



PÉCSI TUDOMÁNYEGYETEM
UNIVERSITY OF PÉCS

Geographical Proximity and Regional Growth Convergence in Sub-Saharan Africa: The Role of Public Debt-Investment and Economic Growth Linkages.

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Dissertation Submitted to the Doctoral School of Regional Policy and Economics, in Partial Fulfillment of the Requirements for the Award of Doctor of Philosophy Degree in Regional Development & Policy

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November 2024.

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ACKNOWLEDGEMENTS

I would like to begin by expressing my sincere gratitude to my PhD supervisor, Prof. Dr. Dániel Kehl. It has been an immense privilege to be his Ph.D. candidate. I am truly appreciative of the time and ideas that he has contributed, which has made my Ph.D. journey both productive and stimulating. His passion and enthusiasm for his research group was inspiring and provided me with motivation, even during the most challenging phases of my Ph.D. journey. I would also like to express my appreciation to the following professors of the Doctoral School of Regional Policy and Economics, without whom my PhD journey would not have been possible: Prof. Dr. László Szerb, Prof. Dr. Tamás Sebestyén, Prof. Galambosné Dr. Mónika Tiszberger, Prof. Dr. Katalin Erdos, Prof. Dr. Gál Zoltán, Prof. Dr. Richárd Farkas, Prof. Dr. Körösi Gábor, Prof. Dr. Somogyiné Komlósi Éva, Prof. Dr. Beatrix Lányi, Prof. Dr. Pálné Kovács Ilona, Prof. Dr. Geoffrey Wood and Ms. Edina Jakabfi (PhD administrator). Furthermore, I would like to express my thanks to the following two professors from the University of Vienna, who were also influential in developing my research and article writing skills: I would like to extend my gratitude to Prof. Dr. Emmanuella Plakoyiannaki and Prof. Dr. Josef Windsperger. My story is not complete without mentioning the following great friends from the University and the city of Pécs: Gansuld Daashinkhuu Sharga, Darko Topler, Julianna Kovács, Tibor Takácsné.

Furthermore, I would like to express my gratitude to Dr Junxi Qian and Prof Ernesto López-Morales, the managing editors and reviewers of *Area Development and Policy*, the journal of the Regional Studies Association (RSA), for their invaluable and constructive feedback, which has significantly improved the content and clarity of my dissertation research questions; RQ1 to RQ7. As a result of these contributions, an article derived from these research questions has been accepted for publication by Area Development and Policy with minor corrections. In addition, an extended abstract of this article was submitted to the North American Regional Science Council (NARSC). I am particularly grateful to Low Sarah of the University of Illinois, Tim Komarek, and Stephan Weiler of Colorado State University for their review and approval of the manuscript for presentation at the NARSC meeting. Finally, I would like to thank John Sporing, Executive Director of NARSC, and the conveners of the regional/rural development session, for inviting me to present this article at the 71st NARSC meeting in New Orleans, USA.

In addition, I would like to extend my sincere appreciation to Prof. Dr. Tomás Ponce Dentinho, the editor-in-chief of Regional Science, Policy and Practice (RSPP), and the journal reviewers for their insightful contributions to the development of my dissertation research questions eight (RQ8) and nine (RQ9). Their valuable comments and suggestions were instrumental in the publication of these research questions in *Regional Science, Policy and Practice (Volume 16, Issue No. 6)*, a Journal of the Regional Science Association International (RSAI). In addition, I am extremely indebted to Prof. Katarzyna Kopczewska, Regional Editor, Regional Science, Policy and Practice, for giving me an opportunity to review one article for the RSPP Journal. Prior to publication, I presented

the methodology section of this article in a PhD workshop held by the Central East and South-East European PhD Network (CESEENET PhD Workshop) hosted by the Faculty of Business and Economics, University of Rijeka, Croatia, on June 10th, 2023. I would like to thank the discussant, Prof. Vinko Zaninović, for her useful suggestions, which significantly improved the methodology before publication. Additionally, the foreign direct investment component of this article was presented at a conference organized by the Regional Science Research Group of the Budapest Business School. This article is published in a conference proceedings book titled ***“Economic, Diplomatic and Cultural Challenges”***. I am particularly grateful to Dr. Jáki Csaba for the opportunity to participate in the conference and for the positive contributions that further enhanced my research questions eight (RQ8) and nine (RQ9). I also wish to thank the organizers of the Hungarian Regional Science Association 21st Annual Meeting (HRSA), held on November 2nd - 3rd, 2023, and hosted by the Faculty of Business and Economics at the University of Pécs, Hungary. The final version of this article was presented in this conference, where it received very positive recommendations from the discussant.

Furthermore, I would like to extend my sincere gratitude to Dr. Geza Toth, as well as the editorial board and reviewers of *Regional Statistics*, the journal of the Hungarian Statistics Office, for their thorough review, insightful comments, and valuable suggestions, which significantly enhanced the content and clarity of my article, leading to publication of the tenth research question (RQ10) in ***Regional Statistics Volume 13 Issue (5), 2023***. A previous version of this article was presented at the 11th PhD Workshop organized by the Hungarian Society of Economics and hosted by the Doctoral School of Regional Policy and Economics at the University of Pécs, on April 14th –15th, 2023. I am thankful to the organizing committee for the opportunity to present my paper and to the workshop participants for their constructive feedback, which contributed to improving the article before its publication. Additionally, this article was presented in a conference organized by the Doctoral School of Economics, University of Szeged, in collaboration with the European Association for Comparative Economic Studies. I extend my gratitude to the conference participants for their valuable comments, especially to the discussant, Dr. Stacey-Lee Marais, for her careful reading of the manuscript and her perceptive feedback.

I would also like to express my heartfelt gratitude for the opportunity to publish my research in ***Regional and Sectoral Economic Development Studies, Volume 23, Issue 1***, Journal of the Euro- American Association of Economic Development Studies. A part of the literature review of this publication is a crucial component of the research question two (RQ2) of my dissertation, I am truly honored to have my work featured in this prestigious journal. I am especially grateful to the reviewers for their invaluable feedback, which greatly improved the quality of my research. Their insightful comments and suggestions were essential in aligning my work with the journal’s high standards. I would also like to thank the Journal editor, Prof. Maria-Carmen Guissan for her dedication to

advancing research in regional and sectoral economic development, which has provided an exceptional platform for scholars like me. It is a privilege to contribute to the significant body of knowledge represented by Regional and Sectoral Economic Development Studies.

Finally, I would like to express my gratitude to the funding body that made my doctoral studies possible. I am a recipient of Stipendium Hungaricum Scholarship. I'm grateful to Tempus Public Foundation and the Hungarian government for providing me with the invaluable opportunity to pursue my PhD studies abroad.

To all of you, I extend my heartfelt thanks!

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List of Abbreviations

NARDL	Non-Linear Autoregressive Distributed Lag
I-GLS	Iterated Generalized Least Squares
TFP	Total Factor Productivity
ECM	Error Correction Model
DIGNAR	Dynamic Stochastic General Equilibrium Modeling
LSDV	Least Square Dummy Variable
TVAR	Threshold Vector Autoregression
TVP-SVAR	Time Varying Parameter Structural Vector Autoregression
MNE	Multi-national Enterprise
MNC	Multi-national Cooperation
SEM	Spatial Error Model
SAR	Spatial Autoregressive Model
CIMO	Context, Intervention, Mechanism and Outcome
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
WGI	Worldwide Governance Indicators
GCC	Gulf Cooperation Council
GMM	Generalized Method of Moments
OLS	Ordinary Least Squares
PSTR	Panel Smooth Transition Regression
LQR	Logistic Quartile Regression
VAR	Vector Autoregression
SVAR	Structural Vector Autoregression
PVAR	Panel Vector Autoregression
SDG	Sustainable Development Goals
GDP	Gross Domestic Product
FDI	Foreign Direct Investment
UNCTAD	United Nations Conference on Trade and Development
IMF	International Monetary Fund
UNECA	United Nations Economic Commission for Africa

EU	European Union
WB	World Bank
SSA	Sub-Saharan Africa
ARDL	Autoregressive Distributed Lag
MSM	Markov-Switching Model
HIPC	Heavily Indebted Poor Countries
MDRI	Multilateral Debt Relief Initiative
VECM	Vector Error Correction Model
MSD	Maximum Sustainable Debt
SFA	Stochastic Frontier Analysis
OECD	Organization of Economic Co-operation and Development
EMP	Exchange Market Pressure
PCA	Principal Component Analysis
CEE	Central and Eastern European Countries
TNC	Transnational Cooperations
BRICS	Brazil, Russia, India, China and South Africa
MINT	Mexico, Indonesia, Nigeria and Turkey
BMA	Bayesian Model Averaging
NEG	New Economic Geography
R&D	Research and Development
IHP	Innovative Human Capital
NUTS	Nomenclature of Territorial Units for Statistics
USS	Urban Spatial Expansion
USE	Urban Socio-economic Expansion
EEG	Evolutionary Economic Geography
ICT	Information Communication Technology
MLE	Maximum Likelihood Estimators
FE	Fixed Effects
RE	Random Effects
SAC	Spatial Autocorrelation

SDM	Spatial Durbin Model
LM	Lagrangian Multiplier
SLM	Spatial Lag Model
SARAR	Spatial Autoregressive – Autoregressive Model
MC	Monte-Carlo
LR	Likelihood Ratio
ADF	Augmented Dickey Fuller
PP	Phillips Perron
VD	Variance Decomposition
IRF	Impulse Response Function
GIRF	General Impulse Response Function
WDI	World Development Indicators
HDR	Human Development Report
UNPD	United Nations Population Division
CPI	Consumer Price Index
ECCAS	Economic Community of Central African States
SADC	Southern Africa Development Community
ECOWAS	Economic Community of West African States
EADC	Eastern African Development Community
AIC	Akaike Information Criteria
SIC	Schwarz Information Criteria
BP	Breusch Pagan
CI	Condition Index
KB	Koenker Basset
DF	Dickey Fuller
ODA	Official Development Assistance
HDI	Human Development Index
HQC	Hannan-Quinn Criteria
FPE	Final Prediction Error
PPP	Public Private Partnership

Abstract

To achieve Sustainable Development Goals, resilience, inclusivity, and sustainable regional development constraints and opportunities must be assessed comprehensively. Despite efforts to promote regional development in Sub-Saharan Africa, outcomes vary due to issues such as macroeconomic instability, governance and institutional frameworks among other factors. The existing literature on regional development in Sub-Saharan Africa fails to account for the spatial dependence and geographical proximity among countries. This dissertation presents an empirical examination of the regional growth dynamics in Sub-Saharan Africa, incorporating geography, financial integration, governance, and institutional factors. The spatial effects have been modelled through the application of geographical distance spatial weight matrices, including the standardized queen contiguity matrix, inverse distance matrix, and K-nearest neighbours, with the objective of assessing the spatial dependence across regions. The Maximum Likelihood method and geographical distance matrices are employed to demonstrate that the spatial arrangements of countries are best described by a standardized queen contiguity spatial weight matrix for each region under investigation. Moreover, the study assesses the beta-convergence hypothesis, macro-regional factors, and economic growth disparities across Sub-Saharan African regions. The results indicate that the coefficient of real GDP per capita is positive and statistically significant across all four convergence clubs, thereby demonstrating regional growth divergence. This research contributes to the existing literature by employing spatial weights to examine the interactions between economic growth and a range of other macroeconomic factors relevant to regional growth. The employment of spatial weight matrix enables the identification of spatial spillover effects and an investigation of the influence exerted by the geographical proximity of countries. The results of our analysis indicate that foreign public debt and foreign direct investment, have a significant short-run and long-run spatial spillover effect on regional economic growth in Sub-Saharan Africa. The application of spatial econometric methods demonstrates a positive correlation between fiscal fundamentals in a given country and those in neighbouring countries. Consequently, a change in economic growth fundamentals in a particular country has ripple effects that extend beyond the borders of that country, affecting neighbouring countries as well. Furthermore, the results provide evidence of debt overhang and crowding-out hypothesis among the selected Sub-Saharan African Countries. By employing novel spatial methodologies, the research addresses significant shortcomings in the existing empirical literature and contributes to the academic discourse on the dynamics of regional development in Sub-Saharan Africa. The report presents a data-driven framework for policymakers and demonstrates the necessity for a multifaceted approach to sustainable regional development in Sub-Saharan Africa.

Key Words: Regional Economic Growth; Spatial Spillover effects; β – Convergence.

Chapter1

INTRODUCTION

1.1. Research Background

The significance of the role played by regions in driving contemporary globalization has been increasingly acknowledged in recent studies. However, in developing countries, national and regional policies have primarily followed growth models from the 1950s, including those introduced by [Swan \(1956\)](#), [Solow \(1956\)](#), and [Rostow \(1959\)](#). The Rostow growth theory postulates that economic growth will be uneven as production factors adjust to market signals in order to maximize welfare and drive national development. The theory posits that the initial phases of economic growth are characterized by increasing income disparities. The emergence of processes of income equality is only observable at more advanced stages of development. These policy interventions have frequently overlooked the crucial aspects of knowledge spillovers, economic geography, the complex interrelationship between these elements and institutional dynamics. The theory of convergence posits that regional disparities are transient, given the free movement of labour and capital across regions over time ([Solow, 1956](#); [Barro & Sala-i-Martin, 1991](#)).

The convergence process denotes the phenomenon where less affluent economies close the development gap with wealthier ones by experiencing faster rates of growth. β -convergence offers valuable insights into the capacity of underdeveloped areas to stimulate growth processes ([Barro and Sala-i-Martin, 1995](#)). The increase in capital stocks in developing regions has led to a rise in economic growth. Unfortunately, this growth rate has decreased due to the decreasing returns on these factor inputs. Consequently, the augmented capital stock is anticipated to foster a convergence in income per capita among the regional economies in the long run ([Romer, 2018](#)). The concept of β -convergence was first proposed by [Baumol \(1986\)](#) and [Abramovitz \(1986\)](#) in their seminal work on the subject. The concept of economic convergence represents a fundamental tenet of the neoclassical growth model. The concept was initially proposed by [Baumol \(1986\)](#) and subsequently developed by [Barro and Sala-i-Martin](#)

(1991). Conventional neoclassical growth theory, along with its associated empirical studies, typically considers countries and regions as isolated economic units, thereby failing to adequately account for their interdependence. Nevertheless, endogenous growth theory and the new economic geography (NEG) literature recognize the existence of regional heterogeneity and interdependence (Rey and Montouri, 1999). Ertur and Koch (2007) developed extensions to the Solow-Swan model that emphasize the importance of economic location. By integrating technological interdependence into the neoclassical growth model and incorporating exogenous geographic proximity as a factor of technological externalities, they were able to account for the spillover effects that arise from these factors. Consequently, their argument posits that an economy's position in relation to other economic systems is a pivotal factor influencing long-term economic growth. Ertur and Koch (2007) conducted an analysis of regional economic growth in China by including knowledge spillover effects in the neoclassical growth model. Fischer (2011) integrated human capital into the Mankiw-Romer-Weil (MRW) framework, building upon the work of Ertur and Koch (2007). Subsequently, the resulting model was applied empirically to a set of European countries. Dell'erba and Llamosas-Rosas (2015) further developed the spatial MRW framework by integrating elements drawn from both endogenous growth and new economic geography (NEG) theories, while also considering the influence of private and public investment, as well as human capital. The application of this model enables an investigation of the impact of these additional factors on economic convergence across US states.

Economic growth theory suggests that obstacles to achieving convergence stem from various factors such as limitations in transferring technology and fostering innovation, deficiencies in human capital, geographical constraints, institutional shortcomings, and policy inefficiencies (Johnson & Papageorgiou, 2020). Mankiw et al. (1992) argue that variations in savings rates, human capital and other behavioral factors can influence steady-state growth equilibrium between regions. Moreover, the absence of convergence in some regions is due to the expansion of country-specific shocks and the variation in balanced growth trajectories between the regions (Young et al., 2008).

Economic convergence research has evolved over the past decades from a broader, non-spatial approach that emphasized absolute convergence to a more localized approach that incorporates geographical factors (Le Gallo, 2004; Ertur, Le Gallo, & Lesage, 2007; Sala-i-Martin, 1996a, 1996b; Ertur, Le Gallo, & Baumont, 2006). Historically, the concept of convergence has been employed to examine disparities in regional economic growth (Egger & Pfaffermayr, 2006; Brida et al., 2021; Dall'Erba & Le Gallo, 2008). As illustrated by Sun et al. (2017), spatial spillovers manifest not only in the economic progress of adjacent areas but also in their initial economic conditions. Balcerzak and Pietrzak (2017) conducted a comprehensive examination of spatial effects and identified both supporting and opposing evidence with regard to convergence in Poland from 2004 to 2012. Other studies have employed spatial econometrics within growth models for the purpose of evaluating regional economic growth and the hypothesis of regional convergence. These studies include those by Cuaresma et al. (2014); Ramajo and Hewings (2018); Ertur and Koch (2007); Piribauer (2016), Resende et al. (2016), Valdez (2019), Cartone et al. (2021), and Royuela and García (2015).

1.1.1. Research Motivation

Since gaining independence, most African nations have prioritized regional development. A significant body of academic work have investigated inter-regional disparities; region-specific socio-economic development policies such as urban policies; infrastructural inequalities (Harrison & Turok, 2017), along with regional development strategies and the persistent regional disparities. Particular emphasis has been placed on the politics of regional differences; the paradoxical presence of underutilized natural resources, the presence of structurally fragmented and disorganized regional planning, the provision of quantity and quality infrastructure and inter-regional spatial inequalities (Todes & Turok, 2018). Regions represent intricate and inherently dynamic spaces, rendering a uniform approach to their development challenging. The growing emphasis on inclusivity, resilience, and sustainability, as highlighted in the Sustainable Development Goals (SDGs), necessitates a critical

examination of the constraints and opportunities that regions present in advancing these objectives.

Recent economic growth theories have revitalized discussions in spatial policy, particularly by emphasizing internal causal macro-regional mechanisms, institutional factors and agglomeration economies (Barca et al., 2012; Pike et al., 2016). For example, European countries have a longstanding tradition of spatial targeting policies. These policies have evolved from traditional approaches that directed investment and jobs from wealthy to poorer regions using significant financial incentives and major infrastructure projects. Over time, they have developed into more sophisticated regional development strategies managed by partnerships involving local and regional stakeholders (Pike et al., 2017). Studies on African urbanization have been conducted using spatial-temporal methods to investigate the phenomena and its driving forces. However, these studies have largely overlooked the convergence of growth within different regional economic blocs (Kassouri and Okunlola, 2022; Kassouri, Y., 2021; Agergaard et al., 2019). A more recent study by Ibourk and Elouaourti (2023) delves into the convergence study of African economies. They comparatively analyzed macroeconomic factors and institutional quality from a spatial perspective. However, their analysis omits the consideration of factors such geographical proximity, and spatial implications of global macro-regional parameters.

1.1.2. Geographical Proximity and Regional Development

The geographical proximity of neighbouring countries is still a crucial factor in the explanation of spatial interdependence. Economic geography plays a significant role in the broader economic discourse, particularly in discussions surrounding spatial dynamics within economic growth and development. Geographers assert with conviction that occurrences at one location are intricately intertwined with other regions. This interconnectedness between regions facilitates the ability to formulate spatial forecasts (Tobler, 1979; Krugman, 1991; Quah, 1996). Most economists agree that geography plays an important role in shaping countries' economic landscapes. This

stems from the fact that the paths to economic growth within regions are shaped not just by their unique attributes but also by those of neighboring economies ([Rey and Montouri, 1999](#) and [Abreu et al., 2005](#)). To prove this claim, we employ spatial methodologies and argue for improved coordinated regional development policies in Sub-Saharan Africa that aim to achieve the Sustainable Development Goals (SDGs) while considering regional growth spillovers, foreign capital inflows, governance and institutional framework. By employing spatial growth regression model, which encompasses a robust estimation of the spatial weight matrix, to determine geographical proximity and spatial interdependence, we are able to gain a more intricate and multifaceted insight into the spatial spillover effects that drive economic growth of regions in Sub-Saharan Africa. The dissemination of ideas has been found to be influenced by geographical proximity, technological expertise, and economic development ([Fujita et al., 1999](#); [Fingleton, 1999](#)). Despite the importance of spillover effects for regional economic growth, these effects occur both within and across states.

The regional spatial interactions that are observed are characterized by a number of key processes, including, capital movement, trade, migration, exchange of information and technology transfer ([Nijkamp and Poot, 1998](#)). The failure to consider cross-regional externalities in studies can result in biased outcomes and inaccurate regional policies ([Vaya et al., 2004](#)). Such externalities manifest in regional economies that are geographically contiguous ([Fingleton and Lopez-Bazo, 2006](#)). Scholarly works within the realm of endogenous growth theory have underscored the significance of inter-country linkages when examining growth in regional income ([Barro and Sala-i-Martin, 2003](#); [Arbia, 2006](#); [Rivera-Batiz and Romer, 1991](#)). [Bourdin \(2015\)](#) provides evidence supporting the influence of geography on economic convergence processes across 15 EU nations. Given the dynamic interplay of intra- and inter-regional economic interactions, it can be anticipated that proximity effects will exert enduring influences on labour and capital markets. There is a growing body of empirical evidence indicating that the geographical distribution of economic activities within countries is not arbitrary ([Nijkamp and Poot, 1998](#)).

In theory, spatial effects can be attributed to externalities that transcend regional boundaries. This is based on the development of new economic geography and endogenous growth models. [Mankiw et al. \(1992\)](#) argue that growth models with spatial spillover effects may be used to motivate and analyze the increasing interdependence between regions ([López-Bazo et al., 2004](#) and [López-Bazo and Fingleton, 2006](#)). [Rey and Montouri \(1999\)](#) emphasized the importance of integrating spatial effects into economic convergence analysis. Their study employed a spatial econometric approach to examine the influence of geography on income growth patterns in the US. [Lucas \(2000\)](#) proposes that the spillover effect serves as the primary catalyst for both economic growth and regional inequality. Another strand of literature evaluates convergence in real GDP Per-Capita of African economies without considering spatial temporal-dimensions ([Garang and Erkekoglu, 2021](#); [Kant, 2019](#)). Over the past two decades, there has been a shift towards employing more contextual and spatial-temporal approaches in the evaluation of regional growth disparities ([Eva et al., 2022](#)).

In traditional growth models, regional technological interdependence is acknowledged through the concept of production linkages, which facilitate the dissemination of innovations from one region to others. As a consequence of technological progress in one region, neighbouring regions may also benefit from spillover effects. In these models, spatial externalities represent a significant element ([López-Bazo et al., 2004](#); [Fischer, 2011, 2018](#)), leading to the development of spatial econometric formulations that consider the factor endowments of neighboring regions, as well as the region's initial conditions, in order to ascertain regional growth rates. In an effort to shed light on the phenomenon of spatial spillovers in regional knowledge production, recent studies have underscored the necessity of incorporating spatial proximity into the analytical framework ([Sheng and LeSage 2021](#); [Quatraro and Usai 2017](#), [Mattes 2012](#)). The application of spatial econometric techniques has become a crucial aspect of empirical investigations into regional economic growth ([Basile et al., 2014](#); [LeSage and Pace, 2009](#)). The necessity of incorporating spatial dependencies when examining regional economic dynamics is becoming increasingly recognized in the academic

literature (Crespo Piribauer, 2016; Ertur and Koch, 2007; Ramajo and Hewings, 2018). To capture these spatial relationships, exogenous weight matrices, which represent spatial interactions between regions, are typically employed as a means of capturing the relevant spatial relationships between the regions in question. Geographical proximity is frequently employed as a proxy for economic distance in such matrices (Piribauer, 2016).

This study emphasizes the value of assessing development convergence and neighborhood dynamics as a means of gaining deeper insights into the drivers of regional growth in Sub-Saharan Africa. Our focus is particularly on the geographical dimensions of regional growth processes in Sub-Saharan Africa. We investigate whether regional economic growth has the effect of exacerbating or reducing regional inequalities. Furthermore, we examine the factors that contribute to disparities in economic growth among countries in Sub-Saharan Africa. Our analysis focuses on three key areas: first, the macro-regional factors that influence economic growth differentials across the region, second, the role of spatial context, including spatial dependence and geographical spillovers, in explaining regional growth disparities and third, the macroeconomic shock transmissions and economic growth linkages. Three weight matrices are assessed in order to identify the most appropriate spatial models for the four Sub-Saharan African regions: contiguity weights (w_{contg}), k-nearest neighbors (w_{knn}), and inverse distance square matrix ($w_{inversq}$). This study contributes to knowledge by examining regional growth and convergence in Sub-Saharan Africa, taking account of geographical location effects, foreign capital inflows and governance and institutional factors. Using innovative spatial econometric methods, this study analyzes the spillover effects of international capital inflows as a theoretical contribution to the literature. It is not just the intrinsic characteristics of a region that determine the growth rates; neighbouring regions have an equally important effect. The integration of spatial externalities into the growth model is achieved through the construction of a spatial weight matrix, derived from geographical distances, which is employed to evaluate the dynamics of development convergence and the extent of spillover effects. Ultimately, we put forth policy recommendations with the aim of

reducing regional growth inequalities and advancing Sustainable Development Goals within the convergence clubs. Furthermore, the study highlights the pivotal influence of governance and institutional frameworks on the economic growth outcomes at the national and regional level. In conclusion, the study considers the policy implications for accelerating the catch-up process in Sub-Saharan Africa, drawing on insights from the East Asian developmental state model, the European Union (EU) Cohesion policy, place-based approaches to regional development, and the World Bank's three-dimensional development strategy.

1.2. Problem Statement

1.2.1. Development Financing and Public Debt Challenges

The global financial capital pool presents a substantial opportunity for development in numerous developing nations. A historical constraint on output levels in these economies has been the low ratio of capital to labor. The net inflow of foreign resources, as reflected in current account deficits, can facilitate greater capital accumulation and growth in these countries. The financing of such resources flows is made possible by the existence of international capital markets ([Bosworth et al., 1999](#)). Since the adoption of the Monterrey Consensus in 2002, African countries have made only limited progress in mobilizing domestic resources for development. The rate of gross domestic savings remains below 20 percent, which is insufficient to support the level of investment needed to achieve the Sustainable Development Goals (SDGs). To address this deficit, numerous African countries must implement significant reforms with the aim of bolstering government revenues. Moreover, foreign capital flows and trade finance for African development were adversely affected by the global financial crisis. In 2007, the global financial crisis resurfaced, underscoring the destabilizing impact of mounting public debt servicing expenses in emerging economies ([IMF, 2018](#)). As indicated by the [IMF \(2018\)](#) report, an increase in global interest rates may result in a redirection of a substantial portion of budgetary resources away from crucial infrastructure and social services towards debt repayment. Consequently, this may present considerable risks to low-income countries and emerging economies. The report indicated that debtor governments will encounter heightened difficulties in

refinancing bonds and loans due to the underlying growth potential in most developing and emerging economies. However, by 2011, there were expectations of a recovery in the global economy, which should have served as the catalyst for a robust resurgence in foreign development capital to less developed countries ([United Nations Economic Commission for Africa, 2011](#)).

In particular, the low-income Sub-Saharan Africa economies are facing a broader set of challenges related to foreign capital inflows. These include funding constraints from international financial institutions due to tighter global financial conditions and reduced concessional financing. Those responsible for formulating policy in these countries must navigate a complex landscape, striving to reconcile the imperative of addressing urgent financing needs in areas such as social programmes, healthcare and education with the challenge of managing rising public debt levels, debt service obligations and the need to increase domestic revenues. In the context of deficit financing, public debt can be defined as the total amount of money that a government has borrowed, including financing from external sources and from domestic lenders ([Bonga et al., 2015](#)). In the event that tax revenues are insufficient, governments may have recourse to public debt for the purpose of investing in vital sectors of the economy. [Ramos et al. \(2013\)](#) posit that government spending financed by public debt can have a detrimental impact on the economy. By borrowing and accumulating public debt, the government can bridge the gap between tax revenues and expenditures, thereby ensuring that its investment and development responsibilities are met. Nevertheless, when a country reaches its debt ceiling or is burdened by an excess of public debt, its economic growth may be significantly constrained. Consequently, there is a possibility of an increase in interest rates, an increase in inflation and a decrease in private investment ([Boccia, 2013](#)).

External public debt is of critical importance in guaranteeing that governments possess the requisite financial resources to finance public expenditure and to stimulate economic growth. It contributes to the coverage of essential budgetary needs, such as those pertaining to education, healthcare and defense, and supports infrastructure development with the aim of improving public welfare ([Sáez, 2016](#)). [Balassone and](#)

[Franco \(2000\)](#) posit that public debt is an efficacious instrument for the administration of budgetary deficits. When employed in a prudent manner, it does not constitute an inherent threat to public finances. Furthermore, [Stiglitz and Rosengard \(2015\)](#) posit that government borrowing can be justified on the condition that the funds are allocated to specific and productive purposes. Furthermore, [Del Castillo et al. \(2022\)](#) and [Cabral et al. \(2022\)](#) argue that the maintenance of sustainable public debt is conducive to economic growth and long-term development. It is therefore imperative that a country's public debt be subjected to rigorous analysis in order to inform the design of public policies that will ensure a stable macroeconomic environment and, ultimately, support sustainable regional growth and economic development ([Rivas Valdivia, 2021](#)). Over the past five decades, the global economy has experienced a series of waves of debt accumulation, with notable consequences for low-income countries and emerging markets. In 2018, global debt reached an unprecedented level, representing a significant increase from previous years. This represents a significant increase since the global financial crisis, with the figure reaching nearly 230 percent of global gross domestic product. Similarly, levels of both sovereign and private debt increased markedly, reaching approximately USD 55 trillion in 2018. This represents an increase of 54 percentage points from the level observed in 2010. While China was the primary contributor to this expansion of debt, the increase was pervasive, with nearly 80% of low-income countries and emerging markets exhibiting elevated levels of debt in 2018 relative to 2010. The increase in emerging market and low-income countries was evenly split between domestic and external debt, with the exception of China, where the debt surge was mainly domestic. By 2018, the debt burden for low-income countries had reached 67% of GDP, amounting to approximately \$270 billion. This figure is in comparison to 48 per cent (or \$137 billion) in 2010, as reported by [Kose et al. \(2019\)](#).

The external debt crisis in Sub-Saharan Africa has been exacerbated by a complex interplay of domestic and external factors. Domestically, the implementation of distorted trade policies and overly expansionary fiscal policies has constituted a significant contributing factor. From an external perspective, the deterioration in terms of trade has resulted in balance of payments deficits and an increase in interest rates.

The burden of external public debt, not only in Sub-Saharan Africa but globally, has been further exacerbated by the global pandemic caused by the 2019 novel coronavirus. The necessity of integrating debt into growth models is underscored by the dual-gap theory, an extension of the Harrod-Domar growth model. In accordance with this theory, the available foreign exchange and domestic savings may prove inadequate to sustain the desired rate of economic growth. Consequently, external public debt can stimulate growth by addressing the larger of two gaps: the gap between imports and exports, or the gap between savings and investment (Daud & Podivinsky, 2011). In 2021, a number of countries in Sub-Saharan Africa had public debt-to-GDP ratios that exceeded the debt sustainability thresholds (IMF, 2021). This increase has been largely attributed to the growing dependence of African governments on Chinese loans to fund ambitious infrastructure projects under the Belt and Road Initiative across the region. The considerable accumulation of debt in developing countries has prompted a re-examination of the principles of fiscal sustainability and the impact of mounting public debt on economic performance and financial markets. A country's capacity to repay its debt is diminished by weak productivity and slow economic growth, which heightens its vulnerability to fiscal constraints (Calderón et al., 2013). In light of the unfavorable growth outlook, constrained fiscal space and mounting refinancing risks associated with short-term public debt, emerging market and low-income countries are confronted with intensified development challenges. In sub-Saharan Africa, the substantial increase in public external debt, largely attributable to recent development initiatives, has exerted considerable pressure on the region's macroeconomic policy frameworks. Historically, sudden spikes in public debt have been identified as a significant trigger for financial crises, including government defaults and bank failures, with substantial economic costs (Kose et al., 2019).

Globally, economic growth is contingent upon the availability of financial resources, as borrowing and saving facilitate expenditure and investment even in the absence of current income. While the borrowing of funds can have a stabilizing effect on economies, excessive debt can have the opposite effect, weakening macro-financial management. A correlation has been identified between debt ratios exceeding certain thresholds and an increased likelihood of an economic crisis (Reinhart & Rogoff,

2009). As high public debt burdens impede the capacity of governments to respond effectively to unforeseen crises, it is imperative that debt levels are maintained at a minimum, in order to prevent the emergence of potential crisis triggers (World Bank, 2015). A series of adverse shocks, including the global pandemic caused by the SARS-CoV-2 virus, led to an increase in public and private debt in 2020. This occurred concurrently with an accommodative monetary policy and low inflation (Citaristi, 2022).

The accumulation of public debt in sub-Saharan Africa represents a significant challenge to debt sustainability and macroeconomic stability. The high cost of debt servicing represents a significant opportunity cost for developing countries in the region, contributing to the persistence of widespread poverty, high levels of unemployment, and limited access to basic public services (Were, 2024). Ndulu and O'Connell (2021) highlight the potential threat to critical developmental assets, including major public infrastructure nearing completion and advances in human capital. Despite the critical role of domestic savings in achieving financial independence and sustainable development, savings rates in the region remain low. Consequently, governments are compelled to rely on both domestic and external borrowing in order to finance public spending and investment, a practice which serves to exacerbate existing debt burdens and thereby jeopardizes the achievement of the Sustainable Development Goals (SDGs). The substantial reliance on debt can be attributed, to a considerable extent, to the insufficient generation of tax revenues, which has compelled numerous countries to implement fiscal austerity measures in response to the mounting public debt. The discrepancy between revenue generation and development needs is considerable, with tax revenues as a percentage of GDP being considerably lower than in transition economies and in developed economies. Furthermore, these countries are compelled to pursue external financing through multilateral and bilateral arrangements due to the constraints imposed by limited export activity. Over the past decade, there has been a notable increase in the issuance of Eurobonds as countries have sought to bridge financing gaps through international markets. The situation was further compounded by the SARS epidemic, which resulted

in the implementation of cash transfer programmes for vulnerable households, businesses and pivotal sectors such as health and tourism. This has resulted in a deceleration of economic growth in the region, augmented budget deficits and augmented expenditure, which has further augmented the necessity for countries to seek international financial support.

1.2.2. Foreign Direct Investment and Sub-Saharan Africa Development Dynamics

The advent of globalization has precipitated a heightened interdependence within the global economy. This can be attributed to the implementation of a range of policies and initiatives across various sectors, including trade, technology, and investment. The removal of regulatory barriers has enabled global firms to expand their operations into new markets and reduce their transaction costs. In numerous instances, outward foreign direct investment (FDI) has been employed by firms as a means of fostering trade, bolstering infrastructure in other nations, and enhancing their competitive edge ([Pradhan 2005](#)). There has been a notable increase in the volume of foreign direct investment (FDI) directed towards Africa over the past two decades. Foreign direct investment (FDI) reached approximately US\$18.4 billion in the early 2000s, before increasing to US\$49.1 billion in the latter half of the decade. This upward trajectory persisted from 2012 to 2017, with an average annual inflow of approximately US\$51.1 billion. According to the United Nations Conference on Trade and Development (UNCTAD), Africa's average annual FDI from 2000 to 2017 was approximately US\$39.5 billion ([UNCTAD, 2022](#)).

In 2021, the global flow of foreign direct investment (FDI) increased by 64.3% to reach a value exceeding \$1.6 trillion. Furthermore, the ratio of foreign direct investment (FDI) to gross domestic product (GDP) increased from 4.3% in 2020 to 7.1% in 2021. The developed economies spearheaded the investment activity, with inflows exceeding \$1 trillion, while the remainder were directed towards overseas destinations. The outflows from developing countries increased by 17.8%, reaching approximately

\$400 billion. While the number of foreign direct investment (FDI) flows to developing nations increased by 29.9% to reach approximately \$837 billion, these flows were eclipsed by those directed towards developed economies. In 2021, Africa witnessed a considerable surge in its FDI inflows, which reached an unprecedented level of \$83 billion. Notwithstanding the considerable growth in Africa's FDI inflows, the continent's share of the global FDI flow remained relatively modest at 5.2%. Europe was the primary destination for foreign direct investment, accounting for 32.3% of the total outflows, while the Americas followed with 28.9% (UNCTAD – WIR, 2022). The growth of foreign direct investment to Africa has been driven by increased investment in the natural resource sector (UNCTAD, 2018). However, the decline in FDI can be attributed to a number of factors, including a reduction in commodity prices, political instability in the region, and global economic downturns (UNCTAD, 2018; Geda & Yimer, 2018). A notable discrepancy has been identified between African economies with abundant resources and those with limited resources in terms of foreign direct investment inflows and economic growth rates. The inflows of foreign direct investment to nations with abundant natural resources have been markedly higher than those to nations with scarce resources over the past two decades (UNCTAD, 2022). This outcome aligns with the prevailing view that foreign direct investment in Africa is predominantly driven by the pursuit of natural resources, with a concentration in countries that possess a wealth of such resources.

In the context of sub-Saharan Africa, the impact of the global pandemic on the regional economy has been considerable. The continent has experienced economic stagnation as a consequence of heightened infection rates and the implementation of stringent measures to contain the spread of the disease. The global economic downturn resulting from the pandemic has been the most severe since the Great Depression. In 2020, indications of distress emerged in the context of a decline in the financial market. The global pandemic has had a significant impact on economic activity across the continent. The pandemic has had a detrimental impact on the production capacities of a multitude of industries, in addition to causing significant disruption to labour markets. In order to mitigate the impact of the economic downturn and address the

various crises that have affected the continent, policymakers in sub-Saharan Africa must develop effective strategies. One of the most significant factors that can facilitate economic growth in the region is foreign direct investment. It has been demonstrated that the expansion of foreign direct investment has the potential to stimulate economic growth.

1.3. General Objective

To evaluate geographical proximity and regional economic growth convergence in Sub-Saharan Africa, considering the role of foreign capital inflows and economic growth linkages.

1.4. Research Questions and Objectives

RQ1: What significance does the geographical proximity of countries hold in understanding regional development in Sub-Saharan Africa?

RQ2: How does regional development convergence, measured by real GDP per capita, vary when accounting for governance and institutional factors in Sub-Saharan Africa?

RQ3: What is the impact of foreign public debt on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

RQ4: What is the impact of foreign direct investment on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

RQ5: What is the impact of human capital development on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

RQ6: What is the impact of population growth on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

RQ7: What is the impact of gross fixed capital formation on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

RQ8: Do geographical proximity and spatial spillover effects of foreign public debt matter on regional economic growth in Sub-Saharan Africa when governance and institutional factors are considered?

RQ9: Do geographical proximity and spatial spillover effects of foreign direct investment matter on regional economic growth in Sub-Saharan Africa when governance and institutional factors are considered?

RQ10: What is the response of real GDP Per Capita to fiscal and monetary policy shocks in selected Sub-Saharan African countries?

1.5. Research Hypothesis

In light of the aforementioned framework, the following hypotheses are formulated and tested:

H₀₁: There is a positive significant impact of geographical proximity of countries on regional growth in Sub-Saharan Africa.

H₀₂: Controlling for governance and institutional framework, the lagged spatial weight of real GDP Per Capita has a positive significant effect on regional economic growth in Sub-Saharan Africa.

H₀₃: Controlling for governance and institutional framework, foreign public debt has a positive significant effect on regional economic growth in Sub-Saharan Africa.

H₀₄: Controlling for governance and institutional framework, foreign direct investment has a positive significant effect on regional economic growth in Sub-Saharan Africa.

H₀₅: Controlling for governance and institutional framework, human capital development has a positive significant effect on regional economic growth in Sub-Saharan Africa.

H₀₆: Controlling for governance and institutional framework, population growth has a positive significant effect on regional economic growth in Sub-Saharan Africa.

- H₀7:** Controlling for governance and institutional framework, gross fixed capital formation has a positive significant effect on regional economic growth in Sub-Saharan Africa.
- H₀8:** Controlling for governance and institutional framework, foreign public debt has indirect positive significant spatial spillover effect on regional economic growth in Sub-Saharan Africa.
- H₀9:** Controlling for governance and institutional framework, foreign direct investment has indirect positive significant spatial spillover effect on regional economic growth in Sub-Saharan Africa.
- H₀10:** There is a positive significant impact of fiscal and monetary policy shocks on real GDP Per Capita in selected Sub-Saharan African countries.

1.6. Study Rationale

The study of economic geography, and in particular the examination of spatial dynamics, is of great importance in the analysis of economic growth and development of countries. In light of Tobler's initial formulation of the law of geography, [Tobler \(1979\)](#), which underscores the interconnectivity of locations, geographers argue that occurrences in one region are inherently linked to neighbouring areas. Economic outcomes in one region are not isolated but exert an influence on neighbouring economies ([Rey & Montouri, 1999](#)). The theory put forth by Tobler underscores the movement of goods, services, technology, and information across national borders. These flows have a significant impact on the global economic landscape. These linkages, including trade, capital flows, and shared political or social ties, have the potential to exert a significant influence on the growth of a region ([Sahar & Ali Fagheh, 2020](#)). Consequently, investment and trade activities within a single country frequently have a positive impact on neighbouring countries. The process of globalization has led to an increase in the extent to which developments in one country can affect those in neighbouring countries. This is due to the interconnected nature of the global economy, whereby changes in the fiscal fundamentals of one country can have knock-on effects on the fiscal fundamentals of neighbouring countries. The findings of studies conducted by [Balaguer-Coll & Toneva \(2019\)](#) indicate that the level of debt in a given

region is frequently influenced by the level of debt in neighbouring regions. By employing spatial econometrics, researchers can quantify these spillovers through the examination of the simultaneous co-movement of international financial flows (Perović, 2018). In addition to its empirical findings, this study serves as a springboard for empirical investigations. It encourages academic discussion on the dynamics of regional development in Sub-Saharan Africa. By providing a sturdy, data-driven foundation for policymakers, the research addresses a crucial gap in empirical literature and lays the groundwork for future academic investigations. Amid the escalating sustainable development challenges confronting the global community, which transcend both geographical and political boundaries, this study underscores the imperative of embracing a multifaceted approach to regional development in the Sub-Saharan Africa.

