the role of external aid on economic growth and various development indicators
- investigate the roles of institutional quality and other mediating factors on the aid – growth nexus

- these earlier studies have been carried out in different countries (and a panel of countries)

Reinforcing the need to measure the non-linear effect of external aid on growth and development, Feeny and Fry (2014) captured this by including an aid stock and its square in order to validate the prospect of diminishing returns. While this is an improvement over numerous other studies that have only considered the linear estimates, the current research considers the role of aid volatility on sustainable development in SSA. This is important to address the macroeconomic instability that may arise from volatility of aid, which is a challenge to many developing economies. It is equally important because a mere use of a quadratic term to measure the non-linear effect may result in misleading conclusions and specification bias because of the arbitrary introduction of this functional form. Furthermore, even though higher economic growth may be attained at the cost of environmental quality, sustainability is important for pollution reduction, economic growth and poverty alleviation (Hoa et al., 2023). This highlights the need to separate the economic impact of foreign aid from its environmental and social impacts, as a result of which this study is novel. Further to this, this research recognises the importance of this empirical estimation on sustainable development and several goals of sustainable development advanced by the United Nations. This is necessary, given that there have not been sufficient studies, to date, that have measured the impact of this important capital flow on sustainable development in a panel of SSA countries. Again, the case for sustainable development is based on its consideration of environmental quality, even as improved economic welfare is pursued.

More so, as much as it is evident that COVID-19 has affected the global health and economic well-being, its mediating role on the nexus between foreign aid and sustainable development

has not been found in the empirical studies. This study, thus, advances the need to establish this empirical channel, through which economic development is impacted, by extracting the index of COVID-19 from the World Uncertainty Index database (WUI).

4.2 Method and Data

4.2.1 Hypotheses

In view of the identified areas of improvement to the earlier studies, the following hypotheses were formulated:

H1: COVID-19 influenced the impact of foreign aid on sustainable development in SSA.

H2: the quality of governance and level of financial development moderate the effects of foreign aid on sustainable development.

H3: Foreign aid impacts SDG outcomes via economic, environmental and social impactss.

H4: the volatility of foreign aid may exert unintended consequences on sustainable development.

4.2.2 Model Specification

To estimate the volume of capital necessary for sustainable economic development, Chenery (see, e.g., Chenery & Strout, 1956; Bruno & Chenery, 1962) postulated that every developing economy undergoes structural transformations, including rising life expectancy and literacy rates; shifts from rural to urban status, and from agricultural to

industrial sector. Thus, they are confronted with two gaps: a foreign exchange gap (where foreign exchange needs exceed net export earnings) and a savings gap (where domestic savings rate falls short of the needed investment for the target growth rates).

Assume a simple income model, **E – Y ≡ I – S ≡ M – X ≡ F;**

where E and Y are national expenditure and income, respectively; I and S are investment and savings, respectively; and M and X are imports and exports, respectively. Even though the size of the gaps is not expected to be equal, and foreign exchange and savings cannot be substituted since an economy cannot convert its potential savings to exports, F denotes the amount of external aid required to fill the savings (I — S) and foreign exchange (M—X) gaps (Jhingan, 2012). This contends that since foreign assistance complements an economy's stock of capital, a higher capital deepening stimulates economic growth. Because of the diminishing returns to capital stock, nonetheless, the effect of aid on growth is only temporary unless it supports the growth of total factor productivity and human capital (Solow, 1956; Maruta et al., 2020).

Following the Two-Gap and other aligning theories, and some earlier studies, the following models are specified to study the impact of COVID-19 in the relationship between foreign aid and sustainable development.

$$SD_{it} = \gamma_0 + \gamma_1 FA_{it} + \gamma_2 COVID19_{it} + \gamma_3 X_{it} + v_{it} \quad [1]$$

$$SD_{it} = \gamma_0 + \gamma_1 FA_{it} + \gamma_2 COVID19_{it} + \gamma_3 IQ_{it} + \gamma_4 FD_{it} + \gamma_5 (FA * COVID19)_{it} + \gamma_5 (FA * FD)_{it} + \gamma_6 (FA * IQ)_{it} + \gamma_7 X_{it} + v_{it} \quad [2]$$

Equation [1] models the relationship between foreign aid (FA), COVID19, and sustainable development (SD) in a panel of 45 SSA countries. One of the limitations of the two-gap model is its failure to consider an economy's absorptive capacity (Jhingan, 2012). Taking cognizance of this, institutional and financial sector indicators have been included as absorptive capacity in SSA. Hence, equation [2] is specified to examine the interactive roles of COVID-19, institutional quality (IQ) and financial development (FD) on the nexus between foreign aid and sustainable development. The need to control for financial development, for example, arises since foreign aid fosters the level of investment and growth.

Following Brambor et al. (2006), all the variables forming the interaction terms have been incorporated into the model. The other relevant drivers of sustainable development are captured by X. These include economic growth (RGDPPC), infrastructure (FTS), government size (SIZE), interest rate (DIR), natural resources (NRR), industrialisation (MVA), and size of the informal sector (INFECO). γ_i (i = 0,1,2,...,45) denotes the representative parameters for the intercept and slope coefficients; v_{it} is a residual term, which captures the impacts of other variables that are not included in the model; i represents the cross-section (countries); t is the time-series (in years).

These equations are estimated using both static and dynamic models. In line with Boateng et al. (2021), the volatility of foreign aid is estimated using the generalised autoregressive conditional heteroskedasticity (GARCH) method. By first testing for GARCH effect on external aid, then estimating the coefficient of the effect, the volatility variable was estimated using the "generate" option in Eviews. This process was repeated for each of the countries forming the panel considered, and the variable was used in further empirical analysis

It is important to note that panel data may be susceptible to heteroskedasticity, cross section dependence, and autocorrelation problems. Hence, the estimates from the traditional methods of estimation – OLS, RE and FE – may be biased. To overcome these possibilities, panel corrected standard error (PCSE) technique is employed for the static model (Xu et al., 2023). Advanced by Beck and Katz (1995), PCSE corrects for the stated problems and efficiently estimates the panel error variation (see Wang & Ibrahim, 2024).

The use of dynamic model goes further to address the potential endogeneity of aid (possible simultaneity; reverse causality between aid and sustainable development), as well as omitted variable bias (unobservable heterogeneity) that may render the OLS estimates inconsistent (Baltagi, 2008; Mahembe & Odhiambo, 2021). Besides, a dynamic panel model well exhibits the inertia features and dynamic changes of sustainable development. The instrumental variable regression (GMM options) is, therefore, employed, given its relevance where the distribution of errors cannot be said to be independent of the distribution of the explanatory variables. While the IV regression generates efficient estimates of the coefficients, as well as consistent estimates of the standard errors, the GMM option better controls for heteroskedasticity of unknown forms (Baum, et al., 2003; Hansen, 1982).

Suppose the instruments are independent of the error term and correlated with the endogenous regressors (all regressors are assumed endogenous), the lag of explanatory variables as instruments certifies that the instruments have a strong correlation with the endogenous variables (see Wooldridge, 2010; Boateng et al., 2021). To address any potential estimation bias, this instrument validity may be tested using the Stock-Wright LM (Stock & Wright, 2000), Hansen J-stat (Hansen et al., 1996), and/or Kleibergen-Paap LM (Kleibergen & Paap, 2006)[19]

[19] see Table 29 (page 146 – 147) for full results, including the efficiency tests

tests, the rejections of the null hypothesis of which affirm the appropriateness of the instruments.

Finally, the impact of foreign aid on sustainable development is disaggregated into several goals of sustainable development, such as poverty eradication (SDG 1), clean and affordable energy (SDG 7), decent work and economic growth (SDG 8), as a result of which equations [4] and [5] are constructed.

$$\begin{cases} LEB= \\ FDPI= \\ HFCE= \end{cases} \qquad \gamma_0 + \gamma_1 FA_{it} + \gamma_2 X_{it} + v_{it} \qquad [4]$$

$$\begin{cases} REC= \\ \\ GDPPE= \\ URB = \end{cases} \qquad \gamma_0 + \gamma_1 FA_{it} + \gamma_2 X_{it} + v_{it} \qquad [5]$$

This disaggregation is essential, following the argument that aid may have varying effects on the recipients at different time, especially when donors target different objectives while allocating aids. This allows for evaluation of aid effects on economic, environmental, and social components of sustainable development, and guides the policymakers in both the donor and recipient countries (see, e.g., Maruta, 2019; Wu et al., 2021).

4.2.3 Source of Data

A panel of 45 SSA[20] countries, spanning 2000 – 2022, are analysed in this study. The description and measurement of each variable, as well as the sources of data, presented in Table 19.

[20] Of the 48 countries in SSA, according to The World Bank, 3 (South Sudan, Somalia, and Eswatini/Swaziland) are excluded because of unavailability of some key variable data. The list of the countries is in Table 25

Table 18: Variable Descriptions and Data Sources for Paper 3

Variable	Measurement	Data Source	Expected Sign
Sustainable Development (SD)	Adjusted net savings, excluding particulate emission damage (% of GNI).	World Development Indicators (WDI)	–
Coronavirus Disease 2019 (COVID19)	It is calculated by counting the percent of the word "uncertain" (or its variant) in the EIU reports; multiplied by 1,000,000.	World Pandemic Uncertainty Index (WPUI)	-ve
Institutional Quality (GE; PSAV)	This assesses the efficiency with which institutional obligations are performed. It is based on a rank from 1 to 100, with an increase suggesting an improved quality of institutions.	World Governance Indicators (WGI); (Kaufmann et al., 2011)	+ve
Informal Economy (INFECO)	In line with Baunsgaard and Keen (2010) and Liu et al. (2021)[21], the size of the informal economy is measured by agriculture, forestry, and fishing, value added (% of GDP).	World Development Indicators (WDI) World Development Indicators (WDI); Penn World Table, PWT 10.01 (Feenstra et al., 2015)	+ve
Economic Growth (RGDPPC / GDPPE)	GDP per capita (constant 2015 US$) / GDP per person employed.	World Development Indicators (WDI);	+ve
Foreign Aid (FA)	Net ODA is disbursement flows (net of principal repayment) that meet the DAC definition of ODA and are made to countries on the DAC list of aid recipients. To control of population differences among the countries, FA is measured as net ODA per capita.	Organisation for Economic Cooperation and Development (OECD) World Development Indicators (WDI)	+ve/-ve/Neutral
Industrialisation (MVA)	Following Efobi et al. (2019) and Dhahri et al. (2024), industrialisation is		+ve