1.7. Definition of Terms

1.7.1. Geographical Economics

Geographical disparities result in unequal access to technology and innovation. The growth of less developed regions is constrained by their limited size and resources, which prevent them from benefiting from advances and spillovers observed in more developed areas (Rodriguez-Pose, 2001). In geographical economics, specific localities and regions are examined to determine their economic performance in trade. Additionally, the field investigates the impact of uneven development across diverse local and regional contexts on growth in the national economy and trade.

1.7.2. Development Convergence

The term "convergence" is used to describe a reduction in the difference between per capita incomes across regions, whereas "divergence" is employed to denote an increase in the disparity between per capita incomes.

Conditional convergence, regions exhibit a tendency towards a steady-state growth rate, characterized by a stabilization of per capita income, consumption and capital-labour ratios.

Absolute convergence is defined as a situation in which the parameters of a growth model are identical across regions or countries. Consequently, nations with higher levels of economic development will experience a deceleration in growth compared to nations with lower levels of development, which have greater potential for growth.

beta convergence can be defined as the rate at which regions exhibit a convergence in their economic development. When less developed or poorer regions experience accelerated growth relative to wealthier regions, the income disparity between them gradually diminishes.

Sigma convergence involves the comparison of per capita incomes across different regions at a specific point in time. In particular, it analyses income disparities across different regions.

1.7.3. Contagion Effect

The phenomenon of contagion occurs when markets in disparate countries become more interconnected during or in the aftermath of a financial crisis. In the context of a crisis, contagion is typically gauged by the extent to which asset prices in a given country exhibit parallel trends to those observed in another country, relative to the norm observed in the absence of a crisis. Theoretically, contagion effects can be attributed to two main causes.

Spillover effect describes the transmission of shock impacts between stock markets. This is driven by the interconnection between real and financial economic activities.

Herding behaviour manifests when irrational investors panic and withdraw their funds, both from the country experiencing a crisis and from unrelated countries. In many instances, investor behaviour is motivated by a sense of fear, a loss of confidence, and an increased inclination towards risk aversion.

1.8. Dissertation Structure

The principal objective of this dissertation is to illustrate the critical role of foreign capital in augmenting investment and propelling regional economic growth. In particular, it aims to assess the influence of foreign capital on regional economic growth convergence, taking into account the role of governance and institutional factors. Furthermore, the study utilizes advanced spatial econometrics to investigate the significance of geographical proximity and the spatial spillover effects of foreign capital among countries in Sub-Saharan Africa. The dissertation is structured as follows: **Chapter One** presents the background and context of the study, with particular emphasis on the impact of geographical proximity on regional development. Furthermore, the chapter presents the problem statement, outlining the challenges related to development financing, foreign public debt, and foreign direct investment in Sub-Saharan Africa. It also outlines the research questions and hypotheses, the rationale for the study, and the definitions of key terms. **Chapter Two** presents a theoretical and empirical literature review structured around three key thematic areas: foreign public debt, foreign direct investment, and regional economic growth. The chapter commences with a systematic review of literature on foreign public debt, delineating the theoretical and empirical framework, and analyzing neo-classical growth theories, including the β -convergence and conditional convergence models. Furthermore, it presents an in-depth review of empirical studies, with a particular focus on the spatio-temporal aspects of growth convergence. Finally, it offers a concise summary of the literature review, identifying the research gap. **Chapter Three** provides a detailed account of the two principal methodologies employed to simulate the study results. These are the spatial econometrics approach and the structural vector autoregressive models (SVAR). It elucidates the variables, data sources, and spatial analysis procedure employed to identify spatial dependence, along with the model selection criteria and estimation techniques. **Chapter Four** presents and discusses the results and hypothesis testing, establishing connections to Sustainable Development Goals and prior empirical research, and concludes with a discussion of the dissertation's central thesis, presented after every hypothesis tested. Finally, **Chapter Five** provides concluding remarks and policy recommendations based on the study findings.

Chapter2

LITERATURE REVIEW

2.1. Introduction

This chapter presents an investigation of the multifaceted aspects of regional development convergence, the interconnection between public debt and macroeconomic policies, and the interrelationship between foreign direct investment (FDI) and regional economic growth. It delineates the pivotal thematic domains for analytical inquiry. This comprehensive approach enabled us to demonstrate how empirical findings enhance and supplement theoretical models through an extensive review of the relevant literature. The following structure is employed in the chapter: Section 2.2 presents a systematic literature review, examining the theoretical and empirical relationship between public debt and economic growth. It incorporates aspects such as monetary and fiscal policy, governance and institutional relationships, the spatial dimensions of foreign capital flows and macroeconomic shock transmission. Section 2.3 presents a review of the theory and empirical evidence on foreign direct investment (FDI), with a particular focus on its spatial analysis, geographical proximity, economic productivity, and the impact of social institutions on economic growth. Section 2.4 presents a comprehensive review of the theoretical and empirical literature on regional development. It includes an analysis of neo-classical and endogenous growth approaches, as well as an examination of the spatial analysis of human capital development. The final section, 2.5 concludes with a summary of the literature and an identification of research gaps.

2.2. Systematic Literature Review and Meta-Analysis

In developing, transition, and industrialized countries, a variety of theoretical frameworks and analytical approaches have been used to examine the public debt and economic growth relationships. A fundamental aspect of classical economic theory (Modigliani, 1961; Mankiw, 2000) is that domestic government borrowing can lead to liquidity problems and interest rate spikes, which crowds out private investments.

Furthermore, the critics of debt-financed government spending also claim that it cannot fully offset the adverse effects of crowding out private investment, which could result in an economic recession (Domar, 1944). In the classical perspective of the 18th century, scholars such as Hutcheson (1714), Davenant (1700), and Smith (1776) espoused the view that public credit must be either destroyed or it will destroy the economy (Churchman, 2001). Panizza and Presbitero (2014); Kumar and Woo, 2010 found that servicing domestic and external public debt can negatively impact economic growth due to crowding out effects. Additionally, classical economists have critiqued government borrowing on the grounds that it diverts private capital from its productive function to unproductive applications, which impedes capital accumulation and overall economic growth. The argument is made that debt acts as an impediment to a nation's progress towards prosperity and wealth. This is on the grounds that resources that would otherwise be directed to productive uses in the private sector are instead used for wasteful government spending. In an economy with high levels of indebtedness, the phenomenon of crowding-out can occur as a result of a number of factors, including high real interest rates, a deterioration in the trade balance, and the unavailability of external credit markets. Classical economists advanced the argument that public debt should be allocated to productive investment rather than consumption (Say, 1880). From this perspective, it is not advisable to finance government spending through debt. Furthermore, the crowding-out effect can diminish a country's capacity to service its debt, leading to constrained resources for domestic investment when it is experiencing difficulties in meeting its previous obligations (Patenio and Agustina, 2007). A decline in investment may result from a lack of resources available to finance investment and macroeconomic activities (Claessens et al., 1996). Krugman (1988) characterizes the inverse correlation between public external debt and economic growth as 'debt overhang', which arises when the capacity to repay outstanding debt declines below its contracted value. The theoretical case for debt overhang has been supported by several scholars, including Chowdhury (2001), Greene and Villanueva (1991) and Elbadawi et al. (1997)).

Moreover, In Keynesian analysis, government debt is regarded as a source of income generation, and its servicing costs are not considered to have a detrimental impact on society. Furthermore, Keynesian theory suggests that increased debt-financed government spending leads to higher tax revenues, which in turn support debt service ([Buchanan, 1964](#)). Post-Keynesian perspectives on public debt servicing emerged in response to significant increases in both public debt levels and government spending on non-developmental initiatives ([De Broeck et al., 2015](#)). [De Broeck et al. \(2015\)](#) argue that investor concerns about fiscal policies, sovereign debt servicing, and economic downturns have contributed to the intensification and recurrence of financial crises and economic downturns in debtor nations. The Keynesian approach places significant emphasis on the role of the state in economic activity and challenges a number of classical assumptions about the economy and society. Keynesians posit that the state should intervene in the economy with the objective of complementing market activities and rectifying market deficiencies. Keynesians adopt a contrasting perspective to that of classical economists with regard to public debt. They argue that public borrowing can have a positive effect on growth, in contrast to the view held by classical economists that public debt is inherently detrimental. The Keynesian view is that debt-financed spending by the public sector has a crowding-in effect, which leads to a positive multiplier effect on growth. By leveraging debt, governments can finance productive investment that raises national income and stimulates economic growth. However, the misallocation of public debt has the potential to yield adverse consequences, such as increased government expenditure, which could serve to stimulate domestic economic activity and attract private investors ([Biza, Kapingura, & Tsegaye, 2013](#)).

Contrary to the neoclassical growth environment, there is no consensus on the effect of public debt on growth. A study by [Diamond \(1965\)](#) suggests that public debt promotes economic growth. However, [Modigliani \(1961\)](#) and [Saint-Paul \(1992\)](#) claim that in an environment where growth is endogenous, public debt is detrimental to growth. Furthermore, the standard neoclassical model suggests that debt has a positive effect on growth during transitory periods since it accounts for capital mobility and

foreign borrowing flexibility. In countries with limited capital, external borrowing and investment are more attractive than domestic borrowing and investment, given that the marginal product of capital is higher in developing countries than in high-income countries. Evidence suggests that developing countries with sustainable borrowing limits are more likely to achieve increased economic growth. The two primary factors that contribute to economic growth are capital accumulation and productivity growth. Further, [Smith \(1776\)](#) argued that tax increases to repay public debt result in the transfer of productive capital to creditors. Therefore, public debt servicing would have a markedly detrimental impact on trade and capital formation. Consequently, [Smith \(1776\)](#) argue for the complete elimination of public debt to free public revenue from debt obligations.

The primary rationale for opposing public debt, as espoused by neo-liberal economists, is the phenomenon of the "crowding-out effect." This phenomenon occurs when public authorities employ public borrowing as a means of addressing budgetary deficits. In the market for loanable funds, the crowding-out effect indicates that an increase in public debt increases demand for loanable funds, while supply remains unchanged. This, in turn, gives rise to an increase in interest rates. Consequently, this has an impact on private investment, which is sensitive to changes in interest rates. As a result, private capital is reallocated towards the public sector with the objective of financing public expenditure. Accordingly, monetarists posit that the anticipated positive impact on GDP growth resulting from the promotion of debt-financed budget deficits may prove to be either modest or non-existent. As evidenced by the work of [Krugman \(1988\)](#) and [Sachs \(1989\)](#), the concept of debt overhang and excessive debt servicing requirements serve as an implicit tax on domestic income, which has the effect of discouraging investment.

Moreover, [Sachs \(1989\)](#) noted that heavily indebted low-income countries allocate a significant portion of their foreign exchange reserves to debt servicing. Consequently, the repayment of debt restricts the availability of funding for activities that could otherwise contribute to economic growth. As [Krugman \(1988\)](#) and [Serven \(1997\)](#) posit,

the practice of both domestic and foreign government borrowing at elevated levels has the potential to contribute to a number of economic challenges, including misallocation of resources, inefficiency in capital allocation, and increased instability in the broader economic landscape. In order to meet their obligations with respect to debt repayment, governments frequently adopt measures that distort economic activity and which, in the longer term, have an adverse effect on rates of economic growth. Consequently, potential investors may choose to defer investments or, in contrast, may engage in a process of capital flight with the intention of evading potential tax increases that may result from the uncertainty (Serven, 1997). Borensztein (1990) identified two mechanisms through which external debt could affect investment: debt overhang and credit rationing. Iyoha (1997) conducted an assessment and identified the presence of crowding-out effects in Nigeria. Furthermore, Edo (2002) corroborated the theory of crowding out by employing Morocco and Nigeria as case studies to examine the challenges associated with external borrowing encountered by African nations. Ashinze and Onwioduokit (1996) corroborated the crowding-out effect through the utilization of macroeconomic modelling in their investigation of the Nigerian economy.

2.2.1. Systematic Literature Review Process

This study presents an in-depth examination of the relationship between public debt dynamics and the macroeconomic policy framework. The objective of the literature review was to identify the most relevant studies through a systematic search of academic databases, including Scopus, Elsevier, Science Direct and Web of Science. The research process included formulating specific research questions, establishing a review protocol, systematically searching and screening publications for relevance, conducting quality assessments, carefully extracting data, and critically analyzing and synthesizing the results. The analysis was based on a review of recent English-language academic articles published after the global financial crisis between 2011 and 2024, with a particular focus on public debt topic. Studies were selected using the PRISMA methodology, which involves four main stages: identification, screening, eligibility and inclusion. The initial search yielded 661 peer-reviewed articles and an additional ten articles with notable citations from the reference lists of selected studies. After applying

the inclusion and eligibility criteria, a total of 104 publications were selected for the final synthesis. The primary objective of systematic literature review was to answer the following research questions:

- i. What studies have been conducted to investigate the relationship between public debt and economic growth?
- ii. What methodologies have been employed to examine the nexus between public debt and economic development in developed, emerging, and developing economies?
- iii. What public debt management policies would ensure macroeconomic sustainability, fiscal discipline, and economic growth in developed, emerging, and developing economies?

A comprehensive electronic search strategy was employed for the study, as illustrated in Figure 1. Furthermore, additional pertinent and highly cited articles were identified from a list of selected references. A preliminary search was conducted between 21/02/22 and 03/05/22 to gain an initial overview of the subject matter. The Zotero software was employed to document the particulars of the retrieved studies, including the titles, keywords, and abstract notes. The titles, abstracts and full texts of all selected manuscripts were screened for duplicates. From 4th May 2022 to 8th July 2022, data extraction and management were conducted using a standardized data extraction form. The following parameters were extracted from each study: authors, title, keywords, year of publication, abstract, research questions/objectives, focus, location, population, topic, paradigm/discipline, theory, study design, estimation procedures, data collection procedures, data characteristics/sample size and significant findings. Prior to synthesis, the selected articles were evaluated by experts in order to assess their quality. A total of 661 peer-reviewed articles were identified through the three search sources.

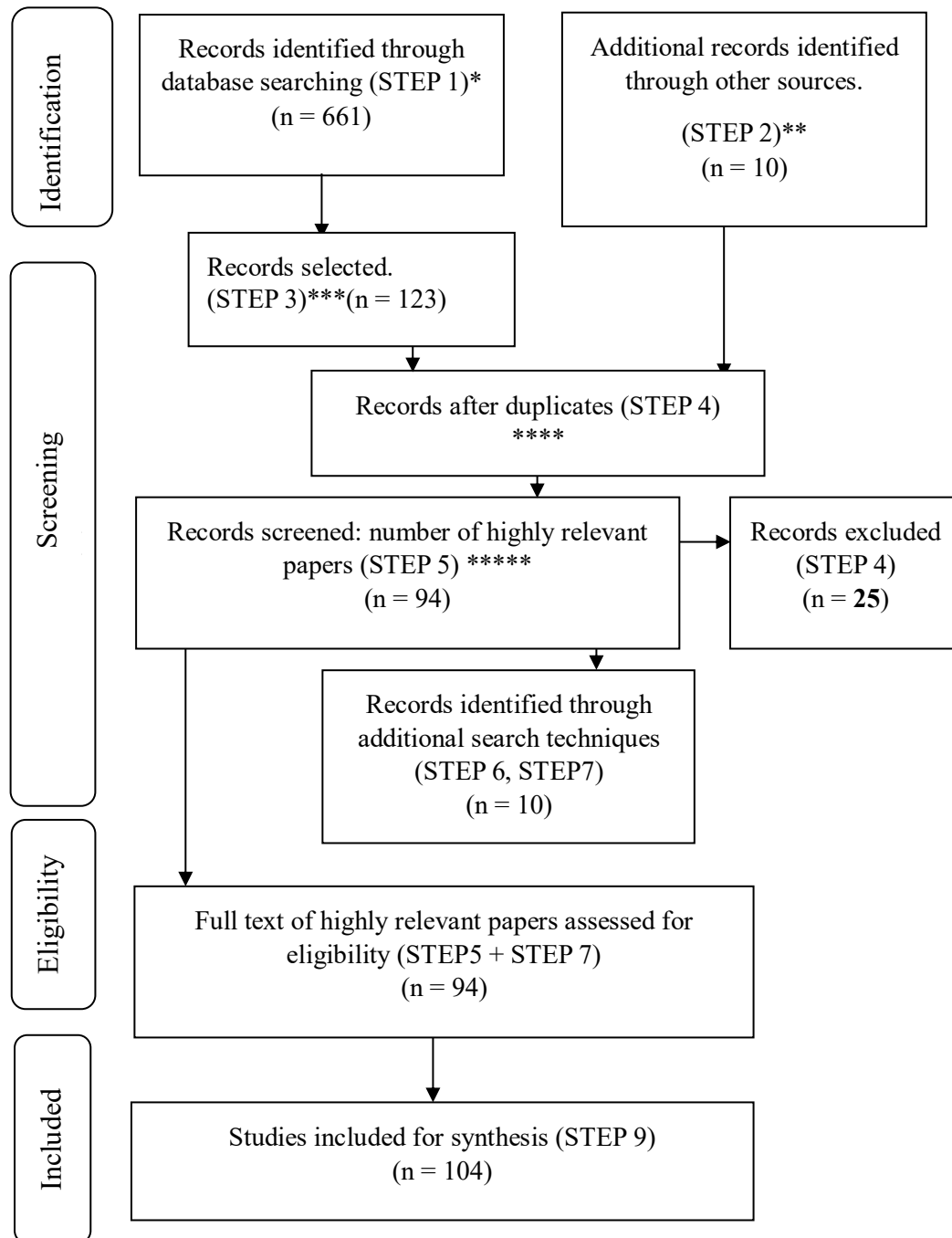


Figure 1: PRISMA - Flow Diagram Reporting Systematic Literature Review Items; Author Generated (2024)

A total of 123 articles were selected based on the pre-established inclusion criteria. Following the removal of duplicates, a total of 104 articles were selected for inclusion, with 25 articles excluded. In order to obtain the final literature synthesis, an additional

10 articles were sourced using alternative search techniques, leaving a total of 104 recent, relevant and highly cited articles. Results of the preliminary scoping search are given in [Figure 1](#). A total of 104 papers that fully met the inclusion criteria for quality assessment were retained for data extraction. The data from the articles was extracted using the Context, Intervention, Mechanism, and Outcome (CIMO) framework. A comprehensive synthesis of the literature was conducted based on the 104 selected articles. The study yielded insights into several pivotal aspects of public debt and the macroeconomic policy environment. In order to achieve this objective, six themes of study were identified and subjected to a comprehensive analysis of the relevant literature, with the aim of demonstrating how the evidence lends support to and enhances existing theory.

2.2.2. Public Debt, Economic Growth, and Monetary Policy Nexus

Recent studies on the relationship between public debt and economic growth in different contexts have revealed the significance of prudent fiscal management in complex economic dynamics. [Makun \(2021\)](#) examines the Fijian economy from 1980 to 2018. The findings indicate that external debt has a negative impact on long-term growth, with positive contributions from exports and total factor productivity. However, exceeding certain debt thresholds has been identified as a significant impediment to economic growth. Similarly, [Chirwa and Odhiambo \(2020\)](#) emphasize the necessity for fiscal sustainability and structural reforms within the Eurozone Stability and Growth Pact. Their findings indicate that public debt, government consumption and real exchange rates have a detrimental impact on economic growth in ten European countries.

[Abdelkafi \(2018\)](#) contributes to this body of research by demonstrating the interdependence between public debt, economic growth and monetary policy in Tunisia. The analysis reveals that conflicting policy objectives lead to inflationary pressures and a reduction in economic activity. The findings of research on emerging market economies also indicate a positive correlation between public debt and growth at low levels of debt. However, they suggest that there is a negative impact once certain

thresholds are exceeded, particularly in emerging market economies. The results of studies conducted on developed countries, which have examined data from 1970 to 2012, consistently indicate a significant negative relationship between debt and economic growth. Additionally, there is minimal evidence to suggest that nonlinear effects play a role in this relationship. [Agyeman et al. \(2022\)](#) employed a dynamic system generalized method of moments with data from 2000 to 2015 to investigate the impact of capital flight on the effect of external debt on economic growth in sub-Saharan African countries. The results demonstrate that both capital flight and external debt exert a negative and significant impact on economic growth. Furthermore, the adverse effects of external debt are exacerbated by higher levels of capital flight, underscoring the imperative of reducing capital flight for the enhancement of external debt management in the region.

[Guei \(2019\)](#) employ a panel auto regressive distributed lag (ARDL) model with both linear and nonlinear specifications to examine the relationship between external debt and economic growth in 13 emerging economies from 1990 to 2016. The findings indicate that external debt does not exert a robust long-run effect on economic growth. However, a notable negative correlation exists between external debt and short-term economic growth. This suggests that the impact of debt on growth is more pronounced in the short run than in the long run. In a study employing data from 1990 to 2015 and an autoregressive distributed lag cointegration approach, [Kharusi and Ada \(2018\)](#) investigated the influence of the government's external borrowing on the economic growth of Oman. The results indicate that external debt should be employed in a more productive manner to facilitate economic development, given that external debt has a detrimental impact on economic growth, whereas gross fixed capital has a beneficial effect on growth. [Akram \(2016\)](#) examines the impact of public debt on economic growth and poverty in five South Asian countries (Bangladesh, India, Pakistan and Sri Lanka) between 1975 and 2010. The study finds that, despite the negative impact of public debt on economic growth, neither public external debt nor debt service has a significant impact on income inequality. This implies that both the rich and the poor experience similar effects. In contrast, domestic debt has been found to have a positive

impact on economic growth and to reduce income inequality, thereby indicating that it is beneficial for poverty reduction.

[Mutai et al. \(2024\)](#) examined the sustainability of public debt in African countries, with a particular focus on China's growing role in financing infrastructure. The findings indicate that while some African countries demonstrate sustainable debt, others are experiencing fiscal distress. However, based on trend analysis, debt-to-GDP ratios and a panel autoregressive distributed lag model, it can be concluded that Chinese loans contribute to long-term economic growth when used effectively for infrastructure development. In consideration of the diverse nature of the relationship, [Eberhardt and Presbitero \(2015\)](#) investigated the influence of public debt on economic growth across a diverse panel of countries. The researchers employed both linear and non-linear models, as well as advanced time series methods. The findings revealed a negative correlation between debt and growth, yet no uniform debt threshold was identified across countries. [Kengdo \(2023\)](#) examined the impact of military spending and public debt on economic growth in Cameroon between 1980 and 2021. The research employed ARDL models to analyze the data. The results demonstrate that both public debt and military expenditure exert a detrimental impact on economic growth. Conversely, the provision of development assistance and a reduction in the size of the government have been observed to stimulate economic growth. Furthermore, the research has identified specific thresholds for public debt (56.42% of GDP) and military expenditure (1.29%–1.47% of GDP) that may have a detrimental impact on growth.

[Fincke and Greiner \(2015\)](#) identify a statistically significant positive correlation between public debt and per capita GDP growth in selected emerging markets. They observe that while population and investment drive growth, high initial real GDP per capita indicates conditional convergence, with inflation, trade balance, and exchange rates having minimal impact. In contrast, [Bökemeier and Greiner \(2013\)](#) analyzed data from seven developed countries from 1970 to 2012, revealing a robustly negative relationship between debt and growth over various intervals, with no significant non-

linearities observed. [Mencinger et al. \(2015\)](#) further examined the impact of public debt on short-term fiscal policy transmission using a dataset comprising 36 countries. Their findings revealed a non-linear, concave relationship, whereby low levels of debt stimulate growth. However, exceeding specific debt-to-GDP thresholds (90-94% for developed and 44-45% for emerging economies) has a detrimental effect, confirming that adverse growth effects are more pronounced in emerging economies.

[Hassan and Meyer \(2021\)](#) addressed the previously underexplored non-linear impact of external debt on economic growth in Sub-Saharan Africa by analyzing panel data from 30 SSA countries from 1985 to 2018, employing the AMG and CCEMG estimators. The findings indicate that external debt has an inverted U-shaped relationship with economic growth, with identified thresholds at 44-53% of GDP and 196-232% of exports, beyond which debt begins to hinder growth. The study suggests that Sub-Saharan Africa governments should adopt a pragmatic approach to external debt management, ensuring efficient use of existing debt while incorporating these thresholds into their strategies to mitigate negative economic impacts. In a study based on a Markov-switching model, [Doğan and Bilgili \(2014\)](#) examined the relationship between external debt and economic growth in Turkey between 1974 and 2009. The analysis demonstrates that key growth variables, including investment and human capital, exert a positive influence on growth. Conversely, external borrowing by the public and private sectors has been found to exert a negative influence on economic growth, with public borrowing exerting the most significant negative impact. Moreover, the relationship between economic development and external borrowing is characterized by a complex interaction, indicating a non-linear relationship.

[Dawood et al. \(2024\)](#) employed sophisticated econometric models to investigate the relationship between external debt, debt servicing, and economic growth in 32 Asian developing economies. The study identifies debt overhangs and crowding-out effects as the primary factors influencing growth. The study concludes that public and private investment, productivity, and savings represent crucial channels through which external debt affects growth. The findings emphasize the necessity of optimizing debt

management, enhancing productivity and bolstering domestic savings in order to diminish foreign debt and facilitate sustainable growth. [Bozatli et al. \(2024\)](#) investigated the occurrence of structural breaks and the frequency characteristics associated with public debt and economic growth over the period 1870 to 2020 in G7 countries. The findings, based on Fourier Toda-Yamamoto and frequency-domain causality techniques, indicate that there are varied causal relationships in Italy and Japan, with permanent feedback effects, no causality in France, and diverse evidence for other countries. These insights offer new perspectives for policymakers and researchers alike.

[Chiu and Chien-Chiang \(2017\)](#) employed panel data analysis to investigate the nonlinear effects of four country risk indices on debt-growth relationships for 61 countries. The impact of public debt on economic growth is more pronounced in environments characterized by elevated risk, whereas the detrimental effects of debt are less significant in low-risk settings. This is particularly evident in contexts where financial and political risk is minimal, and even in situations where income and debt levels are relatively low, debt can potentially stimulate growth. [Olaoye and Olomola \(2022\)](#) examined the prospective trajectory of public debt in Nigeria, South Africa, Angola, Ghana, and Ethiopia, with a particular focus on the five largest economies of Sub-Saharan Africa. An analysis based on a Markov-switching model (MSM) of the global pandemic caused by the novel coronavirus, SARS-CoV-2, reveals two distinct debt regimes. The first, designated State 1, is characterized by low debt and sustainable economic growth. The second, designated State 2, is characterized by high debt and unsustainable economic growth. In light of these findings, it seems plausible to suggest that the African Union's 2063 development goals may be impeded by the prospect of persistently elevated public debt levels in the future.

From 1996 to 2014, 30 countries in sub-Saharan Africa benefited from debt relief initiatives, including the Heavily Indebted Poor Countries (HIPC) and the Multilateral Debt Relief Initiative (MDRI). The objective of these initiatives was to stimulate growth and investment in the region. [Djimeu \(2018\)](#) finds that while participation in

the enhanced HIPC initiative led to increased public and private investment, especially in countries with limited access to international capital, it did not significantly impact overall growth or foreign direct investment. This indicates that enhancements to institutional quality may be essential for debt relief to be more efficacious. In a different context, [Della Posta \(2018b\)](#) attributes the euro region crisis's speculative attacks to the absence of a lender of last resort. The author employs a model adapted from exchange rate target zones to illustrate that central bank liquidity is instrumental in stabilizing public debt and maintaining credibility. In a related study, [Whajah et al. \(2019\)](#) demonstrate that in 54 African countries, a larger government size is conducive to inclusive growth, whereas higher public debt has a detrimental impact on it. This indicates the necessity for an optimal allocation of funds and manageable debt levels.

[Gómez González \(2019a\)](#) examined the phenomenon of inflation-linked (IL) public debt in emerging economies. The author observes that IL debt represents 23% of local currency debt and is countercyclical in nature, becoming more cost-effective to issue during periods of economic downturn and exhibiting reduced rates in numerous recent crises. In certain instances, the rates have declined to a point below that of the local currency, even when adjusted for inflation. [Udoh and Rafik \(2017\)](#) investigate the growth of Malaysia's external debt, utilizing data from 1970 to 2013 to examine its long-term consequences. The findings of the study's Vector Error Correction Model (VECM) indicate that external debt maintains a permanent relationship with determinant variables. In particular, there is a positive long-term correlation between exchange rates, recurrent and capital expenditures, while GDP exhibits a negative correlation. The Granger causality test indicates that capital expenditure is the sole variable that can be identified as a cause.

[Karadam \(2018\)](#) employed panel smooth transition regression to investigate the threshold effects in the relationship between public debt and economic growth. The findings suggest that the non-linear relationship between debt and growth is predominantly influenced by the structure of the debt itself. As debt levels increase, the impact of public debt on economic growth undergoes a shift from positive to negative.

Moreover, the findings indicate that developing countries are more vulnerable to debt thresholds, suggesting that public debt has a deleterious impact on their growth at lower levels of indebtedness than in advanced economies. Furthermore, the negative effect of short-term external debt and long-term public external debt is more pronounced when debt levels are high. The relationship between external debt and economic growth in emerging economies from 2006 to 2016 was examined by [Shkolnyk & Koilo \(2018\)](#) using econometric tools, including the Autoregressive Distributed Lag (ARDL) model and correlation analysis. The findings indicate that external debt exerts a non-linear influence on economic growth. Furthermore, high debt levels, when coupled with macroeconomic instability, serve to constrain growth in emerging economies. The study proposes a novel model which involves the involvement of autonomous agencies to consolidate and augment public debt management efforts, particularly in the case of Ukraine, with the objective of achieving effective external debt management. Similarly, [Alsamara et al. \(2024\)](#) investigated the influence of public debt on economic growth in 14 Middle Eastern and North African countries from 1980 to 2021, revealing significant discrepancies between oil and non-oil economies. The findings indicate that non-oil countries benefit more from public debt, with a higher debt threshold and less severe negative effects on growth when debt exceeds the threshold. This serves to emphasize the moderating role of energy resources in this relationship. A substantial body of literature exists on the relationship between public debt and economic growth. Notable contributions to this field include those of [Nagou et al. \(2021\)](#) and [Bittencourt \(2015\)](#).

[Mohsin et al. \(2021\)](#) employed a series of statistical techniques, including panel OLS, fixed effects, quantile regression, and robust output regression, with the objective of assessing the influence of external debt on economic growth in South Asia. The analysis employed data from Afghanistan, Bangladesh, Bhutan, India, Pakistan, Sri Lanka, the Maldives, and Nepal, spanning the period from 2000 to 2018. The results indicate that external debt has a generally deleterious impact on economic growth. However, the stock of external debt exerts a positive influence, with robust regression indicating that total external debt and debt service have a significant effect on growth,

accounting for 39% and 31%, respectively. Moreover, the results demonstrate that gross capital formation and trade openness exert a positive influence on economic growth. However, beyond a certain threshold, high external debt becomes a significant impediment to economic growth. This indicates that enhancements to institutional quality could serve to mitigate these adverse effects. As [Siddique et al. \(2016\)](#) observe, during the 1970s and 1980s, the external debt of poor countries reached crisis levels, primarily due to surplus revenues from the 1970s oil price boom. However, a considerable number of these countries did not exercise prudent management of their external debt. As a result, the subsequent decline in oil prices during the 1980s left heavily indebted poor countries (HIPCs) facing difficulties in servicing their debts. This paper examines the impact of external debt on GDP in HIPCs, with a particular focus on the long-term economic challenges associated with high debt levels.

In a previous study, [Collard et al. \(2015a\)](#) put forth a proposed measure of maximum sustainable government debt (MSD) for advanced economies. This was determined by a formula based on three key factors: the expected primary surplus, growth rate volatility, and future borrowing capacity for debt servicing. Subsequently, the authors conducted an empirical investigation into the relationship between sovereign yield spreads and the theoretical probability of default (PD) across 23 OECD countries. A strong statistical correlation was identified. Utilizing stochastic frontier analysis (SFA), [Al-Qalawi and Al-Rabbaie \(2024\)](#) investigated the immediate impact of debt on production efficiency across 18 OECD countries between 2015 and 2021. The findings indicate that an increase of \$1 billion in debt results in a 0.04% improvement in efficiency. Moreover, the countries with the highest levels of indebtedness, such as the United Kingdom and France, also exhibit the highest levels of efficiency. In their examination of the impact of public debt on economic growth in developing countries, [Presbitero \(2012\)](#) revealed that debt has a negative effect on growth up to a 90% debt-to-GDP ratio, beyond which the effect becomes negligible. Additionally, the nonlinear impact is found to be influenced by country-specific factors, particularly in nations with robust macroeconomic policies and stable institutions.

In a recent study, [Wang et al. \(2023\)](#) examined the relationship between natural resource rents and public debt in resource-rich African countries. The authors drew attention to the potential dangers inherent in the use of resource windfalls as collateral for debt, particularly in the context of price volatility. The results demonstrate that while the relationship is negative at the aggregate level, it becomes positive when disaggregated. This highlights the necessity for country-specific fiscal strategies and responsible borrowing practices. [Chen et al. \(2017\)](#) employed a nonlinear theoretical model and panel smoothing transitional regression to ascertain the optimal levels of government investment and public debt across 65 economies. The findings indicated that while both initially exert a positive influence on growth, their effects diminish and may even become negative when certain thresholds are exceeded. However, the investment and debt ratios in China in 2014 remained below the aforementioned thresholds, thereby sustaining positive growth effects throughout the study period. Other studies have reached the same conclusion regarding the negative effects of public debt or debt overhang, and the crowding-out effects that result from it. These include the studies by [Akram \(2011\)](#), [Ighodalo Ehikioya et al. \(2020\)](#), [Silva \(2020\)](#), [Çiftçioglu & Sokhanvar \(2018\)](#), and [Yusuf & Mohd \(2023\)](#); [Augustine and Rafi \(2023\)](#).

2.2.3. Public Debt and Trade Policy Relationships

[Qian & Steiner \(2017\)](#) demonstrated that higher international reserves lead to longer external debt maturities by flattening the yield curve. This was evidenced by empirical data from 66 emerging and developing countries, which showed that increased reserves raise the proportion of long-term debt, thereby enhancing financial stability. [Koh \(2017\)](#) found that fiscal multipliers are larger in advanced economies, particularly when public debt is low and financial development is high. Furthermore, the effectiveness of fiscal policy is contingent upon exchange rate responses and domestic monetary policy. [Neaime et al. \(2018\)](#) identified the 2010 Eurozone debt crisis as being rooted in Greece's balance of payment imbalances and competitiveness loss, which were further exacerbated by the country's inability to adjust nominally within the Eurozone. [Kim and Zhang \(2021\)](#) demonstrated that the relationship between debt and output is intricate. They found that debt decreases following positive output shocks in

developing countries and that output declines after debt shocks in both developed and developing nations. These effects are influenced by the debt sector and financing source, and they vary across different economic contexts. These studies collectively demonstrate the complex and context-specific effects of international reserves, fiscal policy, and debt dynamics on economic stability and growth. They emphasize the importance of considering the specific circumstances of different regions and time periods, including factors such as reserve levels, fiscal conditions, and structural imbalances, in understanding the diverse economic outcomes observed. [Klutse et al. \(2022\)](#) examined the destabilizing effect of a loss in domestic currency value on developing countries and the role of exchange rate interventions in preventing crises. The authors emphasize that conventional approaches relying on international reserves alone to explain exchange rate fluctuations may not fully account for exchange market pressure (EMP) in developing economies. The study introduces innovative methods utilizing ratios of foreign reserves to imports, short-term external debt, and broad money. These adjusted measures were found to be effective in identifying EMP in Sub-Saharan Africa. It is recommended that they be employed in combination for more comprehensive currency crisis risk assessment.

In their study, [Attiya et al. \(2021\)](#) examined the correlation between public debt and foreign reserves in Iraq over the period from 2003 to 2019. They placed particular emphasis on the economic implications of the country's dependence on fluctuating oil revenues. The study, which employed the ARDL model for cointegration, revealed that these variables significantly impact the model, with the Bound Test affirming the existence of a relationship, whether long-term or short-term. In contrast, [Ahmed et al. \(2021a\)](#) examined fiscal dominance from 2000 to 2017, discovering that advanced economies generally exhibit lower policy interest rates due to a declining natural interest rate. In contrast, emerging markets under non-inflation targeting regimes display stronger fiscal dominance, which is influenced by debt levels, exchange rate volatility, and commodity exposure. Meanwhile, [Soukiazis et al. \(2014\)](#) applied a model integrating both internal and external imbalances to Italy, finding that internal fiscal problems notably constrained growth and recommending strategies to improve

competitiveness and reduce financing costs. [Dat \(2020\)](#) investigated the influence of public debt on Vietnam's economy from 2010 to 2018. The findings indicated that elevated debt levels have a detrimental impact on GDP growth and exert a significant influence on exchange rates and trade balances. These insights offer valuable guidance for debt management strategies. Furthermore, [Galstyan and Velic \(2017\)](#) investigated the impact of elevated debt levels on real exchange rate misalignments. Their findings indicated that high debt environments are characterized by heightened volatility and diminished persistence, with nominal exchange rates and inflation differentials emerging as key determinants. In their 2020 analysis of Bosnia and Herzegovina's external debt from 2004 to 2017, [Huric and Hadziahmetovic \(2020\)](#) identified foreign trade deficits as a significant contributor to rising debt. They proposed a shift towards export-oriented production as a means of more effectively managing the country's debt. Lastly, [Campos and Cysne \(2021\)](#) examined the market discipline hypothesis and found that there is considerable variation in debt limits among emerging countries. Those that exceed these limits often encounter difficulties in securing new loans or requiring international assistance, thereby supporting the strong version of the hypothesis.

[Zestos et al. \(2023\)](#) employ a Nonlinear Autoregressive Distributed Lag (NARDL) model to investigate the nexus between public debt and economic growth in Germany. Furthermore, the current account is incorporated as an additional variable within the NARDL model. The findings indicated that while an increase in public debt has a detrimental effect on economic growth, a reduction in public debt has no significant impact. Conversely, an enhancement in the current account exerts a more pronounced influence on GDP growth than an increase in public debt. [Suryandaru \(2023\)](#) examined the influence of Indonesia's public debt and trade openness on economic growth through the application of both symmetrical (ARDL) and asymmetric models over the period 2010–2019. The results demonstrate that external debt has a negative impact on economic growth, whereas domestic debt has a positive effect on long-term growth. Furthermore, trade openness contributes to growth in the asymmetric model. [Coulibaly et al. \(2024\)](#) investigated the impact of foreign exchange reserves on public debt levels

in African economies, with a particular focus on their role as a buffer against the negative effects of exchange rate depreciation. The findings indicate that elevated foreign currency reserves serve to diminish the ratio of public debt to gross domestic product (GDP), particularly during periods of substantial currency depreciation. This effect is particularly pronounced in countries with floating exchange rates.

2.2.4 Public Debt, Fiscal Policy Rules and Economic Growth Linkages.

[Khémiri and Noubbigh \(2021\)](#) conducted an empirical analysis of the debt-growth relationship at the firm level in sub-Saharan Africa from 2004 to 2014. Their research focused on the combined effects of debt and financial liberalization on firm growth, as measured by sales. The study employed a system Generalized Method of Moments (GMM) estimator to ascertain the relationship between debt and firm growth. The findings revealed an inverted U-shaped relationship between the two variables, which shifted to a U-shaped relationship when capital account liberalization, implemented by regional regulatory authorities, was considered. The findings also emphasize the pivotal role of investment in firm growth, in accordance with both agency and trade-off theories. It is thus recommended that policymakers optimize financial decisions and adopt a gradual approach to financial liberalization in order to support the long-term sustainability of firms. Similarly, [Apergis and Cooray \(2015\)](#) analyzed the dynamics of Greek public debt using macroeconomic data from 1980 to 2008. They employed a three-stage least squares approach and a structural VAR methodology to forecast public debt trends up to 2020. The results indicated the necessity of a restrictive fiscal policy that combines increased government revenues with reduced expenditures in order to achieve debt sustainability. Furthermore, it was suggested that intensifying tax revenue policies could accelerate this process, thereby providing crucial guidance for the design of macroeconomic policies.

[Adarov \(2021\)](#) employed Bayesian and GMM panel VAR frameworks to examine the interrelationships between financial and macroeconomic imbalances across 24 countries from 1998 to 2012. The findings indicated that financial cycles exert a considerable influence on macroeconomic imbalances, with periods of expansion

leading to economic overheating and reductions in public debt-to-GDP ratios. Furthermore, the study revealed that financial misalignments gave rise to more pronounced business cycle responses in economies with a banking system, whereas these effects were less pronounced but more enduring in market-based economies, particularly in countries with elevated public debt. In conclusion, [Saat \(2020\)](#) investigated the challenge of mounting public debt in countries with budget deficits, with a particular focus on Turkey's experience over the past decade. Since 2002, Turkey has made notable advancements in the management of public debt risks through the implementation of fiscal discipline and effective debt management strategies. These initiatives have contributed to the restoration of market confidence, a reduction in risk perception, a decline in borrowing costs, and an extension of borrowing maturities, signifying a successful transition in the country's public debt management approach. [Bal and Rath \(2014\)](#) employed the autoregressive distributed lag (ARDL) model to examine India's economic growth from 1980 to 2011. The results of the error correction model (ECM) indicate that debt servicing, total factor productivity (TFP), and central government debt are related to economic growth in the short run, which is consistent with prior expectations. In light of the global financial crisis, the study recommends that the government give priority to intergenerational equity in fiscal management. A super multiplier model based on the work of the economist Paul A. Samuelson emphasizes autonomous demand as a significant driver of economic growth. However, it also highlights the importance of stable financial stocks in facilitating sustainable growth.

[Morlin \(2022\)](#) examined the stability of growth driven by government spending and exports, concluding that growth is stable when both public and external debts are controlled. The study put forth the implementation of a fiscal policy rule that oversees foreign debt. Simulation results indicate that the model's stability conditions are met, particularly in comparison to structural change policies in open economies that are exposed to foreign currency liabilities. [Gnangnon \(2021\)](#) examined the impact of tax reform on public debt instability in developing countries. The findings illustrate that more extensive tax reform can mitigate the volatility of public debt, particularly when

public revenue streams are robust, or economies are open to international trade. [Banerjee \(2024\)](#) employed proxy-VAR models to investigate the impact of inflationary oil supply and demand shocks on fiscal balance and public debt in seven oil-importing OECD countries and the Eurozone. The study revealed that fiscal balances are enhanced, and debt-to-GDP ratios are reduced following such shocks, indicating that policymakers possess greater fiscal space than is commonly assumed. This may potentially avert the implementation of overly contractionary macroeconomic policies. [Eminidou et al. \(2023\)](#) examined the relationship between public debt levels and fiscal policy shocks in fifteen-euro area economies between 2000 and 2019. The findings indicate that government spending shocks have a more pronounced positive impact on output and consumption in economies with high levels of debt, with cross-sectional debt variation exerting a more substantial influence than serial debt variation.