[21] The authors inferred that informality may be correlated with the size of the agricultural sector, whose effect will be picked up indirectly. Also, informality is more frequent in less developed economies, with higher shares of unskilled workers and larger agricultural sectors – who are the main recipients of aid.

	measured by manufacturing, value added (% of GDP)		
Household Consumption Expenditure (HFCE)	Households and NPISHs final consumption expenditure (% of GDP)		
Natural Resources (NRR)	Measured by total natural resources rents (% of GDP), NRR aggregates natural gas rents, minerals rents, coal rents (hard and soft), and forest rents.	World Development Indicators (WDI)	+ve/-ve
Size of Government (SIZE)	General government final consumption expenditure (% GDP)		+ve
Interest Rate (DIR)	Measured by deposit interest rate, DIR is the rate paid by commercial or related banks for time, demand, or savings deposits.		+ve
Financial Development (FD)	Measured by domestic credit to private sector (% of GDP), FD entails financial resources provided to the private sector by financial corporations.		+ve
Health (DGGHE)	Domestic general government health expenditure (% of GDP)		
Education (GEE)	Government expenditure on education, total (% of GDP).		
Life Expectancy (LEB)	Life expectancy at birth, total (years)		
Sustainable Cities & Communities (URB)	This is measured by urbanisation (urban population as % of total population).		+ve
Food Access (FDPI)	Measured by food production index, FDPI covers food crops that are deemed edible and that contain nutrients. They exclude coffee and tea that have no nutritive value.		+ve
Renewable Energy (REC)	Renewable energy consumption (% of total final energy consumption).		+ve
Infrastructure (FTS)	Fixed telephone subscriptions (per 100 people)		+ve

4.3 Result and Discussion

4.3.1 Introduction

This section presents the empirical results, which incorporate eighteen (18) estimations as shown in Tables 21, 22, and 23; the preliminary estimations are provided in Tables 19 and 20. In Table 21, Model 1 presents the static regression results, while Models 2, 3, 4, 5, and 6 show the dynamic estimations, including the interaction of foreign aid with COVID19, financial development and institutional quality. In each of these models, the dependent variable is sustainable development.

4.3.2 Preliminary Analysis and Baseline Estimates

As stated in Table 19, the measures of variability and central tendency are evaluated using the values of minimum, maximum, mean, and standard deviation. The outcome shows that the average value of sustainable development for every economy ranges from 46 to 3250; that of COVID-19 ranges from 0 to 17.23; while that of foreign aid varies from 46 to 5203. More so, the values of the standard deviation explain that economic performance deviates farthest away from the mean, while COVID-19 fluctuates least away from the mean. Similarly, the normality conditions of the variables are explained by the kurtosis and the skewness values[22]. Showing the lopsided distribution of the data points, the skewness values imply that COVID-19 and industrialisation are positively skewed – implying the asymmetry of the distribution, while the other variables are negatively skewed. Finally, apart from industrialisation, interest rate and sustainable development whose kurtosis values are less than 3 (thus, exhibiting platykurtic),

[22] The detailed Descriptive Statistics is included as Table 26

the other variables exhibit leptokurtic behaviour (peaked, having kurtosis values greater than 3).

The correlation estimates in Table 20 reveal that each of the coefficients of governance indicator and COVID-19 is negative; all other variables have positive correlations with sustainable development.

The empirical analysis begins with the static model, based on the panel corrected standard error (PCSE) procedure. A significant and positive relationship is established between foreign aid and sustainable development, and the coefficient suggests that the latter improves by 0.35% for a $ increase in the former (see Model 1, Table 21). This contends that by supporting infrastructure, human capital, and facilitating productive activities, external aid may promote sustainable development. This finding is consistent with Liu et al. (2014) who proposed that foreign assistance should be distributed along the balanced growth path, such that as more aids are earmarked for growth maximisation, more should also be allotted for welfare maximisation (via transfer payments). It is, however, in contrast to that of Ouedraogo et al. (2021) who provided evidence of a negative connection between aid and economic growth.

Conversely, the coefficient of external aid volatility is significant and negative. This reveals that sustainable development is impaired by 3.5% as a result of aid volatility. This huge impact reveals that aid volatility threatens the attainment of sustainable development in SSA. It, thus, advances the need for the predictability and stability of aid to the region in order not to worsen its already fragile economy. This finding aligns with Boateng et al. (2021) and Kathavate and Mallik (2012) who proposed that aid is more effective when it is consistent and predictable.

Moreover, the impact of COVID-19 is as expected; it drags down the progress towards the attainment of sustainable development in the region. The study of Adegboye and Okorie (2023) confirms this, having obtained a negative nexus of COVID-19 dummy with human development. The global pandemic adversely affected almost all economic activities. While the SSA region had some of the least cases and deaths from the pandemic, it experienced some of its worst economic impacts arising from slower growth and the first recession in more than two decades (World Bank, 2020).

The dynamic models are presented in columns 3, 4, 5, 6, and 7. In Table 21, the estimates of the IV regressions (with GMM option) are presented, and the empirical associations between foreign aid, COVID-19 and sustainable development are shown. These estimates are robust to, and efficient for, arbitrary autocorrelation and heteroscedasticity. Besides, instruments validity and relevance are important issues with this estimation method. While controlling for the country heterogeneity in each of the estimates, the coefficients of Kleibergen-Paap rk LM statistic and Hansen J Statistic, respectively, confirm that the models are neither under-identified nor over-identified. The efficiency of these estimates is further confirmed by the significant values of the F-statistics.

Beginning with the lagged value of sustainable development, a significant and positive coefficient in each of the models shows that the variable has a strong path dependence, and the snowball effect is evident. This affirms that sustainable development is persistent in the SSA region. Furthermore, the effects of foreign aid and COVID-19 are mostly consistent with the static model. Likewise, the interaction of foreign aid and COVID-19 provides evidence that foreign aid reduces the negative impact of COVID-19 on sustainable development. A careful observation of Models 2 (before the interaction) and 6 (after the interaction) further depicts that

the coefficient of foreign aid increases after the interaction, thereby reinforcing the role of external aid in reducing the adverse effect of the pandemic on the region's economy.

Being a major component of the African economy, the informal sector is observed to facilitate sustainable development. In the same way, each of the coefficients of economic growth, government size, and interest rate is significant and positive. Surprisingly, natural resources endowment exerts a negative effect, while the coefficient of industrialisation is insignificant.

4.3.3 Do Financial Development and Institutional Quality Matter?

The estimates in Models 2, 3, 4, 5 and 6 depict that institutional quality is either insignificantly or negatively connected with sustainable development, contrary to initial expectations. This may imply that the region's institutional environment is weak and the policies that could reduce rent-seeking behaviour are inefficient. It could also signal the absence of adequate checks and balances that could reduce investors' exposure to risks, reduce transaction costs, promote the ease of doing business, and improve competitive market environment that facilitate economic growth and development. Hence, this points to the fact that the SSA region is confronted with poor governance and institutional environments. This, coupled with ill-implemented development policies and civil unrests in many African countries, continually drags the region behind in major development indicators, such as affordable and quality education and health, access to safe drinking water, and food (see, e.g., Akinbode & Bolarinwa, 2020).

On the role of financial sector development, Sobiech (2019) documents that financial development facilitates capital accumulation by converting short term savings into long term investments. The empirical estimates, however, show that financial development exerts a significant and negative impact on sustainable development in SSA.

Further, the empirical analysis is extended by adding the interactions of foreign aid and each of institutional quality and financial development; the findings are presented in Table 21 – Models 3 and 4 (institutional quality) and Model 5 (financial development). Having established that financial development is negatively connected with sustainable development, the interaction effect suggests that increased foreign aid reduces its negative impact by 0.0001%. This contends that, even though the effect is marginal, channelling aid towards financial sector development is crucial to the attainment of sustainable development by reversing its negative effects. This is consistent with Pradhan et al. (2023b), who proposed that financial sector development set countries on the path to sustainable development.

In the same way, the interaction of foreign aid with institutional variable (political stability[23]) produces a significant and positive coefficient. This shows that directing aid towards institutional improvement tends to promote sustainable development in the region, by curtailing its negative impact. This supports the finding of Kathavate and Mallik (2012) who inferred that efficient institutions are necessary to offset the adverse effect of aid on growth. It equally aligns with Maruta et al. (2020) and Bila et al. (2023), who clarified that the growth-effect of aid rises with better institutions.

[23] Political stability and absence of violence (PSAV) is particularly considered in respect of the recent military take-overs in some countries in the SSA region.

4.3.4 Foreign Aid and SDGs

In Tables 23 and 24, the impacts of foreign aid on various SDGs are considered. This is necessary to separate the reactions of each of the goals to the increased flow of aid into the SSA region. Interestingly, the coefficients of the explanatory variables are largely consistent, as in the baseline estimates.

SDG 1 seeks to reduce poverty in all its forms, globally. The United Nations projects that just one-third of countries will have cut down their national poverty levels by half, while 575 million people will remain in extreme poverty by 2030 (UN-DESA). To tackle this in SSA, this study measures the level of poverty by household final consumption expenditure (see, e.g., Dhrifi et al., 2020; Akinlo & Dada, 2021) and life expectancy (see, e.g., Magombeyi & Odhiambo, 2018; Akinlo & Dada, 2021). While foreign aid does not exert a significant impact on HFCE, the estimates in column 2 of Table 22 depict that foreign aid improves life expectancy, thus reducing the level of poverty in the region. Similarly, SDG 2 seeks to achieve food security, end hunger, and promote sustainable agriculture, even as the UN-DESA projects that about 600 million people will face hunger in 2030. As this underscores the needs for improved food access and affordability, the role of foreign aid is examined on food production. Surprisingly, the estimates in column 4 suggests that aid does not exert a significant effect on food production in SSA. In addition, GDP per person employed is used to capture SDG 8, which aims to facilitate inclusive and sustainable economic growth, as well as productive and full employment. Hence, the empirical findings (see column 2, Table 23) show that foreign aid facilitates inclusive economic growth in SSA.

To capture SDGs 3 and 4 which, respectively, pursue well-being and healthy lives for all and ensure equitable and inclusive quality of education, the role of external aid on government

health and education expenditures are investigated this study. The outcome of the empirical estimation suggests that foreign aid stimulates the quality of health and education by increasing government expenditures on the sectors (see columns 5 and 6, Table 22).