[Goedl and Zwick \(2018\)](#) employed a Markov chain model and Bayesian techniques to examine the long-term distribution of Austrian public debt. They incorporated data from other countries to investigate the relationship between this debt and key macroeconomic variables. The results of the analysis indicate that the historical fiscal policy of Austria has resulted in a stable debt-to-GDP ratio, with an expected value approaching the 60% threshold specified in the Maastricht Treaty. Furthermore, the observed increase in debt following the financial crisis should be regarded as a temporary deviation rather than a long-term concern. However, the maintenance of this stability is contingent upon the sustained implementation of fiscal measures designed to reduce the primary deficit in the context of rising debt. The model also assesses the impact of shocks to the primary deficit and GDP growth. Similarly, [Melina et al. \(2016\)](#) introduced the Debt, Investment, Growth, and Natural Resources (DIGNAR) model to address the complex fiscal decisions faced by resource-rich developing countries. The model emphasizes the need to balance public investment for growth with debt sustainability risks. The model demonstrates that a combination of delinked public investment and a resource fund can serve to mitigate macroeconomic instability. However, it is important to note that ambitious borrowing for investment can still pose significant risks, particularly in instances where there is a decline in investment

efficiency or a reduction in expected resource revenues. In a recent study, [Sun et al. \(2022\)](#) investigated the influence of China's economic policy uncertainty on external debt levels in countries participating in the Belt and Road Initiative. Their findings suggest that this uncertainty exerts intermediary effects. The study employs a Propensity Score Matching-Difference in Difference approach to demonstrate that the impact is more pronounced on private debt than on public debt in participating countries.

[Cavalcanti et al. \(2018\)](#) concentrated on the macroeconomic consequences of monetary policy shocks under fiscal rules designed to maintain public debt, utilizing a DSGE model tailored to the Brazilian economy. Their findings indicated that interest rate increases resulting from such shocks necessitate fiscal adjustments, with the impact on GDP varying contingent on the fiscal rule applied, particularly in instances where public investment cuts are employed, which tend to exacerbate economic outcomes. [Demirci et al. \(2019\)](#) empirically examined the influence of government debt on corporate financing decisions across 40 countries between 1990 and 2014. Their findings revealed a negative relationship between government debt and corporate leverage, particularly when debt is domestically financed, among larger and more profitable firms, and in nations with more developed equity markets. This suggests that government debt often crowds out corporate debt. [Ciaffi et al. \(2024\)](#) examined the impact of government expenditure, specifically consumption and investment, on output and debt sustainability in 14 OECD countries from 1981 to 2017. The results demonstrate that government spending multipliers exceed one, with investment multipliers outperforming consumption. Furthermore, the findings indicate that fiscal policy shocks, particularly those resulting from government investment, significantly reduce public debt-to-GDP ratios, making them the most effective means of ensuring debt sustainability.

[Abubakar et al. \(2024\)](#) examine the management of public debt in Sub-Saharan Africa, with a particular focus on the impact of fiscal rules and debt relief. Notwithstanding the beneficial impact of debt relief on debt sustainability, fiscal rules can have the

opposite effect. The study underscores that reducing public debt necessitates higher economic growth and enhanced government balances, which have considerable policy ramifications for developing countries' debt management. [Apeti et al. \(2024\)](#) examine the influence of fiscal frameworks, particularly fiscal rules, on the phenomenon of "original sin" in developing countries. The study, which analyses data from 59 countries between 1990 and 2020, reveals that robust fiscal rules have a significant impact on the reduction of foreign currency debt. The effectiveness of these policies is enhanced by fiscal discipline, financial development and strong institutions, which in turn is mediated by the credibility of fiscal and monetary policy. In light of empirical evidence from 51 developing countries, [Okombi & Mampieme \(2024\)](#) revisit the resource curse theory, finding that natural resource rents increase the procyclicality of public debt. The findings indicate that natural resource rents, particularly those derived from oil and minerals, amplify external public debt procyclicality to a greater extent than domestic debt. This effect is particularly pronounced in African countries, offering insight for resource-rich nations seeking countercyclical fiscal policy. Other studies that have evaluated debt and fiscal policy include: [Barbier-Gauchard et al. \(2023\)](#); [Mara & Maran \(2024\)](#); [Rathnayake \(2020\)](#); [Hory \(2023\)](#); [Barucci et al. \(2023\)](#); [Pfeiffer \(2021\)](#); [Elkhalfi et al. \(2024\)](#).

2.2.5. Public Debt, Governance and Institutional Relationships

[Tarek and Ahmed \(2017\)](#) examine the influence of governance on the accumulation of public debt in Arabian Gulf countries between 1996 and 2015. To assess governance quality, the researchers employed six Worldwide Governance Indicators (WGI). The authors employed a dynamic debt-to-GDP ratio model with panel fixed effects and GLS random effects to analyze the data. Their findings indicate that improvements in governance, as measured by voice and accountability, political stability, government effectiveness, regulatory quality, and rule of law, are associated with lower public debt ratios. However, the results suggest that control of corruption does not show a significant effect. This study offers valuable insights into the influence of institutional quality on public debt, particularly within the context of the Gulf Cooperation Council (GCC). In a related study, [Cooray et al. \(2017\)](#) examine the interactions between

corruption, the shadow economy, and public debt using data from 126 countries between 1996 and 2012. The results, derived from Ordinary Least Squares (OLS), Fixed Effects, System Generalized Method of Moments (GMM), and instrumental variable estimation, indicate that both corruption and a larger shadow economy increase public debt, with the shadow economy intensifying the impact of corruption. This highlights the necessity of addressing corruption in order to reduce public debt and mitigate the adverse effects of the shadow economy.

Furthermore, [Kourtellos et al. \(2013\)](#) employ a structural threshold regression approach to investigate the differential effects of public debt on economic growth across countries. Their findings indicate that high public debt has a detrimental impact on growth, particularly in low-democracy countries. These findings are in accordance with the tenets of new growth theories, which emphasize the pivotal role of economic fundamentals in shaping growth disparities. [Abbas et al. \(2021\)](#) employed data from 106 countries between 1996 and 2015 to empirically examine the relationship between public debt and national output. In this study, governance quality is employed as a mediator in the analysis. In order to address the issue of endogeneity, the study employed both fixed effects (LSDV) and system GMM techniques. The study revealed that public debt has a detrimental effect on economic growth, whereas governance serves to mitigate this impact. When governance levels exceed a certain threshold, public debt has a positive impact on growth; conversely, low governance levels exacerbate the negative effects of debt. This emphasizes the pivotal function of governance in mediating debt-growth dynamics. [Nguyen \(2022\)](#) examined the impact of public debt on private investment in developing countries, as well as its relationship with governance. The results, based on two-step generalized moments estimators applied to 98 countries (2002–2019), suggest that public debt crowds out private investment, while governance stimulates it, along with economic growth and trade openness.

[Apergis and Apergis \(2019\)](#) employed a regime-based approach and Panel Smooth Transition Regression (PSTR) methodology to investigate the non-linear relationship

between corruption and government debt across 120 countries from 1999 to 2015. The findings of the study indicate that an increase in public debt is more pronounced in instances where corruption levels are elevated. Furthermore, the growth of the shadow economy, government spending, inflation, and military expenditure have been identified as factors that contribute to an exacerbation of the debt-to-GDP ratio. The authors highlight the importance of addressing corruption, improving GDP per capita, enhancing school enrollment rates, and increasing tax revenues as key strategies for reducing public debt. Their approach offers a novel perspective on the non-linearity and regime-specific effects in this context. [Ramzan et al. \(2023\)](#) employed World Bank governance indicators to investigate the mediating role of institutional quality in the relationship between public debt and economic growth in Pakistan between 1996 and 2020. While public debt has a positive impact on economic growth in the short term, it has a detrimental effect in the long term. However, improved institutional quality can help to mitigate this effect. [Assoum and Alinsato \(2023\)](#) investigated the mediating role of governance in the relationship between public debt and per capita income in 39 Sub-Saharan African countries between 2002 and 2019. The findings indicate the existence of a non-linear relationship between public debt and income, whereby public debt exerts a positive influence on income at a threshold level of governance. Moreover, the study proffers recommendations for optimizing the debt-income relationship, emphasizing pivotal governance dimensions.

[Chowdhury et al. \(2024\)](#) employed panel data from 133 countries between 2002 and 2020 to investigate the impact of institutional quality on the relationship between sovereign debt and macroeconomic stability. While government debt has a deleterious effect on macroeconomic stability, the interaction between the two modifies the influence of debt. In particular, the study identifies a threshold effect, whereby debt exerts a negative influence on macroeconomic stability prior to reaching a specific level of institutional quality, but a positive influence afterwards. This underscores the pivotal role of robust institutions in effectively managing debt. [Cooray and Özmen \(2024\)](#) employed logistic quantile regression (LQR) and a recentered influence function (RIF) to investigate the impact of institutional quality on government debt in

54 EU and non-EU countries between 2010 and 2022. The authors conclude that regulatory quality, government effectiveness, voice and accountability exert a similar influence on debt in EU and non-EU countries, whereas political stability and control of corruption reduce debt exclusively in EU countries.

[Acharya et al. \(2024\)](#) examine the influence of a government's capacity to borrow externally on economic growth and consumption in a context characterized by self-interest and short-sightedness. The findings revealed that government myopia could, contrary to expectations, lead to an increase in government borrowing, thereby extending the government's planning horizon and boosting private savings. Consequently, countries with high savings rates reduce taxes and experience a "growth boost," leading to increased household consumption in the long term. Conversely, countries with low savings rates may increase their debt capacity through aggressive tax policies but ultimately end up in a "growth trap" that depresses household consumption over time. [Qayyum et al. \(2014\)](#) investigated the impact of foreign aid, external debt and governance on economic growth within an open economy framework, utilizing the Ramsey-Cass-Koopman growth model. The findings indicate that foreign aid and good governance act as catalysts for growth, whereas external debt has a detrimental impact on the economy. Similarly, foreign aid contributes to savings, but does not directly impact investments, and both savings and investments remain independent of external debt. [Betz and Pond \(2023\)](#) investigated the manner in which democratic institutions impact financial market regulation, with a particular focus on government policies designed to enhance the position of their debt in financial markets, referred to as "borrowing privileges." In democratic countries, such policies are more likely to be implemented, which frequently entails banks and institutional investors holding government debt. This is due to the fact that the liberalization of trade has led to an increase in revenue requirements, political competition, transparency and growth in the financial markets. This study contributes to a more nuanced understanding of the ways in which democratic institutions promote financial market growth, demonstrating how they can achieve a balance between revenue objectives and financial market growth.

As posited by [Freytag and Pehnelt \(2009\)](#), the decision of countries to forgive debt in the 1990s was not influenced by the quality of governance. The debt relief Programme displayed a pronounced tendency to persist in a similar manner, with countries that were forgiven at an early stage of the decade exhibiting a heightened probability of receiving further forgiveness at a later point in time. By the early 2000s, however, there was a discernible influence of government quality on the decisions of donor countries with regard to debt forgiveness. [Wang et al. \(2021\)](#) employed panel regression data from low- and middle-income countries between 1970 and 2018 to investigate the relationship between external borrowing and macroeconomic fragility. The results demonstrate that increases in external debt, particularly public debt, consistently predict growth slowdowns in the short and medium term. Furthermore, the evidence suggests that higher borrowing costs can be mitigated by better institutional quality, which reduces the negative impact of external debt on economic growth. The available evidence increasingly suggests that debt has an adverse effect on economic growth above a certain level, although the precise threshold varies considerably between studies.

In a study based on an unbalanced panel of 152 countries from 1996 to 2016, [Butkus & Seputiene \(2018\)](#) examined the potential impact of government effectiveness and trade balance on the debt threshold. The results indicated the existence of an inverted U-shaped relationship between debt and growth, whereby government effectiveness determines the point at which debt reaches its maximum, but trade balance plays a more significant role than institutional quality alone in determining this threshold. Other studies that evaluate public debt, governance and institutional frameworks include those by [Johnston et al. \(2014\)](#); [Briceño & Perote \(2020\)](#); [Munir & Mehmood \(2018\)](#) and [Appiah-Kubi et al. \(2022\)](#). In a study employing a dynamic panel threshold approach, [Law et al. \(2021\)](#) investigated the threshold value of public debt relative to GDP in 71 developing countries over the period 1984 to 2015. The threshold value was found to be 51.65%, which is lower than the previously reported figure. The findings indicate that public debt has a detrimental impact on economic growth at elevated

levels of debt but is inconsequential at lower levels. Improved institutional quality serves to mitigate this effect.

Foreign Public Debt as a Percentage of GDP Selected Sub-Saharan African Countries

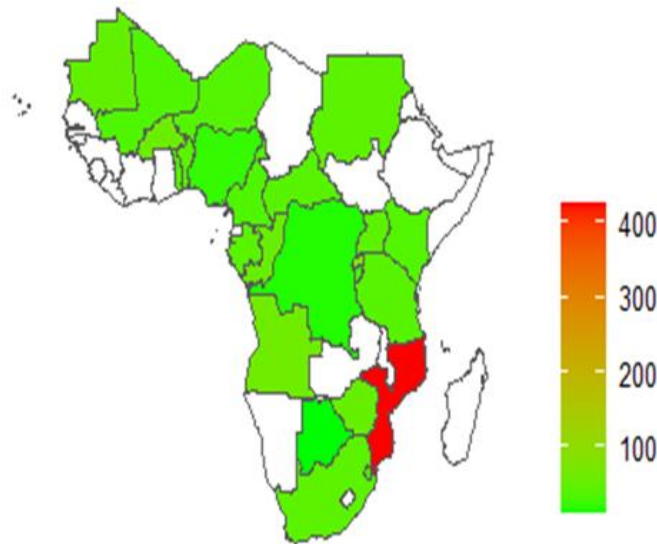


Figure 2: Foreign Public Debt as a Percentage of GDP (2022)

Source: Author Generated, 2024

2.2.6. Spatial Dimensions of Foreign Capital Flows and Regional Economic Growth

The study undertook an evaluation of existing literature that had applied panel data and spatial econometrics in the investigation of foreign public debt, foreign direct investment, and regional economic growth dynamics. A number of scholars have sought to examine the nexus between foreign direct investment and economic growth dynamics from a spatial econometrics perspective. However, there is a paucity of studies that investigate the spatial spillover effect of foreign public debt and economic growth dynamics from a spatial perspective. [Daud and Podivinsky \(2011\)](#) investigated the impact of external debt on economic growth across 31 developing countries, employing spatial econometrics to capture cross-country effects. Their findings revealed a negative relationship between external debt and growth in regions such as

East Asia, Latin America, and Sub-Saharan Africa. Additionally, they identified significant spillover growth effects among neighboring countries. [Claeys et al. \(2012\)](#) employed spatial modeling techniques to investigate the impact of public debt on long-term interest rates. Their findings revealed that, while the crowding-out effect on domestic rates is relatively limited, financial integration among OECD and EU countries enhances spillover effects, whereas emerging markets experience more pronounced crowding-out effects. [Baldacci et al. \(2011\)](#) expanded the investigation of spillovers in sovereign bond markets to encompass 24 emerging economies. Their findings revealed substantial spillovers from sovereign spreads and macroeconomic fundamentals among neighboring markets, underscoring the necessity of considering intra-emerging market spillovers. [Dell'Erba et al. \(2013\)](#) conducted an analysis of the impact of structural funds on regional convergence in 145 European regions. Their findings indicated that, while convergence does occur, structural funds do not exert a significant influence on this process and fail to generate spillovers to neighboring regions. This suggests a need to reassess regional policy strategies.

[Debarsy et al. \(2016\)](#) introduced a framework for creating convex combinations of various dependence structures within spatial econometric models. The effectiveness of this approach was then assessed through Monte Carlo simulations. The approach was subsequently applied to CEO salaries in Texas, incorporating both spatial and peer group weights. [Perović \(2018\)](#) investigated the impact of public debt, deficits, and government bond yields in Central and Eastern Europe. The findings indicated that both public debt and deficits exert a considerable influence on long-term interest rates, with deficits contributing notably to spillover effects. [Bao-Shun \(2013\)](#) conducted an analysis of the spatial spillover effects of public expenditure on regional growth in the Wuhan city circle, identifying both positive and negative impacts based on the type of expenditure in question. [Fossen \(2014\)](#) examined the spatial interdependence of public debt across German municipalities, identifying notable interaction effects whereby municipalities adjust their debt in response to the fiscal behavior of neighboring areas. [Liu and Yu \(2022\)](#) conducted a review of recent advancements in the domain of spatial panel data models, presenting a conceptual framework designed to address issues of

cross-sectional dependence and state dependence. The use of this framework was demonstrated through a series of empirical applications. [Simionescu and Cifuentes-Faura \(2023\)](#) investigated the convergence or divergence in debt per capita among Mexico's 32 states, uncovering robust spatial correlations and indications of divergence. Their findings suggest that poverty plays a pivotal role in this phenomenon and that foreign direct investment, while potentially beneficial in the short term, may not be a sufficient long-term strategy for debt reduction.

2.2.7 Public Debt and Macroeconomic Shocks Transmission

The impact of fiscal policy on broader macroeconomic conditions has been evaluated in a range of academic studies, with some advocating the use of vector autoregression (VAR) models ([Blanchard & Perotti, 2002](#); [Mountford & Uhlig, 2009](#); [Caldara & Kamps, 2008](#); [Perotti, 2005](#)). Other studies have sought to enhance the VAR framework in order to facilitate the capture of state-dependent effects. [Baum and Koester \(2011\)](#) examine the influence of fiscal policy shocks on GDP by analyzing quarterly German data from 1976 to 2009 using an enhanced SVAR model. The linear benchmark SVAR indicates that an increase in government spending has a short-term fiscal multiplier of approximately 0.70, while an increase in taxes and social security contributions yields a multiplier of -0.66. The threshold SVAR model employed in the study demonstrates that fiscal spending multipliers are markedly higher during periods of negative output gaps, but negligible during positive output gaps. In contrast, discretionary revenue policies have been demonstrated to exert a relatively limited influence. These findings indicate that the efficacy of fiscal policies is subject to variation in accordance with the prevailing business cycle, thereby underscoring the necessity for the implementation of an optimal fiscal policy mix that is tailored to the specific characteristics of different economic conditions. [Mirdala and Kamenik \(2017\)](#) employed a threshold vector autoregression (TVAR) model to examine the influence of fiscal policy shocks on real output in the Slovak Republic, the Czech Republic, and Hungary. The study finds that fiscal multipliers and the responsiveness of real output to spending shocks are, in general, higher than those to revenue shocks. Moreover, the magnitude of these effects varies considerably between periods of economic expansion and recession. The

findings demonstrate that the fiscal policy responses to crises diverge from those employed in periods preceding such crises. This emphasizes the importance of adopting customized fiscal strategies that are aligned with the specific economic cycle under consideration.

Foreign Debt Service as a Percentage of GDP Selected Sub-Saharan African Countries

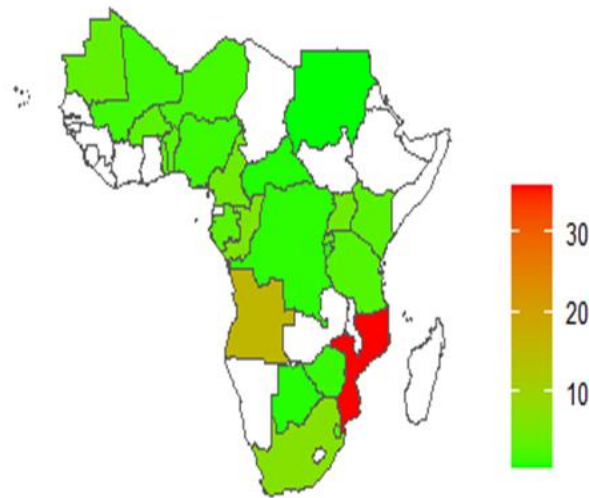


Figure 3: Foreign Debt Service as a Percentage of GDP(2022)

Source: Author Generated, 2024

[Hurić-Bjelan–Hadžiahmetović \(2020\)](#) examined the surge in external debt in Bosnia and Herzegovina (BiH) against the backdrop of the 2009 global economic crisis, which precipitated a notable increase in the country's borrowing requirements. The study, which covered the period 2004 to 2017, employed a Vector Autoregression (VAR) model to identify the principal factors influencing Bosnia and Herzegovina's external debt. The analysis demonstrated that trade deficits were the primary drivers of external debt, while fluctuations in EURIBOR interest rates had a minimal effect. In light of these findings, the research proposes that BiH's macroeconomic policy should prioritize the reduction of trade deficits and the promotion of export-oriented production as key strategies for effectively managing external debt in the long term. Similarly, [Onafowora and Owoye \(2019\)](#) examined the dynamic impacts of external public debt on Nigeria's economy from 1970 to 2014 using a structural vector

autoregression (SVAR) model that included a debt variable. The findings indicated that external debt shocks exert long-term negative effects on economic growth and investment, in accordance with the debt overhang hypothesis. However, the results also indicated that there were short-term positive effects on inflation and negative impacts on trade openness, with minimal influence on the exchange rate. In order to achieve sustainable economic growth and to effectively manage external debt, the study suggests that Nigeria must significantly reduce its debt, increase domestic savings and investment, and allocate borrowed funds towards infrastructure projects that stimulate economic activity without fueling inflation. In a similar vein, [Qureshi and Liaqat \(2020\)](#) employed a panel vector autoregression (PVAR) model to assess the impact of external debt on economic growth across 123 countries from 1990 to 2015. The findings indicated that, while total external debt has a generally adverse effect on growth, it is positively correlated with income growth in lower- and upper-middle-income countries. It is worth noting that their analysis demonstrated that public external debt consistently impedes growth, whereas private external debt has no significant impact. Moreover, the findings indicated that savings and investment represent crucial channels through which external debt exerts an influence on growth. These conclusions were found to be consistent across a range of model specifications and controls.

[Choi and Son \(2016\)](#) employed a time-varying parameter structural vector autoregression (TVP-SVAR) approach to investigate the impact of expansionary government spending shocks on GDP growth in Korea since the 1980s. The findings suggest that, although discretionary government spending has exerted a favourable influence on economic growth in Korea, the magnitude of this impact has diminished over time. Furthermore, cointegrating regression analysis indicates that the government spending multiplier is positively correlated with public investment in infrastructure and household debt levels, while showing a modest negative relationship with trade openness and public debt. Similarly, [Szymańska \(2019\)](#) examined the effects of government spending shocks in the Czech Republic, Hungary, and Poland using structural vector autoregression (SVAR) models, following the identification scheme

of [Blanchard and Perotti \(2002\)](#). The study demonstrated that government spending shocks typically result in an increase in output in the short term, with the peak output response occurring after a delay. However, the peak spending multiplier exhibited considerable variation across countries, with values ranging from 0.2 in the Czech Republic to over 1 in Poland. In all cases, the cumulative impact on GDP was greater than 1. In a related study, [Afonso and Leal \(2019\)](#) employed SVAR to evaluate fiscal multipliers for various components of government fiscal policy across Eurozone countries from 2000 to 2016. The analysis concentrated on the influence of these multipliers on public debt levels, economic growth rates and output gaps. The analysis demonstrates that government spending has a positive effect on output, with an annual multiplier of 0.44. Conversely, the multipliers for income, wealth, and production taxes are negative, at -0.11 and -0.55, respectively. Moreover, the spending multiplier is more efficient in countries with lower public debt, during periods of economic downturn, and in economies with negative output gaps. Conversely, tax shocks have been observed to exert a negative effect in highly indebted countries and those with positive output gaps.

2.3. Theoretical and Empirical Literature Review of Foreign Direct Investment

2.3.1. Introduction to Foreign Direct Investment Theoretical Review

The rise of globalization has resulted in greater interdependence within the global economy. This is attributed to various policies and initiatives that have been implemented in trade, technology, and investment. The removal of regulatory barriers has allowed global firms to expand their operations into new markets and lower their transaction costs. In many cases outward FDI has been used by firms to build trade and support infrastructure in other nations to increase their competitiveness ([Pradhan 2005](#)). In theory, foreign direct investment (FDI) boosts human capital and technology spillovers, which can increase productivity, economic growth and employment in developing countries ([Kang & Lee, 2011](#); [Ozturk, 2007](#)). The literature extensively supports this theory, which encourages developing economies to liberalize their markets and implement FDI promotion policies. [Mamingi & Martin, 2018](#); [Iamsiraroj,](#)

2016; Gherghina et al., 2019 demonstrate that the goal of these efforts is to attract FDI and to harness its benefits. Therefore, attracting foreign direct investment is a strategy for economic growth in many developing nations. In addition to technical knowledge, FDI spillovers include insights into key business functions such as manufacturing, marketing, sales, and commercialization. Furthermore, foreign firms improve local businesses by encouraging high-quality production and manufacturing practices and improving organizational routines through "demonstration effects." As a result, local firms become more capable and efficient. (Von Zedtwitz et al., 2014).

The conventional Foreign Direct Investment (FDI) theory highlighted the importance of the investing firms' ownership-specific competitive advantages, such as technological expertise, managerial skills, and reputation, which they could leverage in foreign markets. According to the internalization theory of Foreign Direct Investment (FDI), firms extend their operations to foreign locations to lower cross-border costs. This is driven by efficiency seekers aiming to minimize transaction expenses (Buckley et al 1976). Transaction costs are considered in the OLI theory by John Dunning, suggesting that foreign direct investment occurs when firms realize the advantages of their ownership-specific competitive advantages (Dunning 1981b). Foreign direct investment can be explained both by new trade theories as well as by institutional approaches. According to the former, FDI is influenced by factors like barriers to entry, factor endowments, market size and transport costs. The latter focuses on fiscal, financial and other economic incentives as tools for attracting foreign investment, emphasizing the importance of multinational enterprises and host governments (Faeth, 2009). Additionally, Dunning and Lundan (2008) argue that institutions are crucial factors affecting FDI decision-making in a specific location, directly affecting transaction costs. In addition, institutions provide the framework for social exchanges, which affects the behaviour and experience of those involved.

The study by Helpman (1984) and Markusen (1984) led to the formal development of Multinational Enterprise (MNE) theory. Krugman (1983) and Markusen (1984) introduced the first theoretical frameworks for horizontal FDI. In his general

equilibrium model, [Markusen \(1984\)](#) argues that MNEs emerge in part due to “a market-access motive”, rather than exports - a concept he calls "horizontal" foreign direct investment. According to [Helpman \(1984\)](#), MNEs are formed as a result of "vertical" foreign direct investment that seeks to acquire cheaper inputs overseas. In both cases, multinational enterprises are conceptualized within a dual-country framework and have been the subject of extensive theoretical research. Theories of FDI have evolved beyond a dual-country assumptions, resulting in new motivations. [Bergstrand and Egger \(2004\)](#) and [Yeaple \(2003\)](#) analyzed models of export-platform FDI, where a parent country invests in a host country with the idea of exporting a host country's final goods to third countries. In addition, an MNE can establish a production chain across many countries to capitalize on the comparative advantages of different locations. Moreover, based on the "preferred firm location" hypothesis, [Krugman \(1992\)](#) developed a micro-foundation for agglomeration economies. This approach builds on [Harris's \(1954\)](#) definition of the accessible market index, which is estimated as "the product of the weighted sum of purchasing powers at all locations and the inverse-distance weighted sum of incomes". The concept of agglomeration economies and determining factors affecting FDI has been widely adopted since then ([Head and Mayer, 2004](#); [Cielik and Ryan, 2004](#)). The interplay of agglomeration effects and FDI policy decisions within new economic geography frameworks has been shown in studies by [Baldwin and Okubo \(2006\)](#), [Brakman et al. \(2009\)](#), [Hoffmann and Markusen \(2008\)](#). Nevertheless, these studies often ignored geographical and spatial interdependencies.

2.3.2 Spatial Analysis of Foreign Direct Investment from Theory to Empirics

Technology and knowledge diffusion processes are important in endogenous growth theories postulated by [Lucas \(1988\)](#) and [Romer \(1986\)](#). The growth model utilized in this study draws upon the work of [De Mello \(1997\)](#) and incorporates various factors to assess their impact on real GDP growth. [Solow \(1956\)](#) proposed early growth models emphasizing the importance of Foreign Direct Investment (FDI) as a catalyst for stimulating investment. By incorporating FDI into the Cobb-Douglas production function, the analysis accounts for the potential external effects it may have on

economic growth. Macroeconomic research provides details on how FDI affects economic growth in numerous ways. Research by [Borensztein et al. \(1998\)](#) for instance, shows that FDI can benefit countries with well-developed human capital stocks. To realize FDI's potential growth effects, [Balasubramanyam et al. \(1996\)](#) highlights the significance of trade openness. Furthermore, growth is influenced by factors such as a conducive business climate and foreign firms' integration into the domestic markets ([Xu, 2000](#)). In the context of regional industrial development, foreign direct investment can facilitate a transition from labor-intensive sectors to capital- and technology-intensive ones ([Kugler & Rapaport, 2007](#)). Furthermore, investing in infrastructure and converting savings into new investments is necessary to attract foreign capital, which expedites capital formation by improving the development environment. As a result of its advanced technology and preferential policies, foreign direct investment may crowd out domestic capital, reducing investment rates and negatively impacting the industrial structure ([Aitken & Harrison, 1999](#); [Fosfuri & Motta, 1999](#)). [Boğa \(2019\)](#) argue that inward FDI can boost international trade, expand job opportunities and deepen capital markets while enhancing labor expertise.

Following the research of [Akinlo \(2004\)](#); [Ramirez \(2000\)](#); [Bosworth and Collins \(1999\)](#); and [De Mello \(1997\)](#), the study incorporates FDI as an exogenously determined variable within the production function. In this method, FDI can be assessed on a global level in terms of its spatial spillover effect on regional growth dynamics. In this study, *fdi*, *fpd*, *hcd*, *gfcf*, *pop*, *hdi* and *trade* are used as inputs into a Cobb-Douglas production function and controlled by governance and institutional factors. In this functional form, we can examine spillover effects of these factors on regional economic growth.

$$Y_t = A_f\{(\gamma L), K_p, \omega\} = A_f(H^Z) = A_t(\gamma L)^\alpha K_p^\beta, \omega^{1-\alpha-\beta} \quad \alpha + \beta < 1$$

Where Y_t is the real output, A_f production efficiency, K_p domestic capital, L labour input, γ human capital level, α private capital share, β labour share, ω FDI derived externality.

$$\omega = \{(\gamma L)K_p, K_f^\delta\}^\tau \quad \delta > 0, \tau > 0$$

$$Y_t = A_f\{(\gamma L), K_p, \omega\} = A_f(H^Z) = A_t(\gamma L)^\alpha K_p^\beta, (\{(\gamma L)K_p, K_f^\delta\}^\tau)^{1-\alpha-\beta}$$

Hence, we assume that technologies in domestic economies are diffused through foreign direct investment, resulting in the relationships below, following [Kinoshita and Lu \(2006\)](#) and [Hsu and Wu \(2006\)](#):

$$A_{t+1} = A_t + (A_t^*(\gamma) - A_t)\theta(k_t)\varphi(M_t)$$

Where $(A_t^*(\gamma))$ is the technology diffusion process; $A_t^*(\gamma) - A_t$ technological advancement derived from FDI; $k_t = K_t/L_t$ capital to labour ratio; $\theta(k_t)$ foreign capital FDI included with $\theta'(*) > 0, \theta''(*) < 0$ implying existence of capital as a necessary condition for technology spillover; $\varphi(M_t)$ denotes domestic financial sector deepening. In addition, domestic interest rates and financial repressions can be included in the output equation as follows:

$$y_t = \frac{Y_t}{L_t} = A_t^{\frac{2-\beta}{1-\beta}} \left[\frac{\beta(1-\theta)}{1+r} \right]^{\frac{1}{1-\beta}}$$

The following is a rough representation of the rate of increase in output per capita G^t .

$$G^t \cong \left\{ \frac{2-\beta}{1-\beta} \right\} \ln \left\{ 1 + \frac{1}{A_{t-1}} (A_{t-1}^*(\gamma) - A_{t-1}) \theta \left[\frac{A_{t-1}^\beta \left(1 - \frac{1}{1-fpd} \right)}{1+r} \right]^{\frac{1}{1-\beta}} \varphi(M_{t-1}) \right\}$$

It is assumed that FDI inflows facilitate regional economic growth by providing technological diffusion and spillover effect; foreign public debt fpd influences economic growth G_t , indicating that the economy is indebted to other countries. The spatial impact of foreign direct investment has been examined in several studies using geographic data. [Madariaga and Poncet \(2007\)](#) show that local and neighboring

foreign direct investments both drive economic growth in Chinese cities. A further study by [Tanaka and Hashiguchi \(2015\)](#) and [Monastiriotis and Jordaan \(2010\)](#) found that FDI presence boosted regional and local productivity spillovers in Greece.

[Aghion and Howitt \(1998\)](#), [Lucas \(1988\)](#), [Barro \(2001\)](#) assert that FDI and international trade are primarily responsible for integrating technology into an economy and driving economic growth. Nonetheless, [Forte and Moura \(2013\)](#) argue that foreign direct investment plays little role in determining production levels in countries with low human capital and limited ability to absorb technology. A study by [Anwar and Nguyen \(2010\)](#) suggests that FDI can lead to stronger economic growth if additional resources are allocated to financial sector deepening programs, education and training, while minimizing the technological gap between local and foreign companies. Encouraging strong regional ties can lead to positive spillover effects that benefit not only the host region but also neighboring countries, ultimately contributing to overall regional economic growth ([Abreu et al., 2005](#)). [Goodchild \(1992\)](#) argues that spatial dependence results in economic agents interacting with each other, which leads to nearby locations exhibiting similar characteristics and affecting each other. There has been a growing trend among multinational corporations (MNCs) to decentralize their operations overseas ([Dunning and Lundan, 2008](#)). Their advanced knowledge of technological processes often makes them competitive in foreign markets, thereby counteracting internationally operating disadvantages ([Hymer, 1970, 1976](#)). The transfer of this expertise to local firms can be termed a technological spillover. These spillovers are caused by local firms taking advantage of MNC affiliates' process technology or markets or advanced knowledge of product, without incurring costs that negate the benefit. There are several empirical papers that investigate the spatial spillover effects of FDI on regional economic growth.

2.3.3. Foreign Direct Investment and Geographical Proximity of Countries

Firms agglomerate in certain regions to maximize profits and minimize transaction costs. The Marshallian externalities results from concentrating production in one area, that offer firms advantages such as knowledge spillovers, proximity to specialized

inputs, and access to a pooled skilled labor market. The firms located in that region benefit from this concentration by increasing their overall productivity and efficiency. The externalities caused by FDI penetration have long been a focus for policymakers and economists (Hale & Long, 2011; Xu & Sheng, 2012; Abraham, Konings, & Slootmaekers, 2010; Damijan et al., 2014). Furthermore, Ellison et al.(2010) demonstrates the tendency for industries using similar types of workers to cluster together. Benos et al.(2015) investigated the impact of proximity on regional growth within a multi-dimensional framework, focusing on seven EU countries from 1990 to 2005. The analysis reveals that spillovers significantly influence regional growth across various proximity measures. Consequently, regions located near dynamic entities tend to experience faster growth than those that are not. Capello et al. (2011) extend Casi and Resmini (2010) conventional FDI factors by incorporating spatial heterogeneity. The study concludes that FDI location decisions are strongly influenced by human capital, agglomeration and market access, although labor costs are non-significant. It is evident from both studies that the ability of a region to attract FDI varies considerably according to its sector. In addition, they identify low-tech manufacturing and service sectors as being particularly affected by location externalities.

Similarly, Villaverde and Maza (2015) analyzed inward foreign direct investment in European NUTS-2 regions by estimating a spatial lag model, which emphasizes the positive spatial dependence as a factor explaining inward foreign direct investment. The study results suggested that foreign direct investment location patterns are strongly influenced by technology, characteristics of the economy, labor market, and competitiveness. On the other hand, the study revealed that factors such as the size of the market and labor regulation are insignificant in explaining FDI location. Hong Hiep et al. (2023) used spatial econometric models to analyze the effects of foreign direct investments (FDI) and regional spatial factors on economic growth across 63 Vietnamese provinces over the period 2007-2018. Based on the findings, FDI has a limited direct and indirect impact on local economic growth, while spatial analysis

indicates significant interprovincial connections, the positive influence of neighboring provinces' capital, and competitive dynamics.

[Blanc-Brude et al. \(2014\)](#) estimate the number of spatial panel regression models (SEM-SAR, SEM and SAR, with serial correlation) using FDI inflows to Chinese prefecture cities from 2004 to 2007. According to the findings, foreign investors' attraction to a specific location is influenced not only by its locational attributes but also by its proximity to alternative locations for FDI. In their study of the relative impact of foreign direct investment on economic growth, [Blanco and Rogers \(2014\)](#) found that FDI from tax haven countries generated positive spillovers into neighboring developing countries, but not into neighboring developed ones. This study emphasized on financial globalization literature in developing, emerging, and developed economies. Specifically, the study evaluated literature that applied spatial econometrics methodology in examining regional economic growth dynamics. [Lin and Kwan \(2016\)](#) investigated the geographical extent and spatial diffusion of FDI technology spillovers. A spatiotemporal autoregressive panel model is used to disentangle direct and indirect effects of FDI across regions. The spatial partitioning of summary measures identifies and quantifies the spillovers of FDI across various geographical channels. China's empirical evidence suggests that while direct FDI generally affects locations negatively, nearby domestic firms reap the benefits of knowledge spillovers, despite widespread negative effects on market share.

[Wang and Kafouros \(2020\)](#) examined the effects of intra and interregional FDI spillovers on the performance of Chinese indigenous business groups, considering their geographic dispersion and affiliate roles. The results indicate that geographic dispersion affects FDI spillover benefits significantly, with affiliates focused on marketing and sales leveraging these benefits most effectively. [Alamá-Sabater \(2016\)](#) analyzed 2007 bilateral FDI flows between the 27 EU member countries and found that similar public debt levels and geographical proximity contribute to cross-country FDI correlations. Specifically, FDI interdependence is strongly influenced by the 60%

public debt-to-GDP threshold set by the Maastricht Treaty, with investors varying between countries according to this standard.

2.3.4. Foreign Direct Investment and Economic Productivity of Regions

[Wen \(2014\)](#) investigated the effects of foreign direct investment (FDI) spillovers and their impact on urban productivity within the Pearl River Delta and Yangtze River Delta regions in China, utilizing a dynamic panel data spatial Durbin model. The findings indicate that foreign direct investment positively influences local cities' productivity. Using spatial econometric methods, [Gutiérrez-Portilla et al. \(2019\)](#) demonstrate how FDI inflows affect regional economic growth in Spanish regions. The study examined how foreign direct investment (FDI) has impacted regional economic growth in Spanish regions from 1996 to 2013, with a particular focus on the "headquarters effect" that can obscure regional FDI spillovers. The findings indicate that FDI promotes economic growth, although spatial spillovers can only be observed when the headquarters effect is considered. Using panel data from 1991 to 2007, [Ma and Jia \(2015\)](#) analyze the effect of FDI on income convergence among Chinese provinces. The study suggests that China's conditional convergence has been substantially driven by FDI inflows throughout the 1990s. Moreover, conventional non-spatial models underestimate both the rate of convergence and the impact of FDI on regional economic growth. [Vujanović et al. \(2021\)](#) examined the impact of FDI spillovers on productivity during the global financial crisis (2006-2014) and the credit shortage that followed. The study revealed that when firms are struggling to access external funding, they are unable to learn from spillovers due to the crisis. The result of this study offers valuable insight for policymakers dealing with economic repercussions of the COVID-19 pandemic. By outlining the importance of financial access during crises, this research extends FDI effects beyond economic crisis periods.

Using Chinese firm-level data from 2004, [Tanaka and Hashiguchi \(2015\)](#) examined spatial externalities of FDI. Although endogeneity issues are addressed, FDI still positively impacts regional productivity of local firms within the same counties and

industries. By using a SAR model, the study showed that local spillovers impact multiple industries through interfirm interactions. Local firms in more remote areas are less likely to benefit from these spatial multiplier effects due to the diminished influence of these spatial multiplier effects with distance. In addition to introducing advanced technology and enhancing competitiveness, FDI also provides a demonstration effect on local firms, motivating them to pursue technological advancements. This promotes the adoption of superior practices by local firms, leading to an upgrade in industrial structures and greater productivity ([Spencer, 2008](#)).

[Mamingi and Martin \(2018\)](#) examined FDI's impact on economic growth from 1988 to 2013 across 34 countries. The researchers found that FDIs have a positive but modest direct effect on economic growth, while their indirect effects are both positive and statistically significant. In addition, the study confirms the importance of infrastructure development, identifying a positive interaction between FDI and infrastructure. Consequently, FDI can be fully leveraged with substantial domestic infrastructure investments. [Mitze and Özyurt \(2014\)](#) examine the relationship between foreign direct investment and trade openness for Chinese provinces. The dynamic error correction model is enhanced by incorporating spatial effects. According to the results, both trade openness and inward FDI, along with domestic factors like infrastructure use and investment intensity, directly affect labor productivity. In addition, regions situated in favorable locations, with strong global economic links and infrastructure, show significant indirect effects on productivity. They have higher productivity rates and levels than regions farther away from high-productivity regions.

[Tao et al. \(2024\)](#) found that FDI shapes regional industrial structure through competition and capital input supply, while industrial structure, in turn, influences FDI flows via market demand and policy. The analysis, based on empirical data from China Pearl River Delta, demonstrates that industrial rationalization and upgrading attract FDI. This further strengthens and enhances these structures, fostering spatial economic growth. The study highlights key factors influencing both FDI inflows and industrial upgrading, such as market size, infrastructure, and research and development levels.

Additionally, it underscores the spatial spillovers among urban areas within the Pearl River Delta, offering relevant insights into regional development strategies in China. Moreover, Globalization of the economy have led to industry linkages that involve foreign firms using advanced technology and management expertise to gain competitive advantage. By creating both forward and backward linkages, foreign firms contribute to the advancement of technology within local companies in the host region (Pineli & Naruli, 2023; Fortanier et al., 2020; Kano et al., 2020; Narula & Pineli, 2019;). Gutiérrez-Portilla et al(2019) examined how inward FDI affected the economic growth of Spanish regions from 1996 to 2013, focusing on the "headquarters effect," where investments are recorded in the region of the firm's headquarters rather than where they are made. Spatial Durbin Models are used to demonstrate that FDI promotes economic growth and that spatial spillovers only arise when headquarters effects are appropriately accounted for, emphasizing its importance for FDI policy formulation.

2.3.5. Foreign Direct Investment, Social Institutions and Economic Indicators

Ascani et al. (2016) advocated for the role of FDI as an integration engine in neighboring countries in the European regional context. The study examined how host countries' economic institutions affect multinational enterprises (MNEs) choice of location. According to the study, foreign direct investment typically favors countries with robust national institutions. However, MNEs display different preferences based on their industries and business functions. Moreover, in their study of outward foreign direct investment into 20 European countries between 1999 and 2008, Regelink and Elhorst (2015) A variety of methodological issues related to spatial econometrics are addressed in this study, that have not been fully explored in existing empirical literature on FDI and third-country effects. Findings support the existence of a competitive environment among European countries to attract American companies. The results align with both pure vertical FDI motivations and export-platform.

[Bhujabal et al. \(2024\)](#) investigated the influence of institutional quality on FDI inflows in South Asian and Southeast Asian countries from 2002 to 2019. They created an institutional quality index using Principal Component Analysis (PCA) for six governance indicators and applied Iterated Generalized Least Squares (I-GLS) for estimation. The study found that higher institutional quality indices significantly affect FDI inflows in both regions. Therefore, countries with a quality legal system, a voice and accountability system, a violence-free environment, low corruption, and a strong regulatory framework attract more FDI, boosting international trade, financial sector development, and economic growth. Moreover, [Mbaku \(2010\)](#); [Teixeira & Guimaraes \(2015\)](#) suggested that enhancing governance structures and corruption control in Sub-Saharan Africa can significantly boost FDI inflows. Other studies observe that FDI flow into countries with weak institutions ([Egger & Winner, 2006](#); [Cuervo-Cazurra, 2006](#); [Habib & Zurawicki, 2002](#)). The importance of institutions in determining FDI inflows have been further recognized by ([Hoskisson et al., 2013](#); [Tihanyi, Devinney & Pedersen, 2012](#); [Hoorn & Maseland, 2016](#)). Additionally, an effective institutional framework can outweigh the benefits of relatively large markets and abundant natural resources in many cases. There is a higher likelihood of foreign direct investment growing in countries with minimal corruption and a strong rule of law ([Asiedu, 2006](#)). According to [Asiedu and Lien \(2011\)](#) foreign direct investment is positively correlated with democracy in countries where natural resources make up a small percentage of exports. The correlation, however, becomes negative when primary commodities are the main exports. [Rodríguez-Pose \(2013\)](#) suggests that a country's ability to attract foreign direct investment will be positively impacted by higher-quality institutions. Additionally, institutional quality may affect FDI for a long time as institutional changes generally occur slowly.

[Rodríguez-Pose & Cols \(2017\)](#) demonstrate that FDI is primarily influenced by factors such as political stability, government effectiveness, and rule of law, which outperforms natural resources and market size in attracting foreign direct investment in Sub-Saharan Africa. In addition, other studies indicate that FDI recipient countries benefit from quality institutions, particularly those that protect property rights and

provide the rule of law (Sabir et al., 2019; Aziz, 2018; Buchanan et al., 2012). Using pooled ordinary least squares estimation methods, Tintin (2013) analyzed standard gravity factors across six Central and Eastern European countries between 1996 and 2009. The study's findings indicated that factors such as EU membership, trade openness, institutional quality, and GDP size affect inward foreign direct investment. According to Gani and Al-Abri (2013), lack of democratic governance and political instability in the GCC countries tend to promote FDI inflows. Using a CEE case study, Paul et al. (2014) assessed the impact of public policies on institutional quality and FDI inflows for Central and Eastern European (CEE) countries between 2007 and 2010. The study concludes that public administration plays a critical role in establishing an environment conducive to FDI, since market forces cannot replace government's essential functions in this regard. Cielik and Hamza (2023) examine factors influencing inward FDI in GCC countries from 2009 to 2017, emphasizing the importance of institutional quality. The study indicated that corruption control, political stability, rule of law and government effectiveness significantly impact FDI. This is primarily motivated by horizontal market motives rather than efficiency motives.

In addition, Ahmad and Hall (2017) use a spatially augmented growth model to account for inter-country dependency. Their work contributes substantially to the current literature on institutions and economic growth. In addition to traditional geographical measures, institutional proximity is introduced as a novel measure of these relationships. Furthermore, the findings suggest that robust institutions within a country can enhance economic growth in neighboring countries. This indicates that strong institutions may benefit beyond national borders. In addition, other studies have demonstrated that both poor institutional environment and a high level of risk discourage foreign direct investment (Wheeler and Mody, 1992; Lipsey, 1999; Wei and Shleifer, 2000; and Cheung Qian, 2009) and other studies have also investigated the role of institutions, social and economic indicators in attracting FDI (Lee et al. 2024). Tian (2010) suggests that transnational corporations (TNCs) can effectively manage technology spillovers from foreign direct investment (FDI) by strategically

choosing entry modes, investment priorities, and technologies in international markets. Several hypotheses, derived from theoretical analysis, are empirically tested using firm-level data from China. The study results have significant implications for TNCs facing strong competition from local firms in emerging markets.

[Casi and Resmini \(2014\)](#) noted that regional FDI capacity is influenced by the own-country effect, which manifests itself as either the between-country effect or the within-country effect. Using spatial econometrics techniques, the study confirms the presence of own-country effects on FDI attraction. There is consistent evidence to suggest that the within-country effect enhances FDI attraction, while the between-country effect is unpredictable, either beneficial or detrimental. As a result, regions in under-performing countries often benefit more from FDI, whereas regions in well-performing countries may not. [Asongu et al. \(2018\)](#) examined the determinants of foreign direct investment flows to BRICS and MINT countries, based on data from 2001 to 2011. This study uses both pooled time-series cross-sectional analysis and a fixed effects approach to identify trade openness, infrastructure availability and market size as major factors attracting foreign direct investment, whereas natural resources and institutional quality have less influence. In order to sustain FDI inflow, BRICS and MINT governments must maintain political stability, create an investment environment that is conducive to absorbing new skills and technologies, and invest in human capital. By incorporating MINT countries alongside BRICS, this research broadens the literature on FDI determinants. Moreover, [Anyanwu and Yameogo \(2015\)](#) found that FDI in Sub-Saharan Africa is influenced by urbanization rates and domestic investments, which are correlated with the development of transportation corridors, urban clusters, and essential infrastructure.

[Cooray et al. \(2014\)](#) determined whether countries liberalize their policies to attract foreign direct investment competitively. The research analyzed panel data from 148 countries between 1992 and 2009 to determine whether FDI-favoring policies have been adopted. This includes operating conditions, sectoral restrictions, and adjustments in approval procedures etc. The findings indicate that liberalizing FDI

policies in one country positively correlate with similar policies in other countries, especially in emerging economies. There are no differences between these results regardless of estimation techniques, sample sizes, weighting schemes or endogeneity controls. The study by [Hintosova et al. \(2018\)](#) uses OLS and fixed effects models to examine the determinants of FDI in the Visegrad countries from 1989 to 2016. They classify the determinants into social, economic, and political factors, which include market and labor size, labor costs, quality of work, trade openness, economic stability, innovation, and taxation. The findings indicate that wage levels and the share of educated workers are significant positive determinants of FDI inflows, while corporate income tax rates, domestic R&D expenditures, and trade openness negatively affect FDI inflows. The study emphasizes the need to balance these determinants to attract FDI. Based on Bayesian model averaging (BMA), [Camarero et al.\(2019\)](#) found horizontal FDI factors dominating developed countries, whereas vertical FDI factors dominate developing countries. Additionally, horizontal FDI is largely concentrated in core countries on the European continent, while vertical investments are more prevalent in peripheral regions. Germany plays an essential role in global value chains, giving policymakers insight into German investment. Increasingly, empirical studies use Bayesian Model Averaging to identify robust determinants of FDI across diverse contexts ([Desbordes et al., 2018](#), [Pham, 2017](#); [Wei and Cao, 2017](#)).

Foreign Direct Investment as a Percentage of GDP

Selected Sub-Saharan African Countries

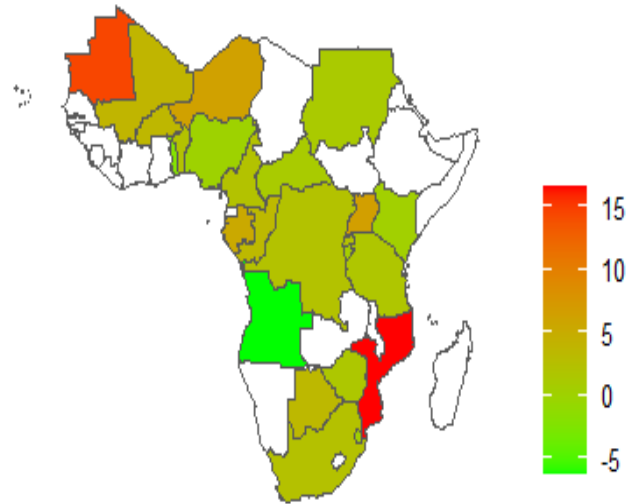


Figure 4: Distribution of FDI as a Percentage of GDP (2022)

Source: Author Generated, 2024

2.4. Theoretical and Empirical Literature Review on Regional Development

To gain a comprehensive understanding of regional economic growth convergence and divergence, this study reviewed both theoretical and empirical literature. In addition, we considered studies that applied spatial econometrics to analyze regional growth differences. By exploring the existing literature, the study aimed to gain insights into the various factors that influence regional economic growth, as well as the mechanisms behind regional convergence and divergence. Through our analysis, we shed light on how policymakers and practitioners can best support sustainable growth and development across geographically proximate regions.

[Labidi \(2019\)](#) argues that development process can be seen as a transition from an earlier condition to an evolved one. The concepts of growth, investment and convergence, provide a clear framework for understanding the level of changes in development. Consequently, catching up will take place, regardless of social frameworks, population characteristics, and historical contexts. In order for an

economy to develop, convergence must be achieved. The necessary steps can be taken by less developed areas to attain the same economic performance levels as affluent regions. It has historically been the case that wealthier regions are located close to other prosperous locations, and the prosperity of the adjacent regions positively influences the economic performance of the region in which it is located. Therefore, development strategies should be re-evaluated focusing on regional growth convergence.

Recent studies have increasingly acknowledged the significant role that regions play in driving contemporary globalization. However, in developing countries, national and regional policies have primarily followed growth models from the 1950s, including those introduced by [Swan \(1956\)](#), [Solow \(1956\)](#), and [Rostow \(1959\)](#). According to Rostow's growth theory, economic growth will be unbalanced when factors of production respond to market signals to optimize welfare and national growth. This theory posits that initial phases of economic growth are characterized by increasing income disparities. Only at more advanced stages of development do processes of income equality begin to manifest. These policy interventions have often neglected the critical considerations of knowledge spillovers, economic geography, and the intricate interplay between these factors and institutional dynamics. The convergence process denotes the phenomenon where less affluent economies close the development gap with wealthier ones by experiencing faster rates of growth. β -convergence offers valuable insights into the capacity of underdeveloped regions to stimulate growth processes ([Barro and Sala-i-Martin, 1995](#)). The increase in capital stocks in developing regions has led to a rise in economic growth. Unfortunately, this growth rate has decreased due to the decreasing returns on these factor inputs. Consequently, the augmented capital stock is anticipated to foster a convergence in incomes per capita among the regional economies in the long run ([Romer, 2018](#)). The intriguing concept of β -Convergence originated from the seminal work of [Baumol \(1986\)](#) and [Abramovitz \(1986\)](#). Economic growth theory suggests that obstacles to achieving convergence stem from various factors such as limitations in transferring technology and fostering innovation, deficiencies in human capital, geographical constraints,

institutional shortcomings, and policy inefficiencies ([Johnson & Papageorgiou, 2020](#)). [Mankiw et al. \(1992\)](#) argue that variations in savings rates, human capital and other behavioral factors can influence steady-state growth equilibriums between regions. Moreover, the absence of convergence in some regions is due to the expansion of country-specific shocks and the variation in balanced growth trajectories between the regions ([Young et al., 2008](#)).

Previous studies suggest that an evaluation of the determinants of uneven economic growth is needed to shape regional and national development policies to reduce regional disparities ([Cibulskiene & Butkus, 2007](#)). According to polarization, the regions which develops infrastructure grows in centrality and pulls capital; resources; labor and economic activities from the periphery to the growth pole. [Perroux \(1955\)](#); [Myrdal \(1965\)](#); ([1957](#)); [Hirschman \(1958\)](#), and others have developed regional development theories based on the idea of polarization. These scholars observed that growth does not take place simultaneously at the same time, the core building block of this theory is that growth takes place on growth poles. Growth pole theory was influenced by Schumpeter's analysis who observed development as "a spontaneous and discontinuous change in the channels of flow, disturbance of equilibrium, which forever alters and displaces the equilibrium state previously existing" ([Ayesha and Haasis 2018](#)). According to Neo-Schumpeterian frameworks, technological spillovers enhance both international and regional technological mobility. As a result of geographic variations, technological innovations and benefits are not equally distributed. There may be a "growth limbo" in regions which are currently behind in terms of development, due to a lack of scale and capability to generate returns and spillovers, as well as a limited capacity to take advantage of spillovers from more advanced regions ([Rodríguez-Pose , 2001](#)). [Myrdal \(1957\)](#) cumulative causation hypothesis and [Francois Perroux \(1955\)](#) growth pole philosophical paradigm proposes solutions influenced by regional development policy concerns, addressing interregional balance, regional deconcentration, and revitalization of underdeveloped areas. According to this theory, growth does not occur uniformly across all regions but rather at specific growth poles with varying concentrations. These regional growth

poles are hypothesized to disseminate development compulsions throughout the spatial system, promoting regional development.

In Sub-Saharan Africa, growth poles are concentrated in large metropolitan cities and decentralized unit headquarters. These nodes function as development hubs, characterized by financial and economic activities, abundant natural resources, upcoming projects, and human capital. As a result, these regions experience significant activities that drives economic transition. The development of these cores, coupled with labor migration from the periphery, initially leads to the shrinkage of peripheral areas, causing regional development disparities. However, over time, the periphery develops due to the backwash effects of the core and capital migration to peripheral regions. The growth poles in Sub-Saharan Africa are organized around dominant and propulsive industrial cities and hubs which pulls factor inputs to the core. [Richardson \(1978\)](#) emphasized that the process of polarization weakens in the later phases of growth and transforms into the diffusion effect, which fosters the growth of less developed regions. [Hirschman \(1958\)](#) observed decentralization of industries; dispersal of capital investments; diffusion of innovation and diversification of industries. When the growth pole is saturated, development centrifuges and neighbouring regions finally grows. This is also synonymous to spread out effect as observed by [Myrdal \(1965\)](#). Gunna's work on economic theories of underdeveloped regions, observed that some regions naturally have a good development start; these regions are typical of Sub-Saharan Africa urban cities classified as growth poles with heavy factor endowment; good connectivity, highly developed infrastructure, energy, transport and communication. Other less developed rural regions are agricultural, with cheap labour, and generally lack proper connectivity and electricity. Development takes place when factor inputs move from the periphery to the core. He further observed that the existence of market inequalities enhances the growth of developed regions. Once the core develops, based on backwash and spillover effect, he talked of development cumulative causation. In his cumulative causation hypothesis, [Myrdal \(1957\)](#) argues that regional inequalities arise from initial disparities in access to development opportunities. These initial inequalities initiate a chain reaction of both

positive and negative development outcomes. In his work “The Strategy of Economic Development”, Albert [Hirschman \(1958\)](#) proposed that interregional disparities in growth are an intrinsic consequence and condition of growth itself. Consequently, growth is geographically uneven, resulting in what he describes as "polarization." He suggests that once growth is established in one part of a region, it activates forces that influence other areas. Ultimately, the "trickling down" effects would outweigh the "polarization" effects ([Hirschman, 1958](#)).

Furthermore, agglomeration emphasizes the spatial aspect of economic activity concentration and is related to the New Economic Geography (NEG) ([Puga, 1999](#); [Krugman, 1991](#); [Fujita & Thisse, 2002](#)). The origin of the core-periphery pattern in the economy can be explained by models of NEG assuming initial general equilibrium. Increasing returns characterize all sectors producing differentiated goods. Finally, the agglomeration describes the spatial concentration of economic activity, while the polarization focuses on the sources of economic growth and its unbalanced nature ([Piętak, 2022](#)). It is widely agreed that the positive externalities resulting from greater agglomeration are responsible for the dynamism of large cities and regions and contribute to their role as engines of economic growth ([Fujita et al., 1999](#); [Duranton and Puga, 2001](#)). Agglomeration, according to [Cooke and Morgan \(1994\)](#), facilitates innovation and reduces barriers to knowledge sharing and transmission. Additionally, [Storper and Venables \(2004\)](#) suggest that it can lead to lower costs in regions. The novel economic theories such as new economic geography (NEG), endogenous growth, and evolutionary economic geography, are raising important queries about the dissemination mechanisms central to neoclassical growth theory, by showcasing that the effects of agglomeration can be predominant in the domain of economic geography ([Iammarino et al., 2019](#)). A spatial econometric framework has recently been used to test regional convergence or divergence in some empirical studies ([Arbia, 2005](#); [Le Gallo et al. 2003](#)).

According to the theoretical work on regional development, regional disparities are an inherent feature of the economy that arises due to uneven economic growth, as

emphasized by [Myrdal \(1957\)](#) and [Perroux \(1964\)](#). Unlike Marxist and socio-economic theories, the theory of polarized growth explained regional growth disparities. According to [Perroux \(1964\)](#), the theory was not originally intended as an explanation for national economic growth, but as a means of promoting regional development. The disparities between regions, however, appear to adversely affect growth, according to some studies. Consequently, the cumulative process of growth may impede the development potential of poorer regions due to the concentration of economic activity in the wealthiest regions. By formalizing Myrdal's model, [Dixon and Thirlwall \(1975\)](#) found that cumulative causation did not necessarily lead to interregional divergence, but rather "permanent divergence of regional development resulting from the Verdoorn effect." Labor efficiency is partly determined by the growth of production volume, and the Verdoorn coefficient or other parameters determined by it only differs between regions if it produces divergent regional development. ([Friedmann, 1966](#); [Kaldor, 1970](#)).

According to [Myrdal \(1957\)](#), economic clustering occurs in regions where industrialization and urbanization occur first, and the growth process feeds on itself. Agglomeration economies offset low-wage labor advantages in underdeveloped regions. In Myrdal and Kaldor's models, early industrialized or urbanized regions have an advantage in international trade due to their increased returns to scale ([Kaldor, 1970](#)). By leveraging scale economies and lower efficiency wages in developed or urbanized regions, cumulative causation occurs when an external shock increases global demand for an industrial good. According to classical economic theory, regional disparities are reduced by immigration and firm movements, as workers flow from poorer areas to high-wage areas and firms move to underdeveloped regions. The existence of these mechanisms reduces regional disparities as evidenced by empirical studies ([Ghali et al., 1978](#); [Giarratani Soeroso, 1985](#); [Kottman, 1992](#)). According to the endogenous growth models, regions with higher human capital and investment rates may grow faster, potentially leading to divergence rather than convergence. Over time, regional disparities may not necessarily diminish, contrary to what is commonly believed([Aghion & Howitt, 1992](#); [Romer, 1990](#)). The issue of regional differences is

raised by the concept of New Economic Geography (NEG). Based on NEG models, economies' spatial structure relies on centripetal and centrifugal forces to promote or weaken agglomeration. Based on these models, regional divergence, rather than regional convergence, is predicted ([Fujita et al., 1999](#); [Krugman & Livas, 1996](#); [Krugman & Venables, 1995](#)). In new economic geography, the study of national economic prosperity and trade is analyzed along with their impact on local and regional development disparities ([Brakman & Garretsen, 2003](#); [Meardon, 2000](#)).

Since gaining independence, most African nations have prioritized regional development. A significant body of academic work have investigated inter-regional disparities; region-specific socio-economic development policies such as urban policies; infrastructural inequalities ([Harrison & Turok, 2017](#)), along with regional development strategies and the persistent regional disparities. Particular emphasis has been placed on the politics of regional differences; the paradoxical presence of underutilized natural resources, the presence of structurally fragmented and disorganized regional planning, the provision of quantity and quality infrastructure and inter-regional spatial inequalities ([Todes & Turok, 2018](#)). Regions represent intricate and inherently dynamic spaces, rendering a uniform approach to their development challenging. The growing emphasis on inclusivity, resilience, and sustainability, as highlighted in the Sustainable Development Goals, necessitates a critical examination of the constraints and opportunities that regions present in advancing these objectives. Recent economic growth theories have revitalized discussions in spatial policy, particularly by emphasizing internal causal macro-regional mechanisms, institutional factors and agglomeration economies ([Rodriguez-Pose, & Tomaney, 2016](#)). For example, European countries have a longstanding tradition of spatial targeting policies. These policies have evolved from traditional approaches that directed investment and jobs from wealthy to poorer regions using significant financial incentives and major infrastructure projects. Over time, they have developed into more sophisticated regional development strategies managed by partnerships involving local and regional stakeholders ([Pike et al., 2016](#)).

2.4.1 Neo-classical Regional Growth Approach.

The theoretical and empirical literature review for this sub-theme encompasses three organization principles: first, examination of development theories; second examinations of convergence through the lens of spatio-temporal dimensions; and third, analysis employing other methodologies to study development convergence. According to the neoclassical growth theory, conventional economic approaches generally rejected policy interventions aimed at less prosperous regions. Based on these approaches, rich, populous regions will eventually spread prosperity and opportunities to less prosperous regions, resulting in a convergence of real incomes and opportunities for firms and households (Glaeser, 2008). According to the convergence theory, regional disparities are expected to diminish over time due to the free movement of capital and labor (Barro & Sala-i-Martin, 1991; Solow, 1956). Barro and Sala-i-Martin (2004) further expanded on this theory by introducing the concept of absolute and conditional convergence, where absolute convergence refers to equal growth model parameters and conditional convergence focuses on the movement of steady-state growth. The speed of regional convergence varies depending on economic cycles, with convergence being more prominent during recessions and weakening during economic booms (Barro & Sala-i-Martin, 2004; Pike et al., 2006).

In neoclassical theory, regional disparities are viewed as temporary because spatial inequalities cause prices, wages, capital, and labor to adjust themselves, eventually leading to convergence of economic and social conditions across regions (Martin & Sunley, 1998). In addition, the diffusion of technology across regions facilitates technology catch-up and promotes geographical equality (Malecki, 2002). There are various forms of regional convergence in the neoclassical framework. Among these forms is conditional convergence, which describes regions that reach steady-state growth. As a result of this convergence, per capita income, consumption levels, and capital-labor ratios are uniform across regions. According to the neo-classical growth model, factors affecting regional growth, such as saving rates, depreciation rates, and population growth rates, are considered external to each country's economy. In absolute convergence, the parameters of the growth model are uniform across regions.

In this scenario, richer countries experience slower growth compared to those with lower development baselines. Neo-classical models predict that absolute convergence leads to equality of per capita income over time among countries. In the long term, beta-convergence occurs when poorer regions experience faster growth than richer ones, leading to equal per capita incomes across economies. Accordingly, per capita income growth rates and initial levels of per capita income are inversely related. On the other hand, Sigma convergence examines the dispersion of per capita incomes between regions at a particular point in time in order to measure income inequality.

Initially, research and development (R&D) were regarded as a primary driver of economic growth in Schumpeterian models ([Romer, 1990](#)) and endogenous growth models ([Aghion and Howitt, 1992](#); [Grossman and Helpman, 1991](#); [Romer, 1990](#)). Despite the fact that endogenous growth models differ, they emphasize the central role that knowledge plays in sustainably growing economies. In contrast, neoclassical exogenous growth theory, from a theoretical standpoint, posits that countries with identical technologies should experience absolute income convergence ([Koopmans, 1965](#); [Solow, 1956](#)). Essentially, beta-convergence implies that regions tend to converge toward a uniform Steady State level ([Barro and Sala-i-Martin, 1992](#); [Barro et al., 1991](#)). In the context of sigma-convergence, convergence is indicated by a reduction over time in the cross-sectional standard deviation of income per capita among a group of countries or regions ([Barro and Sala-i-Martin, 2004](#)). [Galor \(1996\)](#); [Azariadis \(1996\)](#); [Azariadis and Drazen \(1990\)](#) argue that countries may not converge to a single long-run steady state, but instead form multiple convergence clubs, even when they have access to similar technologies. Considering these characteristics, countries and regions may be able to implement targeted policy interventions to address disparities in initial conditions that lead to divergent growth paths. With the development of endogenous growth models, the convergence debate has gained renewed attention by arguing that the equitable distribution of growth benefits across regions should be subject to significant policy influence ([Carvalho & Harvey, 2005](#); [Baumol, 1986](#); [Mankiw, Romer, & Weil, 1992](#)).

2.4.2. Endogenous Growth Theory

2.4.2.1. β – Convergence Approach

In order for a region to grow economically, it must take into consideration the factors that affect its neighboring spatial units. Due to the increasing importance of spatial factors in economic geography, the concept of convergence clubs has been introduced. This concept aims to emphasize the influence of these factors on the regional economy. In neoclassical theory, regional inequalities are transient due to the self-adjusting mechanisms that increase capital, wages, prices, and labor, eventually leading to the convergence of social and economic conditions within a region (Martin and Sunley, 1998). Malecki (2002) argues that diffusion of technologies across regions leads to geographical equalization in technological advancement due to a catch-up process. Theoretical approach of β – convergence is related to Solow – Swan growth theory (Solow, 1956; Swan, 1956). Neoclassical economics assumes exogenous saving rates as well as a production function where capital yields diminish over time. There are various forms of regional convergence according to the neoclassical growth approach. β -convergence, for instance, measures the speed at which convergence occurs. Less affluent regions, for example, typically experience faster growth rates than wealthier ones. There is a tendency for capital and labor to follow opposite paths; high-wage regions may experience capital outflows but may attract labor, whereas low-wage regions exhibit low wages but high returns on investment, resulting in capital inflows. This market adjustment process operates over time to reduce regional disparities in capital-to-labor ratios and promote regional growth (Barro and Sala – i -Martin, 1995). In the long run, this results in an equalization of GDP per capita across economies. In their foundational work, Barro and Sala-i-Martin identified migration as a factor promoting convergence. However, later studies, including Ozgen et al. (2010), have suggested that migration tends to lead to divergence, though the effect is slight. Moreover, the rise in development disparities can be explained by endogenous growth theory. Several factors related to economic growth are responsible for the persistence of these inequalities, such as investments in R&D, human capital and technological innovations (Zhu, He, & Zhou, 2017).

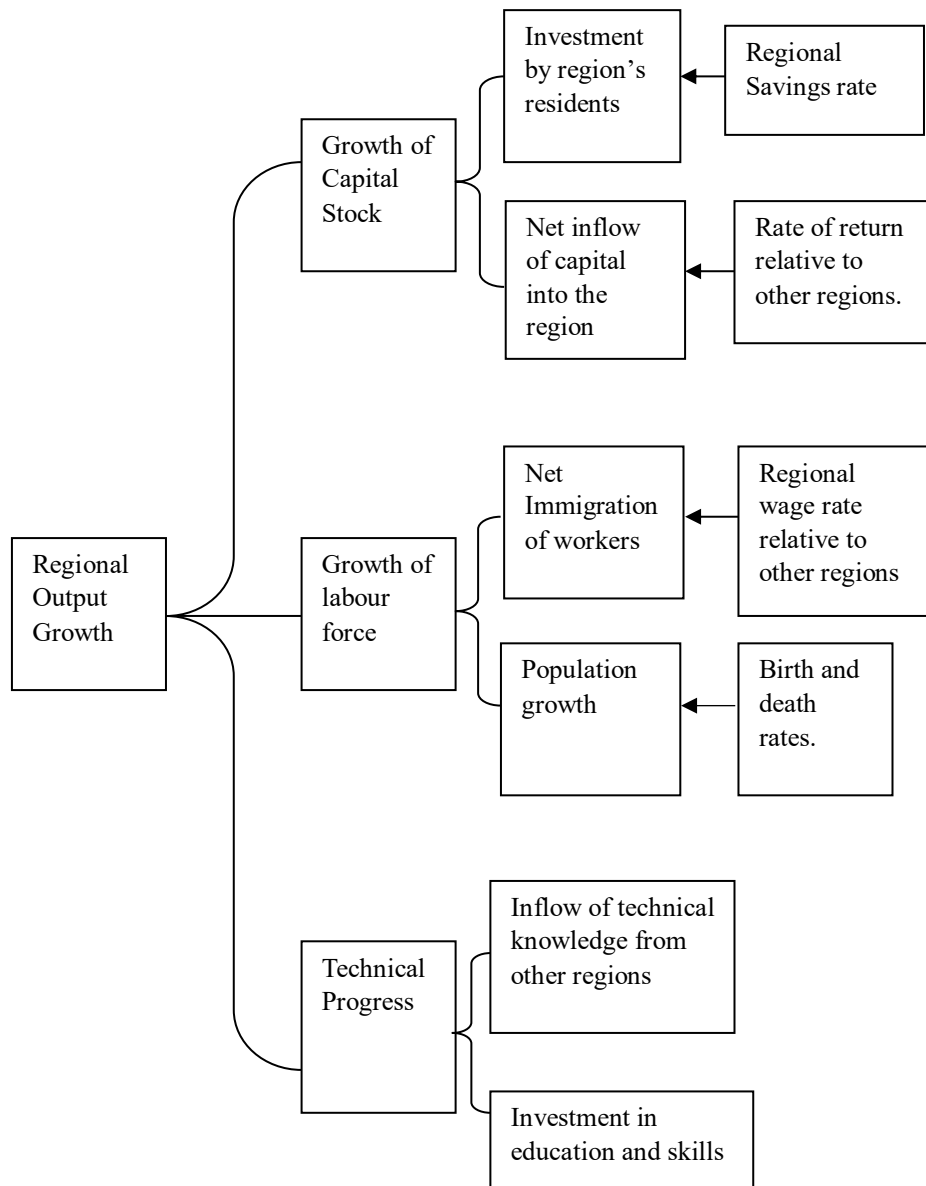


Figure 5: The Determinants of regional output growth.

Source: [Armstrong and Taylor \(2000\)](#)

The specification of the endogenous growth model is given as follows:

$$Y(t) = F[K(t); L(t)]; \frac{\partial y}{\partial t} = sf(k) - \rho k$$

Where; $Y(t)$ is total production at time (t) ; $F(.)$ –production function homogenous of degree one; K – stock of physical capital; L – labour force ; k – capital per capita; $\frac{\partial y}{\partial t}$ – derivative of (k) with respect to (t) ; s – constant saving rate; $f(k)$ – production per capita; ρ – population growth rate. Moreover, [Barro and Sala – i – Martin \(1992\)](#) suggest the following statistical model to measure absolute β – convergence.

$$g_i = \alpha + \beta q_i + \varepsilon_i$$

Where; $g_i = [\ln(y_i, T) - \ln(y_i, 0)]/T$ – measuring GDP per capita average growth rate of an economy between the period 0 and T ; α – is a constant representing growth equation intercept; $\beta = (1 - e^{\gamma T})/T$ – representing convergence co-efficient; γ – is the speed of convergence showing how fast economies will converge towards the steady state; $q_i = \ln(y_i, 0)$ – is the logarithm of the economy i 's initial level of GDP per capita and $\varepsilon_i \sim N(0, \delta^2)$ which assumes normally distributed properties. The positive $(+\beta)$ indicates convergence, showing the rate at which, the economy approaches the steady state. Earlier versions of β – Convergence models ([Barro and Sala – i -Martin, 1991](#); [Sala – i -Martin, 1996a](#) and [1996b](#)) specify the model with the constant term inclusive of technological progress (τ_i) ; per capita GDP steady state value $(\bar{y}^*)$ and initial efficiency $(A, 0)$ expressed as follows.

$$\alpha = \alpha_i = \gamma_i + \frac{1-e^{-\beta_i T}}{T} \cdot \ln(A_i, 0, \bar{y}^*), \forall_i$$

According to the earlier specification of the model, convergence co-efficient is constant across the economies and is specified as follows.

$\beta = \beta_i = \frac{1-e^{-\gamma T}}{T}, \forall_i$ – A positive $(+\beta)$ imply convergence i.e., poor regions unconditionally grow faster than rich ones, at the same state towards a unique steady state independently from initial conditions. The spatial convergence approach employs spatial analysis techniques to assess the effects of mechanisms such as factor mobility,

transfer payments and technology diffusion. These mechanisms drive regional convergence, highlighting the explicit geographical aspects underlying the processes. Furthermore, following a study by [Ray and Montouri \(1999\)](#), a spatial error model (SEM) specification for β – convergence can be represented as follows:

$$\ln \left[\frac{y_{t+1}}{y_t} \right] = \alpha + \beta \ln(y_t) + \rho W \ln \left[\frac{y_{t+1}}{y_t} \right] + \varepsilon_t, / \rho / < 1$$

Where; ρ is the spatially lagged co-efficient of explained variable (y_t). Controlling for the convergence in the spatial effect, the following equation is obtained:

$$(1 - \rho W) \ln \left[\frac{y_{t+1}}{y_t} \right] = \alpha + \beta \ln y_t + \varepsilon_t, / \rho / < 1$$

A vector error term of the above model can be expressed as follows:

$$\ln \left[\frac{y_{t+1}}{y_t} \right] = \alpha + \beta \ln y_t + (I_n - \gamma W)^{-1} \varepsilon_i, / \gamma / < 1$$

Additionally, spatial convergence framework of neo-classical growth model starts from Cobb-Douglas constant return to scale production function for regional output. The model focuses on technological externalities derived from physical capital accumulation and externalities.

$$Y_i(t) = A_i(t) K_i^\alpha(t) L_i^{1-\alpha}(t), < \alpha < 1$$

Where; $Y_i(t)$ – denotes output growth; $A_i(t)$ – aggregated level of technology; $K_i^\alpha(t)$ – capital and $L_i(t)$. Technology is specified following the work of [Ertur and Koch \(2007\)](#) as follows.

$$A_i(t) = \Omega(t) k_i^\emptyset(t) \prod_{j=1}^N A_j^{\gamma w_{ij}}(t)$$

In the above model technology level $A_i(t)$ – is determined by regional externalities $\varepsilon_t, \Omega(t) = \Omega(0)e^{\mu t}$; capital per capita $K_i^\alpha(t)$. Assuming that the level of technological progress in one region increases with its growth in capital per capita; the third factor is the technology level of neighboring regions ([Barro and Sala – i -Martin, 2003](#);

Solow, 1956; Mankiw, 1992). Furthermore, inter-country linkages are important in determining regional economic growth according to endogenous growth models. Several factors are pivotal in driving regional economic growth, including demand interactions, interconnected labor markets, knowledge spillovers, and improved economic integration among neighboring regions (Rivera-Batiz and Romer, 1991; Arbia, 2006; Barro and Sala-i-Martin, 2003).

2.4.2.2. Conditional Convergence Approach

Conditional convergence refers to movements towards a steady state growth rate resulting in constant per capita incomes, consumption levels and capital labour ratios between regions. It is conditional because the saving rates, depreciation rates and population growth rates that influence regional growth but are treated as external to the neo-classical growth model can differ across countries. Mankiw (1992) define conditional growth function, using the following equation:

$$g_i = \alpha + \beta_i q_i + \pi_1 V_i + \pi_2 s_i + \pi_3 h_i + \varepsilon_i$$

Where; g_i – is the average growth rate of GDP per capita; q_i – is the natural logarithm of per capita GDP; $\beta_i = -(1 - e^{-\gamma T})$; T is the period and γ is the speed of convergence; $V_i = \ln(n_1 + l_1 + d_1)$, n_1 is the population growth rate; l_1 - technology level; d_1 – depreciation rate of capital; s_i – natural logarithm of savings; h_i – measures human capital. When the model is specified for spatial units, convergence model is affected from spatial effects such as spatial dependence and spatial heterogeneity. Augmented Solow human capital and immigration model (Mankiw et al., 1992; Dolado et al., 1994) is specified below:

$$Y = HC^\varphi \cdot K^\alpha \cdot (A \cdot L)^{1-\alpha-\varphi}$$

$A_t e^{g^t}$; the growth rate of L is $(n + m) \cong L_t = L_0 e^{(n+m)t}$; $m = M/L$ - net immigration rate; M – new immigrants; K is the physical capital specified below.

$\dot{k} = s_k Y - \delta_k K$; s_k – output ratio invested; δ_k – depreciation rate. Given below is the dynamics of human capital.

$HC = s_{hc}Y - \delta_{hc}HC + m \cdot \varepsilon \cdot HC$; s_{hc} – ratio of human capital invested; δ_{hc} – human capital depreciation rate; ε – ratio of immigrants HC to local citizens, $\varepsilon > 0 \cong$ immigration increases HC . $y = hc^\varphi \cdot K^\alpha$;

$$\dot{k} = s_k y - (g + \delta_k + n + m)k;$$

$$\dot{hc} = s_{hc} y - (g + \delta_{hc} + n + m \cdot (1 - \varepsilon)) \cdot hc$$

$\dot{k}$ and $\dot{hc}$ indicate that immigration exerts a detrimental influence on regional economic growth due to its role in bolstering overall population numbers $n + m$. This phenomenon hinders the accumulation of both physical and human capital per effective labor. Consequently, the migration from poor areas to resource abundant regions foster regional convergence, aligning with the conventional projection of neoclassical growth theory (Barro and Sala-i-Martin, 2003).

2.4.2.3. Spatial Analysis of Human Capital Development and Economic Growth linkages

Generally, researchers believe that regional economic inequality is closely related to disparities in human capital. Lucas (1988) suggested that endogenous growth may result from private human capital investment, which benefits neighboring regions as well as the host region. Romer (1990) emphasizes the importance of knowledge capital in his model of human capital accumulation, whereas Lucas (1988) proposes a model of learning by doing through which countries increase their initial comparative advantages. Researchers have empirically measured systematic growth differences across regions based on location-specific technologies (Cantwell and Lammarino, 2000) using indirect methods. Lucas assumes that the internal human capital H also has an external effect J .

$$Q_t = (\mu H L)^{1-\alpha} K^\alpha J^\varphi$$

This equation is re-written as follows assuming that internal human capital effect equals external human capital effect:

$$Q_t = (\mu H^\theta L)^{1-\alpha} K^\alpha$$

Where $\theta = (1 - \alpha + \gamma)/(1 - \alpha)$. As a prerequisite for endogenous growth, human capital growth should be defined as follows:

$$\frac{\partial H}{\partial t} = H^\rho v(1 - u)$$

Where ρ and v are constants with ρ being greater than or equals to one, in such a way human capital generation doesn't diminish over time. The following is an equation that defines the rate at which human capital grows.

$$Q_t = (\mu L_q e^{\gamma t})^{1-\alpha} K^\alpha$$

According to the model, output growth is attributed entirely to labour through the acquisition of human capital, which was considered as a technology residual in the neoclassical model. Investing in human capital has a positive spillover effect that increases both capital and labor productivity ([Armstrong and Taylor, 2000](#)). [Xu and Li \(2020\)](#) investigated the relationship between innovative human capital (IHC) and economic growth. Their findings revealed that provincial IHC stocks had a significant impact on the region's economic growth. [Cao and Zhao \(2021\)](#) conducted an empirical analysis of the influence of IHC on total factor productivity and found that IHC had a significant inhibitory influence on total factor productivity at the national level. At the regional level, the negative influence of IHC on TFP was higher in eastern and central China than in western China.

2.4.3 Spatio – temporal Perspectives and Regional Growth Convergence

[Cutrini and Mendez \(2023\)](#) applied spatial methodology to assess regional income convergence and its influencing factors across 267 subnational regions of the European Union from 2003 to 2016. Their findings underscored the significant role played by both structural shifts and spatial interdependence in shaping the emergence of convergence clubs. [Aristizábal and García \(2021\)](#) examined how institutions impact economic growth within Colombia's regions. Their findings indicate that, when accounting for institutional and spatial factors, conditional convergence in Colombian

regions results in a convergence rate that surpasses that of a conventional growth model. [Mendez and Santos-Marquez \(2021\)](#) utilized an innovative luminosity-based metric for GDP per capita to investigate spatial dependence and regional convergence across ASEAN countries. Their findings suggest that while there is a general trend towards regional convergence on average, the level of regional inequality within most countries has notably not decreased. [Mendieta and Pontarollo \(2016\)](#) conducted a study on convergence focusing on the cantonal level spanning 2007 to 2012. Their analysis, which considers spatial spillovers, revealed the presence of absolute convergence among highly developed regions in Ecuador. [Fingleton and Lopez-Bazo \(2006\)](#) provide an in-depth analysis of the spatial effects on growth. This study concludes that not only does a region's income level and the savings rate of physical and human capital affect its growth rate, but so do its neighbors' economic circumstances.

Furthermore, [Lee et al. \(2017\)](#) re-explored the debate between deterministic and stochastic convergence, demonstrating that permanent shifts in steady-state growth rates caused by non-transitory shocks result in an underestimation of (conditional) convergence when using deterministic models. [Garang and Erkekoglu \(2021\)](#) examined the emergence of convergence clubs within Africa by applying the beta convergence method across a panel of 34 countries from 1984 to 2014. Their empirical findings identified four convergence clubs and highlighted the critical role of initial conditions, specifically institutional framework, and human capital in the establishment of these convergence clubs. [Kant \(2019\)](#) formulated an index to measure the catch-up progress. Through this index, Kant analyzed 46 countries from 1951 to 2013. The findings reveal that, among the 28 countries in South Asia and Sub-Saharan Africa showing catch-up progress from 1992 to 2013 with the United States as the benchmark, 21 lagged over the extended timeframe. Convergence theories posit that regional disparities initially observed in early stages of development will gradually decrease as a nation progresses beyond a certain threshold of development. This progression involves the redistribution of capital towards less developed regions characterized by lower wages and more affordable land ([Wei, 2015](#)). Indeed, various

studies have explored the sources of regional disparities and the impact of structural change across different subnational scales of the European regions ([Faggian et al., 2018](#); [Angulo et al., 2018](#); [Muštra et al., 2020](#); [Cutrini 2019](#)).