Beyond the above economic and social aspects of sustainable development, this study further measures the impacts of foreign aid on the environment, through access to reliable, affordable, modern and sustainable energy (SDG 7) and promotion of safe, resilient, inclusive and sustainable human settlements (SDG 11). The findings in column 7 (Table 22) provides evidence that foreign aid enhances the attainment of SDG 7[24]. This result is in line with Huong and Ha (2023), who argued that aid raises the consumption of renewable energy, thus facilitating the attainment of ecological sustainability. In the same way, the evidence in column 8 (Table 22) shows that foreign aid facilitates the attainment of SDG 11[25]. An increased flow of aid into the region stimulates the urbanisation rate, thereby enhancing sustainable cities and communities.

Further, SDG 16 seeks to provide access to justice, promote inclusive and peaceful societies, and build accountable, inclusive and effective institutions at all levels. To evaluate the impact of aid in the attainment of this goal, inclusive institutions is measured by governance. The findings displayed in Table 23 (column 3) affirm that foreign aid stimulates the quality of governance in SSA. When the effect of aid is further tested on the disaggregated governance quality, the evidence in columns 4, 5, and 6 affirm that foreign aid does not exert a significant effect on economic governance (ECO_GOV) but promotes the efficacy of institutional (INS_GOV) and political (POL_GOV) governance.

[24] In addition to the results presented, where foreign aid was found to stimulate renewable energy consumption, foreign aid was also observed to reduce fossil fuel energy consumption, thereby promoting the attainment of SDG 7 (see Table 29, page 146 – 147, for full estimates)
[25] SDG 11 is measured by urbanisation, following Dhahri et al. (2024).

Table 19: Summary Statistics for Paper 3

Variable		Mean	Std. dev.	Min	Max	Observations
SD	Overall	1981.42	1344.05	46	3250	N = 1035
	Between		946.65	46	2905.48	n = 45
	Within		964.05	-878.06	4793.59	T = 23
FA	Overall	4489.67	1029.32	46	5203	N = 1035
	Between		196.25	3638.17	4805.74	n = 45
	Within		1010.85	-270.07	6010.50	T = 23
COVID19	Overall	1.35	4.12	0	17.23	N = 1035
	Between		0	1.35	1.35	n = 45
	Within		4.12	0	17.23	T = 23
FD	Overall	6781.97	2337.68	46	8045	N = 1035
	Between		1455.66	2638.83	7891.52	n = 45
	Within		1841.43	-583.16	12105.14	T = 23
RGDPPC	Overall	31479.28	3418.70	46	32359	N = 1035
	Between		2258.79	16833.04	32212.65	n = 45
	Within		2587.27	1359.54	46939.24	T = 23
SIZE	Overall	7639.90	3574.66	46	9738	N = 1035
	Between		3109.38	46	9597.52	n = 45
	Within		1820.89	-855.06	14863.03	T = 23
NRR	Overall	16009.62	3971.42	46	17479	N = 1035
	Between		1182.66	8909.04	16524.91	n = 45
	Within		3795.16	-469.29	24280.58	T = 23
DIR	Overall	16828.47	9535.45	46	22551	N = 1035
	Between		6375.61	46	22462.96	n = 45
	Within		7151.32	-4511.84	30441.51	T = 23
INFECO	Overall	10713.14	1896.93	46	11544	N = 1035
	Between		1226.16	4681.48	11431.91	n = 45
	Within		1458.37	399.70	17000.66	T = 23
MVA	Overall	437.74	286.00	46	946	N = 1035
	Between		184.56	46	848.74	n = 45
	Within		220.13	-178.52	1156.57	T = 23
GE	Overall	26024.73	8774.30	46	34709	N = 1035
	Between		1589.96	23913.78	31381.3	n = 45
	Within		8632.15	-5310.58	36675.9	T = 23

Table 20: Correlation Estimate for Paper 3

	SD	FA	FD	RGDPPC	SIZE	NRR	DIR	INFECO	MVA	GE
SD	1.00									
FA	0.31*	1.00								
COVID19	-0.05	-0.06*	1.00							
FD	0.05*	0.20*	1.00							
RGDPPC	0.15*	0.04	0.22*	1.00						
SIZE	0.40*	0.02	0.02	0.23*	1.00					
NRR	0.35*	0.80*	0.22*	0.43*	0.13*	1.00				
DIR	0.29*	0.15*	0.13*	0.19*	0.07*	0.23*	1.00			
INFECO	0.26*	0.04	0.09*	0.61*	0.20*	0.37*	0.11*	1.00		
MVA	0.12*	0.07*	-0.05	0.15*	0.07*	0.15*	0.14*	0.24*	1.00	
GE	-0.03	-0.06*	-0.03	0.02	-0.02	-0.04	0.07*	0.00	0.02	1.00

* implies significance at 10%

Table 21:Estimation of Coefficient (Baseline) for Paper 3

DV = SD	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	PCSE			2-Step GMM		
FD	-0.004	-0.118**	-0.117**	-0.114**	-0.712**	-0.095**
	(0.013)	(0.051)	(0.050)	(0.050)	(0.351)	(0.047)
RGDPPC	-0.087	0.141*	0.141*	0.149**	0.142*	0.131*
	(0.069)	(0.077)	(0.077)	(0.074)	(0.077)	(0.072)
SIZE	0.135***	0.100**	0.099**	0.100**	0.122**	0.100**
	(0.009)	(0.044)	(0.044)	(0.045)	(0.053)	(0.043)
NRR	-0.080*	-0.459**	-0.458**	-0.472***	-0.465**	-0.436***
	(0.048)	(0.191)	(0.191)	(0.188)	(0.197)	(0.176)
DIR	–	0.014*	0.014*	0.017**	0.020**	0.011
		(0.008)	(0.008)	(0.009)	(0.010)	(0.007)
INFECO	0.199***	0.177*	0.176*	0.183*	0.130	0.164*
	(0.061)	(0.098)	(0.098)	(0.101)	(0.093)	(0.091)
MVA	0.085	0.006	-0.008	-0.008	0.120	-0.013
	(0.098)	(0.207)	(0.207)	(0.202)	(0.250)	(0.198)
L.SD	–	0.596***	0.597***	0.596***	0.491***	0.591***
		(0.0710)	(0.071)	(0.073)	(0.106)	(0.070)
FA	0.353***	1.787***	1.902***	1.253**	1.038**	1.887***
	(0.095)	(0.627)	(0.706)	(0.572)	(0.512)	(0.630)
FAVOLT	-3.504***	–	–	–	–	–
	(0.210)					
COVID19	-17.895**	-18.118*	-18.721*	-15.642	-17.805*	303.954*
	(8.112)	(10.861)	(10.484)	(10.492)	(9.949)	(174.993)
GE	-0.002	-0.002	0.017	–	-0.002	–
	(0.004)	(0.004)	(0.048)		(0.004)	
PSAV	–	–	–	-0.081*	–	-0.005*
				(0.045)		(0.003)
FTS	–	–	–	0.008	0.020	0.004
				(0.010)	(0.017)	(0.010)
FA_GE	–	–	-4.18e-06	–	–	–
			(0.00001)			
FA_PSAV	–	–	–	0.00002*	–	–
				(9.43e-06)		
FA_FD	–	–	–	–	0.0001**	–
					(0.0001)	
FA_COVID19	–	–	–	–	–	-0.069*
						(0.037)
Observation	901	990	990	990	990	990
R-Squared	0.265	0.836	0.836	0.836	0.818	0.853
F-Statistic/Wald Chi^2	1638.74***	118.77***	122.43***	95.81***	35.18***	120.48***
Country Effect	–	YES	YES	YES	YES	YES
Kleibergen-Paap rk LM statistic	–	12.827***	12.763***	13.808***	11.400***	14.089***
Hansen J Statistic	–	Identified	Identified	Identified	Identified	Identified

Table 22:Estimation of Coefficient (SDGs) for Paper 3, with 2-Step GMM

Dependent Variable = SDGs	SDG1: No Poverty		SDG2: Zero Hunger	SDG3: Good Health & Well-being	SDG4: Quality Education	SDG7: Affordable & Clean Energy	SDG11: Sustainable Cities & Communities
	LEB	HFCE	FDPI	DGGHE	GEE	REC	URB
FD	-0.027	-0.530	0.104	-0.183	1.776	0.309	7.16e-06
	(0.121)	(0.643)	(0.365)	(0.581)	(1.808)	(0.234)	(9.31e-06)
RGDPPC	-0.507***	1.683**	-0.072	2.005***	6.541***	0.432	0.00004***
	(0.198)	(0.787)	(0.543)	(0.757)	(2.618)	(0.276)	(0.00001)
SIZE	-0.281***	0.879	0.232	0.406	2.388**	-0.096	-4.19e-07
	(0.090)	(0.546)	(0.214)	(0.337)	(1.213)	(0.113)	(6.26e-06)
NRR	1.577***	-5.840***	-0.512	-5.675***	-20.202***	-1.365*	-0.0001***
	(0.469)	(2.231)	(1.703)	(1.734)	(7.114)	(0.762)	(0.00004)
DIR	-0.003	0.115*	-0.011	0.231***	0.036	0.069**	1.13e-06
	(0.013)	(0.062)	(0.044)	(0.071)	(0.190)	(0.028)	(1.08e-06)
INFECO	-0.564*	3.233**	0.656	2.133**	8.648**	0.698*	0.00003*
	(0.295)	(1.607)	(0.794)	(1.056)	(4.288)	(0.403)	(0.00002)
MVA	-0.624	-3.417	-5.694***	1.339	-0.849	0.495	0.00004
	(0.505)	(2.252)	(2.204)	(1.796)	(7.124)	(0.940)	(0.00004)
L.Dep Variable	-0.089***	0.712***	0.202***	2.656***	0.288***	0.457**	0.992***
	(0.030)	(0.077)	(0.049)	(0.679)	(0.075)	(0.191)	(0.002)
FA	2.402*	18.446***	1.059	9.896***	62.626***	6.608***	0.0003***
	(1.466)	(7.117)	(5.263)	(3.268)	(22.642)	(2.173)	(0.0001)
Observation	990	990	990	990	990	990	990
R-Squared	0.995	0.955	0.971	0.838	0.468	0.945	0.99
F-Statistic/Wald Chi^2	259.62***	252.40***	2.58***	4.07***	7.45***	16.29***	4.2e+05***
Country Effect	YES	YES	YES	YES	YES	YES	YES
Kleibergen-Paap rk LM statistic	16.421***	11.506***	17.604***	13.425***	12.067***	16.534***	15.615***
Hansen J Statistic	Identified	Identified	Identified	Identified	Identified	Identified	Identified

Note: Standard errors are in parenthesis; ***, ** & * imply significance at 1%, 5% & 10% level