[Zhang et al. \(2019\)](#) investigate the trend of income convergence among 329 administrative regions at the prefecture level in China from 1990 to 2014. Employing the club clustering test, they uncover four distinct convergence groups, each gravitating towards a unique equilibrium. Additionally, findings from ordered logit regressions reveal that the likelihood of entering a specific convergence group is notably influenced by initial per capita income, levels of physical and human capital, the proportion of services in the economy, government expenditure, and inflows of foreign direct investment. [Von Lyncker and Thoennessen \(2017\)](#) examine income convergence trends within 194 European NUTS II regions from 1980 to 2011, revealing the existence of several convergence clubs. [Aksoy et al. \(2019\)](#) examine the convergence of GDP per capita among 81 NUTS-III regions in Turkey during two distinct periods, 1987–2001 and 2004–2017, finding several convergence clubs within provinces for both time frames. Estimates from the ordered logit model suggest that the primary factors influencing membership in these clubs include the initial income per capita, the level of human capital, and the volume of total credit. Extensive empirical research indicates that convergence is observed primarily within homogeneous groups of countries. In more diverse and larger samples, income convergence is only evident when adjustments are made for variations in specific macro-level factors ([Oshchepkov et al., 2023](#)). In addition to confirming club convergence among provinces in China, [Maasoumi and Wang \(2008\)](#) identify smaller convergence groups based on metric entropy assessments. Result variations may be explained by differences in data, estimation techniques, and timeframes. A trend towards divergence is evident in the findings, which show an increase in income inequality since 1991. Other studies that examined the emergence of convergence clubs are [Pittau and Zelli \(2006\)](#); [Fotopolos \(2006\)](#), in the European Union and [Andrade et al.\(2004\)](#) in Brazil.

On the other hand, [Petrakos et al. \(2011\)](#) note that regional economic development often involves both convergence and divergence trends among various geographic units. Based on the analysis, regional growth and development levels exhibit a mirror-image J-shaped relationship. This relationship indicates that regional divergence intensifies and ultimately dominates at more advanced stages of development. Utilizing a regional growth model, the study suggests that factors such as geographical characteristics, economic structure, agglomeration economies, and economic integration contribute to creating a generally unfavorable economic environment for lagging and potentially less advantaged regions. [Li and Fang \(2018\)](#) conducted a study in China using neoclassical convergence analysis, cross-sectional specifications, panel data models, and spatial econometric techniques, and found that spatial agglomeration significantly influences economic growth convergence. Moreover, in cross-sectional and spatial panel data, there is evidence of significant conditional β convergence and absolute β in GDP Per Capita. This convergence persists after accounting for factors such as baseline technology level, human capital, rate of savings, demographic growth, advancements in technology and rate of capital depreciation. [Hong et al. \(2010\)](#) concluded that non-spatial models used to analyze β -convergence in China suffer from misspecification, highlighting the importance of employing spatial models to explore regional convergence.

[Chanda and Kabiraj \(2020\)](#) observed absolute convergence at the district level in India from 1996 to 2010, primarily driven by faster catch-up in poorer rural areas. [López-Bazo et al. \(1999\)](#) investigated the impact of EU integration on regional economic disparities and determined that traditional convergence analysis did not effectively reduce these disparities. The study emphasized the role of geographical space in convergence analysis by incorporating spatial effects. [Fan and Sun \(2008\)](#) examined the geographical disparity in China between 1978 and 2006, along with government efforts to reduce inequality. Their findings indicated a decrease in interprovincial inequality during the 1980s, followed by an increase in the 1990s. However, from the late 1990s to 2004, the inequality stabilized, and since then, both interregional and intraregional disparities have declined, suggesting convergence in growth rates. Using military enlistment data, [Martnez-Carrión and Mara-Dolores \(2017\)](#) studied the

alterations in average heights and regional disparities in Spain and Italy between 1850 and 1980. Their results showed a notable increase in average heights in both nations, with a greater convergence over the last half of the 20th century. In addition, Italy showed greater regional inequality in comparison to Spain. [Taymaz \(2022\)](#) identified four convergence clubs, noting the absence of geographical concentration among Russian federal subjects. The study revealed that high-income clubs were typically associated with regions with dynamic population movements. Moreover, income disparities between national republics in low-income clubs may negatively impact long-term growth and stability. Using spatial econometric techniques, [Tian et al. \(2010\)](#) found evidence of a strong spatial dependence among Chinese prefectures from 1991 to 2007. In addition to revealing the typical divergence results, they also discovered a significant degree of conditional convergence when considering spatial spillovers. Furthermore, they identified competitive influences between adjacent regions in terms of urban growth and capital accumulation. Moreover, they discovered spatial convergence clubs, demonstrating the variability of spatial interactions and growth trends.

In addition, [Ghosh et al. \(2013\)](#) conducted a study on per capita income disparities among states in India and identified significant divergence. On the other hand, [Falk and Sinabell \(2009\)](#) investigated the relationship between regional per capita growth rate and volatility. Their findings, based on spatial lag and spatial error models, indicated a positive correlation. [Incalataru et al. \(2021\)](#) conducted a study on regional-economic development in Romania and found that migration plays a role in causing divergence among regions. Similarly, in [Lundberg's \(2006\)](#) study, a positive correlation was identified between net migration rates in neighboring municipalities in Sweden. However, no evidence was found to support the hypothesis of conditional convergence. Instead, the study predicted conditional divergence. These findings were obtained through the application of spatial econometrics in the estimation process. The study suggests the importance of implementing economic incentives to promote development in underdeveloped regions. Similarly, the other study referenced in this context also employed spatial econometrics and highlights the need for economic

incentives to improve underdeveloped regions. [Aritenang & Chandramidi \(2023\)](#) examines the spatial effect of fiscal decentralization on regional inequality and growth in Indonesia using district-level panel data over a decade. The study finds a persistence of regional divergence and highlights the importance of place-based economic policies and understanding the drawbacks of liberalization policies. [Aritenang \(2022\)](#) uses spatial econometric analysis to show that large cities and core-metropolitan areas are more prone to Covid-19 due to higher population density and commuter rates. The study emphasizes the importance of considering spatial and economic activities in urban policies for containing the spread of the pandemic. Based on remote sensing data from nighttime light and urban land datasets in their study, [Chang et al. \(2022\)](#) investigated the regional disparity of urban expansion in China, focusing on two aspects: urban spatial expansion (USS) and urban socioeconomic expansion (USE). The findings revealed that the main factor contributing to the differences between USS and USE is regional disparity. Consequently, the study suggests that governments should adopt regionally tailored approaches to promote sustainable urban development in order to address this disparity effectively.

Using a comprehensive analysis of regional growth and divergence in socialist Yugoslavia, [Kukić, \(2020\)](#) identified two key findings; richer regions relied more on total factor productivity for growth, whereas less developed regions were unable to match their richer counterparts in terms of employment rates and productivity due to an unsuitable governing objective and soft budget constraints. [Gräbner et al. \(2020\)](#) revealed that since the Eurozone was established in 1999, a process of divergence and polarization has occurred among those countries that joined during that time. According to the study, significant heterogeneity within the two Eurozone clusters is associated with a "core-periphery" pattern. Achieving convergence within Europe requires the implementation of industrial policies to facilitate technological catch-up in peripheral countries, public investment, and progressive redistribution policies to maintain adequate levels of aggregate demand across all Eurozone countries. According to [Diemer et al. \(2022\)](#) measure the concept of regional development traps for European regions, which refer to regions facing significant structural challenges in

improving prosperity. Indicators are proposed to identify regions at risk of developing into a development trap or that are currently in one, which poses risks to the national level and for Europe as a whole. In their analysis of national industry trends, [Visagie & Turok \(2022\)](#) found a significant differences in performance within and across sectors and regions in South Africa. The study found that regional-specific influences on growth performance largely contribute to province performance, emphasizing the importance of considering regional economic capabilities when formulating national growth strategies.

[Cartone et al. \(2021\)](#) explored the factors contributing to economic growth in 187 regions from 12 European countries during the period of rising inequalities, notably the global recession from 1981 to 2009. They employed spatial quantile regression to estimate conditional convergence model. The findings indicate that European regions exhibit varying convergence rates and differing impacts of population growth, human capital, and spatial spillovers. Regions with slower growth rates demonstrated a higher degree of convergence. The research highlights the diverse economic performances of EU regions, emphasizing the necessity of formulating policies tailored to the specific needs of each region. According to [Cutrini and Mendez \(2023\)](#), patterns of growth and development of regions differ based on economic geography and historical context. The findings of this study are consistent with both Evolutionary Economic Geography (EEG) and New Economic Geography (NEG) as well as [Hirschman \(1958\)](#) and [Myrdal \(1957\)](#)'s foundational assumptions. Additionally, region-specific factors can influence where knowledge-centric activities take place, potentially resulting in the clustering of economic services in major metropolitan areas as well as certain regions. In these regions, you may find high-tech manufacturing customers or a robust ICT infrastructure and government-funded research and development fostering the growth of an innovative local ecosystem ([Meliciani and Savona, 2015](#)). A study by [Bartkowska and Riedl \(2012\)](#) analyzes the effects of high-tech industries on regional development. Their findings indicate that certain initial factors, such as human capital and income per capita, are crucial in the establishment of convergence clubs among European regions.

Economic Growth Measured by GDP Per Capita Selected Sub-Saharan African Countries

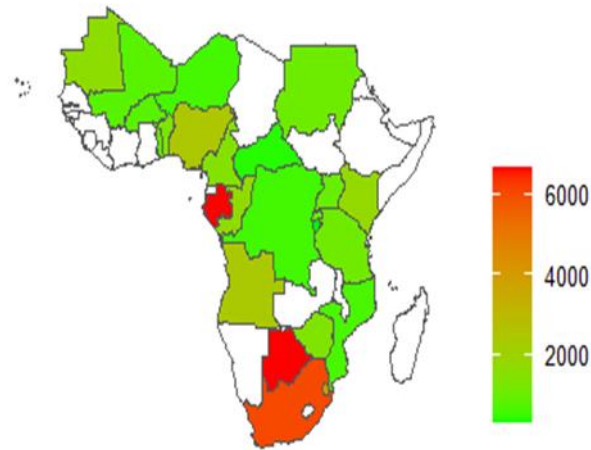


Figure 6: Economic Growth Measured by GDP Per Capita (2022)

Source: Author Generated, 2024

2.5. Summary of Literature Review and Situating Research Gaps

A review of the literature reveals that researchers have employed a diverse array of philosophical paradigms, estimation techniques, and methodologies in developing countries, emerging markets, and developed economies. However, these studies diverge from our objective, which is to examine the manner in which geographically proximate local economies exert influence upon one another. Despite a significant literature on growth convergence, there is scant evidence of spatial-temporal studies investigating regional development in Sub-Saharan African countries. In particular, this study examines the phenomenon of neighborhood effects in the context of financial integration. Our synthesis demonstrates that scholars ([Reinhart & Rogoff, 2011](#)) have largely overlooked the importance of spatial correlation effects on economic growth across regions. This study addresses the aforementioned gap by incorporating a spatial econometric model to examine the relationship between external debt and regional economic growth. The interplay between financial, economic, and spatial analysis in Sub-Saharan Africa has yet to be fully investigated, contributing to a dearth of empirical studies in this region. The majority of research

conducted using spatial analysis has concentrated on developed countries, with particular focus on China, Japan, South Korea, European nations, and the United States. In comparison, Sub-Saharan Africa has received comparatively limited attention from scholars engaged in this field of study. [Rey & Montouri \(1999\)](#); [Claeys et al.\(2012\)](#); [Baldacci et al.\(2011\)](#) and [Dell'Erba et al.\(2013\)](#) suggests that a country's economic growth can be influenced by the performance of its neighbors through mechanisms such as trade openness and financial integration. Studies examining spatial interactions, especially fiscal spillovers, show that debt levels in one region can affect neighbouring regions ([Balaguer-Coll & Toneva, 2019](#)).

Previous researchers in Sub-Saharan Africa have predominantly concentrated on establishing the causal relationship between foreign public debt and economic growth. However, these studies have frequently failed to consider the potential spillover effects from neighboring regions. In light of the interconnected nature of countries in an increasingly globalized world, our study aims to address the aforementioned gap by integrating concepts from financial geography, economic geography, and spatial econometrics. In order to examine the interactions of regional fiscal spillovers, we employ a novel approach that integrates both spatial and temporal aspects. In particular, the study employs spatial econometric techniques to assess the dynamic relationship between external public debt and regional economic growth. To identify the most appropriate spatial models for Sub-Saharan Africa, the study employs three geographic weighting schemes: queen contiguity weights (w_{contg}), k-nearest neighbors (w_{knn}), and standardized inverse distance square matrix ($w_{inversq}$). These geographic distance matrices quantify the spatial proximity between regional units, whereas the queen contiguity matrix delineates neighboring countries based on shared borders. Moreover, spatial econometric models have been extensively utilized in global investigations of regional economic growth ([Jenish, 2016](#)). These findings underscore the significance of regional collaboration and competition in fostering the strength of spatial relationships. For regional development strategies to be effective, it is essential to consider the spatial interdependencies between regions ([Fingleton, 2001](#); [Falk & Sinabell, 2009](#)).

Furthermore, [Dunning's \(2001\)](#) comprehensive framework has had a profound impact on the development of literature on foreign direct investment (FDI). It underscores the pivotal role of ownership, location, and internalization advantages as key determinants of global FDI patterns and entry strategies ([Kang & Jiang, 2012](#); [Andreu et al., 2017](#)). Nevertheless, the regional and place-based effects of both inward and outward foreign direct investment (FDI) have been largely overlooked in the existing literature ([Liu et al., 2014](#); [Tan et al., 2016](#)). Some studies have indicated that the spatial distribution of FDI within a country can contribute to regional disparities in economic development. This underscores the importance of analyzing the spatial interdependence between FDI and regional economic growth, particularly in the context of Sub-Saharan Africa. The analysis focuses on horizontal foreign direct investment (FDI), which is driven by the desire to access local markets and circumvent trade barriers. In addition, the study examines the "proximity concentration trade-off" between foreign direct investment (FDI) and neighboring markets, which is a key factor influencing horizontal FDI decisions ([Blonigen et al., 2007](#)).

Moreover, empirical studies employing the vector autoregression (VAR) framework have investigated a range of techniques for identifying macroeconomic shock transmissions. [Sims \(1980\)](#) introduced the recursive vector autoregression (VAR) approach, [Ramey and Shapiro \(1998\)](#) proposed the event-study method, [Uhlig \(2006\)](#) suggested the sign restriction approach, and [Blanchard and Perotti \(1999\)](#) developed the structural vector autoregressive (SVAR) approach. Moreover, other researchers have employed dynamic stochastic general equilibrium (DSGE) models, Bayesian vector autoregression (VAR) techniques, to assess shocks during economic cycles ([Eyraud et al., 2012](#)). In view of the aforementioned estimation techniques and potential model specification biases, the application of SVAR in this study helps to address the endogeneity issues that are commonly encountered in macroeconomic time series analysis. SVAR identifies shocks through the application of theoretically grounded restrictions, thereby providing a more reliable evidence base and facilitating the prediction of future economic growth based on historical data.

While previous research studies have predominantly focused on the relationship between public debt, foreign direct investment and economic growth, this study finds that external public debt is not a universal solution to the development challenges faced by different countries. The impact of public debt depends on each country's macroeconomic structure and policies, governance, and institutional framework. Further research is needed to examine the interaction between public debt, foreign direct investment and the broader regional macroeconomic environment, taking into account the spatial context and geographical proximity of countries. The results provide valuable insights for policymakers. The findings highlight the need for further research to explicate the relationship between public debt and regional macroeconomic policies. Additionally, the study presents policy recommendations that assist countries in managing their debt while concurrently fostering sustainable economic growth.

Chapter3

METHODOLOGY

3.1. Introduction

This chapter begins with an introduction to spatial econometrics methods (3.1, 3.2), which is followed by a discussion of spatial model specifications and estimation techniques (3.3). The chapter then proceeds to examine the role of spatial effects in fixed effect models (3.3.1) and the phenomenon of spatial spillover effects, encompassing the direct, indirect, and total impacts of covariates (3.3.2). It also delves into the significance of the spatial weight matrix and spatial dependence (3.3.3). The chapter then proceeds to detail estimation techniques, beginning with a discussion of the model estimation process (3.4.1), before moving on to Maximum Likelihood Estimators (MLE) (3.4.2), fixed effect (FE) (3.4.3) and random effect (RE) specifications (3.4.4). Finally, the optimal model choice using Lagrangian Multipliers Tests (3.4.5) is considered. The discussion then moves on to consider the structural vector autoregressive (SVAR) model (3.5) and the associated estimation techniques (3.6), including unit root/stationarity tests (3.6.1), covariance stationarity (3.6.2), series differencing (3.6.3), Granger causality tests (3.6.4), and Johansen cointegration analysis in VAR models (3.6.5). Moreover, the empirical specification of VAR and SVAR models (3.7) is discussed in detail, along with the SVAR model incorporating control predictors (3.8). Finally, the chapter elucidates the concept of variance decomposition (VD) (3.9), culminating in an exposition of the variables and data sources (3.10).

3.2. Methodology I: Spatial Econometrics Methods

A seminal study in the field of spatial econometrics can be traced back to the highly influential 1969 paper by Cliff and Ord, entitled "The Problem of Spatial Autocorrelation." By applying statistical theory to spatial data, this pioneering study demonstrated the close interdisciplinary collaboration between statistics and geography. The combination of these interdisciplinary approaches ultimately led to

the emergence of two distinct subfields. Notable contributions to the field of spatial statistics were made by [Cressie \(1993\)](#) and [Ripley \(1981\)](#). This section outlines the spatial methodology employed for the analysis of geographical proximity, spillover effects and convergence in regional development. The analysis of regional macroeconomic processes necessitates the consideration of their spatial characteristics, including geographical distances and interactions between neighbouring regions. It is of the utmost importance to consider these spatial implications when designing, executing and evaluating state and regional macroeconomic policies, as the spillovers can have either positive or negative effects. The application of spatial analysis is a fundamental aspect of spatial econometrics, whereby observations within a data set are associated with distinct geographical locations or regions. When data are collected in space, nearby observations tend to be correlated, as described by the first law of geography, which states that "everything is related to everything else, but near things are more related than distant things" ([Tobler, 1979](#)). From a modeling perspective, the first law of geography indicates the necessity to consider spatial dependence when analyzing spatial data. Classical regression methods are commonly employed in data analysis, but they are based on the assumption that observations are independent of one another.

Nevertheless, this assumption of independence is frequently an unrealistic one in the context of spatial data. Furthermore, the failure to account for spatial dependence in the data can result in the estimation of parameters that are biased and the formulation of statistical inferences that are flawed. In contrast, the objective of spatial data analysis is to account for spatial dependence in the data, thereby ensuring the accuracy of the resulting parameter estimates and the inferences drawn from them. To illustrate, in the context of cross-sectional data, the term 'spatial lag' is used to describe the phenomenon of spillover effects between adjacent spatial units. In contrast to the temporal lag, this concept is based on spatial relationships rather than time. The assumption is that external shocks propagate instantaneously across space, affecting both immediate neighbours and their neighbours in the same way. It is a common assumption that exogenous shocks propagate instantaneously across spatial

boundaries, reaching both adjacent units and those farther away. However, it is plausible to assume that spatial spillovers can occur within a relatively lengthy observation period, such as with cross-sectional data collected annually. Alternatively, if spatial diffusion occurs gradually, then a one-year interval may not suffice to capture these effects. Consequently, the assumption of an instantaneous spatial lag effect becomes increasingly less tenable as the observational period shortens and spatial diffusion rates decrease (Beenstock & Felsenstein, 2019). Spatial econometrics is a subfield of econometrics that addresses the issues of spatial interaction and spatial heterogeneity in regression models for cross-sectional and panel data (Paelinck and Klaassen, 1979; Anselin, 1988). The field of spatial econometrics builds upon the foundations of standard econometrics models by incorporating spatial components to account for spatial interaction and heterogeneity. The field is comprised of two fundamental elements: the spatial weight matrix and the spatial model specification. In the context of spatial analysis, the spatial weight matrix ($W_{i,j}$) is employed to describe the proximity of two distinct spatial units. The strength of spatial dependence is contingent upon the geographical proximity of the observation units in question.

3.3. Spatial Model Specification and Estimation Techniques

According to Anselin (1988), "Almost all spatial data have characteristics of spatial dependence or spatial autocorrelation", therefore in this study, it is crucial to comparatively examine the spatial spillover effects of regional growth dynamics. The concept of "spatial econometrics" was first proposed by Paelinck, an econometrician from the Netherlands, in 1979. Since then, it has been the subject of continuous investigation and development by Anselin (1988) and other researchers. Additionally, it is widely used in other areas besides regional economic development. The spatial data model was gradually improved by Elhorst (2010) in a systematic examination of estimation methods. The field of spatial econometrics has developed rapidly in recent years, with the development of several spatial econometric models, including spatial Durbin error models, spatial autocorrelation (SAC), spatial dynamic panel models, spatial lag of (X) models, Spatial Durbin Models, general spatial models, and dynamic spatial-time panel data models. In terms of econometric analyses, spatial

autoregressive models (SARs) and spatial error models (SEMs) are the most used and well-established methods (Li & Fang, 2018). In this study we consider three spatial models commonly applied; Spatial Error Model (SEM); Spatial Durbin Model (SDM) and Spatial Lag Model (SLM). It is crucial to determine whether a SAR model or a SEM model is most appropriate for empirical analysis (Elhorst, 2014). A spatial econometric model is tested for LM lag and LM error before SAR and SEM are applied in the estimation process (Elhorst, 2014). In the event that both reject the null hypothesis, the OLS method should not be applied (Anselin, 2004). In cases where both tests are significant, robust LM error and robust LM lag tests are conducted. Anselin (2004) noted that, usually only one of them is significant, or one with a greater magnitude or significance than the other is considered in the analysis. A simple decision would be to estimate the spatial regression model matching the (most) significant statistic. Anselin (2004) recommends selecting the model with the largest test statistic in the rare circumstance that both models would be highly significant. Elhorst (2010) suggested utilizing maximum likelihood estimation (MLE) as an alternative method to the Gauss-Markov assumption and to address the endogeneity issue of variables.

3.3.1 Spatial Effects in Fixed Effect Models

In this model the specification is done to account for spatial autocorrelation in the fixed effects model. Description of these models are given below based on Elhorst (2010) specifications:

i. Manski Model

$$Y_{i,t} = \rho W_{i,j} Y_{i,t} + \alpha l_N + X_{i,t} \beta + W_{i,j} X_{i,t} \theta + \mu; \mu = \lambda W_{i,j} \mu + \varepsilon$$

Manski is the most complete model, it has spatially lagged explained variable ($W_{i,j} Y_{i,t}$), explanatory variable ($W_{i,j} X_{i,t}$) and spatially lagged error term ($W_{i,j} \mu$). It can be simplified into other models mentioned in (ii) to (iv).

ii. Kelejian – Prucha /SARAR/SAC Model

$$Y_{i,t} = \rho W_{i,j} Y_{i,t} + \alpha l_N + X_{i,t} \beta + \mu; \mu = \lambda W_{i,j} \mu + \varepsilon \text{ applied when } \lambda = 0 \text{ in Manski model.}$$

When $\rho = 0$ we have Spatial Error model ($Y_{i,t} = X_{i,t}\theta + \mu; \mu = \lambda W_{i,j}\mu + \varepsilon$); when $\lambda = 0$ we have spatial lag, lag $Y_{i,t}$, SAR model. $Y_{i,t} = \rho W_{i,j}Y_{i,t} + X_{i,t}\beta + \mu$

iii. Spatial Durbin Model (SDM)

$Y_{i,t} = \rho W_{i,j}Y_{i,t} + \alpha l_N + X_{i,t}\beta + W_{i,j}X_{i,t}\theta + \varepsilon$; applied when $\lambda = 0$ in Manski model.

When $\lambda=0$ in Manski model we have spatial Durbin Model given by ($Y_{i,t} = \rho W_{i,j}Y_{i,t} + X_{i,t}\beta + W_{i,j}X_{i,t}\theta + \mu$); when $\rho = 0$ in SDM model we have spatially lagged X (SLX) model given by ($Y_{i,t} = X_{i,t}\beta + W_{i,j}X_{i,t}\theta + \mu$); when $\theta = 0$ in SDM model we have spatial Lag model, Lag $Y_{i,t}$ or SAR model given by ($Y_{i,t} = \rho W_{i,j}Y_{i,t} + X_{i,t}\beta + \mu$); when $\theta = -\rho\beta$ we have spatial Error model (SEM) given by ($Y_{i,t} = X_{i,t}\beta + \mu; \mu = \lambda W_{i,j}\mu + \varepsilon$); Spatial Lag (SAR) and Spatial Error (SEM) are all nested in SDM model.

iv. Spatial Durbin Error Model given by

$Y_{i,t} = \alpha l_N + X_{i,t}\beta + W_{i,j}X_{i,t}\theta + \mu; \mu = \lambda W_{i,j}\mu + \varepsilon$;

Applied when $\rho = 0$ in Manski model such that the model is specified as ($Y_{i,t} = X_{i,t}\beta + W_{i,j}X_{i,t}\theta + \mu; \mu = \lambda W_{i,j}\mu + \varepsilon$); when $\theta = 0$ in Spatial Durbin Error model, then we have Spatial Error Model (SEM) this is given by ($Y_{i,t} = X_{i,t}\beta + \mu; \mu = \lambda W_{i,j}\mu + \varepsilon$); but when $\lambda=0$ in Spatial Durbin Error Model, we have Spatial Lagged X (SLX) model, given by ($Y_{i,t} = X_{i,t}\beta + W_{i,j}X_{i,t}\theta + \mu$).

v. Spatial Lag Model (SLM)

$Y_{i,t} = \rho W_{i,j}Y_{i,t} + \alpha l_N + X_{i,t}\beta + \varepsilon$. The model is applied when, $\lambda = 0$ in Kelejian – Prucha model; $\theta = 0$ in SDM model.

vi. Spatial Error Model (SEM)

$Y_{i,t} = \alpha l_N + X_{i,t}\beta + \mu; \mu = \lambda W_{i,j}\mu + \varepsilon$, SEM model is applied when $\theta = -\rho\beta$ in SDM and $\theta = 0$ is Spatial Durbin Error Model

vii. OLS model

$Y_{i,t} = \alpha l_N + X_{i,t}\beta + \varepsilon$ applied when $\rho = 0$ in SLM and $\lambda = 0$ in SEM.
If the data is not spatial then OLS model is applied.

In the above equations, y_t denotes $rx1$ vector of response variables, real GDP Per Capita, ($rgdp$), which measures economic growth for the sampled regions (i) at time (t) where ($i = 1,2, \dots r$) at time ($t = 1,2,3, \dots, T$), provided that ($i \neq j$), X_{it} is an rxk

vector of covariates. We applied the following covariates: demographic factors; Population (*pop*) and human capital development (*hcd*); global macro-regional variables; foreign direct investment (*fdi*), trade (*trade*), and foreign public debt (*fpd*); domestic factors, gross fixed capital formation (*gfcf*); and governance and institutional factors i.e. political stability (*pol_stab*), government effectiveness (*gov_eff*), rule of law (*r_law*), regulatory quality (*reg_qual*), and control of corruption (*cont_corr*) in the spatial analysis model. ρ represents a scalar spatial lag parameter, indicating the contemporaneous spatial autocorrelation between a specific country and neighboring countries in close geographical proximity. A positive ρ implies that higher growth rates in a host country have a positive spillover effect on growth rates of neighboring countries, it is a spatial autoregressive co-efficient. $W_{i,j}$ is an $n \times n$ symmetric non-negative spatial weight matrix describing geographical proximity of countries in the sample (Lee, 2004); it takes the value of (1) if regions i and j are neighbors, and (0) otherwise, the weights are constructed based on the Sub-Saharan Africa shapefile. $\rho w_{ij}y_{jt}$ this denotes interaction effects of the response variable in the host country (i) and the neighboring country (j) at time t . β is a $k \times 1$ regression co-efficient vector of the covariates. μ_t is $n \times 1$ vector matrix of idiosyncratic stochastic term. The effect of α_i is either fixed (FE) or random probability distribution (RE).

The spatial weight matrix is a standardized first-order queen contiguity, K-nearest neighbours or inverse distance matrix. The weight matrix is a positive matrix with non-zero elements referring to locations that can be considered neighbors in some way geographically or economically. The element $W_{i,j}$ takes the value of (1) if regions i and j are neighbors, and (0) otherwise. The sum of the row elements of the weight matrix is one i.e. $\sum_{j \neq i}^N W_{ij} = 1$. μ_t is $n \times 1$ vector matrix of error term, β is a $k \times 1$ regression co-efficient vector of the exogenous variables; θ is the spatial correlation co-efficient of explanatory variables; λ is the spatial correlation co-efficient of the error term and $\varepsilon_{i,t}$ is the random error term. We introduce lagged values of explained variable ($\rho W_{i,j}y_{jt}$) to account for spatial interaction. The lagged explained variable $W_{i,j}y_{it}$ implies the global spatial spillover effects in the model.

When a random shock occurs in an observation (i) at a particular time (t), it affects the value of y_{it} from this observation, as well as the value of y_{it} from other observations neighboring (i). The model adopted in this study follows SDM model (iv) given above. The Spatial Durbin Model (SDM) is transformed by taking logarithmic values of the variables and incorporating the inverse Tiff matrix as proposed by Lasage and Pace to evaluate the spatial spillover effects of the explanatory variables (Elhorst, 2003). Liu et al. (2018) Spatial autocorrelation is not considered by Spatial Durbin Model. There is a greater cost associated with disregarding spatial autocorrelation than with ignoring omitted variables (Lesage and Pace 2009). When the spatial autocorrelation of the error term is ignored, the efficiency of the model is reduced; however, a maximum likelihood estimation (MLE) can compensate for the lack of efficiency of an OLS. The general specification of spatial panel model is given as follows:

$$y_{it} = \alpha + \tau y_{it-1} + \rho \sum_{j=1}^n W_{ij} y_{jt} + \sum_{k=1}^K x_{itk} \beta_k + \sum_{k=1}^K \sum_{j=1}^n W_{ij} x_{jtk} \theta_k + \mu_i + y_t + V_{it}$$

$$V_{it} = \lambda \sum_{j=1}^n M_{ij} V_{jt} + \varepsilon_{it} \quad i = 1, \dots, n; t = 1, \dots, T$$

The spatial panel models are subjected to the following parameter restrictions (Yu et al., 2008). If $\tau = 0$ this implies a static model, while when $\tau \neq 0$ presents a dynamic model. If $\theta = 0$. This implies spatial autoregressive model with autoregressive disturbances (SAR) If $\lambda = 0$. This presents a Spatial Durbin Model (SDM) If $\lambda = 0$ and $\theta = 0$ the model is Spatial Autoregressive Model (SAR) If $\rho = 0$ and $\theta = 0$ presents a Spatial Error Model (SEM). If $\rho = 0$, $\theta = 0$, and $\mu_i = \emptyset \sum_{j=1}^n W_{ij} \mu_i + \varepsilon_i$ this implies generalized spatial panel random effects (GSPRE) model. The following conditions must hold for the application of spatial analysis (Kelejian and Prucha, 2010); $cov(\sum_{j=1}^N W_{ij}, y_{jt}, \mu_{it}) \neq 0$; $\rho \neq 0$. Under these conditions we have:

$$y_t = \alpha + \rho W y_t + X_t \beta + \mu_t$$

$$y_t = (I_N - \rho W)^{-1} (\alpha + X_t \beta + \mu_t) \text{ when } w_i y_t = \sum_{j=1}^N W_{ij} y_{jt} \text{ and } W_i \text{ is exogenously}$$

given this equation is re-written as follows:

$$w_i' y_t, \mu_t = Cov[w_i'(I_N - \rho W)^{-1}(\alpha + X_t \beta + \mu_t), \mu_t] = Cov[w_i'(I_N - \rho W)^{-1} \mu_t, e_i' \mu_t]$$

e_i' is an $n \times 1$ selection vector $\cong e_i' \mu_t = \mu_{it}$, hence,

$cov(w_i' y_t, \mu_t) = [w_i'(I_N - \rho W)^{-1} D e_i]$ when $\rho \neq 0$ we have the following equation:

$$w_i'(I_N - \rho W)^{-1} D e_i = w_i' D e_i + \rho w_i' W D e_i + \rho^2 w_i' W^2 D e_i + \dots = \rho \sigma_i^2 (w_i' W e_i + \rho w_i' W^2 e_i).$$

The justification for the use of the Spatial Durbin Model in the analysis of growth and convergence in a spatial environment is based on two primary grounds. Firstly, it is probable that the residuals of the ordinary least squares (OLS) model will be spatially dependent ([Abreu et al., 2005](#)). Secondly, the presence of unobservable factors, such as omitted explanatory variables that may be spatially correlated with the modelled variables, can also present a challenge. The latter can be addressed by utilizing the initial values of covariate variables in neighbouring areas as proxies, which the SDM is equipped to accommodate. Moreover, the application of an SDM specification to regional growth regression analysis is firmly grounded in economic theory. For instance, [Ertur and Koch \(2007\)](#) developed an endogenous growth model that incorporates spatial knowledge spillovers. Their findings demonstrate that the convergence equation is identical to the Spatial Durbin Model, which incorporates both the dependent variable and the initial income level spatial lags.

3.3.2. Spatial Spillover Effects - Direct, Indirect and Total Impact of Covariates

[LeSage and Pace\(2009\)](#) the variance-covariance matrix of the coefficients and the series of traces of the powered weights matrix are essential components for calculating impact measures in spatial lag and Spatial Durbin Models. While the impact measures can be computed directly, an estimate of the coefficient variance-covariance matrix is required for Monte Carlo simulation of these measures. The matrices necessary for the computation of impact measures include the following:

Lag model: $Sr(W) = (I - \rho W)^{-1} I \beta r$

Spatial Durbin Model: $Sr(W) = (I - \rho W)^{-1} + (I \beta r - W \gamma r)$

This study follows [Anselin \(2003\)](#) to model spatial spillovers in both covariates and disturbance terms as follows:

$$Y = (I - \lambda W)^{-1} X Y + (I - \lambda W)^{-1} \varepsilon$$

Where $(I - \lambda W)^{-1}$ is the spatial multiplier effect through which covariates and stochastic term affect the estimate variable. The spatial multiplier implies that a change in X variable will have direct impact on Y_i , but also an indirect spillover effect on all other observations. If variable Y_i changes, then neighbor values of Y_i will also change because of a change in X_i (feedback loop effect). According to [Anselin \(2003\)](#), $(I - \lambda W)^{-1} X Y$ denotes modeled spatial spillover effects and $(I - \lambda W)^{-1} \varepsilon$ represent unmodeled spatial spillovers, their impacts are random and not observable by researchers. A covariate variable X_n ($r = 1, \dots, K$), related to a partial derivative X_n , in spatial analysis is the derivative of the growth rate $(g) = (I_n - \rho W)^{-1}$ of vector $n \times 1$ with respect to the r th covariate variable.

$$Y_t = (1 - \rho W_{i,j})^{-1} + (1 - \rho W_{i,j})^{-1} (X \beta + W_{i,j} X \emptyset) + (1 - \rho W_{i,j})^{-1} \varepsilon.$$

The impact matrix Y_t is given by:

$$Y_t = (1 - \rho W_{i,j})^{-1} = I_n + \rho^n W + \rho^2 W^2 + \rho^3 W^3 + \dots \dots \dots \rho^n W^n$$

$$\delta g / \delta x_r = (I_n - \rho W)^{-1} I_n \beta_r = P I_n \beta_r$$

Regional growth rate (g) will be affected by changes in the r th covariate variable if (a) (W_t) contiguity matrix which determines the degree of reactions between the regions change; (P) is the matrix of partial derivatives of (Y_t) (b) spatial dependence between the regions measured by the strength of spatial rho (ρ) (c) the estimator parameter (β_r) . The change in covariates (X_n) in region (i) does not only affect the growth rate of region (i) or g_i but also has spatial spillover effects on growth rate of neighboring regions (j) or (g_j) . The principal diagonal elements of the matrix given

below represents the direct effect of covariates on the response variable, the auxiliary diagonal or off-diagonal elements denotes the indirect effect.

([Anselin, 1999](#)).

$$\left[\frac{\partial Y}{\partial X_{1k}} \dots \dots \frac{\partial Y}{\partial X_{nk}} \right] = \begin{bmatrix} \frac{\partial Y}{\partial X_{1k}} & \dots & \frac{\partial Y_n}{\partial X_{nk}} \\ \vdots & \ddots & \vdots \\ \frac{\partial Y_n}{\partial X_{1k}} & \dots & \frac{\partial Y_n}{\partial X_{nk}} \end{bmatrix} = (1 - \rho W)^{-1} \begin{bmatrix} \beta_k & W_{12}\theta_k & \dots & W_{1n}\theta_k \\ W_{21}\theta_k & \beta_k & \dots & W_{2n}\theta_k \\ \vdots & \dots & \ddots & \vdots \\ W_{n1}\theta_k & W_{n2}\theta_k & \dots & \beta_k \end{bmatrix}$$

Taking matrix P as the matrix of partial derivatives of the response variable (y_{it}), the partial derivatives of (y_{it}) for an $n \times n$ symmetric matrix of partial derivatives of the initial n -period effect with respect to the r th covariates $x_t(r)$ are given as follows

$\frac{\delta y_t}{\delta x_{t-n}^r}$ so that the symmetric spatial multiplier matrix (P) plays a pivotal role indicating

a partial effect of a change in covariate variable on the response variable (y_{it}). The principal diagonal elements are spatial direct effect multipliers given by the following

partial derivatives; $\frac{\delta y_t}{\delta x_{t-n}^r}$ own regional multiplier effect of covariates. On the other

hand, the auxiliary diagonal elements show cross-regional spatial indirect spillover effects of covariates given by the partial derivative of the response variable $\frac{\delta y_t}{\delta x_{j,t-n}^r}$

([LeSage and Pace 2009](#); [Debary et al., 2018](#)). The significance of the degree of indirect effect shows the existence of spatial spillover effect of covariates in the study (foreign public debt, foreign direct investment, human capital development and other macro-regional factors modeled). Based on [LeSage and Pace \(2009\)](#), the direct effect of a change in the estimate variable in region (i) is given by the following equations for the r^{th} variable.

$$M(k) = N^{-1}tr[\hat{\delta}_k(I_n - \hat{\rho}W)^{-1}]$$

Where $\hat{\delta}_k$ is the estimate for the co-efficient of the r^{th} variable and $\hat{\rho}$ is the estimate of the spatial autoregressive co-efficient. The implication of the average direct effect is that, if country or region (i) receives more foreign capital, the marginal effect on economic growth in country (i) will take the spillover effects of a change in foreign

capital on country (i) economic growth rate of the geographically proximate region (j). On the other hand, the concept of marginal total effect is understood in two ways. It addresses the question; if all regions experience an increase in foreign capital, what would be the marginal overall effect on economic growth of the host region? Secondly, it evaluates the cumulative impact of a region (j) receiving more foreign capital on economic growth rate of other neighboring regions (Le Gallo et al., 2011). LeSage and Pace (2009) demonstrate that the marginal total effect value for the r^{th} variable is calculated using the formula given below:

$$M(k) = N^{-1}e'_n tr[\hat{\delta}_k(I_n - \hat{\rho}W)^{-1}]e_n$$

The marginal direct impact is given by the following:

$$M(k)_{Indirect} = M(k)_{total} - M(k)_{direct}$$

Another way to express it as the average sum of the off-diagonal elements in each row. For example, it could be employed to gauge the influence of increased foreign capital in all other regions on economic growth of the host region averaged across all regions.

3.3.3. Spatial Weight Matrix and Spatial Dependence

Spatial dependence can be integrated into a spatial model through two distinct approaches: by including it in the error structure or by incorporating a spatially lagged dependent variable as an additional explanatory variable (W_y) in the model. When integrated into the model's error structure, spatial dependence is represented as follows; ($E[\varepsilon_j, \varepsilon_j] \neq 0$) (Anselin, 1988). In order to specify the fundamental panel model with spatial structure and a fixed effect, the following model should be employed.

$$y_{it} = \beta'X_{it} + \mu_{it} + \varepsilon_{it}$$

$$\varepsilon_{it} = \delta W\phi + n_{it}, E(\varepsilon_{it}) = 0, E(\varepsilon, \varepsilon') = \sigma^2 I_N$$

Where y_{it} is the economic growth of country i in time period t , X_{it} is a set of

explanatory variables including lagged values of the explained variable Wy_{it} , ε_{it} represent stochastic term, δ spatial autocorrelation co-efficient and W is the spatial weight matrix. In our study we are capturing spatial dependence by incorporating lagged values of the explained variable into the model $W_{i,j}Y$. The SAR model with spatially lagged explanatory variable is therefore represented as follows:

$$y_{it} = \sigma WY_{it} + \beta' X_{it} + \mu_{it} + \varepsilon_{it}$$

$$E(\varepsilon_{it}) = 0, E(\varepsilon, \varepsilon'_t) = \sigma^2 I_N$$

$$\text{Univariate Local Moran's I} = \frac{\sum_{i=1}^n \sum_{j=1}^n W_{i,j} (Y_i - \bar{Y})(Y_j - \bar{Y})}{S^2 \sum_{i=1}^n \sum_{j=1}^n W_{i,j}}$$

The equation mentioned above can be defined as follows: Y_i represents the normalized value of the dependent variable in region i , $W_{i,j}$ denotes the element of the weight matrix corresponding to regions i and j , S represents the sum of all weights (elements in the weight matrix), and n denotes the number of observations. The Moran's I index is employed to assess the extent of spatial dependence in regional economic growth, specifically measured by real gross domestic product (GDP_2015). The weight matrix used in the analysis is a standardized first-order queen contiguity matrix. In this matrix, the element $W_{i,j}$ takes the value of (1) if regions i and j are neighbors, and (0) otherwise. The study evaluated cross-sectional dependence by applying univariate Local Moran's I. The Moran's I index is utilized to examine spatial correlation, where a positive value indicates positive spatial correlation, a negative value indicates negative spatial correlation, and the absolute value of Moran's I indicates the degree of spatial correlation. The Moran's I index ranges between (-1) and $(+1)$. A positive value indicates the presence of spatial dependence between economic growth of one region and that of its neighbouring regions. Positive spillovers occur when one region's growth impacts its neighbouring region's growth, suggesting that one region influences the growth of its neighbours. In contrast, a negative value (-1) implies that neighbouring regions provide resources to a growing region. There is no interaction or process between different regions if the coefficient is insignificant.