Table 23:Estimation of Coefficient (Further SDGs) for Paper 3, with 2-Step GMM

Dependent Variable = SDGs	SDG8: Decent Work & Economic Growth	SDG16: Peace, Justice & Strong Institutions			
	GDPPE	INST	ECO_GOV	INS_GOV	POL_GOV
FD	-0.001	0.0002	-0.0001	0.0002	0.0001
	(0.036)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
RGDPPC	0.419***	0.001**	-0.00002	0.001**	0.0004**
	(0.089)	(0.0002)	(0.0001)	(0.0002)	(0.0002)
SIZE	-0.042***	0.0002**	-0.0001*	0.0002**	0.0002**
	(0.007)	(0.0001)	(0.00003)	(0.0001)	(0.0001)
NRR	-0.246**	-0.002***	0.0002	-0.002***	-0.001***
	(0.103)	(0.001)	(0.0002)	(0.001)	(0.0004)
DIR	0.020***	0.00004*	0.00001*	0.00004*	2.92e-06
	(0.007)	(0.00002)	(6.90e-06)	(0.00002)	(0.00001)
INFECO	0.233***	0.001**	-0.0001	0.001**	0.001**
	(0.069)	(0.0004)	(0.0001)	(0.0004)	(0.0003)
MVA	-1.320***	-0.0004	-0.0001	-0.0004	-0.001
	(0.179)	(0.001)	(0.0003)	(0.0006)	(0.0005)
Lagged DV	–	-0.223*	-0.018	-0.223*	-0.077
		(0.130)	(0.037)	(0.130)	(0.073)
FA	0.920**	0.006***	-0.001	0.006***	0.004***
	(0.396)	(0.002)	(0.001)	(0.002)	(0.001)
Observation	1035	990	990	990	990
Country Effect	–	YES	YES	YES	YES
Kleibergen-Paap rk LM statistic	–	13.510***	17.045***	13.510***	16.556***
Hansen J Statistic	–	Identified	Identified	Identified	Identified

Note: Standard errors are in parenthesis; ***, ** & * imply significance at 1%, 5% & 10% level

Table 24: Estimation of Disaggregated Model for Paper 3, with GMM

DV = SD	Commitment			Disbursement		
	Official	DAC	Non-DAC	Official	DAC	Non-DAC
FA	0.0001***	0.0002***	3.09E-05	0.0002***	0.0002***	0.0013**
	(2.83E-05)	(6.24E-05)	(0.0006)	(2.59E-05)	(7.89E-05)	(0.0006)
FD	-0.1158**	-0.2088***	-0.1421	-0.0205	-0.1533**	-0.0994
	(0.0498)	(0.0569)	(0.0853)	(0.0538)	(0.0640)	(0.0859)
RGDPPC	-0.0007	0.0003	0.0055	-0.0025	0.0010	0.0031
	(0.0028)	(0.0022)	(0.0033)	(0.0024)	(0.0021)	(0.0026)
SIZE	0.2212	0.3810	-0.1539	-0.2517	-0.1088	0.1161
	(0.3490)	(0.3473)	(0.3110)	(0.3063)	(0.2971)	(0.3688)
NRR	-0.0683	-0.1367	-0.1039	-0.0173	-0.1597	-0.0719
	(0.0774)	(0.0965)	(0.1136)	(0.0854)	(0.1205)	(0.1160)
INFECO	0.0837	0.0179	0.2948	0.2736	0.2306	0.2874
	(0.1522)	(0.2784)	(0.3661)	(0.2036)	(0.3468)	(0.3229)
MVA	-0.0003	0.1561	0.0966	0.1826	0.2947	-0.2180
	(0.2112)	(0.2584)	(0.4314)	(0.2430)	(0.2396)	(0.4471)
Observation	22	22	22	22	22	22
Adj R^2	0.72	0.67	0.48	0.68	0.62	0.53

Note: Standard errors are in parenthesis; ***, ** & * imply significance at 1%, 5% & 10% level

4.3.5 Robustness Checks

Finally, robustness analysis[26] is presented in Table 24, where the impact of aid commitments is separated from aid disbursements from development assistance committee (DAC) and non-DAC member countries. This further examination suggests that even though aid commitments from non-DAC donors do not have a significant effect, commitments from official and DAC donors promote sustainable development. Similarly, the impact of aid disbursements from official, DAC and non-DAC donors is found to be significant and positive on sustainable development.

[26] To contribute to some empirical arguments that the impact of aid may not be instantaneous, this research also examined the lagged impacts of foreign aid (using lags 1, 2, and 3) on sustainable development. Interestingly, the findings were consistent with those of the contemporaneous effects (see Table 30, page 155 – 160, for the full results).

4.4 Conclusion

This study evaluated the impact of the COVID-19 pandemic on the nexus between foreign aid and sustainable development in SSA. The empirical estimates also include the interactive roles of institutional quality and financial development on the nexus between the two variables. Using both static and dynamic estimation procedures, the findings of the study revealed that development assistance facilitates the attainment of sustainable development and many of its goals. Even though the pandemic exerts a diminishing effect, foreign aid not only eases the adverse effect of the pandemic but also enhances the complementary roles of financial and institutional infrastructures on the attainment of sustainable development in the region. These findings were robust to different empirical methodologies, as well as several measures of foreign aid and various SDGs.

These findings have useful implications, both for the recipient SSA countries and the donors. As more aid is provided, the donors should ensure that aid commitment and disbursements to the region are more consistently matched with the anticipated levels of aid, so as to ensure effective use. Besides, there is the need for improved institutional and financial infrastructures for the region to effectively use the increasing foreign assistance continually received. Given the positive aid-institutions effect, aid donors are advised to demand favourable pre-conditions and identify the relative importance of foreign assistance that may promote reforms in political, economic and financial environments before those aids are dispatched. This may be achieved if the donors target both the institutional and financial indicators in aid disbursements, while closely evaluating the impacts of the aids. Also, improvements to institutional and financial infrastructures may be set as a necessary condition for the region to continue benefitting from

aids by, for instance, strengthening the democratic institutions in the region to avoid repeated coups in many of its countries.

While these are essential requirements from the donors, they also need to ensure that aid interventions are environmentally friendly. For instance, the empirical evidence shows that the rising level of foreign assistance is associated with increased consumption of renewable energy in SSA. This suggests that to complement sustainable development efforts, more aids should be directed towards clean energy by facilitating more accessibility and affordability. Moreover, aid commitments (and disbarments) should be targeted at other key sustainable development goals, with a focus on improving sustainable growth and employment, education and healthcare.

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Appendices

Table 25: List of Countries Considered for Paper 3

Angola	Cabo Verde	Congo, Dem. Rep.	Ethiopia	Guinea-Bissau	Malawi	Namibia	Senegal	Tanzania
Benin	Cameroon	Congo, Rep.	Gabon	Kenya	Mali	Niger	Seychelles	Togo
Botswana	Central African Republic	Cote d'Ivoire	Gambia, The	Lesotho	Mauritania	Nigeria	Sierra Leone	Uganda
Burkina Faso	Chad	Equatorial Guinea	Ghana	Liberia	Mauritius	Rwanda	South Africa	Zambia
Burundi	Comoros	Eritrea	Guinea	Madagascar	Mozambique	Sao Tome and Principe	Sudan	Zimbabwe

Table 26: Full Descriptive Analysis for Paper 3


```
ANSG
-------------------------------------------------------------
      Percentiles      Smallest
 1%           46             46
 5%           46             46
10%           46             46       Obs                 1,035
25%           46             46       Sum of wgt.         1,035

50%         2733                      Mean           1981.417
                        Largest       Std. dev.      1344.051
75%         2992            3247
90%         3147            3248      Variance        1806473
95%         3199            3249      Skewness      -.7139522
99%         3240            3250      Kurtosis       1.577878

                            ODAPC
-------------------------------------------------------------
      Percentiles      Smallest
 1%           46             46
 5%         4220             46
10%         4272             46       Obs                 1,035
25%         4427             46       Sum of wgt.         1,035

50%         4686                      Mean           4489.669
                        Largest       Std. dev.      1029.323
75%         4945            5200
90%         5100            5201      Variance        1059506
95%         5152            5202      Skewness      -3.758282
99%         5193            5203      Kurtosis       16.50835

                          COVID19_A
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
```

5%	0	0		
10%	0	0	Obs	1,035
25%	0	0	Sum of wgt.	1,035
50%	0		Mean	1.350872
		Largest	Std. dev.	4.119536
75%	0	17.22881		
90%	2.381298	17.22881	Variance	16.97058
95%	11.37577	17.22881	Skewness	3.090819
99%	17.22881	17.22881	Kurtosis	11.15164

FD

	Percentiles	Smallest		
1%	46	46		
5%	46	46		
10%	46	46	Obs	1,035
25%	7269	46	Sum of wgt.	1,035
50%	7528		Mean	6781.966
		Largest	Std. dev.	2337.678
75%	7787	8042		
90%	7942	8043	Variance	5464741
95%	7994	8044	Skewness	-2.498389
99%	8035	8045	Kurtosis	7.361804

RGDPPC

	Percentiles	Smallest		
1%	46	46		
5%	31376	46		
10%	31428	46	Obs	1,035
25%	31583	46	Sum of wgt.	1,035
50%	31842		Mean	31479.28
		Largest	Std. dev.	3418.704
75%	32101	32356		
90%	32256	32357	Variance	1.17e+07
95%	32308	32358	Skewness	-9.021538
99%	32349	32359	Kurtosis	83.02282

SIZE

	Percentiles	Smallest		
1%	46	46		
5%	46	46		
10%	46	46	Obs	1,035
25%	8962	46	Sum of wgt.	1,035
50%	9221		Mean	7639.901
		Largest	Std. dev.	3574.658
75%	9480	9735		
90%	9635	9736	Variance	1.28e+07
95%	9687	9737	Skewness	-1.644928
99%	9728	9738	Kurtosis	3.731549

NRR

	Percentiles	Smallest
1%	46	46
5%	46	46

10%	16548	46	Obs	1,035
25%	16703	46	Sum of wgt.	1,035
50%	16962		Mean	16009.62
		Largest	Std. dev.	3971.418
75%	17221	17476		
90%	17376	17477	Variance	1.58e+07
95%	17428	17478	Skewness	-3.7527
99%	17469	17479	Kurtosis	15.16863

DIR

	Percentiles	Smallest		
1%	46	46		
5%	46	46		
10%	46	46	Obs	1,035
25%	18534	46	Sum of wgt.	1,035
50%	22198		Mean	16828.47
		Largest	Std. dev.	9535.454
75%	22389	22548		
90%	22469	22549	Variance	9.09e+07
95%	22500	22550	Skewness	-1.188799
99%	22541	22551	Kurtosis	2.421473

INFECO

	Percentiles	Smallest		
1%	46	46		
5%	10561	46		
10%	10613	46	Obs	1,035
25%	10768	46	Sum of wgt.	1,035
50%	11027		Mean	10713.14
		Largest	Std. dev.	1896.926
75%	11286	11541		
90%	11441	11542	Variance	3598330
95%	11493	11543	Skewness	-5.31698
99%	11534	11544	Kurtosis	30.01486

MVA

	Percentiles	Smallest		
1%	46	46		
5%	46	46		
10%	46	46	Obs	1,035
25%	170	46	Sum of wgt.	1,035
50%	429		Mean	437.7391
		Largest	Std. dev.	285.9957
75%	688	943		
90%	843	944	Variance	81793.54
95%	895	945	Skewness	.1148268
99%	936	946	Kurtosis	1.711716

GE_Rnk

	Percentiles	Smallest		
1%	46	46		
5%	20409	46		
10%	20443	46	Obs	1,035

```
25%        20596              46       Sum of wgt.       1,035

50%        21007                       Mean           26024.73
                        Largest        Std. dev.      8774.295
75%        34494          34706
90%        34623          34707       Variance       7.70e+07
95%        34667          34708       Skewness      -.8585926
99%        34702          34709       Kurtosis       3.888683
```

Table 27:Full Correlation Analysis for Paper 3


```
             |     ANSG    ODAPC COVID1~A     FD   RGDPPC     SIZE      NRR
-------------+------------------------------------------------------------
        ANSG |   1.0000
       ODAPC |   0.3101*  1.0000
   COVID19_A |  -0.0489  -0.0569*  1.0000
          FD |   0.0516*  0.1999* -0.0459   1.0000
      RGDPPC |   0.1541*  0.0383  -0.0304   0.2222*  1.0000
        SIZE |   0.3992*  0.0162   0.0277   0.0233   0.2330*  1.0000
         NRR |   0.3534*  0.8031* -0.0559*  0.2211*  0.4330*  0.1272*  1.0000
         DIR |   0.2896*  0.1506* -0.1786*  0.1274*  0.1865*  0.0697*  0.2275*
      INFECO |   0.2574*  0.0426  -0.0065   0.0885*  0.6068*  0.2042*  0.3664*
         MVA |   0.1181*  0.0707* -0.0590* -0.0468   0.1454*  0.0741*  0.1542*
      GE_Rnk |  -0.0304  -0.0646* -0.1390* -0.0252   0.0213  -0.0175  -0.0385

             |      DIR   INFECO      MVA   GE_Rnk
-------------+------------------------------------
         DIR |   1.0000
      INFECO |   0.1046*  1.0000
         MVA |   0.1370*  0.2391*  1.0000
      GE_Rnk |   0.0652*  0.0010   0.0154   1.0000
```

Table 28:Estimations with the Lags (1, 2, AND 3) of Foreign Aid


```
Linear regression, correlated panels corrected standard errors (PCSEs)

Group variable:   Country                     Number of obs     =      1,034
Time variable:    Year                        Number of groups  =         45
Panels:           correlated (unbalanced)     Obs per group:
Autocorrelation:  no autocorrelation                          min =         22
Sigma computed by casewise selection                          avg =  22.977778
                                                              max =         23
Estimated covariances      =      1035        R-squared         =     0.2862
Estimated autocorrelations =         0        Wald chi2(9)      =     547.17
Estimated coefficients     =        10        Prob > chi2       =     0.0000

------------------------------------------------------------------------------
             |            Panel-corrected
        ANSG | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
    lagODAPC |    .109826   .0509666     2.15   0.031     .0099333    .2097186
```

```
   COVID19_A |  -15.67623   12.60143    -1.24   0.213    -40.37457    9.022112
      GE_Rnk |  -.0001641   .0053483    -0.03   0.976    -.0106466    .0103184
        FD   |  -.0032406   .0159094    -0.20   0.839    -.0344224    .0279412
         NRR |   .1079545     .01488     7.25   0.000     .0787901    .1371189
        SIZE |   .1367784   .0082693    16.54   0.000     .1205709    .1529859
      INFECO |    .112333   .0488483     2.30   0.021     .0165921    .2080739
      RGDPPC |  -.0679106    .020942    -3.24   0.001    -.1089562   -.0268651
         MVA |    .135601   .1213359     1.12   0.264     -.102213     .373415
       _cons |  -364.5632   518.1726    -0.70   0.482    -1380.163    651.0364
------------------------------------------------------------------------------
```

```
Linear regression, correlated panels corrected standard errors (PCSEs)

Group variable:   Country                       Number of obs     =      1,033
Time variable:    Year                          Number of groups  =         45
Panels:           correlated (unbalanced)       Obs per group:
Autocorrelation:  no autocorrelation                          min =         21
Sigma computed by casewise selection                          avg =  22.955556
                                                              max =         23
Estimated covariances      =      1035          R-squared         =     0.2917
Estimated autocorrelations =         0          Wald chi2(9)      =     565.30
Estimated coefficients     =        10          Prob > chi2       =     0.0000

------------------------------------------------------------------------------
             |           Panel-corrected
        ANSG | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
    lagODAPC |   .1691333   .0480652     3.52   0.000     .0749272    .2633395
   COVID19_A |  -19.96116   10.74399    -1.86   0.063    -41.01899    1.096673
      GE_Rnk |  -.0131538   .0051872    -2.54   0.011    -.0233204   -.0029871
        FD   |  -.0029727   .0160163    -0.19   0.853    -.0343641    .0284187
         NRR |   .1053627   .0130568     8.07   0.000     .0797719    .1309535
        SIZE |   .1358372   .0080882    16.79   0.000     .1199847    .1516897
      INFECO |   .1100398   .0501207     2.20   0.028     .0118049    .2082746
      RGDPPC |  -.0632916   .0210453    -3.01   0.003    -.1045397   -.0220435
         MVA |   .1457143   .1181758     1.23   0.218    -.0859061    .3773347
       _cons |  -366.7846   463.6784    -0.79   0.429    -1275.578    542.0084
------------------------------------------------------------------------------
```

```
Linear regression, correlated panels corrected standard errors (PCSEs)

Group variable:   Country                       Number of obs     =      1,032
Time variable:    Year                          Number of groups  =         45
Panels:           correlated (unbalanced)       Obs per group:
Autocorrelation:  no autocorrelation                          min =         20
Sigma computed by casewise selection                          avg =  22.933333
                                                              max =         23
Estimated covariances      =      1035          R-squared         =     0.2875
Estimated autocorrelations =         0          Wald chi2(9)      =     551.71
Estimated coefficients     =        10          Prob > chi2       =     0.0000

------------------------------------------------------------------------------
             |           Panel-corrected
        ANSG | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
    lagODAPC |   .1141105   .0447217     2.55   0.011     .0264577    .2017633
   COVID19_A |   -15.4576   11.51822    -1.34   0.180     -38.0329    7.117699
      GE_Rnk |    .000547    .004832     0.11   0.910    -.0089235    .0100176
        FD   |   .0017124   .0164771     0.10   0.917    -.0305821    .0340068
         NRR |   .1066948   .0139258     7.66   0.000     .0794008    .1339888
        SIZE |   .1375975   .0085042    16.18   0.000     .1209295    .1542654
```

```
      INFECO |   .1128554   .0505692     2.23   0.026     .0137415    .2119692
      RGDPPC |  -.0668637   .0207957    -3.22   0.001    -.1076226   -.0261048
         MVA |   .1357477   .1165766     1.16   0.244    -.0927384    .3642337
       _cons |  -462.9823   496.0661    -0.93   0.351    -1435.254    509.2894
------------------------------------------------------------------------------
```