3.3.4. The Regional Growth Model

The study employed a widely accepted approach to quantitatively measure convergence, based on the concept of the β -convergence model (Durlauf and Quah, 1999). The growth approach is based on the neoclassical version of the Solow-Swan exogenous growth model (Solow, 1956; Swan, 1956). In accordance with the aforementioned model, we assume a closed economy with a production function that is characterized by diminishing capital productivity. In order to account for the potential influence of omitted variables, heterogeneity, and spatial dependence, a panel fixed effect is employed in the SDM specification. The following statistical baseline model was proposed by Barro and Sala-i-Martin (1992) and Mankiw et al. (1992).

$$\ln[y_{T,i}/y_{0,i}] = \mu_i + \beta \ln y_{0,i} + \varepsilon_i.$$

Where $\ln[y_{T,i}/y_{0,i}]$ is the economic growth rate measured by real GDP per capita (*rgdp_2015*) approximated at constant USD as provided by the WDI data; $y_{T,i}$ this is the current economic growth rate and $y_{0,i}$ is the initial economic growth rate. In our estimation $y_{T,i}$ and $y_{0,i}$ varies across the four Sub-Saharan African regions; Central African region ($y_{T,i} = 2000$, $y_{0,i} = 2021$); Southern African region ($y_{T,i} = 1994$, $y_{0,i} = 2020$); West African region ($y_{T,i} = 1992$, $y_{0,i} = 2019$) and Eastern African region ($y_{T,i} = 1992$, $y_{0,i} = 2020$). These periods are contingent upon the availability of balanced panels for all variables, as is pre-requisite for spatial analysis. ε_i is the stochastic random term component in the convergence equation. The systematic component is illustrated as follows:

$$\mu_i = \alpha + (1 - e^{-\gamma k}) \ln y_{0,i}.$$

The parameter γ – represent the speed of convergence, which is used to estimate the rate at which countries within the sub-regions approach a steady state. In accordance with the tenets of the classical linear regression model, it is assumed that the stochastic term is constant and normally distributed across observations $(0, \delta^2)$ and independent of $\ln y_{0,i}$. It is further assumed that $\{\varepsilon_1, \varepsilon_2, \varepsilon_3 \dots \dots \varepsilon_n\}$ are independent across various observations in the model. By re-parameterization $\beta_i = (1 - e^{-\gamma k})$, is estimated by the SDM model. β – convergence is said to be present if the estimated β is negative and statistically

significant, the null hypothesis ($\beta = 0$) is rejected implying that ($\beta < 0$) and therefore presenting a case of absolute convergence. We therefore conclude that poor regions are growing faster than rich regions and that they are all converging to the same level of economic growth or per capita income (Arbia et al., 2005). Considering a panel spatial data model used in this study, the β convergence can be presented using the following equation:

$$\ln[y_{t+m,i}/y_{t,i}] = \alpha_i + \beta \ln y_{t,i} + \varepsilon_i$$

where $i(i = 1, \dots, 4)$ denoting the four Sub-Saharan African regions, $t(t = 1, 2, \dots, T)$ denotes time periods which varies depending on the region and also informed by the availability of balanced panels in this study. m is the periodic interval within which economic growth is computed, $y_{t+m,i}$ this is the current period economic growth rate (*rgdp_2015 Per Capita*), $y_{t,i}$ is the initial period economic growth rate. To account for the spatial effects, we incorporate a standardized queen contiguity weight matrix generated for different regions as shown in Table 3 to Table 6. This introduces a spatially lagged term to the explained variable. $\ln[y_{t+m,i}/y_{t,i}]$ (Pace & LeSage, 2010). The lagged values of growth show that the growth rate of a country is partly influenced by the weighted average of neighbouring countries growth rates. Therefore, the convergence with regional integration is represented as follows considering the spatial weight:

$$\ln[growth] = \alpha_i + \rho \sum_j^n W_{ij} \ln[growth] + \beta \ln y_{t,i} + X' \beta + \varepsilon_i$$

The spatial weight matrix W_{ij} show the strength of the relationship between region i and j , ρ is the spatial rho showing the relationships between the countries within these regions. As a first step, if rho (ρ) is positive or negative and statistically significant, this indicates that regional economic growth has mutually beneficial or detrimental effects between countries. $X' \beta$ this is a vector of all other explanatory variables (Foreign public debt, population, foreign direct investment, human capital development, gross fixed capital formation and trade) and additional control variables (governance and institutional factors; government effectiveness, political stability, control of corruption,

rule of law and voice accountability). By incorporating FDI and foreign public debt into the spatial growth model, we are able to ascertain the impact of foreign capital inflows on regional development convergence.

3.4. Estimation Techniques

3.4.1. Model Estimation Process

The estimation procedure applied in this study involves several steps to determine the appropriate spatial model for the analysis. Initially, Moran's I test is conducted to assess the presence of spatial autocorrelation in the error terms, indicating the necessity of a spatial model estimation. The spatial regression analysis focuses heavily on the assumption of error independence, which is compromised by spatial dependence. The analysis process begins with a non-spatial linear regression run by Maximum Likelihood estimation method (MLE). A specific to general approach was applied to determine whether a spatial interaction effect should be used to extend the model to spatial analysis. The OLS results obtained from MLE serves as a benchmark for a more generalized spatial model. In cases where spatial dependence is clearly apparent, standard OLS regression may not be suitable, requiring more specialized approaches. To detect spatial dependence, particularly spatial autocorrelation, Moran's I residual statistics was used in this study as described in ([Anselin et al., 1996](#); [Florax et al., 2003](#)). Following this step, a model selection strategy is employed: a Lagrangian Multiplier (LM) test is performed to ascertain if the Spatial Lag and Spatial Error models are preferable over a simple OLS model; Consequently, if errors display spatial dependence, traditional linear regression models are extended to spatial linear regression models. The LM-test is often used to determine the optimal model choice between spatial lag and spatial error. Moreover, when both the spatial lag and spatial error models exhibit statistical significance according to the LM-test, a robust LM-test can be employed to further uncover spatial dependence. Notably, the robust LM-test is instrumental in diagnosing spatial lag dependence in the presence of spatial error dependence and vice versa, especially in the context of a spatially lagged dependent variable ([Anselin et al., 1996](#)). Subsequently, the spatial Durbin model (SDM) is

estimated, and a Likelihood ratio (LR) test is conducted to compare it against reduced forms, such as Spatial Lag or Spatial Error models.

Once the best model (assuming spatial Durbin model) is identified, fixed and random effects are estimated, and a Hausman test is conducted to choose between them. Finally, if the spatial model is confirmed as significant through the Hausman test, the preferred model becomes the spatial Durbin model with fixed effects. Using the SDM model is advantageous because prior restrictions are not imposed, estimates are consistent, and unbiased, especially when spatial lag and spatial error are applied. Moreover, Spatial Durbin Models (SDMs) provide a means for determining whether the models are nested within Spatial Autoregressive Models (SARs) or Spatial Error Models (SEMs), since both incorporate dependence between residual errors as well as explanatory variables ([Elhorst, 2014](#); [LeSage & Pace, 2009](#)). The SDM model enables the testing of hypotheses $H_0: \gamma = 0$ and $H_0: \gamma + \delta\beta = 0$. While the former examines whether the SDM model integrates within the SAR model, the latter examines whether it is integrated into the SEM model. Each test follows a chi-square (χ^2) distribution with "n" degrees of freedom. A likelihood ratio test (LR test) can be used to identify which SAR and SEM models fit the data well if they are estimated separately ([Elhorst, 2014](#)). The Wald and LR tests can be combined if the models are not estimated. Taking this into consideration, the SDM model is the optimal model choice if the two hypotheses are rejected. On the other hand, when the first hypothesis is accepted, then the SAR model is most suitable to describe the data, especially if robust LM tests also support the SAR model. Similarly, if the second hypothesis is accepted, it suggests that the SEM model offers the most accurate description of the data, especially if the robust LM tests also favor the SEM model.

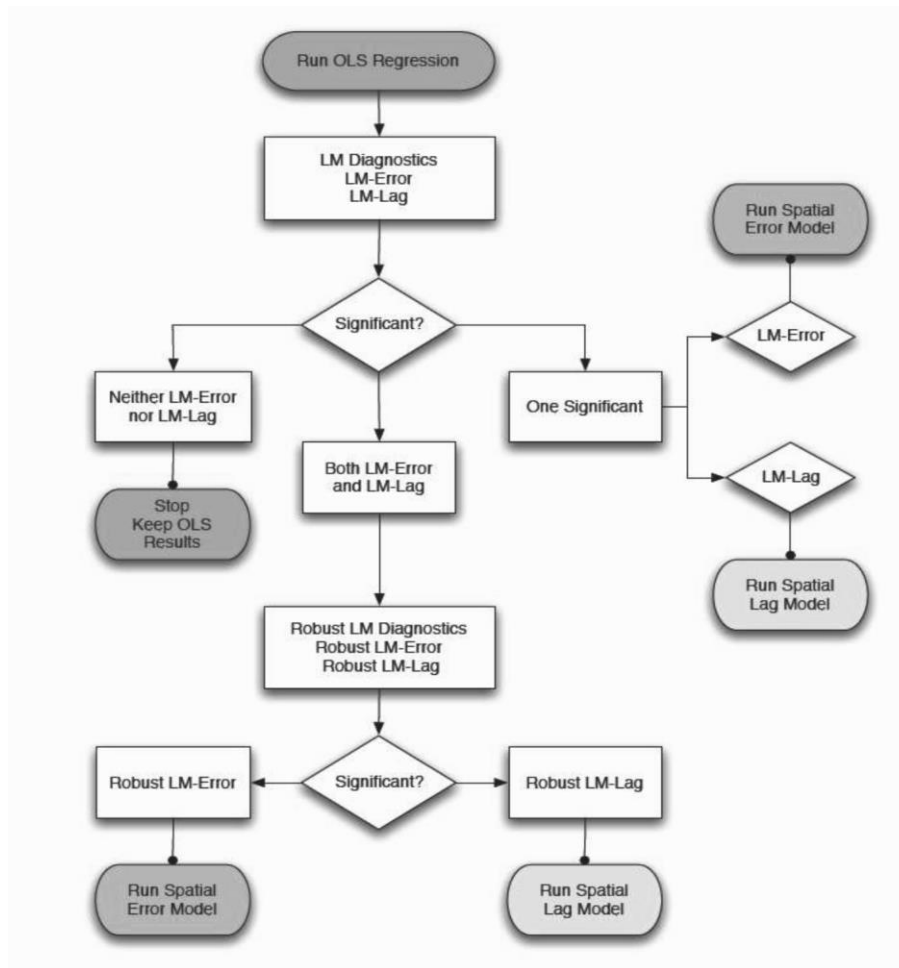


Figure 7: Spatial Econometrics Decision Model (Anselin, 2005)

Elhorst (2014) suggests that if any of these conditions are not met namely, if the (robust) LM tests indicate a different model than the Wald/LR tests then the SDM model should be utilized. This recommendation stems from the SDM model's ability to encompass both the SAR and SEM models.

3.4.2. Maximum Likelihood Estimators (MLE)

Recent decades have seen considerable interest in studying the properties of maximum likelihood estimators based on panel data, especially when faced with heterogeneity and spatial dependence (Lee and Yu, 2010; Baltagi et al., 2013; Elhorst, 2003; Baltagi et al., 2003).

3.4.3. Fixed Effect Specification (FE)

The MLE specification examines spatial lag models with SAR errors, as illustrated in the regression model given below:

$$y_t = \alpha + \rho W_1 y_t + X_t \beta + \mu_t$$

$$\mu_t = \delta W_2 \mu_t + \varepsilon_t$$

Two distinct spatial weights W_1 and W_2 are employed to construct the spatial lags in the preceding equations. The log-likelihood functions corresponding to these equations are provided as follows:

$$\ell(\theta) = -\frac{N(T-1)}{2} \ln(2\pi\sigma_\varepsilon^2) + (T-N)[\ln|I_N - \rho W_1| + \ln|I_N - \rho W_2|] - \frac{1}{2\sigma_\varepsilon^2} \sum_{t=1}^{T-1} \varepsilon_t^{*'} \varepsilon_t^*$$

3.4.4. Random Effect Specification (RE)

The random effect model specification as outlined by [Baltagi et al. \(2013\)](#) posits the inclusion of spatial processes, incorporating random group effects alongside residual disturbances.

$$y_t = \rho W_1 y_t + X_t \beta + V_t ; V_t = \alpha + \mu_t ; \alpha = \gamma W_2 \alpha + \mu ; \mu_t = \delta W_3 \mu_t + \varepsilon_t$$

This model makes a clear distinction between time-invariant spatial error spillovers and spatial spillovers of transitory shocks. It aligns with the propositions presented by [Kapoor et al. \(2007\)](#). The log-likelihood ratio function derived from the model is given below. A joint set of conditional specifications Lagrange multiplier (LM) tests spatial effects within the RE framework are proposed by [Baltagi et al. \(2013\)](#).

$$\ell(\theta) = -\frac{N(T)}{2} \ln(2\pi) - \frac{1}{2} \ln \left[T \delta_\mu^2 (A'A)^{-1} + \delta_\varepsilon^2 (B'B)^{-1} \right] - \frac{T-1}{2} \ln |\delta_\varepsilon^2 (B'B)^{-1}| + T \ln |I_N - \rho W_1| - \frac{1}{2\sigma_\varepsilon^2} V' \Sigma_v^{-1} V .$$

3.4.5. Optimal Model Choice Using Lagrangian Multiplier Tests

In order to determine the optimal model between spatial error and spatial lag models for club convergence, this study utilized Lagrangian Multiplier error and Lagrangian Multiplier lag tests, along with their robust versions. Furthermore, the assessment of spatial dependence also relied on LM tests ([Burridge, 1980](#)), which are specified as follows:

$LM (error) = \frac{(\hat{\varepsilon}'W\hat{\varepsilon}\frac{1}{\sigma^2})}{tr(W'W+W^2)}$ Where ; tr – trace operator; σ^2 – is a maximum likelihood estimator for the error variance. $\hat{\sigma}^2 = \frac{1}{n}(\hat{\varepsilon}'\hat{\varepsilon})$. A test for significant spatial dependence observed in this study is provided by the Lagrange Multiplier lag and is outlined as follows:

$$LM (Lag) = \frac{[\hat{\varepsilon}'Wg\frac{1}{\sigma^2}]^2}{J} \text{ Where } J = \frac{1}{\sigma^2} [(WY\hat{\gamma})'M(WY\hat{\gamma}) + tr(W'W + W^2)\hat{\sigma}^2]$$

Where Wg –is the spatial lag; $WY\hat{\gamma}$ –spatial lag for the estimators; $Y\hat{\gamma}$ and M – are the projection matrices; $M = I_n - Y(Y'Y)^{-1}Y'$. [Anselin and Florax \(1995\)](#) demonstrated that robust LM tests exhibit greater effectiveness in distinguishing between meaningful and incidental spatial dependence.

$$Robust LM^*(error) = \frac{[(\hat{\varepsilon}'W\hat{\varepsilon}\frac{1}{\sigma^2} - tr(W'W + W^2) - \hat{f}^{-1}\hat{\varepsilon}'Wg\frac{1}{\sigma^2})^2]}{tr(W'W + W^2)[(1 - tr(W'W + W^2)\hat{f})^{-1}]}$$

$$Robust LM^*(Lag) = \frac{[\hat{\varepsilon}'Wg\frac{1}{\sigma^2} - \hat{\varepsilon}'W\hat{\varepsilon}\frac{1}{\sigma^2}]^2}{\hat{f} - tr(W'W + W^2)}$$

Table 3 presents the estimation of these statistics using maximum likelihood estimation of standard OLS estimators. To assess spatial dependence for club convergence, the commonly used approach is the application of Moran's I. In matrix notation, Moran's I statistics are expressed by the following equation, as proposed by [Cliff and Ord](#)

(1972; 1973). *Moran's I* = $\frac{\hat{\varepsilon}'W\hat{\varepsilon}}{\hat{\varepsilon}'\hat{\varepsilon}}$ where; W – is the spatial weight matrix and ε – is an $n \times 1$ matrix of OLS residuals specified as $g = Y\gamma + \varepsilon$.

3.5. Methodology II: Structural Vector Autoregressive (SVAR) Model

The SVAR model is an exceptionally versatile tool, particularly for examining the impact of policy actions on the real economy. In the SVAR framework, all variables are treated as endogenous. This model is utilized for structural analysis, with the principal objective of identifying the dynamic effects of shocks on the economy. The process entails a methodical identification and isolation of the shocks in question, with the objective of assessing their effects on real economic variables. In contrast to standard unrestricted VAR models, which may yield erroneous conclusions, SVAR models address this issue by isolating the specific impacts of shocks. Consequently, SVAR provides a more reliable method for evaluating the effects of public spending in this study, as it accounts for the endogenous reactions to economic changes. Such shocks are typically associated with changes in policy rates or increases in fiscal spending. Once the structural shocks have been identified and their responses recorded, it is possible to make predictions regarding key economic variables. This capability is exclusive to structural models, which facilitate the isolation of structural shocks and the monitoring of included variables in the VAR system following the occurrence of such shocks in the economy. In order to provide guidance for this study, and in accordance with the approach set forth by [Pagan and Pesaran \(2008\)](#), the general SVAR equations are presented as follows:

$$K_0 y_t = K_1 y_{t-1} + K_2 y_{t-2} + \mu_t$$

The SVAR specification is transformed as follows.

$$K_0 \Delta y_t = -K(1)y_{t-1} - K_2 \Delta y_{t-1} + \mu_t ; K(1) = K_0 - K_1 - K_2$$

The associated reduced form equation is presented below.

$$\Delta y_t = -K_0^{-1}K(1)y_{t-1} - K_0^{-1}K_2 \Delta y_{t-1} + K_0^{-1}\mu_t = -\pi y_{t-1} + \psi \Delta y_{t-1} + \varepsilon_t$$

As shown in the above equations, K is an nxn vector of unknown co-efficient; K_o is non-singular and μ_t is an $nx1$ vector of structural innovations or shocks.

3.6. Estimation Techniques

3.6.1. Unit root Test/Stationarity Test

The first step is to check for stationarity of the time series, when a time series variable is non-stationary, regression outcomes derived from the ordinary least squares method may yield biased results (Granger and Newbold, 1974; Hendry, 1995). The study introduces the formal notions of stationarity and unit root, as proposed by Geda (2012), while analyzing African time series data using econometric techniques as outlined by Hendry (1995), Granger and Newbold (1974), and Enders (2004).

3.6.2. Covariance Stationarity

The generalization of the above formulation for an AR(p) process involves the expected value $E(y_t) = \mu$ and $Var(y_t) = \delta_y^2, Cov(y_t, y_{t-s}) = Cov(y_{t-j}, y_{t-s-j}) = \gamma_s$ Where μ, δ_y^2 and γ_s represent the mean, variance, and covariance, respectively. These parameters remain constant over time in a stationary process but vary over time in a non-stationary process (Hendry, 1995; Granger and Newbold, 1974 and Enders, 2004).

$$E(y_t) = \mu \text{ and } Var(y_t) = \delta_y^2, Cov(y_t, y_{t-s}) = Cov(y_{t-j}, y_{t-s-j}) = \gamma_s$$

Where μ, δ_y^2 and γ_s are mean, variance and covariance and they are all constants in the estimation process. They are time invariant in a stationary process and time variant in a non-stationary process. A series is non-stationary in an autoregressive process if; $y_t = \phi y_{t-1} + \varepsilon_t$ and $|\phi| \geq 1$. Where ϕ is the memory strength of variable y_t , the variable predicts itself from the history in an autoregressive process. A test for unit root, is a test to show whether $\phi \leq 1$ or not. Using a p th order autoregressive process, we show that:

$$y_t = \phi_1 y_{t-1} + \phi_2 y_{t-2} + \phi_3 y_{t-3} + \dots + \phi_p y_{t-p} + \varepsilon_t$$

This equation can be re-written as follows:

$$\phi(L)y_t = \mu_t \text{ Where } \phi(L) = 1 - \phi_1 L - \phi_2 L^2 \dots \dots \dots - \phi_p L^p$$

If the roots of the characteristic equation $(1 - \phi_1 L - \phi_2 L^2 \dots - \phi_p L^p) = 0$ are all greater than unity in absolute terms, then variable y_t is stationary (Enders, 2004).

3.6.3. Differencing of the series

The above formulation for an AR(p) process is generalized in terms of the change in $y_t [= \Delta y_t]$ or the first difference of the variable y_t . Theoretically, a series becomes stationary upon differencing. A differenced series is represented by the following equation (Hendry, 1995; Granger and Newbold, 1974 and Enders, 2004).

$$\Delta y_t = \phi^* y_{t-1} + \phi_1^* \Delta y_{t-1} + \phi_2^* \Delta y_{t-2} + \dots \dots \dots + \phi_{p-1}^* \Delta y_{t-p+1} + \varepsilon_t$$

We expect that if $\phi^* = 0$ there is unit root in the above equation. If we formulate the above equation as an AR (3) process this generates the equation given below:

$$(1 - \phi_1 L - \phi_2 L^2 - \phi_3 L^3)y_t = \mu_t$$

If unit roots exist, the lag operator in the above equation is factorized to generate.

$$(1 - \phi L - \beta L^2)(1 - L)y_t = \mu_t$$

$$(1 - \phi L - \beta L^2) \Delta y_t = \mu_t$$

The above two equations could be solved for a Δy_t to generate the equation given below.

$$\Delta y_t = -\alpha L \Delta y_t - \beta L^2 \Delta y_t + \mu_t = -\alpha L \Delta y_{t-1} - \beta \Delta y_{t-2} + \mu_t$$

We tested for stationarity of all the variables considered in this study i.e., real GDP per capita (y_t), inflation (pi) foreign public debt (f_d) and real interest rate (r). We employed a summary of unit root test statistics in E-Views as shown in Table 17 in chapter four i.e., Augmented Dickey fuller (ADF- Fisher Chi-square test) and Phillips

Perron (PP – Fisher Chi-Square) tests, ADF and PP tests assume individual unit root process. We applied these tests with an intercept and trend to improve their power and size in the estimation process. [Geda \(2012\)](#) In unit root testing, theoretic decision is based on Mackinnon critical values and computed t-statistics. The absolute values of computed t-statistics must be greater than Mackinnon critical values at 1%, 5% and 10% levels of significance for variables to be stationary otherwise non-stationarity is established. The null hypothesis (H_0): unit root is present in the series implying that the time series is integrated of order one $I(1)$ and therefore non-stationarity is confirmed, alternative hypothesis (H_1): the time series variables are stationary, implying no unit root and therefore the series is integrated of order zero $I(0)$. We check stationarity at level and at first difference, it is expected that the variables become stationary after first differencing.

3.6.4. Granger Causality Test

[Granger \(1969\)](#) causality is based on the idea that the cause occurs before the effect; hence if an event (x) is the cause of another event (y), then (x) should precede (y). Variable (x) is considered to cause variable (y) if the forecast for the current value of Y is enhanced by including the lagged values of (x), along with other pertinent information used in the original prediction, *ceteris paribus*. If the forecast of (y) is enhanced by considering the current value of (x), then (x) is said to cause (y) instantaneously. Granger causality involves using the optimal linear unbiased least squares predictors and the one-step-ahead prediction error to assess accuracy. Thus, the operational definition of causality is that a variable (x) is said to Granger-cause another variable (y) if incorporating past values of (x) among the relevant explanatory variables reduces the variance of the one-step-ahead optimal linear unbiased least squares estimator of (y). The null hypothesis of granger causality is rejected if the probability value is less than 5 percent ($p < 0.05$) implying that the explanatory variable has a cause-effect relationship with the explained variable. If the probability is more than 5 percent ($p > 0.05$) we accept the null hypothesis of no causality implying that the estimator does not granger cause the estimated variable homogeneously. We implement Granger-Causality (GC) to establish the cause-effect

relationship between the economic growth, monetary and fiscal policy variables. Following [Dufour and Renault \(1998\)](#) we take two series $\{y_t\}$ and $\{x_t\}$; If we consider $y_{T+h/T}^*$ to be the predictor of y_{T+h} at time (T) with Ω_T as the information set and $\tilde{y}_{T+h/T}^*$ based on Ω_T . The process $\{x_t\}$ is said to GC $\{y_t\}$ if $E[L_q(y_{T+h}, y_{T+h/T}^*)] < E[L_q(y_{T+h}, \tilde{y}_{T+h/T}^*)]$ Where $h = 1, 2, \dots, n$

In case there is no causality between $\{x_t\}$ and $\{y_t\}$, this implies that the mean square forecast error of $y_{T+h/T}^* = \tilde{y}_{T+h/T}^*$.

3.6.5 Johansen Cointegration Analysis in VAR Models

Two time series variables are cointegrated if they are bound together in a long-run equilibrium relationship. Economically speaking two variables will be cointegrated if they have a long-run or equilibrium relationship between them. [Johansen\(1988\)](#) demonstrated that cointegration can be modelled within a modified VAR framework. In cointegration test, the following process is followed (i) we run the model to obtain the residuals (μ_t) :

$$Y_t = \beta_1 + \beta_2 X_t + \mu_t$$

We test for unit root of the estimated error term $\hat{\mu}_t$ using Dickey Fuller (DF) or Augmented Dickey Fuller (ADF). If $\hat{\mu}_t$ is stationary, we reject the null hypothesis of no cointegration, if $\hat{\mu}_t$ is non-stationary we accept the null hypothesis of no-cointegration. If two variables Y_t and X_t are cointegrated, the relationship between the two are expressed via error correction model (ECM):

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 \hat{\mu}_{t-1} + \varepsilon_t$$

Alternatively, the equation can further be stated as follows:

$$\Delta Y_t = \alpha_0 + \alpha_1 \Delta X_t + \alpha_2 (Y_t - \beta_1 - \beta_2 X_t) + \varepsilon_t$$

Where $\hat{\mu}_{t-1}$ is the lagged error term, α_1 and β_2 are short-run and long-run co-efficient respectively i.e., they measure the effects of X_t on Y_t in the short and long-run periods respectively. α_2 this is the error correction term (ECM) it measures how fast X_t and Y_t

converge to their long-run equilibrium also known as adjustment co-efficient. This study applied Johansen unrestricted cointegration rank test, consisting of trace and maximum eigen value, to evaluate the long-run relationship between output gap, fiscal and monetary policy variables.

3.7. Empirical Specification of the Vector Autoregressive (VAR) and Structural Vector Autoregressive (SVAR) Models.

Following [Sims \(1980\)](#) methodology, the study presents the VAR model framework by the following system of equations to show the response of economic growth proxied by real GDP per capita (y_t) due to a standard deviation shock in fiscal policy proxied by foreign public debt (f_d). In vector autoregressive (VAR) processes, a limited number of time series variables are generated by considering their interconnected dynamics and assuming exogeneity for each variable. Using this method, we can capture the dynamics of how a collection of N time series variables interact dynamically i.e., $y_t = (y_{1t}, \dots, y_{nt})$. Following [Lutkepohl-Kratzig \(2004\)](#) a standard VAR (p) methodology can be described by the following reduced form equation:

$$y_t = m + A_1 y_{t-1} + \dots + A_p y_{t-p} + \mu_t$$

$$E(\mu'_t \mu_s) = \sum \text{if } t = s; E(\mu'_t \mu_s) = 0 \text{ if } t \neq s; E(\mu'_t) = 0$$

Where $m = (m_1, \dots, m_n)$ is an m – dimensional vector of constants, y_t is an $rx1$ vector of endogenous variables, F_i illustrated below is an $m \times m$ matrix of co-efficient, $\mu_t = (\varepsilon_{1t}, \dots, \varepsilon_{nt})$ is $rx1$ vector of unobserved stochastic term, which is discrete, white noise with a Gaussian distribution with the following normally distributed properties $\mu_t \sim [0, E(\mu_t, \mu'_t)]$, it is a matrix of structural shocks which are independent and exogenous. The above equation can be formulated with various parameter constraints. A Cholesky decomposition can outline shock sequences, whereas Blanchard-Quah's long-term restriction specifies shock occurrence timing. The reduced consists of three variables with structural coefficients A and A_s and a time lag of p .

$$Ay_t = A_1^s y_{t-1} + \dots + A_p^s y_{t-p} + B\mu_t, \text{ Where } \varepsilon_t = A^{t-1}B\mu_t \text{ and } S = A^{-1}B$$

The Cholesky restriction (4) assumes certain coefficient values are zero and μ_{1t} directly affects the other variables, μ_{2t} only affects variables 2 and 3, and μ_{3t} only affects variable 3. Matrix A represents the contemporaneous relationships within the model and is also known as the structural matrix. By applying economic intuition, restrictions are placed on this matrix to uncover the structural shocks and structural parameters using the reduced form VAR estimation. The minimum number of restrictions on Matrix A is determined by the difference between the number of unknown and known elements. In a VAR system with k variables, the unknown elements are the off-diagonal elements of Matrix A , denoted by $(k^2 - k)$. Moreover, there are also k unknown variances of μ_t the total of which is k^2 . The known elements are given by $(k^2 - k) / 2$ distinct elements contained in the symmetric variance-covariance matrix denoted by

$$E\mu_t\mu_t' = \Sigma_{\mu t}.$$

$$\varepsilon_t = S\mu_t = \begin{bmatrix} s_{11} & 0 & 0 \\ s_{21} & s_{22} & 0 \\ s_{31} & s_{32} & s_{33} \end{bmatrix} \begin{bmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \end{bmatrix}$$

In contrast, [Blanchard and Quah \(1989\)](#) adopt a different approach to long-term restriction. They isolate the shock within the row of the F -matrix corresponding to the variable in question. Consequently, the cumulative long-term effect of the shock is null, denoted by Ψ , which represents the long-term multiplier ($F = \Psi S$).

$$(I - A - \dots - A_p)^{-1}\varepsilon_t = \varphi\varepsilon_t = F\mu_t$$

$$\text{while } F = \begin{bmatrix} f_{11} & 0 & 0 \\ f_{21} & f_{22} & 0 \\ f_{31} & f_{32} & f_{33} \end{bmatrix} \quad S = \begin{bmatrix} s_{11} & 0 & 0 \\ s_{21} & s_{22} & 0 \\ s_{31} & s_{32} & s_{33} \end{bmatrix}$$

$$y_t + a_{12}r_t = \beta_{10} - \beta_{11}y_{t-1} + \beta_{12}r_{t-1} + \mu_{yt}$$

$$a_{21}y_t + r_t = \beta_{20} - \beta_{21}y_{t-1} + \beta_{22}r_{t-1} + \mu_{rt}$$

In the above two equations, real GDP per capita (y_t) and foreign public debt (r_t) are stationary and μ_{yt} and μ_{rt} are uncorrelated white noise disturbance. These equations are not reduced form equations since it is assumed from macroeconomic perspective that foreign public debt (r_t) has a contemporaneous impact on economic growth (y_t) through β_{12} and y_t has a contemporaneous impact on r_t through β_{21} . As a result, μ_{yt} is correlated with r_t and similarly μ_{rt} is correlated with y_t and this present the problem of endogeneity in the model or simultaneity bias. The system is transformed to circumvent endogeneity and to obtain consistent, best linear unbiased estimators.

$$\begin{bmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ r_t \end{bmatrix} = \begin{bmatrix} \beta_{10} \\ \beta_{20} \end{bmatrix} + \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{22} & \beta_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ r_t \end{bmatrix} + \begin{bmatrix} \mu_{yt} \\ \mu_{rt} \end{bmatrix}$$

$$B = \begin{bmatrix} 1 & \beta_{12} \\ \beta_{21} & 1 \end{bmatrix}, x_t = \begin{bmatrix} y_t \\ r_t \end{bmatrix}, T_0 = \begin{bmatrix} \beta_{10} \\ \beta_{20} \end{bmatrix}, T_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{22} & \gamma_{22} \end{bmatrix}, \mu_t = \begin{bmatrix} \mu_{yt} \\ \mu_{rt} \end{bmatrix}$$

The above system is therefore re-written as follows.

$$Bx_t = T_0 + T_1x_{t-1} + \mu_t$$

Pre-multiplying the system by the inverse of the B Matrix, B^{-1} we obtain the following equation.

$$x_t = A_0 + A_1x_{t-1} + e_t$$

x_t – denotes a vector of explained variables, x_{t-1} is a vector of explanatory variables, A_0 is an intercept term, A_1 is a co-efficient matrix or a matrix of impulse multipliers and e_t is a vector of innovations or shocks in the system, it is unobservable zero mean and white noise term.

$$\begin{bmatrix} y_t \\ r_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{22} & \beta_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ r_t \end{bmatrix} + e_t$$

Where:

$$A_0 = B^{-1}T_0 \quad A_1 = B^{-1}T_1 \quad e_t = B^{-1}\mu_t$$

$$r_gdp_t = a_{10} + a_{11}r_gdp_PC_{t-1} + a_{10}expd_{t-1} + e_{r_gdp_t}$$

3.8 The SVAR Model with Control Predictors

Currently, there are ongoing academic discussions regarding how fiscal policy shocks are identified (Ramey 2016, 2011a and 2011b). The predominant empirical studies examining the impacts of fiscal policy shocks rely heavily on SVAR models with a limited set of three to six fundamental variables. To pinpoint the fiscal policy shock, researchers typically apply theory-based constraints to VAR impulse responses. This can be achieved through either the recursive technique, as outlined in Blanchard and Perotti (2002), or the sign restrictions approach advocated by Mountford and Uhlig (2009). Other studies (Auerbach and Gorodnichenko, 2013a, Owyang et al., 2013; Ramey and Zubairy, 2018) have used local projections with single equation iterations as proposed by Jordà (2005) to evaluate fiscal policy shocks. The SVAR methodology is a seminal contribution of Sims (1986), Bernanke (1986), Blanchard and Watson (1986). To recover the structural disturbances underlying the estimates and to ensure that shocks are independent of one another, they applied economic theory to restrict the observed values of the estimated residuals(e_t).

In SVAR model, coefficients are not interpreted directly but innovation accounting techniques are adopted to interpret the results, and these are impulse response function (IRF) and structural variance decomposition (VD). By using these techniques, we examine the relationship between economic growth, foreign public debt, interest rates, exchange rates, and inflation in the SVAR system. While the IRF shows the dynamic effect of each variable on shocks in other variables in the system, the variance decomposition shows the variability of forecast error for each variable to shocks in all the other variables (Enders, 1995). The study applied the structural IRF to forecast the response of current SVAR error values. It is assumed that errors revert to zero in subsequent periods *ceteris paribus*. Stock and Watson (1996) developed a three-variable SVAR as a benchmark against which new forecasting systems are measured. Despite their usefulness as benchmarks, small SVARs of two or three variables are often unstable and thus presents poor predictors of the future. Therefore, to avoid instability, model misspecification and poor prediction, some theoretically guided macroeconomic variables were deemed suitable for influencing economic growth and

used as control predictors in the study i.e., exchange rates, interest rates and inflation. McCoy (1997) the SVAR model is an extension of traditional VAR is outlined as follows:

The VAR framework $x_t = A_0 + A_1x_{t-1} + e_t$ equation (4) treats each variable as endogenous in the system. In this study, the identification of structural shocks is formulated based on Blanchard and Perotti (2002) methodology. We re-state the equation to incorporate the control predictors as follows:

$$y_t = \omega_0 + \beta y_{t-p} + \mu_t$$

Where:

$$y_t = f\{\mu_t^{yt}, \mu_t^{fd}, \mu_t^{ir}, \mu_t^{er}, \mu_t^{pi}\}$$

The equation above embodies unobservable structural shocks which is uncovered by imposing restrictions on the stochastic term. SVAR estimations are primarily used to estimate a non-recursive orthogonalization of the error terms applied to IRF analysis. The study considered five variables to obtain structural shocks for the analysis of the dynamic behavior of output growth.

$$A_0 y_t = \omega_0 + A(L)y_{t-p} + \mu_t$$

Where y_t is a 5×1 vector of explained variable, ω_0 is 5×1 vector of constants, μ_t is a 5×1 vector of structural disturbances or innovations and p indicates the number of lags. The square matrix A_0 (5×5) is described as follows:

$$Matrix A_0 = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \end{pmatrix} Matrix \mu_t = \begin{pmatrix} \mu_t^{yt} \\ \mu_t^{fd} \\ \mu_t^{ir} \\ \mu_t^{xr} \\ \mu_t^{pi} \end{pmatrix}$$

The equation (8), $A_0 y_t = \omega_0 + Z(L)y_{t-p} + \mu_t$ is multiplied by its inverse A_0^{-1} to yield $Z(L)y_t = c + \mu_t$ where $c = A_0^{-1}\alpha$; ε is the vector of error from the reduced form VAR models; $\varepsilon_t = A_0^{-1}\mu_t$; thus, the structural disturbance μ_t and reduced form errors

ε_t are related by $\mu_t = A_0 \varepsilon_t$; $Z(L) = A_0^{-1} A(L) = I_n - A_1 W - A_2 W^2 \dots A_p W^p$. The IRF is given by $Z(L)^{-1} A_0^{-1}$ at least $(n(n-1))/2$ restrictions are imposed to exactly identify the system and to make matrix A_0 invertible. In the VAR and SVAR framework, all variables are considered to be endogenous, i.e., determined within the model. Following [Perotti \(2002\)](#) SVAR results are not sensitive to the ordering of the fiscal shocks. In the model, the level of inflation (π) is thought to be influenced by changes in the level of foreign public debt (f_d) as well as, eventually, by its previous levels. An increase in foreign public debt (f_d) signals that the government is injecting additional funds into the economy, therefore stimulating aggregate demand (AD). Additionally, holding government securities increases households' perceived wealth, which increases their consumption. Consequently, higher prices are experienced within the economy due to the elevated aggregate demand. It is commonly assumed that the real interest rate (ir) is influenced by shocks in inflation and foreign public debt, as well as its own historical values. The new government securities are introduced into the securities market due to foreign debt financing. As a result of an increased supply of government securities, the price of these securities would be pushed downwards, assuming all other factors are held constant. Consequently, this leads to an increase in domestic interest rates. The Fisher effect explains the relationship between inflation and interest rates. There is a presumption that the level of interest rates, inflation, public debt, and the previous level of the economy influence economic growth. Economic growth is facilitated by moderate and stable inflation rates, which improve export competitiveness, create a conducive business environment, and encourage investment. Conversely, an environment of persistent high inflation may create uncertainty regarding future investment profitability. Therefore, borrowing needs and foreign debt burdens are likely to affect interest rates on government bonds, potentially attracting additional capital inflows. Additionally, the interest rate is expected to affect growth through inflation and investment. It is postulated that variations in foreign public debt (crowding-out or crowding-in effects), interest rates, inflation, and economic growth have an impact on investment ([Mohanty and Panda, 2020](#)).

3.9. Generalized Impulse Response Function and Variance Decomposition

Vector autoregressive models are used in impulse response analysis (IRF) to explain how the model's variables respond to a shock in one or more variables. Using IRF, we explore the dynamic effects of shocks or innovations resulting from fiscal and monetary policy variables on economic growth in the Sub-Saharan Africa. Using foreign public debt innovation as a predictor variable, we evaluate economic growth behavior in the VAR system. In addition, we predict how innovations affect Sub-Saharan African macroeconomic policy framework using inflation, interest rates, and exchange rates as instrumental variables. [Koop et al., \(1996\)](#) outlines IRF as one of the ways of examining dynamic models. The IRF equation is given by $IRF(h, \delta) = \frac{\partial Y_{t+h}}{\partial \epsilon_t}$. The equation shows how a shock $\epsilon_t = \delta$ in period t impacts on a VAR system at period $t + h$, assuming no further innovations, $\epsilon_{t+h} = 0 \forall h$. Alternatively, two concurrent realizations can be compared, one with the shock and one without as shown below:

$$IRF(h, \delta, \omega_{t-1}) = E\{Y_{t+h} | \epsilon_t = \delta, \epsilon_{t+h} = 0, \omega_{t-1}\} - E\{Y_{t+h} | \epsilon_t = 0, \epsilon\}$$

where ω_{t-1} refers to the history of the process, i.e., the values up to time $t-1$. For linear processes, IRF is characterized by (1) independent of the history, such that $IRF(h, \delta, \omega_{t-1}) = IRF(h, \delta, \omega'_{t-1})$, (2) symmetric in the shocks and (3) linear in the innovations, i.e.,

$$IRF(h, \lambda\delta, \omega_{t-1}) = \lambda IRF(h, \delta, \omega_{t-1})$$

The initial conditions of a threshold model matter greatly ω_{t-1} , it determines if the IRF impacts will differ if the model is launched at a low or high regime. Additionally, shock size δ or standard deviation also matters because it determines whether the shock stays within the same process regime, or whether it causes a change of regime, and hence impacts the process differently. Finally, if an initial shock maintains the existing regime, how subsequent shocks ϵ_{t+h} affect the process also matters. An IRF measures how shocks affect the progress of SVAR system over time. In formal terms, a Markov model's IRF is defined as follows:

$$IRF(n; \delta, F_{t-1})E[\{Y_{t+n}|\varepsilon_t = \delta, \varepsilon_{t+n} = 0, \dots \varepsilon_{t+n} = 0, F_{t-1}\} - E\{Y_{t+n}|\varepsilon_t = 0, \varepsilon_{t+n} = 0 \dots \varepsilon_{t+n} = 0, F_{t-1}\}]; n = 1, 2, \dots \infty$$

Where δ is the size of the shock and F_{t-1} information filtration up to time $t - 1$.