Table 29: Alternative Estimation for SDG 7


```
2-Step GMM estimation
---------------------

Estimates efficient for arbitrary heteroskedasticity
Statistics robust to heteroskedasticity

                                                      Number of obs =       990
                                                      F( 53,   936) =    107.42
                                                      Prob > F      =    0.0000
Total (centered) SS     =  5.25385e+11                Centered R2   =    0.6547
Total (uncentered) SS   =  8.08819e+11                Uncentered R2 =    0.7757
Residual SS             =  1.81398e+11                Root MSE      =     13536

------------------------------------------------------------------------------
             |               Robust
        FFEC | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
          FD |  -.7839384   .6448228    -1.22   0.224    -2.047768    .4798909
      RGDPPC |  -1.683011   .8276792    -2.03   0.042    -3.305233   -.0607897
        SIZE |   -1.18409   .4645696    -2.55   0.011     -2.09463   -.2735503
         NRR |    7.40718   2.037487     3.64   0.000     3.413779    11.40058
         DIR |  -.0678428   .0789655    -0.86   0.390    -.2226123    .0869268
      INFECO |  -3.157271   1.318779    -2.39   0.017     -5.74203   -.5725124
         MVA |   .9831974   2.748679     0.36   0.721    -4.404115     6.37051
             |
        FFEC |
          L1. |   .8413748   .0376697    22.34   0.000     .7675434    .9152061
             |
       ODAPC |  -22.52543   6.475942    -3.48   0.001    -35.21804   -9.832813
        dum1 |  -3596.081   4475.941    -0.80   0.422    -12368.77    5176.603
        dum2 |   4791.377   3953.201     1.21   0.226    -2956.756    12539.51
        dum3 |   839.1984   3617.003     0.23   0.817    -6249.997    7928.394
        dum4 |   2191.816   2948.356     0.74   0.457    -3586.857    7970.488
        dum5 |   567.4031   3284.063     0.17   0.863    -5869.242    7004.048
        dum6 |  -5499.469   3505.939    -1.57   0.117    -12370.98    1372.045
        dum7 |  -4281.365   3644.804    -1.17   0.240    -11425.05    2862.319
        dum8 |  -18163.19   7173.746    -2.53   0.011    -32223.47   -4102.904
        dum9 |   -1570.66   2586.861    -0.61   0.544    -6640.814    3499.495
       dum10 |   2365.815   3195.166     0.74   0.459    -3896.596    8628.226
       dum11 |  -855.7631   3503.868    -0.24   0.807    -7723.217    6011.691
       dum12 |  -2309.145   3621.703    -0.64   0.524    -9407.553    4789.263
       dum13 |  -9390.102   4715.029    -1.99   0.046    -18631.39   -148.8139
       dum14 |    8199.08    6313.94     1.30   0.194    -4176.015    20574.18
       dum15 |   932.6086   5976.718     0.16   0.876    -10781.54    12646.76
       dum16 |  -8819.787   4580.588    -1.93   0.054    -17797.57    158.0008
       dum17 |    1825.98   3344.376     0.55   0.585    -4728.877    8380.838
       dum18 |   541.9921     2963.8     0.18   0.855     -5266.95    6350.934
       dum19 |   3934.574   3659.963     1.08   0.282    -3238.821    11107.97
       dum20 |   -1568.91   2656.609    -0.59   0.555    -6775.768    3637.948
       dum21 |   1658.297   3885.812     0.43   0.670    -5957.754    9274.349
       dum22 |   1383.446   3507.635     0.39   0.693    -5491.393    8258.285
       dum23 |  -2618.726   3319.687    -0.79   0.430    -9125.193    3887.742
       dum24 |  -14946.84   5855.818    -2.55   0.011    -26424.03   -3469.651
```

```
       dum25 |  -6179.356   3161.403    -1.95   0.051    -12375.59    16.87981
       dum26 |   -10493.2   5562.762    -1.89   0.059    -21396.01    409.6158
       dum27 |   2917.423   3091.042     0.94   0.345    -3140.907    8975.753
       dum28 |  -5552.687   3672.181    -1.51   0.131    -12750.03    1644.655
       dum29 |   2905.876   3559.767     0.82   0.414    -4071.139     9882.89
       dum30 |  -1619.353   5207.814    -0.31   0.756    -11826.48    8587.776
       dum31 |   2572.632   4138.603     0.62   0.534    -5538.881    10684.14
       dum32 |   668.8688   3787.059     0.18   0.860    -6753.631    8091.368
       dum33 |  -15637.34   6494.503    -2.41   0.016    -28366.33   -2908.349
       dum34 |   927.4565    3349.42     0.28   0.782    -5637.287      7492.2
       dum35 |  -18133.47   6277.053    -2.89   0.004    -30436.27   -5830.675
       dum36 |   6600.564   4211.685     1.57   0.117    -1654.187    14855.31
       dum37 |  -20793.53   9625.661    -2.16   0.031    -39659.48   -1927.582
       dum38 |   4449.337     3208.5     1.39   0.166    -1839.207    10737.88
       dum39 |  -5943.531   3857.709    -1.54   0.123     -13504.5    1617.439
       dum40 |   1157.028   4457.143     0.26   0.795    -7578.811    9892.867
       dum41 |   2067.581   3718.192     0.56   0.578    -5219.941    9355.102
       dum42 |   1184.518   3984.236     0.30   0.766    -6624.441    8993.477
       dum43 |  -1655.797   3460.317    -0.48   0.632    -8437.893      5126.3
       dum44 |  -1545.371   4612.216    -0.34   0.738    -10585.15    7494.405
       _cons |   88734.37    30745.3     2.89   0.004     28474.69    148994.1
------------------------------------------------------------------------------
Underidentification test (Kleibergen-Paap rk LM statistic):             24.624
                                                      Chi-sq(1) P-val =    0.0000
------------------------------------------------------------------------------
Weak identification test (Cragg-Donald Wald F statistic):                1.978
                         (Kleibergen-Paap rk Wald F statistic):          3.487
Stock-Yogo weak ID test critical values:                       <not available>
------------------------------------------------------------------------------
Hansen J statistic (overidentification test of all instruments):         0.000
                                                     (equation exactly identified)
------------------------------------------------------------------------------
Instrumented:         FD RGDPPC SIZE NRR DIR INFECO MVA
Included instruments: L.FFEC ODAPC dum1 dum2 dum3 dum4 dum5 dum6 dum7 dum8 dum9
                      dum10 dum11 dum12 dum13 dum14 dum15 dum16 dum17 dum18
                      dum19 dum20 dum21 dum22 dum23 dum24 dum25 dum26 dum27
                      dum28 dum29 dum30 dum31 dum32 dum33 dum34 dum35 dum36
                      dum37 dum38 dum39 dum40 dum41 dum42 dum43 dum44
Excluded instruments: L.FD L.RGDPPC L.SIZE L.AvgCP L.DIR L.INFECO L.MVA
------------------------------------------------------------------------------
```

Chapter Five: Conclusion

5.0 General Conclusion

To allow for governments and policymakers to formulate effective policies geared towards sustainable development post-COVID, estimating the impacts of the pandemic on the relationships between remittances, FDI and foreign aid was considered, being some important drivers of economic growth and development in SSA. This was conducted in three separate papers. In each of the papers, an empirical evaluation of the impacts of the pandemic on each of the forms of capital flows was considered. The findings from the first paper showed that remittances are positively connected with sustainable development, both before and after the threshold, based on the absorptive capacities of the SSA economies. In addition, COVID-19 was observed to adversely affect sustainable development, both directly and when it is interacted with remittances. Among the other variables considered, the coefficient of financial development upholds that sustainable development rises with an improved financial system. While this positive effect turns negative after the threshold, the interaction effect of remittances and financial development is negative, thereby upholding the 'substitutability hypothesis'. More so, the institutional quality adversely affects sustainable development before the threshold and stimulates it after the threshold, while its moderating role on remittances – sustainable development is positive.

In the second paper, where the impact of the pandemic on the role of FDI on sustainable development was examined, the empirical findings showed that FDI does not have a significant impact on sustainable development, even when an institutions variable was incorporated into

the model. When the effect of FDI was further analysed on economic growth, the environment, and human development, the estimates remained consistent. While COVID-19 reduces the levels of economic growth, the environment, human development, and sustainable development, the moderating effect showed that FDI reduces the negative effect of COVID-19 on economic growth and sustainable development. More so, it was observed that rule of law promotes sustainable development; financial development does not exert a significant connection with sustainable development, and negatively affects economic growth and human development, yet the interaction effects of economic growth and financial development on sustainable development was statistically insignificant.

Similarly, the findings from the third paper revealed that foreign aid facilitates the attainment of sustainable development and many of its goals. Even though the pandemic exerts a diminishing effect, foreign aid not only reduces the negative effect of the pandemic but also enhances the complementary roles of financial and institutional infrastructures on the attainment of sustainable development in the region. These findings were robust to different empirical methodologies, as well as several measures of foreign aid and various SDGs.

5.1 Contributions

One of the motivations of this research is the COVID-19 pandemic, how it severely impacted the SSA region's economic fundamentals, and how its economic impacts may linger for years. Being a region with some of the worst development indicators, this study showed the reactions of various cross-border flows to the pandemic in the region that has relied on external assistance for decades. While the scope of research may have majorly concentrated on the impact of the pandemic on various advanced economies, this, to the best of the author's knowledge, is a pioneer attempt to comprehensively estimate the economic impact of COVID-19 in SSA. This

is significant as the pandemic has exacerbated the already fragile economies and created some other economic challenges that the region may continually deal with for long. In addition, the study covers as many countries in SSA as the data were adequately available, thus providing a more representative analysis of the relationships.

The attainment of sustainable development in the region is another major motivation of this study. Having failed to achieve most of the goals in the earlier development agenda (Millennium Development of Goals), there is a need for sustained efforts towards achieving the SDGs agenda. While earlier researchers have evaluated the role of capital flows on growth and some development indicators, the author is not aware of earlier studies that have progressed this line of research into sustainable development in SSA. In view of the global outcry on the environment and climate issues, estimating how various capital inflows affect sustainable development and several SDGs is an important contribution to African literature. This is done by separating the economic effects of the various capital inflows from their environmental and social impacts.

Similarly, this study addressed some widely discussed methodological issues in earlier studies. These include the presumption that the impacts of these cross-border flows are always instantaneous and linear. It also improves on some earlier studies that have measured the non-linear effects with random introduction of quadratic terms, which assumes that the economy benefits from such inflows at the same rate over time. In addressing this as an essential improvement to earlier studies, this study measured the lagged effects of FDI and foreign aid on sustainable development. It also estimated the threshold effects of remittances and FDI, as well as the impact of aid volatility on sustainable development. Further to this, this research estimated the threshold value of the region's absorptive capacity at which the impact of

remittances changes. Likewise, economic growth of the region is also considered an important moderating factor in the nexus between FDI and sustainable development, given that an increased economic growth raises the levels of employment, investment and consumption, thereby facilitating sustainable development.

5.2 Policy Implications

While the debate on the impacts of cross-border capital flows on SSA had been increasingly important, it has assumed another dimension in recent times because of the economic adversities following the COVID-19 pandemic. In view of the findings from this research, the policy recommendations are provided for Africa in both the short-run and the long-run, as well as for the rest of the world.

5.2.1 Africa in the Short-run

While FDI may be potentially beneficial to the SSA region, the empirical evidence showed that the impact is not contemporaneous. Therefore, the SSA countries should make effective use of remittances and foreign aid in key development indicators in the short-run, and prepare a sustainable environment for the long-run benefits of FDI and other forms of capital.

Governance and financial sector improvements are two important areas that have been identified as reversing the development of the SSA region. As observed in this research, a more developed financial system could facilitate higher remittances, from which the region greatly benefits. Also, appropriate institutional environments that strengthens the rule of law should be provided. These would not only encourage both the existing and new foreign investments but would also promote the gains from such investments.

Likewise, to protect domestic investments from potential crowding-out effects, the growth of inwards investments should be sought as complementary to local investments. This may be achieved by advancing credits and technologies that would boost the operations of the local firms, at favourable terms, while foreign investments should be better integrated into the local economy.

In addition, inwards capital should be targeted at reducing environmental degradation, thereby promoting sustainable development. This may be achieved with emission-reduction technology and environmentally sustainable inward investments.

5.2.2 Africa in the Long-run

As the SSA region were more vulnerable because of their inefficient capacities to take care of health emergencies, the leaders and policymakers in the region are advised to direct a significant share of both domestic resources and foreign inflows towards the advancement of healthcare facilities. This would not only prepare the region against any future emergencies but would also improve the level of human capital and raise productivity in the region.

Moreover, it has been shown in this research that despite experiencing relatively lower cases and deaths from the pandemic, the African continent experienced some of the worst economic impacts. This underlies the need to redefine African's global relations from reliance on advanced economies towards promoting competitive economic relations. One way to achieve this is to enhance value-addition to Africa's exports, as the primary industry covers most Africa's exports to the rest of the world. Stimulating value additions would protect the sector against any similar global shock in the future, facilitate a more favourable relations in the global

trade, and reduce reliance on aid to implement their development programmes, some of which come with stringent conditions.

Furthermore, it is necessary to promote intra-African trade as a way of stimulating essential cooperations and developments in the region. It is evident that Africa trades with the rest of the world than it does within itself. Hence, increasing economic relations among countries in the continent would not only reduce dependence on advanced economies but promote their absorptive capacity and accelerate the process of the attainment of sustainable development.

5.2.3 The rest of the world

At the peak of COVID-19 in 2021, foreign financial assistance to SSA increased even when these developing economies were dealing with their shares of the pandemic impacts. Also, the FDI inflow to SSA swiftly recovered from the impact of the pandemic in 2021 and rose faster than the pre-pandemic level. Among other things, these show that the global pandemic has proven that the world is better together as partners, and supporting the development of the SSA region would reduce burdens of excessive migration and continued financial assistance on developed countries. Hence, developed countries are encouraged to increase their supports for the development of the SSA region, and developing countries in general, by ensuring that aid advanced to them are properly monitored and targeted at essential sectors that promote sustainable development. The donors should also demand improvements to institutional environments as a necessary condition for continued assistance to developing countries.

5.2 Potential for Future Research

While this research has comprehensively evaluated the impacts of the global pandemic on the relationship between each of remittances, foreign direct investment, and foreign aid on sustainable development in Sub-Saharan Africa, the research is never complete. Since the findings from other regions may not be entirely relevant to Africa – because of their distinctive characteristics – it is important that research occurs across space and time. For example, this study could not examine the sectoral impacts of foreign aid on different development indicators (such as education aid on the level of education) since data on sectoral foreign aid are only available for developing countries as a whole, rather than specific to SSA. It would, therefore, be important to explore this line of research if such data becomes available in the future. Furthermore, it may be important to consider the effects of other cross-border capital flows (such as portfolio investments) which, for reasons of scope and data, were not captured in this study. Besides, this study may also be replicated in other regions that have comparative economic fundamentals with SSA, including and Latin America and the Caribbean, and East Asia.

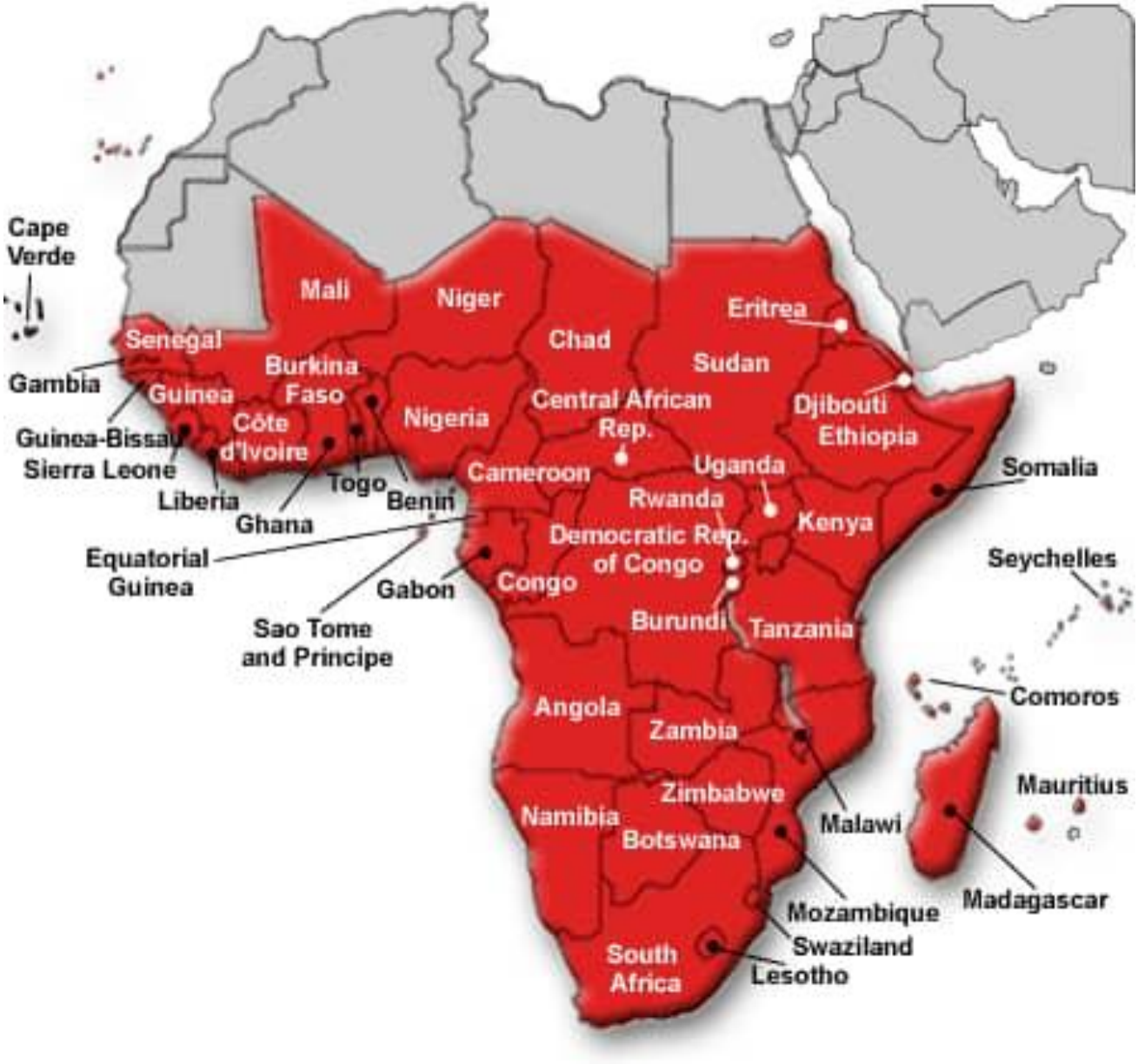

Figure 8:Map of Africa Showing SSA Countries

Source : https://i.pinimg.com/originals/25/59/30/2559302604b1a6b334ad302dec1864ce.gif

Further Appendices

Table 30: Estimation with Higher Lags (of FDI)

Estimations with Lags 2 and 3 of FDI

LAG 2 OF FDI

```
OLS estimation
--------------
Estimates efficient for homoskedasticity only
Statistics robust to autocorrelation
  kernel=Quadratic Spectral; bandwidth=3
  time variable (t):  Year
  group variable (i): Country
                                                      Number of obs =      835
                                                      F( 52,   782) =    58.38
                                                      Prob > F      =   0.0000
Total (centered) SS     =   3702906904                Centered R2   =   0.7783
Total (uncentered) SS   =  1.66323e+10                Uncentered R2 =   0.9507
Residual SS             =  820780102.3                Root MSE      =    991.4
------------------------------------------------------------------------------
        ANSG | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
        ANSG |
         L1. |   .5814543   .0253188    22.97   0.000     .5318304    .6310782
             |
      lagFDI |   .0587268   .0308295     1.90   0.057    -.0016978    .1191514
   COVID19_A |  -95.11448   10.08964    -9.43   0.000    -114.8898   -75.33915
         LEB |   .0876266   .0572786     1.53   0.126    -.0246374    .1998907
         URB |   17.38418   13.13378     1.32   0.186    -8.357561    43.12591
        NSER |   .0047591   .0057682     0.83   0.409    -.0065463    .0160645
          FD |  -.0045211   .0171715    -0.26   0.792    -.0381766    .0291343
       GDPPC |   .0089755   .0455668     0.20   0.844    -.0803338    .0982847
```

SIZEG	-.1402278	.060164	-2.33	0.020	-.258147	-.0223085
NRR	.017518	.0766613	0.23	0.819	-.1327353	.1677714
DGGHE	.2478504	.0197813	12.53	0.000	.2090798	.2866211
HFCEG	.0536149	.0076275	7.03	0.000	.0386653	.0685645
LIR	.0188804	.0091369	2.07	0.039	.0009724	.0367885
FA	-.0252815	.027204	-0.93	0.353	-.0786002	.0280373
PAEL	-.5673878	.1472887	-3.85	0.000	-.8560684	-.2787073
dum1	-259.9979	464.4932	-0.56	0.576	-1170.388	650.3921
dum2	30.1105	311.6979	0.10	0.923	-580.8061	641.0271
dum3	-223.6571	476.0299	-0.47	0.638	-1156.659	709.3445
dum4	122.2311	298.4593	0.41	0.682	-462.7382	707.2005
dum5	390.5921	407.3563	0.96	0.338	-407.8115	1188.996
dum6	-341.8988	460.728	-0.74	0.458	-1244.909	561.1116
dum7	219.3139	387.0719	0.57	0.571	-539.3331	977.9609
dum8	364.5982	309.3931	1.18	0.239	-241.8012	970.9976
dum9	-182.2845	304.2918	-0.60	0.549	-778.6855	414.1165
dum10	-416.7276	489.821	-0.85	0.395	-1376.759	543.3039
dum11	789.4063	373.4894	2.11	0.035	57.38047	1521.432
dum13	226.2387	355.8522	0.64	0.525	-471.2187	923.6961
dum14	-886.0912	719.9591	-1.23	0.218	-2297.185	525.0027
dum15	-237.4355	419.9372	-0.57	0.572	-1060.497	585.6264
dum16	102.6647	381.3121	0.27	0.788	-644.6932	850.0226
dum17	291.199	300.1165	0.97	0.332	-297.0185	879.4165
dum18	110.2573	303.5687	0.36	0.716	-484.7265	705.2411
dum19	269.3957	314.6116	0.86	0.392	-347.2316	886.0231
dum20	192.4721	309.1467	0.62	0.534	-413.4443	798.3885
dum22	132.2585	290.4071	0.46	0.649	-436.9289	701.4459
dum23	-835.7158	351.8624	-2.38	0.018	-1525.353	-146.0781
dum24	194.4325	449.8255	0.43	0.666	-687.2093	1076.074
dum25	-198.0058	282.396	-0.70	0.483	-751.4919	355.4802
dum26	-14.79167	352.5838	-0.04	0.967	-705.8432	676.2599
dum27	465.7654	359.9797	1.29	0.196	-239.7818	1171.313

```
       dum28 |   295.4779   320.7818     0.92   0.357    -333.2429    924.1988
       dum29 |   -374.856   354.2605    -1.06   0.290    -1069.194    319.4818
       dum30 |   54.22075   315.9898     0.17   0.864    -565.1079    673.5494
       dum31 |  -548.6442   602.1684    -0.91   0.362    -1728.873    631.5841
       dum32 |  -43.46957   294.2559    -0.15   0.883    -620.2006    533.2615
       dum33 |   -253.344   481.1682    -0.53   0.599    -1196.416    689.7283
       dum34 |    132.595   286.8286     0.46   0.644    -429.5787    694.7688
       dum35 |   205.5525   292.8994     0.70   0.483    -368.5198    779.6247
       dum36 |   449.4493   333.2867     1.35   0.177    -203.7807    1102.679
       dum37 |  -376.0871   351.2526    -1.07   0.284    -1064.529    312.3552
       dum38 |   525.6627   300.5149     1.75   0.080    -63.33573    1114.661
       dum12 |   446.0915   365.8614     1.22   0.223    -270.9837    1163.167
       dum21 |          0  (omitted)
       _cons |  -1793.215   566.6032    -3.16   0.002    -2903.737    -682.693
------------------------------------------------------------------------------
Included instruments: L.ANSG lagFDI COVID19_A LEB URB NSER FD GDPPC SIZEG NRR
                      DGGHE HFCEG LIR FA PAEL dum1 dum2 dum3 dum4 dum5 dum6 dum7
                      dum8 dum9 dum10 dum11 dum13 dum14 dum15 dum16 dum17 dum18
                      dum19 dum20 dum22 dum23 dum24 dum25 dum26 dum27 dum28
                      dum29 dum30 dum31 dum32 dum33 dum34 dum35 dum36 dum37
                      dum38 dum12
Dropped collinear:    dum21
------------------------------------------------------------------------------
```