[Koop et al. \(1996\)](#) suggest using GIRF for non-linear models described below.

$$GIRF(n; \delta, F_{t-1})E[\{Y_{t+n}|\varepsilon_t = \delta, F_{t-n}\} - E\{Y_{t+n}|F_{t-1}\}]; n = 1, 2, \dots \infty$$

A general impulse response function *GIRF* can further be expressed as follows:

$$GIRF(h, \delta, \omega_{t-1}) = E\{Y_{t+h}|\varepsilon_t = \delta, \varepsilon_{t+h} = \delta, \omega_{t-1}\} - E\{Y_{t+h}|\omega_{t-1}\}$$

In a *GIRF*, one is not comparing anymore the shock $\varepsilon_t = \delta$ to the absence of shock $\varepsilon_t = 0$. Instead, the benchmark innovations are averaged out, the above equations are derived from [Koop et al., \(1996\)](#). It is not possible to directly interpret coefficients in a VAR model; instead, innovation accounting techniques are used, including impulse response function (*IRF*) and variance decomposition (VD). These techniques allow us to understand how each variable in a system affects the others. While the *IRF* shows the dynamic effect of each variable on shocks in other variables in the system, the variance decomposition shows the variability of forecast error for each variable to innovations in all the other variables. We use the *IRF* to forecast the response of current SVAR error values. It is assumed that errors revert to zero in subsequent periods *ceteris paribus*. Furthermore, several variables were deemed suitable for influencing economic growth to avoid misspecification of the model i.e., exchange rates, interest rates, foreign public debt and inflation. The forecast variance decomposition is the percentage of the variance of the errors made in forecasting economic growth due to innovations in foreign public debt, interest rates, exchange rates and inflation from period one (1) to period ten (10). Variance decomposition is applied to show the percentage interaction between economic growth and the variables as ordered in the SVAR system. In the subsequent chapter, we apply the SVAR methodology to real data of some selected highly indebted Sub-Saharan African countries obtained from the World Development Indicators (WDI). We place our focus on output (y_t) response to inflation (pi), interest rate (r) and foreign public debt (f_d).

3.10 Data Sources and Variable Description

Table 1: Data Sources and Variable Description

#	Variable	Description	Source
1	<i>rgdp</i>	Real GDP (constant 2015 international USD)	WDI ^a
2	<i>fdi</i>	Foreign direct investment, net inflows (BoP, current USD)	WDI ^a
3	<i>fpd</i>	Foreign Public Debt stock, Total (constant 2015 international USD).	WDI ^a
4	<i>gfcf</i>	Gross Fixed Capital Formation (Constant 2015 International USD)	WDI ^a
5	<i>hcd</i>	Human Capital Development Index	HDR ^b
6	<i>dser</i>	Foreign debt service as a percentage of GDP	WDI ^a
7	<i>inf</i>	Inflation - Consumer Price Index (2010 = 100)	WDI ^a
8	<i>xr</i>	Exchange Rate	WDI ^a
9	<i>ir</i>	Interest Rate	WDI ^a
10	<i>trade</i>	Trade as a percentage of GDP	WDI ^a
11	<i>pop</i>	Total population	UNPD ^d
12	<i>pol_stab</i>	Political stability and absence of violence	WGI ^c
13	<i>gov_eff</i>	Government Effectiveness	WGI ^c
14	<i>reg_qual</i>	Regulatory Quality	WGI ^c
15	<i>r_law</i>	Rule of Law	WGI ^c
16	<i>Cont_corr</i>	Control of Corruption	WGI ^c

a. World Development Indicators (<https://databank.worldbank.org/source/world-development-indicators>) b. Human Development Report, UNDP. (HDR) <https://hdr.undp.org/data-center/documentation-and-downloads> c. World Governance Indicators (WGI) United Nations Population Division (UNPD)

In order to assess the regional convergence process, we validate the β -convergence output using data obtained from the World Development Indicators (WDI) for the period 1992 to 2021. The estimation of β -convergence employs real GDP growth rates (*rgdp*) data covering the period from 1992 to 2021. The calculation of real GDP per capita entails the consideration of all products produced within the economy, with the exclusion of any taxes or subsidies that are not included. The total population (*pop*) is

calculated by conducting a census of all individuals residing in a given country. All individuals residing in the country are included, irrespective of their citizenship or legal status. The population is incorporated as a control variable that affects demand. Furthermore, the analysis incorporates additional variables, namely foreign public debt (*fpd*), which represents long-term debt, that is to say, a debt with an original or extended maturity of more than one year. The debt can be classified into three categories: public, publicly guaranteed, and private non-guaranteed. The data are presented in current U.S. dollars. Foreign direct investment (*fdi*) is defined as the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. Gross fixed capital formation (*gfcf*) encompasses land improvements, plant, machinery, and equipment purchases, and other capital investments. Furthermore, the construction of infrastructure, including roads, railways, and other public works, is also included. Additionally, the construction of educational, medical, commercial, and industrial facilities is also included. The inflation rate is a measure of the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. Additionally, the trade and foreign debt service rate is incorporated. The data set for these variables was sourced from the WDI database. The data pertaining to human capital development were sourced from the United Nations Development Programme's (UNDP) Human Development Reports (HDR).

Furthermore, the study considered measures of institutional quality as outlined by the Worldwide Governance Indicators (WGI) from the World Bank as control variables. These included political stability and absence of violence (*pol_stab*), which assesses perceptions about political instability, political violence, including terrorism, and the effectiveness of government. (*gov_eff*) gauges perceptions of public service quality, civil service competence, independence from political influence, effectiveness of policy formulation and implementation, and the commitment of the government to maintaining policy credibility. Regulatory quality (*reg_qual*) assesses the government's capacity to devise and implement policies and regulations that facilitate and encourage private investment. The rule of law (*r_law*) variable assesses individuals' confidence in and

adherence to societal norms. These norms include the degree to which contracts are enforced, property rights are protected, law enforcement agencies are effective, the prevalence of crimes and violence occurs, as well as the effectiveness with which corruption is controlled. The variable "Control of corruption" (*cont_corr*) examines perceptions of the abuse of power and corruption in the context of state governance, including various forms of corruption. The aforementioned institutional variables are estimated in unit values ranging from -2.5 to +2.5, as outlined by [Kaufmann et al. \(2009; 2010\)](#).

In total, four Sub-Saharan Africa regions were subjected to examination: **Region 1** comprises the Economic Community of Central African Countries (ECCAS), which includes the following countries: the Congo Republic, the Congo Democratic Republic, Gabon, Angola, and the Central African Republic. In **Region 2**, South Africa, Zimbabwe, Botswana, Mozambique, and Eswatini are members of the Southern African Development Community (SADC). **Region 3** comprises the Economic Community of West African States (ECOWAS), which includes Nigeria, Togo, Burkina Faso, Niger, Mali, Algeria, Mauritania, Benin, and Cameroon. **Region 4** comprises the Eastern Africa Development Community (EADC), which includes Kenya, Tanzania, Uganda, Rwanda, Sudan, and Burundi.

Chapter4

RESULTS AND DISCUSSIONS

4.1. Introduction

In this chapter, we analyze and discuss the findings of the study in light of the objectives and questions outlined in the introduction. The findings are organized into themes and sub-themes that correspond to the five main research questions and objectives. This study addresses the following research questions and objectives: RQ1 examines the significance of spatial context in understanding regional development in Sub-Saharan Africa. RQ2 assesses regional development convergence through GDP per capita, considering governance and institutional factors. RQ3 to RQ4 investigates the impact of macro-regional factors and foreign capital inflows on economic growth in the region, RQ8 and RQ9 explores the role of geographical proximity and the spatial spillover effects of foreign public debt and foreign direct investment on regional growth. RQ10 analyses how real GDP per capita responds to fiscal and monetary policy shocks in selected Sub-Saharan African countries. This chapter includes a discussion of the analyzed results, highlighting the relationship between the study's findings and existing economic theories as well as previous empirical studies. Furthermore, it demonstrates how the analysis addresses the research questions. The chapter also delineates the study's contribution to Sustainable Development Goals.

4.2. Descriptive Statistics

Table 2: Descriptive Statistics

Region	Variables	Obs.	Mean	SD	Min	Max
<i>ECCAS</i>	<i>rgdp</i>	60	1.84E+10	1.88E+10	1.68E+09	7.24E+10
	<i>fpd</i>	60	5.58E+09	4.15E+09	2.88E+08	1.82E+10
	<i>fdi1</i>	60	1.05E+10	1.12E+09	6.77E+09	1.36E+10
	<i>dser</i>	60	7.34E+08	1.19E+09	0	4.50E+09
	<i>gfcf</i>	60	18.5785	8.677462	6.404793	42.79249
	<i>pop</i>	60	1.68E+07	2.18E+07	1235274	6.78E+07
	<i>trade</i>	60	85.44985	38.39986	25.04194	156.8618
	<i>bcd</i>	60	0.4753667	0.110036	0.329	0.668
<i>SADC</i>	<i>rgdp</i>	95	5.79E+10	1.01E+11	2.06E+09	3.29E+11
	<i>fpd</i>	95	5.66E+09	9.44E+09	2.32E+08	6.11E+10
	<i>fdi1</i>	95	5.76E+09	9.44E+09	3.32E+08	6.12E+10
	<i>dser</i>	95	1.25E+09	2.23E+09	1.80E+07	1.07E+10
	<i>gfcf</i>	95	17.37996	6.290695	2.000441	31.46583
	<i>pop</i>	95	1.61E+07	1.65E+07	944404	5.06E+07
	<i>trade</i>	95	82.28223	32.65328	37.11461	175.798
	<i>bcd</i>	95	0.5096842	0.118255	0.242	0.696
<i>ECOWAS</i>	<i>rgdp</i>	162	6.70E+10	1.24E+11	3.43E+09	5.09E+11
	<i>fpd</i>	162	7.27E+09	1.03E+10	6.25E+08	6.00E+10
	<i>fdi1</i>	162	1.91E+09	1.63E+09	1.16E+08	9.84E+09
	<i>dser</i>	162	7.71E+08	1.70E+09	1.48E+07	1.34E+10
	<i>gfcf</i>	162	1.47E+10	2.46E+10	4.54E+08	8.02E+10
	<i>pop</i>	162	3.20E+07	4.77E+07	2778097	2.01E+08
	<i>trade</i>	162	55.16423	16.68396	20.72252	110.7881
	<i>bcd</i>	162	1.684601	0.427911	1.088122	2.60311
<i>EADC</i>	<i>rgdp</i>	120	2.54E+10	2.53E+10	1.28E+09	9.73E+10
	<i>fpd</i>	120	4.84E+09	3.79E+09	3.63E+08	1.53E+10
	<i>fdi1</i>	120	3.27E+08	5.08E+08	524808.7	2.06E+09
	<i>dser</i>	120	1.89E+08	2.14E+08	3226554	9.04E+08
	<i>gfcf</i>	120	17.60221	6.394235	2.781138	36.06015
	<i>pop</i>	120	2.30E+07	1.21E+07	5570206	4.62E+07
	<i>trade</i>	120	38.18412	13.78341	9.955145	72.85848
	<i>bcd</i>	120	0.4094333	0.074811	0.26	0.55

Source: Author's Estimation, 2024; Note; only main variables are captures in the descriptive statistics table, other control variables such as indicators of governance are omitted.; ECCAS – Economic Community of central African States; SADC – Southern Africa Development Community; ECOWAS – Economic Community of West African States; EADC – Eastern Africa Development Community.

4.3. Model and Estimation Techniques

The spatial model testing procedure applied in this study involves several steps to determine the appropriate estimation model for the analysis. Initially, Moran's I test is conducted to assess the presence of spatial autocorrelation in the error terms, indicating the necessity of a spatial model estimation. The spatial regression analysis focuses heavily on the assumption of error independence, which is compromised by spatial dependence. Lagrangian Multiplier for spatial dependence in linear models are evaluated using the following methods; simple Lagrangian Multiplier test for error dependence (*LMerr*); simple lagrangian Multiplier test for missing spatially lagged dependent variable (*LMlag*); variant of these robust variables to the presence of the other (*LMlag* or *LMerr*) and a portmanteau test (SARMA, in fact *LMlag* + *LMerr*). In cases where spatial dependence is clearly apparent, standard OLS regression may not be suitable, requiring more specialized approaches. To detect spatial dependence, particularly spatial autocorrelation, Moran's I residual statistics was used in this study as described in (Anselin et al., 1996; Florax et al., 2003). Following this step, a model selection strategy is employed, the key concern is to evaluate whether the data generating process is spatial error SAR or spatial lag SAR; a Lagrangian Multiplier (LM) test is performed to ascertain if the Spatial Lag (*LMlag*) and Spatial Error (*LMerr*) models are preferable over a simple OLS model; Consequently, if errors display spatial dependence, traditional linear regression models are extended to spatial linear regression models. *LMerr* is a robust test that takes into account the possibility both of an omitted spatially lagged dependent variable and spatially autocorrelated residuals. The LM-test is often used to determine the optimal model choice between spatial lag and spatial error. Moreover, when both the spatial lag and spatial error models exhibit statistical significance according to the LM-test, a robust LM-test is employed to further uncover spatial dependence. Notably, the robust LM-test is instrumental in diagnosing spatial lag dependence in the presence of spatial error dependence and vice versa, especially in the context of a spatially lagged dependent variable (Anselin et al., 1996). Subsequently, the Spatial Durbin Model (SDM) is estimated, and a Likelihood ratio (LR) test is conducted to compare it against reduced forms, such as Spatial Lag or Spatial Error models. Once the best model (assuming Spatial Durbin Model) is identified, fixed and random effects

are estimated, and a Hausman test is conducted to choose between them. Finally, if the spatial model is confirmed as significant through the Hausman test, the preferred model becomes the spatial Durbin model with fixed effects.

4.3.1 Diagnostics for Spatial Dependence

This study adopts the methodology suggested by [Florax et al. \(2003\)](#); [Anselin and Florax \(1995\)](#) for determining the most suitable econometric specification for regional growth models when spatial dependence is present. This approach involves estimating standard OLS models using maximum likelihood estimation (MLE) as shown in [Table 3](#) to examine spatial dependence and conducting Lagrange multiplier (LM) tests. [Table 3](#) present the outcomes of spatial dependence analysis and optimal model selection, as determined by Moran's I residual statistic, Lagrangian Multiplier, and log likelihood ratio (LR) tests. The robust LM error test and robust LM lag test reveal the existence of spatial dependence within the dataset. The results suggested a positive statistically significant Moran's I residual statistic across the four regions. Given that both the LM spatial lag and the LM spatial error are statistically significant across all regions, the selection of the optimal model hinges on the significance of the robust LM Lag and robust LM error. As the robust LM lag statistic exhibits significance in comparison to the robust LM error statistic, the interpretation of the regression findings is based on the spatial lag model, as depicted in [Table 3](#). Moreover, the likelihood ratio (LR) tests for the four regions are highly significant at 1% level, suggesting that the spatial lag model specifications are suitable for estimation. In order to implement the spatial dynamic panel model, spatial interaction effects must first be tested. This study adopts the methodology suggested by [Florax et al. \(2003\)](#); [Anselin and Florax \(1995\)](#) for determining the most suitable econometric specification for growth models when spatial dependence is present. This approach involves estimating standard OLS models using Maximum Likelihood estimation as shown in [Table 3](#) to examine spatial dependence and conducting Lagrange Multiplier (LM) tests. When spatial models are evaluated using MLE, the aim is to test two main objectives: (i) To test whether SDM model can be evaluated by using LM spatial lag model (ii) To test whether SDM model can be estimated by applying LM spatial error model.

Response to research question and Hypotheses one

RQ1: What significance does the geographical proximity of countries hold in understanding regional growth in Sub-Saharan Africa?

H₀₁: There is a positive significant impact of geographical proximity of countries on regional growth in Sub-Saharan Africa.

This objective examines the geographical dimension that underlies spatial regional growth processes in Sub-Saharan Africa. By incorporating spatial effects into the analysis, we avoid treating economic blocks as independent regions. We employ this methodology to investigate the role of geographical proximity of countries in understanding regional growth convergence in Sub-Saharan Africa. In recent years, researchers have increasingly focused on spatial models that incorporate both explained and explanatory variables to evaluate spatial dependence (LeSage & Fischer, 2008; Fingleton & Lopez-Bazo, 2007). The logic behind these models is twofold. First, they fit well with theoretical regional growth models that consider spatial externalities, such as knowledge diffusion and technology transfer, resulting from the accumulation of factors in nearby regions (Egger & Pfaffermayr, 2006; López-Bazo et al., 2004). Secondly, Pace & LeSage (2008) have demonstrated that when residuals in a standard growth regression are spatially dependent particularly when an omitted variable is correlated with an exogenous regressor a substantive spatial dependence model is required.

Prior to estimating the spatial models, it is imperative to define a spatial weights matrix. The selection of this matrix represents a pivotal aspect of spatial econometric analysis, as the choice of spatial weights can exert a considerable influence on the outcomes of the model (Kelejian & Prucha, 2010; Elhorst, 2014b). For this reason, spatial connectivity and dependence between countries are assessed using the weight matrix (W_N). It determines the degree of "nearness" or "proximity" between countries, which affects spatial spillovers. In order to define the weight matrix, we consider geographical concepts such as physical distance, k-nearest neighbors, and contiguity, as well as distance decay functions. By using a geographical matrix, we effectively address issues

of causal reversal and identification due to its clear exogeneity (Ahmad & Hall, 2017). As this is a crucial component of spatial econometric models (Corrado & Fingleton, 2012), we explore a wide range of different weight (W) configurations. We adopt geographical weight matrices, which are measured based on the geographical proximity of countries. A simple binary first order queen contiguity weight matrix denoted by (w_{contig}), where $w_{ij} = 1$ if region i and j share physical border and $w_{ij} = 0$ when they do not. We next consider other weight matrices to allow for effective evaluation of the best weight to be applied for the regions in Sub-Saharan Africa. Based on the concept of exponential distance decay, we employ the inverse squared distance matrix whose off-diagonal elements are defined by $w_{ij} = \frac{1}{d_{ij}^\alpha}$ for $\alpha = 1.25, \alpha = 1.50 \dots \dots \alpha = 3.0$, denoted by (w_{invsq}), we set a minimum threshold distance to ensure that each country in the sample has at least one neighbouring country (Elhorst et al., 2013; Keller & Shiue, 2007).

$$W_{ij} = \begin{cases} w_{ij} = 0 \\ w_{ij} = d_{ij}^{-2} / \sum_j d_{ij}^{-2} ; w_{ij} = 0 \text{ if } i = j ; \\ w_{ij} = 0 \end{cases}$$

$$w_{ij} = d_{ij}^{-2} / \sum_j d_{ij}^{-2} \text{ if } d_{ij}^{-2} \leq \overline{d}^{-2} \text{ and } w_{ij} = 0 \text{ otherwise.}$$

The variable d_{ij} represent the great circle distance between capital cities of country i and j , while $\bar{d}$ denotes the critical distance threshold beyond which spatial effect are deemed negligible such that $w_{ij} = 0$ if $d_{ij}^{-2} > \bar{d}^{-2}$. In order to facilitate comparison and interpretation, the rows are standardized to ensure that $0 \leq w_{ij} \leq 1$. This process allows the spatially lagged variables to reflect a weighted average of the neighboring values (Arbia et al., 2010). However, Anselin (2002) suggests that geographic distance may explain only a limited number of factors influencing economic relationships across space. Next, we consider weight matrices based on the k –nearest neighbors denoted by (w_{knn}) where $k = 4, 6, 8 \dots, 10$ calculated based on the great circle distance between the centroids of the different regions. k is set at 10 in this study beyond which spatial dependence is deemed negligible, with the element $w_{ij} = 1$ if country j is among the ten

nearest neighbors to country i and $w_{ij} = 0$ otherwise (Le Gallo & Ertur, 2003 ; Ezcurra & Rios (2015)). A variety of criteria are used in the literature to determine what spatial weights matrix best represents the data. In most cases, log-likelihood function values are compared. The disadvantage of this approach is that it may only identify a local maximum among competing models, thereby leaving the correct specification of the spatial weight matrix unidentified (Vega & Elhorst, 2013; Harris et al., 2011). Dray et al. (2006) applied the minimum values of Akaike Information Criterion.

Alternatively, LeSage and Pace (2009) recommended incorporating Bayesian posterior model probabilities, while Elhorst et al. (2013) suggest choosing the model with the lowest residual variance parameter estimate. Hall et al. (2023) presented an encompassing test that accommodated multiple spatial weighting matrices within the final model. However, this technique has not yet been incorporated into statistical softwares. In this study, we evaluate spatial dependence based on Akaike Information Criterion following three methods i.e., w_{contig} , w_{knn} and w_{invsq} . Furthermore, we ensure that our panel data accounts for cross-sectional dependence among similar economies within the regions. The cross-sectional dependence arises largely from countries' interconnectedness through trade and financial integration. Events in one country can trigger spillover or backwash effects in others, particularly in financial flows and or fiscal policy spillovers. When modeling panel data, cross-sectional dependence is a major challenge, as it compromises estimator efficiency and produces unreliable test statistics if overlooked. However, many commonly used panel data estimation methods neglect this critical issue, assuming cross-sectional independence. To assess cross-sectional dependence, we utilize the Pesaran CD, Friedman, and Frees tests. Cross-sectional dependence is confirmed when the p-values for these tests are less than 0.05 ($Pr < 0.05$). Selecting the appropriate weights is critical because they embody prior knowledge about spatial relationships intensity (Stetzer, 1982).

Simulation output for research question and Hypotheses one

Table 3: Standard Linear Regression Model by Maximum Likelihood Method for Economic Community of Central Africa States.

Testing for Spatial Dependence - Economic Community of Central African States			
Variable	w_contg	w_knn	w_invsq
<i>fpd</i>	0.51948**	0.534797**	0.534797**
<i>fdi1</i>	-0.4886	-0.488422	-0.488422
<i>gfcf</i>	6.95434e+08***	7.05599e+08***	7.05599e+08***
<i>dser</i>	5.39828***	5.33704***	5.33704***
<i>trade</i>	3.37898e+07	2.95668e+07	2.95668e+07
<i>bcd</i>	-8.3947e+09***	-6.25873e+09	-6.25873e+09
<i>infl</i>	-5.47608e+07***	-5.95707e+07	-5.95707e+07***
<i>pop</i>	347.847***	354.317***	354.317***
<i>pol_stab</i>	3.83019e+08***	3.84521e+08***	3.84521e+08***
<i>gov_eff</i>	2.29578e+08	2.01888e+08	2.01888e+08
<i>reg_qual</i>	2.70397e+08	2.69921e+08	2.69921e+08
<i>r_law</i>	-1.03398e+09***	-1.0716e+09***	-1.0716e+09***
<i>cont_corr</i>	1.63542e+08	1.42652e+08	1.42652e+08
<i>-const</i>	4.13266e+08	-1.57051e+09	-1.57051e+09
	w_contg	w_knn	w_invsq
<i>Moran's I</i>	6.0493***	7.0159***	14.1885***
<i>Spatial Lag</i>			
<i>LM Lag</i>	80.181***	76.3297***	79.6984***
<i>Robust LM Lag</i>	75.273***	56.1036***	55.6984***
<i>Spatial Error</i>			
<i>LM Error</i>	6.873 ***	21.3881***	24.7407***
<i>Robust LM Err</i>	1.920	1.1620	0.8692
<i>LM (SARMA)</i>	82.107***	77.4917***	80.5677***
<i>AIC</i>	-134.041	4574.47	4574.47
<i>SIC</i>	-112.437	4612.78	4612.78
Testing for Cross-Sectional Dependence			
<i>Pesaran CD Test</i>	Co-efficient: 18.568	Pr. 0.0010	
<i>Friedman Test</i>	Co-efficient: -0.575	Pr. 0.5655	
<i>Frees Test</i>	Co-efficient: 0.517	Pr. 0.1360	

*** $p < .01$, ** $p < .05$, * $p < .1$; LM - Lagrangian Multiplier; w_contg , contiguity matrix; ; w_invsq , inversed squared distance matrix; w_knn , 5-nearest neighbors' matrix; Akaike Information Criterion; SIC; Schwarz Information Criterion. Source - Author's Estimation, 2024.

Table 4: Standard Linear Regression Model by Maximum Likelihood Method for Southern Africa Development Community

Testing for Spatial Dependence - Southern Africa Development Community			
Variable	w_contg	w_knn	w_invsq
<i>fpd</i>	0.527194	0.498386	0.498386
<i>fdi1</i>	5.77429***	2.77575	2.77575
<i>gfcf</i>	-4.17235e+09***	8452.44	7.05599e+08***
<i>dser</i>	0.558917	0.45717	0.457171
<i>trade</i>	3.1473e+08	8.81452e+07	8.81452e+07
<i>bcd</i>	2.51184e+11***	2.34134e+11***	-2.47983e+09***
<i>infl</i>	1558.24	-5.95707e+07	8452.44
<i>pop</i>	3839.73***	5209.08***	354.317***
<i>pol_stab</i>	-5.93955e+08**	2.8458e+08	2.8458e+08
<i>gov_eff</i>	4.05857e+07	1.5873e+09***	1.5873e+09***
<i>reg_qual</i>	1.03724e+09	8.69867e+08	8.69867e+08
<i>r_law</i>	-4.85124e+08	-6.54212e+08	-6.54212e+08
<i>cont_corr</i>	1.07732e+09**	7.22431e+08	7.22431e+08
<i>-const</i>	-1.54323e+11	-1.67308e+11	-1.67308e+11
	w_contg	w_knn	w_invsq
<i>Moran's I</i>	1.0149 **	4.0283***	16.8600***
<i>Spatial Lag</i>			
<i>LM Lag</i>	75.9984***	69.0513***	55.4884***
<i>Robust LM Lag</i>	87.2688***	74.2250***	63.8414***
<i>Spatial Error</i>			
<i>LM Error</i>	0.0047	4.3884**	5.3500**
<i>Robust LM Err</i>	11.2751***	9.5620***	13.7031***
<i>LM (SARMA)</i>	87.2735***	78.6133***	69.1915***
<i>AIC</i>	-601.202	4790.21	4790.21
<i>SIC</i>	-577.96	4828.52	4828.52
Testing for Cross-Sectional Dependence			
<i>Pesaran CD Test</i>	Co-efficient: 2.660	Pr. 0.0078	
<i>Friedman Test</i>	Co-efficient: 30.152	Pr. < 0.0001	
<i>Frees Test</i>	Co-efficient: 0.118	Pr. 0.1782	

*** $p < .01$, ** $p < .05$, * $p < .1$; LM - Lagrangian Multiplier; w_contg , contiguity matrix; ; w_invsq , inversed squared distance matrix; w_knn , 5-nearest neighbors' matrix; Akaike Information Criterion; SIC; Schwarz Information Criterion. Source - Author's Estimation, 2024.

Table 5: Standard Linear Regression Model by Maximum Likelihood Method for Economic Community of West African States.

Testing for Spatial Dependence - Economic Community of West African States			
Variable	w_contg	w_knn	w_invsq
<i>fpd</i>	-0.579078	-0.585364	-0.585364
<i>fdi1</i>	-2.20488	-2.27572	-2.27572
<i>gfcf</i>	1.63319***	1.62059***	1.62059***
<i>dser</i>	0.662932	0.648145	0.648145
<i>trade</i>	-3.11575e+08 **	-3.04013e+08**	-3.04013e+08**
<i>bcd</i>	4.26398e+10***	4.21292e+10***	4.21292e+10***
<i>infl</i>	-0.0320235	0.0833108	0.0833108
<i>pop</i>	2027.71***	5209.08***	2041.71***
<i>pol_stab</i>	-981407	1.19017e+07	1.19017e+07
<i>gov_eff</i>	-7.32003e+08***	-7.14749e+08***	-7.14749e+08***
<i>reg_qual</i>	5.76175e+08**	5.61971e+08**	5.61971e+08**
<i>r_law</i>	1.03967e+09	1.04741e+09***	1.04741e+09***
<i>cont_corr</i>	-5.1784e+07	-3.42278e+07	-3.42278e+07
<i>-const</i>	-9.31584e+10	-9.24862e+10	-9.24862e+10
	w_contg	w_knn	w_invsq
<i>Moran's I</i>	28.9639***	15.5265***	30.9701***
<i>Spatial Lag</i>			
<i>LM Lag</i>	205.1980***	187.9662***	208.9985***
<i>Robust LM Lag</i>	29.0370***	91.4106***	34.6617***
<i>Spatial Error</i>			
<i>LM Error</i>	413.4043***	114.7270	201.4411
<i>Robust LM Err</i>	237.2432***	18.1714***	27.1044***
<i>LM (SARMA)</i>	442.4412***	206.1376***	236.1029***
<i>AIC</i>	-1059.56	8079.92	8079.92
<i>SIC</i>	-1027.79	8126.23	8126.23
Testing for Cross-Sectional Dependence			
<i>Pesaran CD Test</i>	Co-efficient: 16.353	Pr. 0.0376	
<i>Friedman Test</i>	Co-efficient: -0.430	Pr. 0.6673	
<i>Frees Test</i>	Co-efficient: 1.772	Pr. 0.1438	

*** $p < .01$, ** $p < .05$, * $p < .1$; LM - Lagrangian Multiplier; w_contg , contiguity matrix; ; w_invsq , inversed squared distance matrix; w_knn , 9-nearest neighbors' matrix; Akaike Information Criterion; SIC; Schwarz Information Criterion. Source - Author's Estimation, 2024.

Table 6: Standard Linear Regression Model by ML Method for Eastern Africa Development Community.

Testing for Spatial Dependence - Eastern Africa Development Community			
Variable	w_contg	w_knn	w_invsq
<i>fpd</i>	1.1442***	1.0287**	1.0287**
<i>fdi1</i>	16.6926***	11.7927***	11.7927***
<i>gfcf</i>	-4.8334e+08**	-6.14098e+08***	-6.14098e+08***
<i>dser</i>	-3.10226	-0.679979	0.457171
<i>trade</i>	1.59539e+08	6.00536e+08***	6.00536e+08***
<i>hcd</i>	1.74578e+11***	7.46335e+10	7.46335e+10
<i>infl</i>	-310957	-2.05242e+06	-2.05242e+06
<i>pop</i>	505.7***	1139.84***	1139.84***
<i>pol_stab</i>	-7.06413e+08	-6.17475e+08***	-6.17475e+08***
<i>gov_eff</i>	5.22549e+08**	5.56976e+08***	5.56976e+08***
<i>reg_qual</i>	-5.29899e+08***	-5.14649e+08***	-5.14649e+08***
<i>r_law</i>	-4.88797e+08***	-2.85887e+08	-2.85887e+08
<i>cont_corr</i>	2.72185e+08***	1.733e+08	1.733e+08
<i>-const</i>	-5.44767e+10	-2.63288e+10	-2.63288e+10
	w_contg	w_knn	w_invsq
<i>Moran's I</i>	7.0610*****	9.3563***	7.1800***
<i>Spatial Lag</i>			
<i>LM Lag</i>	94.5203***	114.3472 ***	87.7246***
<i>Robust LM Lag</i>	72.1185***	80.4804***	77.0098***
<i>Spatial Error</i>			
<i>LM Error</i>	24.0433***	34.3777**	17.9835***
<i>Robust LM Err</i>	1.6415	0.5109	7.2688
<i>LM (SARMA)</i>	96.1618***	114.8581***	94.9933***
<i>AIC</i>	-479.96	5542.83	5542.83
<i>SIC</i>	-454.734	5583.87	5583.87
Testing for Cross-Sectional Dependence			
<i>Pesaran CD Test</i>	Co-efficient: 17.611	Pr. 0.0035	
<i>Friedman Test</i>	Co-efficient: 0.364	Pr. 0.7156	
<i>Frees Test</i>	Co-efficient: 1.772	Pr. 0.1888	

*** $p < .01$, ** $p < .05$, * $p < .1$; LM - Lagrangian Multiplier; w_contg , contiguity matrix; ; w_invsq , inversed squared distance matrix; w_knn , 5-nearest neighbors' matrix; Akaike Information Criterion; SIC; Schwarz Information Criterion. Source - Author's Estimation, 2024.

4.3. Diagnostics for Spatial Dependence Using Moran's I Test.

Table 7: Moran's I and Robust LM tests statistics Using Different Weight Matrices

Moran's I and Robust LM tests statistics Using Different Weight Matrices				
	ECCAS	SADC	ECOWAS	EADC
<i>w_contg</i>				
Spatial Lag: Robust LM Lag	75.273***	87.2688***	29.0370***	72.1185***
Spatial Error: Robust LM Error	1.920	11.2751***	237.2432***	1.6415
Moran's I test Statistic	6.0493***	1.0149 **	28.9639***	7.0610***
<i>w_knn</i>				
Spatial Lag: Robust LM Lag	56.1036***	74.2250***	91.4106***	80.4804***
Spatial Error: Robust LM Error	1.1620	9.5620***	18.1714***	0.5109
Moran's I test Statistic	7.0159***	4.0283***	15.5265***	9.3563***
<i>w_invsq</i>				
Spatial Lag: Robust LM Lag	55.6984***	63.8414***	34.6617***	77.0098***
Spatial Error: Robust LM Error	0.8692	13.7031***	27.1044***	7.2688
Moran's I test Statistic	14.1885***	16.8600***	30.9701***	7.1800***
*** $p < .01$, ** $p < .05$, * $p < .1$; LM - Lagrangian Multiplier; <i>w_contg</i> , contiguity matrix; ; <i>w_invsq</i> , inversed squared distance matrix; <i>w_knn</i> , 5-nearest neighbors' matrix; Source - Author's Estimation, 2024.				

Prior to the implementation of the spatial dynamic panel model, it is essential to ascertain the veracity of the proposed spatial interaction effects. This approach entails estimating conventional OLS models through maximum likelihood estimation, as illustrated in [Table 3](#) to [Table 6](#). A synopsis of these findings is presented in [Table 7](#). To evaluate the extent of spatial dependence, which denotes the significant influence of geographical proximity, Moran's I and Lagrange Multiplier (LM) tests are employed. The results indicate the presence of spatial autocorrelation in the disturbance term, which gives rise to the potential for biased OLS estimators and model misspecification. The results demonstrate a positive and statistically significant Moran's I residual statistic at one percent significance level across the four regions. The consistent positive and statistically significant Moran's I across all regions indicates that economic growth in one country within a region can affect neighbouring countries positively, as opposed to those further away. Several factors may be contributing to this effect, including labour mobility, firm agglomeration, and transportation cost reductions. Furthermore, the presence of cross-sectional dependence is confirmed by the statistical significance of Pesaran CD tests, as reported in [Table 3](#) to [Table 6](#). In addition, an assessment of the spatial weight matrices

using the lowest Akaike Information Criterion values, indicates that the queen contiguity weight matrix (w_{contig}) provides the most optimal model fit for the four Sub-Saharan African regions. In light of the aforementioned evaluation, the queen contiguity weight (w_{contig}) is deemed the optimal weight matrix for model selection, with the findings presented in [Table 7](#) and [Table 8](#).

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By evaluating geographical weight matrices, the study contributes to the development of spatial methodology. Our novel finding of the significant impact of different geographical weights and the existence of spatial dependence suggests that countries in Sub-Saharan Africa situated in close geographical proximity are perceived as being of greater significance, more interconnected and dependent than countries located at a greater distance. It follows that Sub-Saharan African countries are subject to spatial externalities, in that, regional growth rates are contingent upon the growth rates of neighboring countries. We conclude that growth factors can have positive spillover effects on neighbouring countries, taking into account the spatial dependence. The complex dynamics of economic interactions, evidently reveal that proximity effects are likely to exert a substantial and pervasive impact on labor and capital markets (Benos et al., 2015). Marshall (1920) postulated the existence of agglomeration economies, whereby firms operating within the same industry and situated in close proximity to one another derive benefit from the pooling of labor, knowledge exchange, and a local supply of specialized inputs. In a modern context, there is greater emphasis placed on the significance of inter-firm interactions, with a particular focus on how geographical proximity of countries can foster collaboration and contribute to enhanced overall firm performance. Moreover, the proximity of innovative entities can encourage their interaction, which can facilitate the transfer of tacit knowledge. The proximity of such actors can enhance innovation outcomes across regions. Geographical proximity is, therefore, especially crucial in periods of substantial transformation or transitions between technological paradigms. Furthermore, the findings illustrate the necessity for integrated economic growth strategies in Sub-Saharan Africa. It is therefore imperative that policy makers in Sub-Saharan Africa recognize the importance of spatial interdependence when designing regional development policies.

4.4. Model Selection Strategy Using Lagrangian Multiplier (LM) Test

As previously discussed, we utilize Lagrange Multiplier test statistics to determine whether the SAR or SEM model is most appropriate for our data. To identify the best-fitting model for the regions, we employed a two-stage testing procedure. The initial

assessment is conducted and presented in [Table 7](#) using the LM tests developed by [Anselin et al. \(1996\)](#). For selecting the optimal model, we adhere to the testing sequence proposed by [Elhorst \(2010\)](#). When spatial models are evaluated using Maximum Likelihood, the aim is to test two main objectives: (i) To test whether SDM model can be evaluated by using LM spatial lag model (SAR) (ii) To test whether SDM model can be estimated by applying LM spatial error model (SEM). [Table 3](#) to [Table 6](#) presents standard OLS estimates by Maximum Likelihood method for the optimal model selection, as determined by Lagrangian Multiplier tests. Given that both the LM spatial lag and the LM spatial error are statistically significant across all the four Sub-Saharan Africa regions when queen contiguity (*w_contg*) is applied as the suitable weight matrix, the selection of the optimal model hinges on the significance of the robust LM Lag and robust LM error, presented in [Table 7](#). Since the robust LM lag statistic is more statistically significant with lower p-values compared to robust LM spatial error, i.e. a more significant version is preferred ([Anselin, 2005](#)). Therefore, the interpretation of the regression results depends on the spatial lag model (SAR), as shown in [Table 3](#) to [Table 6](#). As shown in [Table 7](#), the spatial error model does not adequately describe the data, as indicated by robust LM error test statistics. In contrast, the spatial lag (SAR) model consistently demonstrates significance according to robust LM lag test statistics across all three geographical matrices used. These findings suggest that the spatial lag model is the most appropriate for the four Sub-Saharan Africa regions. A "robust" LM test is essential because it ensures that one type of spatial dependence does not introduce bias to the test for detecting another type ([Ahmad & Hall, 2017](#)). Additionally, the spatial lag model exhibits lower Akaike Information Criterion (AIC) values compared to the Schwarz Information Criterion (SIC), as presented in [Table 8](#) and [Table 9](#) for all four regions. Building on these results, we further compare the Spatial Durbin Model (SDM) against the SLM/SAR model and the SEM model. In the subsequent step, we estimate the Spatial Durbin Model, which includes all explanatory and control variables. This model is considered a better fit for the data, as evidenced by the minimum AIC values and the significance of spatial rho (ρ) presented in Appendix [Table 22](#) across all four regions.

Table 8: Model Selection for Central and Southern Africa Regions

	ECCAS		SADC	
	<i>w_cont</i>	<i>w_cont</i>	<i>w_cont</i>	<i>w_cont</i>
	(1) SLM	(2) SEM	(1) SLM	(2) SEM
<i>w_rgdgdp_2015</i>	0.9444*** (0.015)	- -	0.935*** (0.012)	- -
<i>fpd</i>	0.140*** (0.045)	0.403*** (0.059)	0.007 (0.039)	0.0278312 (0.0528446)
<i>fdi1</i>	0.038 (0.062)	0.1312** (0.059)	-0.468** (0.237)	-0.598547*** (0.199972)
<i>dser</i>	0.295 (0.187)	-0.246 (0.197)	-0.093 (0.132)	-0.111528 (0.130412)
<i>gfcf</i>	1.07308e+07 (2.68632e+07)	3.07522e+07 (3.04559e+07)	1.35341e+08 (8.95136e+07)	1.6596e+08* (9.01337e+07)
<i>pop</i>	39.9775*** (9.49279)	70.6057*** (15.6763)	428.639*** (92.132)	410.9*** (111.958)
<i>trade</i>	-1.54744e+07*** (5.78658e+06)	-1.45211e+07** (7.08553e+06)	1.55176e+07 (2.21166e+07)	1.2828e+07 (2.23154e+07)
<i>infl</i>	-2.69171e+07*** (3.9382e+06)	-3.66854e+07*** (4.73427e+06)	974.052 (3009.75)	217.112 (3019.29)
<i>bcd</i>	1.29619e+10*** (3.78074e+09)	2.20315e+10*** (4.33378e+09)	4.54982e+10*** (4.84086e+09)	4.80977e+1*** (5.65827e+09)
<i>pol_stab</i>	1.32905e+07 (2.78185e+07)	4.09391e+07*** (3.02594e+07)	5.41925e+07 (4.01632e+07)	5.66447e+07 (4.1668e+07)
<i>gov_eff</i>	-7.73529e+07 (4.74066e+07)	-7.83523e+07 (4.89815e+07)	1.7246e+08 (8.57925e+07)	2.06596e+08** (8.8876e+07)
<i>reg_qual</i>	-8.98012e+07*** (3.72942e+07)	-7.60946e+07** (4.12778e+07)	-1.41737e+08 (8.71821e+07)	-1.40713e+08 (9.32173e+07)
<i>r_law</i>	1.35995e+07 (5.09387e+07)	-3.93817e+06 (5.53267e+07)	-2.49236e+08** (7.30061e+07)	-2.23779e+08 (8.95452e+07)
<i>cont_corr</i>	8.22762e+07** (4.02696e+07)	4.14324e+07 (4.42566e+07)	-2.88245e+10 (3.76927e+09)	-5.79556e+07 (7.78329e+07)
<i>_cons</i>	-3.27684e+09 (1.50367e+09)	2.82431e+10 (1.68605e+10)	-2.88245e+10 (3.76927e+09)	4.54964e+10 (6.89577e+10)
<i>v_acc</i>	-943624 (4.58144e+07)	-9.97069e+06 (4.76249e+07)	4.42358e+07 (6.99443e+07)	5.73204e+07 (7.36155e+07)
R ²	0.998017	0.997665	0.999528	0.999512
Log Likelihood	-2123.89	-2137.11	-2204.06	-2214.759
Akaike IC	4279.77	4304.22	4440.12	4459.52
Schwarz IC	4320.63	4342.52	4480.98	4497.83
Breusch Pagan Test	105.2441*	86.2912*	182.8629	130.5845*
Likelihood Ratio Test	296.6995***	270.2560***	352.0986***	330.6951***

Robust standard errors are in parentheses *** $p < .01$, ** $p < .05$, * $p < .1$; SLM_Spatial Lag Model; SEM_Spatial Error Model; BP_Breusch Pagan Test; *w_cont_spatial* queen contiguity weight matrix; ECCAS – Economic Community of central African States; SADC – Southern Africa Development Community.