LAG 3 OF FDI

```
OLS estimation
--------------
Estimates efficient for homoskedasticity only
Statistics robust to autocorrelation
  kernel=Quadratic Spectral; bandwidth=3
  time variable (t):  Year
  group variable (i): Country
                                                      Number of obs =       834
                                                      F( 52,   781) =     58.66
                                                      Prob > F      =    0.0000
Total (centered) SS     =   3701033249                Centered R2   =    0.7787
Total (uncentered) SS   =  1.66041e+10                Uncentered R2 =    0.9507
Residual SS             =  819144389.5                Root MSE      =     991.1
------------------------------------------------------------------------------
        ANSG | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
        ANSG |
         L1. |   .5818124   .0252492    23.04   0.000     .5323248       .6313
             |
      lagFDI |   .0699149   .0307665     2.27   0.023     .0096136    .1302162
   COVID19_A |  -95.22447   10.08476    -9.44   0.000    -114.9902    -75.4587
         LEB |   .0874749   .0572532     1.53   0.127    -.0247394    .1996891
         URB |   16.66897   13.13743     1.27   0.205    -9.079915    42.41786
        NSER |   .0056404   .0057654     0.98   0.328    -.0056595    .0169404
          FD |  -.0046718   .0171777    -0.27   0.786    -.0383395     .028996
       GDPPC |   .0075901   .0454421     0.17   0.867    -.0814748     .096655
       SIZEG |   -.138318   .0607781    -2.28   0.023    -.2574408   -.0191952
         NRR |   .0101772   .0765076     0.13   0.894    -.1397749    .1601292
       DGGHE |   .2474598   .0197757    12.51   0.000     .2087002    .2862194
       HFCEG |    .053212   .0076334     6.97   0.000     .0382508    .0681732
         LIR |   .0182971   .0091316     2.00   0.045     .0003995    .0361947
```

FA	-.0263195	.0271608	-0.97	0.333	-.0795536	.0269146
PAEL	-.5297154	.1463726	-3.62	0.000	-.8166004	-.2428303
dum1	-244.6691	467.4459	-0.52	0.601	-1160.846	671.5079
dum2	38.28902	310.8368	0.12	0.902	-570.9399	647.5179
dum3	-202.9932	475.1466	-0.43	0.669	-1134.263	728.2769
dum4	115.2952	297.4527	0.39	0.698	-467.7013	698.2918
dum5	371.935	406.5631	0.91	0.360	-424.914	1168.784
dum6	-341.9266	458.868	-0.75	0.456	-1241.291	557.4381
dum7	216.1033	385.5943	0.56	0.575	-539.6477	971.8542
dum8	352.2734	307.8491	1.14	0.252	-251.0998	955.6467
dum9	-169.1636	303.633	-0.56	0.577	-764.2733	425.9461
dum10	-399.6115	489.062	-0.82	0.414	-1358.155	558.9323
dum11	784.9386	371.6557	2.11	0.035	56.50679	1513.37
dum13	209.4605	355.7183	0.59	0.556	-487.7346	906.6555
dum14	-860.115	719.0702	-1.20	0.232	-2269.467	549.2367
dum15	-227.3926	418.8356	-0.54	0.587	-1048.295	593.5102
dum16	91.87469	379.3045	0.24	0.809	-651.5484	835.2978
dum17	286.136	298.8908	0.96	0.338	-299.6792	871.9512
dum18	123.8581	302.8597	0.41	0.683	-469.7359	717.4522
dum19	261.3881	313.438	0.83	0.404	-352.9392	875.7153
dum20	177.4509	308.1812	0.58	0.565	-426.5732	781.4749
dum22	131.4506	289.408	0.45	0.650	-435.7786	698.6798
dum23	-834.015	350.8092	-2.38	0.017	-1521.588	-146.4416
dum24	190.3806	446.6139	0.43	0.670	-684.9667	1065.728
dum25	-203.4062	281.417	-0.72	0.470	-754.9733	348.1609
dum26	-17.95979	350.5034	-0.05	0.959	-704.9338	669.0142
dum27	443.4253	359.5829	1.23	0.218	-261.3441	1148.195
dum28	300.2271	319.3007	0.94	0.347	-325.5907	926.0449
dum29	-382.5016	353.3394	-1.08	0.279	-1075.034	310.0309
dum30	50.62378	314.7234	0.16	0.872	-566.2228	667.4704
dum31	-538.0113	599.3755	-0.90	0.369	-1712.766	636.7432
dum32	-38.07645	293.3571	-0.13	0.897	-613.0458	536.8929

```
       dum33 |  -239.2621   479.2888    -0.50   0.618    -1178.651    700.1267
       dum34 |   129.1767   285.8922     0.45   0.651    -431.1617    689.5151
       dum35 |   207.5145    291.828     0.71   0.477    -364.4578    779.4868
       dum36 |   438.1355   332.6187     1.32   0.188    -213.7851    1090.056
       dum37 |  -370.1096   350.5675    -1.06   0.291    -1057.209    316.9901
       dum38 |   521.1578   299.5676     1.74   0.082    -65.98386      1108.3
       dum12 |   430.4982   364.1164     1.18   0.237    -283.1569    1144.153
       dum21 |          0  (omitted)
       _cons |  -1827.813   563.3052    -3.24   0.001    -2931.871   -723.7552
------------------------------------------------------------------------------
Included instruments: L.ANSG lagFDI COVID19_A LEB URB NSER FD GDPPC SIZEG NRR
                      DGGHE HFCEG LIR FA PAEL dum1 dum2 dum3 dum4 dum5 dum6 dum7
                      dum8 dum9 dum10 dum11 dum13 dum14 dum15 dum16 dum17 dum18
                      dum19 dum20 dum22 dum23 dum24 dum25 dum26 dum27 dum28
                      dum29 dum30 dum31 dum32 dum33 dum34 dum35 dum36 dum37
                      dum38 dum12
Dropped collinear:    dum21
------------------------------------------------------------------------------
```

Table 31: FE Threshold Regression Estimates

Fixed Effect Threshold Regression Result

```
Threshold estimator (level = 95):
-------------------------------------------------
     model |    Threshold         Lower         Upper
-----------+-------------------------------------
      Th-1 |    6447.0000     6445.0000     6449.0000
     Th-21 |    6454.0000     6412.0000     6456.0000
     Th-22 |    6488.0000     6447.0000     6490.0000
-------------------------------------------------
Threshold effect test (bootstrap = 300 300):
------------------------------------------------------------------------------
 Threshold |       RSS        MSE      Fstat    Prob   Crit10    Crit5    Crit1
-----------+------------------------------------------------------------------
    Single |  1.74e+08   2.04e+05       6.38  0.9400  32.5644  43.0759  63.0918
    Double |  1.64e+08   1.92e+05      52.63  0.0100  22.5882  29.4399  50.2229
------------------------------------------------------------------------------
Fixed-effects (within) regression               Number of obs      =       874
Group variable: Country                         Number of groups   =        38

R-sq:  Within  = 0.2118                         Obs per group: min =        23
       Between = 0.2738                                        avg =      23.0
       Overall = 0.2658                                        max =        23
                                                F(15,821)          =     14.71
corr(u_i, Xb)  = 0.2786                         Prob > F           =    0.0000
------------------------------------------------------------------------------
      RGDPPC | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
   COVID19_A |  -3.871935   4.524735    -0.86   0.392    -12.75335    5.009475
         LEB |  -.0072221     .02546    -0.28   0.777    -.0571965    .0427523
         URB |   43.31958   5.254496     8.24   0.000     33.00575     53.6334
```

```
        NSER |  -.0092577   .0025439    -3.64   0.000    -.0142511   -.0042643
       SIZEG |   .0042363   .0266776     0.16   0.874    -.0481281    .0566006
         NRR |   .0107111   .0299429     0.36   0.721    -.0480625    .0694848
       DGGHE |  -.0017595   .0085107    -0.21   0.836    -.0184649    .0149458
       HFCEG |   .0087083   .0032811     2.65   0.008     .0022681    .0151486
         LIR |   .0018879   .0040324     0.47   0.640    -.0060272    .0098029
             |
  (Threshold Level)FDI |
           0 |  -.0351936   .0265355    -1.33   0.185    -.0872791    .0168919
           1 |   .2182602   .0425404     5.13   0.000     .1347594     .301761
           2 |  -.0143841   .0279427    -0.51   0.607    -.0692316    .0404633
             |
 (Threshold Level)FD |
           0 |  -.0013749   .0111921    -0.12   0.902    -.0233433    .0205936
           1 |   -.213681   .0273493    -7.81   0.000    -.2673639   -.1599982
           2 |  -.0106701   .0096283    -1.11   0.268     -.029569    .0082287
             |
       _cons |   368.2043   241.6647     1.52   0.128    -106.1491    842.5577
-------------+----------------------------------------------------------------
     sigma_u |  2422.0009
     sigma_e |  446.37143
         rho |  .96714981   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(37, 821) = 497.18                     Prob > F = 0.0000
```

Further Readings

Allison, P. (2022). *When do suppressor effects occur?* Assessed through https://statisticalhorizons.com/when-do-suppressor-effects-occur/

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