Table 9: Cont. Model Selection for West and Eastern Africa Regions

	ECOWAS		EADC	
	<i>w_cont</i>	<i>w_cont</i>	<i>w_cont</i>	<i>w_cont</i>
	(1) SLM/SAR	(2) SEM	(1) SLM	(2) SEM
<i>w_rgdgdp_2015</i>	0.825 (0.035)	- -	0.977 (0.005)	- -
<i>fpd</i>	0.050 (0.145)	0.0304 (0.109)	0.006 (0.033)	0.070 (0.044)
<i>fdi1</i>	0.609 (0.766)	1.405 (0.548)	0.049 (0.205)	-0.193 (0.196)
<i>dser</i>	-0.319 (0.384)	-0.393 (0.243)	-0.151 (0.228)	-0.072 (0.234)
<i>gfcf</i>	0.262*** (0.087)	0.559 (0.099)	-3.32987e+07** (1.74941e+07)	-1.29693e+07 (2.00275e+07)
<i>pop</i>	254.533*** (92.324)	1401.17*** (117.819)	55.0509*** (18.0241)	-104.43*** (32.583)
<i>trade</i>	-2.648e+08*** (5.82323e+07)	-5.50524e+07 (3.58492e+07)	2.39816e+07* (1.33724e+07)	-2.67069e+06 (1.56449e+07)
<i>infl</i>	0.480612 (1.12019)	-0.914 (0.665)	-458842** (217347)	-76272.9 (200589)
<i>bcd</i>	1.12823e+10*** (2.62311e+09)	1.21432e+10*** (1.87566e+09)	4.66205e+09 (3.03076e+09)	1.1397e+10*** (4.12294e+09)
<i>pol_stab</i>	-8.73104e+07 (5.38256e+07)	1.2652e+08*** (3.19617e+07)	-3.00501e+06 (1.19467e+07)	1.77426e+07 (1.45218e+07)
<i>gov_eff</i>	-6.28555e+06 (9.21515e+07)	1.41753e+08*** (5.87856e+07)	3.03819e+07** (1.44201e+07)	1.01202e+07 (1.48608e+07)
<i>reg_qual</i>	2.36626e+07 (1.04356e+08)	1.25204e+08** (6.12973e+07)	-2.95833e+07*** (1.24771e+07)	-2.40062e+07 (1.50316e+07)
<i>r_law</i>	-4.42191e+07 (1.00111e+08)	-9.25778e+07 (6.42761e+07)	-6.60155e+06 (1.27657e+07)	1.00352e+07** (1.52047e+07)
<i>cont_corr</i>	7.71406e+07 (8.55185e+07)	-8.72365e+07* (5.08296e+07)	9.4501e+06 (9.87769e+06)	1.06926e+07 (1.08194e+07)
<i>_cons</i>	-4.47034e+09 (5.23861e+09)	-6.06391e+09 (2.35498e+10)	-2.01847e+09 (1.01968e+09)	4.39172e+10 (1.52898e+10)
<i>v_acc</i>	1.07605e+08 (7.17117e+07)	1.08478e+08 (4.2357e+07)	-4.3933e+07*** (1.36993e+07)	-1.69595e+07 (1.52079e+07)
R ²	0.997523	0.999167	0.999612	0.999635
Log Likelihood	-3888.86	-3814.499	-2493.77	-2499.90
Akaike IC	7809.71	7659	5019.54	5029.8
Schwarz IC	7859.11	7705.31	5063.31	5070.84
Breusch Pagan Test	155.3508	282.77	64.8196*	54.5406
Likelihood Ratio Test	272.2044***	420.91***	525.2913***	513.0245***

Robust standard errors are in parentheses *** $p < .01$, ** $p < .05$, * $p < .1$; SLM_Spatial Lag Model; SEM_Spatial Error Model; BP_Breusch Pagan Test; *w_cont*_spatial queen contiguity weight matrix; ECCAS – Economic Community of central African States; SADC – Southern Africa Development Community; ECOWAS – Economic Community of West African States; EADC – Eastern Africa Development Community.

4.5. Comparing SDM against Spatial Lag Model and Spatial Error Model

Table 10: Comparing SDM against SAR and SEM Models

Tests	(1) ECCAS	(2) SADC	(3) ECOWAS	(4) EADC
<i>SDM against SLM/SAR</i>				
<i>Chi2(x)</i>	(13) 215.99 ***	(12) 103.72***	(12) 197.59***	(13) 83.80***
<i>Prob> Chi2(x)</i>	<0.0001	<0.0001	<0.0001	<0.0001
<i>LR Test</i>	0.0000	0.0000	0.0000	0.0000
<i>SDM against SEM</i>				
<i>Chi2(x)</i>	(13) 274.86***	(4) 147.40***	(12) 88.76***	(13) 198.19***
<i>Prob> Chi2(x)</i>	<0.0001	<0.0001	<0.0001	<0.0001
<i>LR Test</i>	0.0000	0.0000	0.0000	0.0000
<i>Appropriate Spatial Panel Model</i>	Reject <i>H₀</i> and use SDM Model	Reject <i>H₀</i> and use SDM Model	Reject <i>H₀</i> and use SDM Model	Reject <i>H₀</i> and use SDM Model
<i>Model fit</i>				
<i>Log Likelihood</i>	177.3533	159.2863	284.1536	169.2701
<i>AIC</i>	-238.8892	-266.5726	-601.6875	-278.5402
<i>BIC</i>	-162.2729	-200.1718	-521.41	-196.4542
<i>Selecting Between SDM - FE and SDM -RE Based on Hausman Test</i>				
<i>Hausman Test Pr> Chi2</i>	0.0000	0.0000	0.0000	0.0000
<i>Appropriate SDM Model</i>	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect

*** $p < .01$, ** $p < .05$, * $p < .1$; Hausman test Prob = 0.0000 we use SDM – FE Model for interpretation of the results; AIC – Akaike Information Criterion; BIC – Schwarz Bayesian Information Criterion; SAR – Spatial Autoregressive Model; SEM – Spatial Error Model; SDM – Spatial Durbin Model; Source: Author's Estimation, 2024.

The spatial autoregressive model (SAR) and the spatial error model (SEM) are all nested in Spatial Durbin Model . The likelihood ratio (LR) test is used to identify the most suitable specification among these three models. The tests evaluate whether the spatial Durbin model can be simplified to either the spatial autoregressive model ($H_0: \theta = 0; H_1: \theta \neq 0$) or the spatial error model ($H_0: \theta + \rho\beta = 0; H_1: \theta + \rho\beta \neq 0$.) (Elhorst, 2010; LeSage & Pace, 2009). We tested whether any coefficients differed significantly from zero, for the spatially lagged independent variables. The following hypotheses are tested for SAR Vs SDM model: $H_0: \theta = 0; H_1: \theta \neq 0$ and for SEM Vs SDM model: $H_0: \theta + \rho\beta = 0; H_1: \theta + \rho\beta \neq 0$. Based on log-likelihood ratio and Chi-square probabilities test presented in Table 10, the null hypothesis is rejected in all the four

regions implying that SDM is the most preferred model for estimation. The statistical significance of Hausman tests further validated the suitability of using the Spatial Durbin Model (SDM) with spatial fixed effects for model estimation. The Spatial Durbin Model (SDM) incorporates both a spatially lagged explained variable and spatially lagged explanatory variables. With these spatially lagged variables included, the SDM explicitly accounts for the convergence hypothesis, direct, indirect, and total spillover effects from the explanatory variables. In addition, this allows us to analyze how foreign public debt and foreign direct investment (FDI) and other control variables affect regional economic growth in the host country and the neighboring countries. We use the spatial panel fixed effects estimation technique as described by [Elhorst \(2003\)](#), [Elhorst \(2009\)](#) and [Anselin et al. \(2008\)](#). This method allows unobserved heterogeneity to be addressed, resulting from omitted variables that may potentially affect the growth process. In order to ensure the robustness of the baseline results, we incorporate additional control variables into the baseline model. Among these variables are Solow correlates as well as governance and institutional variables such as political stability, rule of law, efficiency of government, control of corruption, and civic engagement or voice accountability.

Table 11: Diagnostic Tests

Tests	(1) ECCAS	(2) SADC	(3) ECOWAS	(4) EADC
<i>Multicollinearity</i>				
<i>Condition Index Number (CI)</i>	396.5399	125.7313	223.553	27.2148
<i>Normality of Errors</i>				
<i>Jarque Bera (JB)</i>	3.3713	4.7212*	4.1379	4.2735
<i>DF</i>	2	2	2	2
<i>Prob.</i>	0.1853	0.0943	0.1263	0.1180
<i>Heteroscedasticity</i>				
<i>Breusch-Pagan Test (BP)</i>	14.1479**	17.5296***	27.1157***	46.9018***
<i>DF</i>	7	7	7	7
<i>Prob.</i>	0.0486	0.0142	0.00032	<0.0001
<i>Koenker Bassett Test (KB)</i>	13.9723**	29.16107***	27.6805***	40.3621***
<i>DF</i>	7	7	7	7
<i>Prob.</i>	0.0516	0.00014	0.00025	<0.0001
<i>Specification Test</i>				
<i>Whites Test</i>	73.3196***	104.8283***	140.5866***	100.166***
<i>DF</i>	35	35	35	35
<i>Prob.</i>	0.0001	<0.0001	<0.0001	<0.0001

*** $p < .01$, ** $p < .05$, * $p < .1$ Source: Author's Estimation, 2024

Table 3 to Table 6 presents MLE outcomes of spatial dependence, optimal model selection, as determined by Moran's I residual statistic, Lagrangian Multiplier, and log likelihood ratio (LR) tests. From a spatial regression standpoint, one key concern revolves around the assumption of error independence, which can be compromised by spatial dependence. Should there be compelling evidence of such spatial dependence, the conventional Ordinary Least Squares (OLS) linear regression model might no longer be suitable (Elhorst, 2010). The presence of spatial dependence or spatial heterogeneity can lead to unreliable statistical inference when OLS estimations are applied in econometrics. Should both the LM tests and LM robust tests indicate evident spatial dependence in the residuals, opting for a spatial error model over the standard linear regression model is advisable (Baller et al., 2001). Additionally, while social scientists traditionally gauge the fit of standard linear regression models using R^2 and adjusted $\bar{R}^2$ this study applied alternative goodness of fit measures. These include the likelihood ratio (LR) test, Akaike Information Criterion (AIC) (Akaike, 1973), and Schwarz Bayesian Information Criterion (BIC) (Schwartz, 1978) in the context of addressing spatial regression models. The spatial dependence suggests interconnectedness among neighboring regions, where their economies mutually influence one another. However, Moran's I statistic highlights the prevailing assumption of spatial dependence, it lacks the capability to differentiate between Spatial Error Model (SEM) and Spatial Lag Models (Anselin and Rey, 1991). The application of the robust LM error test and robust LM lag test unveiled the presence of spatial dependence within the dataset. The overall results show positive statistically significant Moran's I residual statistic estimated at one percent level of significance across three regions and at five percent level of significance in Southern Africa. Given that both the LM spatial lag and the LM spatial error are statistically significant across the regions, the selection of the optimal model hinges on the significance of the robust LM Lag and robust LM error. Because the robust LM lag statistic is statistically significant compared to the robust LM error statistic, the interpretation of the regression results depends on the spatial lag model, as shown in Table 3 to Table 6. Moreover, the likelihood ratio (LR) tests for the four regions are highly significant at 1% level, suggesting that the spatial lag model specification is suitable for estimation.

Table 11 displays the diagnostic tests conducted to evaluate the suitability of the model employed in this research. To evaluate the normality of residuals or errors in our regression model, we apply Jarque-Bera (JB) test (Jarque-Bera, 1980). In linear regression, one of the key assumptions is that the residuals follow a normal Gaussian distribution. As per the Jarque-Bera (JB) test results, the errors in the ordinary least squares (OLS) model conform to a normal distribution, as evidenced by their lack of significance across all the four regions. This suggests that the normality assumptions in classical linear regression models hold true for the errors in the OLS. Given that many statistical tests and estimators rely on normally distributed errors, the OLS model and its findings can be deemed reliable and thus utilized for the analysis. Furthermore, the study employed the Breusch-Pagan (BP) test to assess the presence of heteroskedasticity. The Breusch-Pagan (BP) test is a technique used to detect heteroskedasticity in a linear regression framework. The BP test involves fitting a linear regression model to the residuals of an existing linear regression model, typically using the same explanatory variables as those in the main regression model. Under the null hypothesis, the BP test follows a chi-square distribution. If a significant portion of the variance is explained by the additional explanatory variables, the null hypothesis is rejected. The test is based on the idea that if heteroskedasticity exists, the variance of the residual term will be related to the model's explanatory variables (Breusch and Pagan, 1979). The Breusch-Pagan (BP) tests, along with the Koenker-Bassett (KB) test and White's specification test, indicate the presence of heteroscedasticity within the model, as shown in Table 11. This suggests that the model's errors are not constant across the dataset, likely due to the variables being in their level form during estimation using GeoDa. While heteroscedasticity affects the standard errors and p-values, it does not introduce bias into the coefficients. However, GeoDa coefficient estimates are not utilized directly, the software is employed to guide in model selection. The effects of the variables are reassessed after log transformation using the Spatial Durbin Fixed Effect model, yielding results that are homoscedastic.

The condition index (*CI*) also acts as a tool for assessing the overall multicollinearity between variables. It is derived from the variable's eigenvalues. The condition index (*CI*) always exceeds one, with higher values indicating multicollinearity. A *CI* value greater

than 30 indicates significant multicollinearity in the model. The condition index (*CI*) given in [Table 11](#), confirms the presence of multicollinearity in OLS estimates across the four regions, this is further diagnosed by taking logs and weights of the variables in spatial lag analysis. Additionally, lag length selection criteria were evaluated using the minimum values of AIC and SIC. Additionally, the optimal lag length was determined by evaluating the minimum values of information criteria, specifically the Schwarz Information Criterion (SIC) and the Akaike Information Criterion (AIC). As shown in [Table 10](#), a minimum value is obtained from AIC for all the four regions evaluated. A minimum value of AIC suggests that the spatial specification provides a better fit with respect to the non-spatial model. The coefficient of multiple determination, R-squared (R^2), validates that the ordinary least squares (OLS) adequately fit the data well. According to these results, the model used in this study is appropriate for analyzing the data and drawing conclusions.

Based on the analysis of regional data presented in

[Table 12](#), we provide a fresh perspective on regional development convergence. While there isn't a definitive theoretical framework outlining which explanatory variables to include in convergence analysis, the macro-regional parameters integrated into the spatial model are notably influenced by endogenous growth theory. These variables are considered potential determinants of economic growth. Following the Solow growth model and its augmented versions, it is customary to account for rates of physical and human capital investment. According to post-neoclassical endogenous growth theory, regional convergence and divergence, as well as the spatial distribution of high and low growth areas are explained by integrating factors previously considered exogenous, including, saving rates, human capital development, population growth, and technological developments. Although it has faced criticism, the endogenous growth theory has significantly influenced regional development policies, shifting the focus towards enhancing the economic performance of all localities and regions. This shift aims to enhance local, regional, and ultimately national development ([Martin and Sunley, 1998](#)). This aspect is effectively addressed in the study by integrating gross fixed capital formation and the human capital development index into the spatial analysis model. The summary statistics for these variables are presented in [Table 2](#).

4.3. Testing for β - convergence hypothesis Using Real GDP Per Capita

Response to Research Question 2 and Hypotheses 2

RQ2: How does regional development convergence, measured by real GDP per capita, vary when accounting for governance and institutional factors in Sub-Saharan Africa?

The following hypothesis is tested:

H₀2: Controlling for governance and institutional framework, the lagged spatial weight of real GDP Per Capita has a positive significant effect on regional economic growth in Sub-Saharan Africa.

The study examines economic growth convergence or divergence in Sub-Saharan African regions, considering macroeconomic, governance and institutional factors. It emphasizes the importance of macro-regional influences in understanding regional growth patterns, exploring the factors contributing to economic disparities within Sub-Saharan Africa. The research investigates whether regional economic growth exacerbates or mitigates growth inequalities in the region. The prevailing narrative of Sub-Saharan Africa's economic rise is criticized as overly optimistic, as it often focuses on real GDP growth without accounting for demographic dynamics. The study underscores the significance of real GDP per capita as a more accurate growth measure, given its consideration of population growth, which is frequently overlooked. Additionally, the analysis highlights how governance and institutional factors; political stability, rule of law, voice accountability, governance effectiveness and corruption control, are essential in fostering a conducive environment for investment and growth. Using a spatial model grounded in the neoclassical growth framework, the study incorporates demographic factors (population and human capital), global macro-regional variables (foreign direct investment, trade, and foreign public debt), domestic factors (gross fixed capital formation), and governance and institutional elements to assess regional economic growth dynamics.

Table 12: Estimation Results for β – Convegence at Regional Level

SDM – FE Model Estimation Based on WDI Data (1992 – 2021)				
	2000-2021	1994 – 2020	1992 -2019	1992 -2020
Variables	(1)	(2)	(3)	(4)
	ECCAS	SADC	ECOWAS	EADC
<i>Wlnrgdp_2015</i>	-0.198*** (0.058)	0.5340*** (0.023)	0.026*** (0.000)	0.549*** (0.055)
<i>W_lnpop</i>	1.313*** (0.043)	1.632*** (0.005)	1.024*** (0.118)	1.667*** (0.018)
<i>Spatial rho__ρ</i>	3.726*** (0.137)	1.363*** (0.058)	0.219*** (0.101)	0.342*** (0.118)
<i>Variance Sigma 2_e</i>	0.0020 (0.000)	0.002 (0.000)	0.001 (0.000)	0.003 (0.000)
<i>Obs.</i>	95	95	162	114

*** $p < .01$, ** $p < .05$, * $p < .1$; Source: Author's Estimation, 2024

H₀₂: Controlling for governance and institutional framework, the lagged spatial weight of real GDP Per Capita has a positive significant effect on regional economic growth in Sub-Saharan Africa.

The objective of this study was to ascertain whether disparities in economic growth are diminishing or increasing in Sub-Saharan African countries. In comparison to previous studies on convergence in Sub-Saharan African countries, this study places particular emphasis on the spillover effects of foreign capital, specifically foreign public debt and foreign direct investment (see section 4.5, Table 15 and Table 16). It also highlights the importance of geographical location. We treat Sub-Saharan African countries as interconnected spatial units, rather than as independent or isolated spatial entities. A second hypothesis examines whether lower-income countries in the region are experiencing a catch-up process with respect to wealthier countries. The variable of interest in regional growth convergence analysis is the spatially lagged real GDP Per Capita (*wlnrgdp_2015*). The expected result was for the coefficient of spatially lagged real GDP Per-Capita variable to be negative and statistically significant, aligning with the β convergence hypothesis. However, contrary to theoretical expectations, using contiguity weight matrix (*w_contg*), the findings revealed consistent positive and statistically significant lagged real GDP Per Capita (*wlnrgdp_2015*) variable, thereby contradicting the

convergence hypothesis. Across all regions, except Central Africa states, a pattern of growth disparity is evident. We therefore provide evidence for Hypothesis 2 in

[Table 12](#). We accept the null hypothesis of divergence across the three regions. Moreover, Central Africa states stands out as it exhibits a trend towards development convergence when Per-Capita GDP is analyzed. Spatial ρ (ρ) reflects the magnitude of economic growth spatial spillovers. The results presented in

[Table 12](#) offer compelling evidence that countries with similar growth rates tend to form clusters, as indicated by positive spatial ρ (ρ) in all the regions. A region's growth is thus influenced not only by its internal characteristics but also by those of neighbouring regions. Specifically, real GDP per capita growth in any given region is influenced by the region's initial growth level and a weighted average of growth levels in adjacent regions. The presence of convergence is demonstrated by the observation that poor regions tend to experience more rapid growth compared to wealthier regions. In our growth analysis, regions exhibited different rates of catch-up, with the Central Africa states showing the highest growth trajectory compared to West Africa, Eastern Africa, and Southern Africa regions. The observed divergence among sub-regions in this study could stem from their heterogeneity. Countries within these sub-regions possess varying steady states, influenced by a range of country-specific institutions and policies driving their sustainable development goals. Additionally, it's commonly assumed that two regions or countries will reach a similar steady state only if they start with identical initial conditions. However, considering that location is a fundamental aspect of these initial conditions, and each region possesses its unique geographical position, it's logical to infer that each region will converge towards its distinct steady state ([Le Gallo et al., 2011](#)).

The contemporary era of globalization presents several important aspects concerning economic geography. Much of the global economy is undergoing a phase of gradual international convergence ([Spence, 2011](#)), wherein poorer nations are narrowing the gap with wealthier ones. This convergence is driven by internal structural changes within poorer countries and by firms in richer countries capitalizing on new trade and investment opportunities in lower-income nations. However, this trend is not uniform; a significant portion of Africa remains outside this convergence process ([Venables, 2010](#)). In recent

years, various challenges have emerged within Sub-Saharan African regions, impacting the efficacy of regional development efforts. Particularly significant are the consequences of political tension, limitations on inter-regional trade, macroeconomic disturbances both domestically and internationally. These factors, coupled with climate change, profoundly impact the socio-economic and ecological dynamics of various Sub-Saharan African regions. This introduces increased complexities, thereby demanding novel approaches and methodologies to effectively address these challenges. Nevertheless, there remains a notable gap in the comprehensive development and understanding of tools, methodologies, data, and policies for regional development planning. For instance, in certain African contexts, regional planning initiatives have primarily existed in theoretical frameworks, with limited practical implementation observed ([Landau, 2011](#)). Several challenges contribute to this phenomenon. Besides the scarcity of development funding, obstacles related to the complexities of regional operations ([Odero, 2001](#)), and the absence of standardized regional development tools and methodologies, the acute shortage of regional data significantly impedes effective regional development practices ([Gambe et al., 2022](#)).

Developing countries often demonstrate a variety of agglomerations with diverse outcomes, where some regions experience growth while others face decline. Numerous areas lack significant urban concentrations or are characterized by a blend of urban and rural elements. A considerable degree of heterogeneity exists between regions regarding both their attributes and their growth trajectories ([Woodward, 2009](#)). Various factors might be attributed to Sub-Saharan Africa regional growth divergence, including the shortage of skilled labor, trade restrictions, intellectual property rights, and institutional frameworks ([Johnson and Papageorgiou, 2020](#)). Additionally, according to economic growth theories, there are various other factors that can hinder countries from achieving convergence. These include the governance and institutional frameworks, lack of policy dynamics, lack of innovation capacity, disparities in human capital development, bottlenecks to technological transfer, and geographical constraints ([Carrington and Jiménez-Ayora, 2021](#)). Institutions encompass the formal legal framework that governs economic activities. This framework includes aspects such as the clarity and security of property rights, the enforceability of contracts, the separation of legal and political systems, the

extent of regulatory compliance required by firms, the ease of capital movement, restrictions on asset ownership, levels of taxation, and the prevalence of corruption ([World Bank, 2009](#)).

The findings of this study are consistent with those of [Putnam \(1993\)](#), who conducted a historical analysis of various Italian regions. Putnam argued that the significant disparities in growth and development between the northern and southern regions of Italy can be attributed to the presence of robust and trusted institutions in the north, in comparison to the south. A correlation has been identified between lower levels of trust in formal legal and governmental institutions and lower levels of economic development. Conversely, higher levels of trust have been found to encourage increased investment and commercial risk-taking. It can be reasonably argued that there is a strong correlation between social trust and economic activity over time. Consequently, the long-term development of a region is seen as being inextricably linked to its institutional history ([Putnam, 1996](#)). Many Sub-Saharan African countries have historically struggled with poor governance and weak institutional frameworks, characterized by political frictions during election cycles and pervasive systemic corruption, which hinders regional development. Recent evidence suggests a relationship between long-term economic growth and levels of inequality, with higher levels of social capital potentially diminishing as institutional frameworks strengthens. The sustainability of economic growth may also hinge on the extent to which a broad spectrum of society can access and benefit from growth opportunities ([Berg and Ostry, 2011](#)).

The results of this study are consistent with previous research conducted in the region, which highlighted certain factors that are unique to Sub-Saharan Africa, such as policy distortions and inadequate institutional frameworks, are responsible for driving divergent growth rates within the regions ([Ogun, 2014](#)). [Malamud and Assane \(2013\)](#) Observations indicated that Sub-Saharan African countries tend to converge at a slower pace, or sometimes not at all, compared to the rest of the world. The region's heavy reliance on exports has been identified as a significant factor contributing to this growth differential. In addition, studies suggest that structural change has a bidirectional relationship with

aggregate productivity growth in Sub-Saharan Africa's Least Developed Countries. Assessing the direction of these changes is crucial for understanding their impact on the region's overall growth trajectory. This study noted that in developing Sub-Saharan African countries, labor tends to shift from one low-productivity sector to another ([Azenui, 2024](#)). The West African economies have experienced growth spurts as a result of positive external shocks, specifically FDI investment into the region, and economic liberalization. Conversely, periods of economic slowdown have coincided with short-lived regimes and deteriorating corruption indices ([Imam and Salinas, 2015](#)). There has been an emphasis on the importance of existing macroeconomic frameworks in African countries for achieving long-term growth and economic transformation. This study highlighted the need for coherent policies that align with development priorities in Sub-Saharan African countries ([Lopes et al., 2017](#)).

The Sub-Saharan regions experience different economic growth challenges. Lack of convergence might further be attributed to heightened territorial conflicts, socio-political tensions, natural resource disputes and political insurgence in most parts of the region. The conflicts and insecurity in the subregions have seriously hindered the development of these countries. As a result of regional instability and conflict, sustainable development plans have been greatly affected and the potential for long term structural stability has been undetermined. Furthermore, the Eastern African community is still grappling with various social and political issues, such as, governance and poor institutional frameworks, inadequate healthcare, food insecurity leading to persistent hunger and high illiteracy levels. Vulnerability to famine is particularly pronounced among impoverished and arid communities in the region. The region is vulnerable to global shocks and official development assistance (ODA) reliance. Moreover, environmental issues such as unpredictable rainfall, droughts, and unstable energy supply also affect sustainable development. The growth trajectory of the West African states' region might also be credited to robust global demand for crude oil and cocoa from West Africa. This is also due to the improving macroeconomic management, swift recovery of post-conflict nations, and political stability.

Dissertation Thesis II

The findings of this study demonstrate the existence of convergence clubs, which are defined as groups of economies that exhibit distinct patterns in their pursuit of convergence (Quah, 1997). These convergence clubs encompass regions that are closely connected by both technological and geographical proximity. In general, foreign capital is employed primarily for the purpose of financing physical capital projects in Sub-Saharan Africa. These include projects related to road and transportation infrastructure, renewable energy, and telecommunications, among others. In developing economies with limited capital resources, the marginal productivity of capital is higher, as postulated by Solow's neoclassical growth model. The inflow of foreign capital into these low-income regions has the potential to stimulate growth on a temporary basis, enabling them to exceed their steady-state levels. The eventual diminishing marginal returns to capital result in these economies approaching their steady states, where long-term growth is determined by technological progress. Consequently, a region's capacity for growth in response to the development of other regions is contingent upon its own technological history, which is interconnected with the technological histories of other regions experiencing either growth or growth decline. The diffusion of technology gives rise to convergence growth, albeit at varying rates and patterns across regions. An unequal growth rate may result from lock-in and hysteresis effects associated with established technologies, sectors, occupations, and skills. Regions that are technologically more distant from a leading region are likely to have fewer opportunities for growth through spillovers, regardless of their geographical distance from each other. The observed variations in regional growth of Sub-Saharan African countries can primarily be attributed to the differing technological profiles of various countries. These distinct technological profiles are believed to result in disparities in the regions' capacities to integrate with emerging technologies. Furthermore, our findings are corroborated by the absence of convergence in cross-country analyses, as observed by Barro and Sala-i-Martin (1992). In addition, the tenets of agglomeration theory reinforce the proposition that cross-country convergence is an unlikely phenomenon. In this theoretical framework, the growth rates of densely populated cities and industrial clusters are expected to differ from those of less interconnected, sparsely populated regions. Most countries in Sub-Saharan Africa are sparsely connected and not heavily industrialized, which may be a significant contributing factor to the emergence of regional growth disparities.

4.4. Potential Drivers of Regional Growth Disparities and Interdependence in Sub-Saharan Africa.

Table 13 presents the results of the four regions for comparison purposes. The results from Likelihood ratio tests (LR), LM tests, specifically Spatial LM (Lag) and Spatial LM (Error) as described in [Elhorst \(2010\)](#) and [Florax et al. \(2003\)](#) along with the Hausman test ([Lee and Yu, 2010](#)), suggest the suitability of interpreting the results of this study using SDM – FE model. For a more nuanced and comprehensive model selection process, additional information regarding the evaluated models is presented in [Table 23](#) to [Table 27](#), which are included in the appendix. This section presents a comparative investigation of the effects of macro-regional factors on economic growth across the four convergence clubs. Our findings are juxtaposed with existing theoretical frameworks and past empirical research, offering insights particularly relevant to Sub-Saharan Africa. Subsequently, we discuss the correlation between the findings of this study and the Sustainable Development Goals, elucidating the potential policy implications.

Table 13: SDM – FE Model Estimation Based on WDI and WGI Data.

SDM – FE Model Estimation Based on WDI & WGI Data				
	(1)	(2)	(3)	(4)
Variables	ECCAS	SADC	ECOWAS	EADC
<i>lngfpd</i>	-0.086*** (0.003)	-0.007*** (0.000)	-0.010 (0.008)	0.070*** (0.000)
<i>lnfdi1</i>	0.001 (0.002)	0.013*** (0.000)	-0.015 (0.010)	0.008*** (0.000)
<i>lndser</i>	0.000 (0.000)	-0.005*** (0.000)	0.021*** (0.003)	0.026*** (0.000)
<i>lngfcf</i>	0.006 (0.004)	0.027*** (0.000)	0.068*** (0.023)	0.013*** (0.001)
<i>lnpop</i>	1.313*** (0.043)	1.632*** (0.005)	1.024*** (0.118)	1.667*** (0.018)
<i>trade</i>	0.001*** (0.000)	-0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
<i>infl</i>	-0.001*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
<i>bcd</i>	4.624** (0.000)	1.326*** (0.006)	0.413*** (0.112)	2.410*** (0.016)
<i>pol_stab</i>	0.000 (0.000)	0.000*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
<i>gov_eff</i>	0.001*** (0.000)	0.002*** (0.000)	-0.000 (0.001)	-0.001*** (0.000)
<i>reg_qual</i>	0.000 (0.000)	-0.003*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
<i>r_law</i>	-0.004*** (0.000)	0.001*** (0.000)	0.002*** (0.001)	0.002*** (0.000)
<i>cont_corr</i>	0.004*** (0.000)	-0.001*** (0.000)	0.002*** (0.000)	0.003*** (0.000)
<i>Spatial rho</i>	-3.645*** (0.058)	-3.969 (0.000)	-4.634*** (0.298)	-4.886 (0.000)
<i>variance Sigma 2_e</i>	0.0020 (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
<i>observations</i>	95	95	162	114
<i>r²</i>	0.602	0.655	0.896	0.886

*** $p < .01$, ** $p < .05$, * $p < .1$; WDI – World Development Indicators; WGI – Worldwide Governance Indicators; Source: Author's Estimation, 2024.

4.4.1. Regional Economic Growth and Foreign Public Debt Nexus

RQ3: What is the impact of foreign public debt on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

H03: Controlling for governance and institutional framework, foreign public debt has a positive significant effect on regional economic growth in Sub-Saharan Africa.

The results obtained from the SDM - FE Model highlight a noteworthy adverse impact of foreign public debt on economic growth as depicted in **Table 13**. Specifically, an increase in foreign public debt is associated with a significant 8.6% reduction in regional economic growth in central African nations, a marginal decrease of 0.7% in Southern Africa, a 1% decrease in West Africa and a notable 0.7 % increase in the Eastern African region. The findings of this research contribute to addressing Sustainable Development Goals (SDGs - 10 and 16) that emphasize the necessity for improved financial markets and strong institutional regulations, developing transparent financial institutions, advocating for legitimate institutions that represent developing countries in global decision-making processes such as crafting of foreign public debt contracts with bilateral partners and multilateral institutions.

These observations further align with similar findings reported in various empirical studies conducted elsewhere. [Daud and Podivinsky \(2011\)](#) applied spatial analysis in evaluating foreign public debt incorporating the neighbourhood effect in the debt – growth model, they argued that foreign public debt has a negative effect on economic growth in the Asia-Pacific and Latin America-Caribbean regions. Additionally, their study sheds light on the spillover effects of economic growth among the neighbouring countries. A study by [Suma \(2007\)](#) examined the effects of spatial interactions and spatial dependence among West African countries by using spatial autoregressive (SAR) growth and investment models, and the results indicated that external public debt and regional economic growth in the West Africa are spatially dependent both positively and negatively. [Yildiz and Tuncer \(2021\)](#). investigated the relationship between debt and growth using spatial analysis in the

European Union. According to the study, public debt burden could negatively affect economic growth and have spillover effects across regions.

Furthermore, this assertion finds support in the observations made by [Mumuni and Abille \(2023\)](#), who, through a study of 30 Sub-Saharan African countries, noted that foreign public debt exacerbates income inequality (SDG Goal- 10) within the region. [Fayzullokh et al., \(2023\)](#) observed a significant and positive correlation between high levels of public debt and poverty (SDG Goal- 1) in developing countries. Moreover, [Andoh et al. \(2023\)](#) reported from their study involving 38 African countries that a 1% rise in public debt correlates with a 0.17% increase in income inequality across the region. The result further resonates with findings of [Kilinc \(2023\)](#) who observed that higher levels of debt is associated with higher levels of inequality (SDG Goal- 10) in developing countries. In Sub-Saharan African nations, it has been noted that foreign public debts have adverse effects on the sustainability of cities, communities, and ecosystems (SDG Goal- 11), hindering countries from attaining their sustainable development goals ([Luu et al., 2024](#)). Moreover, public debt and government spending exert a substantial negative effect on the long-term development of economies in Sub-Saharan Africa. Despite efforts to enhance governance and institutional effectiveness, they have been ineffective in mitigating the negative impact of foreign public debt on long-term development ([Abaidoo et al., 2023](#)). There is a lack of direct information on how foreign public debt specifically contributes to the attainment of SDGs in the Sub-Saharan Africa. Therefore, a comprehensive understanding of the impact of foreign public debt on SDGs in Sub-Saharan Africa may require additional research beyond the scope of this study.

Several studies have provided evidence that supports debt overhang hypothesis ([Chowdhury, 2001](#) and [Clements et al., 2003](#)). This study also found support from [Ramzan and Ahmad \(2014\)](#); [Silva \(2020\)](#); [Irfan et al. \(2020\)](#); [Moh'd al-Tamimi and Jaradat \(2019\)](#) who found negative relationship between foreign public debt and economic growth. The result is further supported by economic growth theories, including Classical, and Neo-Classical perspectives. Classical economists criticized government borrowing, arguing that it diverts private capital from productive uses, hindering capital accumulation and

overall economic growth and development. Classical economists' views find support in the work of [Moh'd AL-Tamimi and Jaradat \(2019\)](#); [Bélanger \(2021\)](#); [Mohsin et al. \(2021\)](#); [Zouhaier and Fatma \(2014\)](#), highlighting the potential negative consequences of heavy reliance on foreign public debt for economic growth in the region.

4.4.2. Regional Economic Growth and Foreign Direct Investment Nexus

RQ4: What is the impact of foreign direct investment on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

H04: Controlling for governance and institutional framework, foreign direct investment has a positive significant effect on regional economic growth in Sub-Saharan Africa.

Furthermore, the results indicated no correlation between economic growth and foreign direct investment (FDI) in the west and central African regions. Conversely, a clear and statistically meaningful relationship between FDI and economic growth was identified in the south and eastern African regions. Specifically, for every unit increase in FDI, economic growth rises by 1.3% and 0.8% in the southern and eastern African regions, respectively. The emergence of globalization has fostered increased interconnectedness in the global economy. This shift is credited to diverse policies and initiatives implemented in trade, technology, and investment. The elimination of regulatory hurdles has enabled multinational corporations to broaden their market presence in developing countries ([Pradhan 2005](#)). Previous studies support the negative and sometimes mixed impact of FDI on growth in the Sub-Saharan African region. Several studies suggest that the direct impact of FDI on economic growth in Sub-Saharan African countries is predominantly negative ([Meniago and Lartey, 2021](#); [Awolusi et al., 2017](#)). Nevertheless, the influence of FDI on economic growth exhibits variations contingent upon a country's resource endowment. There is consistency between these findings and previous research highlighting the importance of strong domestic financial sector ([Ben Jelili, 2020](#); [Yeboua, 2019](#)) and quality institutions ([Hayat, 2019](#)) in conjunction with FDI. Additionally, [Doytch and Uctum \(2019\)](#) suggest that foreign direct investment (FDI) in service industries is associated with

real GDP growth, while [Rodríguez-Pose and Cols \(2017\)](#); [Malikane and Chitamber \(2017\)](#) show a constructive correlation between foreign direct investment and economic growth in countries with robust democratic institutions and low levels of corruption.

[Wang et al. \(2004\)](#) conducted a study that revealed FDI, rather than international trade, exerts a greater impact on real GDP growth in high-income countries. However, some critics argue that countries with limited foundational capacities may not fully reap the benefits of FDI, as the public may struggle to comprehend and effectively utilize the human development resulting from the positive spillover effects of FDI ([Xia et al., 2022](#)). Additionally, due to tax incentives offered to FDI enterprises, FDI inflows might adversely affect economic growth ([Wu et al., 2020](#); [Olofin et al., 2019](#)). [Herzer et al. \(2008\)](#) discovered that FDI inflows facilitate real GDP growth when there is a well-established presence of trade openness, human capital, and per capita income. Moreover, according to other researchers, FDI inflows have contributed to economic growth in host countries through physical capital accumulation, human resource development, stimulating technological innovation, and generating positive externalities ([Zeng & Zhou, 2021](#); [Zamani & Tayebi, 2022](#); [Simionescu & Naros, 2019](#)). Other studies that have investigated FDI and economic growth are [Shahbaz et al. \(2019\)](#); [Asongu and Odhiambo \(2020\)](#).

4.4.3. Regional Economic Growth and Human Capital Development Nexus

RQ5: What is the impact of human capital development on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

H05:Controlling for governance and institutional framework, human capital development has a positive significant effect on regional economic growth in Sub-Saharan Africa.

Furthermore, going into a detailed analysis, the study conducted a comparative evaluation of the influence of human capital development on regional growth divergence in Sub-Saharan Africa. The findings, depicted in [Table 13](#), unveiled a statistically significant positive correlation between human capital development and economic growth across all

the four regions. Notably, the impact of human capital development on economic growth is most substantial in central African countries, exhibiting an increase of 4.624%. eastern African countries follow closely with a growth impact of 2.410%, while southern African countries show a moderate impact at 1.326%, and West African States demonstrate the lowest impact at 0.413%, all other factors held constant. The importance of human capital development has been acknowledged as essential in tackling welfare challenges such as inequality, poverty, and unemployment in Sub-Saharan Africa. Studies provide evidence suggesting that investments in human capital are more effective than infrastructure investments in reducing regional inequalities (Rodriguez-Pose and Fratesi, 2002; De la Fuente and Vives, 1995; Barro and Sala-I-Martin, 1995). An analysis of 36 Sub-Saharan African countries revealed a notable and statistically significant correlation between human capital and economic growth. This underscores the importance of investing in human capital development, particularly through the expansion of education, as crucial for economic growth of these nations (Bekele and Mersha, 2023). Significant investment in human capital is widely regarded as a prerequisite for growth and transformative development in Africa. Nations that prioritize such investments often experience benefits reflected in higher per capita GDP (Keita, 2016). The demographic dividend within Sub-Saharan Africa has the potential to substantially bolster GDP growth and alleviate poverty, particularly when accompanied by improved educational outcomes enabling African nations to narrow the gap with other developing countries. Enhanced educational achievements, resulting in a higher skilled workforce in Africa, can stimulate regional economic growth and mitigate poverty levels (Ahmed et al., 2016). Human capital development serves as a response to various Sustainable Development Goals (SDGs) including inclusive growth (SDG Goal-8), quality education (SDG Goal-4), and sustainable economic and social prosperity. Particularly through quality education and skill acquisition, human capital plays a crucial role in fostering inclusive growth. This development contributes to poverty reduction (SDG Goal-1) and economic growth within the context of the SDGs by elevating living standards, fostering inclusive growth, and positively impacting regional domestic product growth (Machmud and Sidharta, 2023). Additionally, human capital significantly influences the accumulation of structural and relational capital, both of which are indispensable for sustainable development.

According to empirical growth literature, human capital stock is a key cause of cross-country growth disparities. In economic growth literature, human capital is emphasized as one of the key factors in enhancing productivity growth through knowledge and technology spillovers. The positive regional growth effect is consistent with [Wei Xia-Hai \(2010\)](#) who established that human capital has significant positive effect on growth and technological progress in China. [Wang and Han \(2013\)](#) study revealed positive impact of human capital on regional economy in China. [Sultana et al. \(2022\)](#) found a positive relationship between economic growth and all aspects of human capital by studying 141 developed and developing countries. The study recommended that developing countries should focus on qualitative rather than quantitative aspects of human capital to support economic growth. [Xu and Li \(2020\)](#) apply spatial econometrics and established positive relationship between innovative human capital and regional economic growth in China. Furthermore, these results align with theoretical growth perspectives of [Barro et al. \(1995\)](#) and [Barro \(1998\)](#). Human capital development, according to [Romer \(1990\)](#), facilitates the absorption of new technologies and enhances productivity. These scholars emphasize that investments in education, skills, and knowledge can lead to increased innovation, efficiency, and overall economic growth. Similarly, [Mankiw et al. \(1992\)](#) highlight the significance of human capital in economic growth models, emphasizing that a well-educated and skilled workforce can drive productivity gains and technological advancements. Other studies that revealed positive relationship between human capital development and economic growth are [Mohanty & Sethi \(2019\)](#); [Musibau et al. \(2019\)](#); [Abdouli & Omri \(2021\)](#); [Kheng et al. \(2017\)](#). [Islam \(1995\)](#) however criticized human capital variables as being important in regressions using panel data. Islam argues that the inadequate specification of human capital variables in empirical models may limit their significance in explaining real GDP. Overall, HCD is acknowledged as an important factor in economic growth, despite this criticism. The importance of human capital, along with physical capital, in enhancing labour productivity and physical capital efficiency has been highlighted by [Lucas \(1988\)](#). Thus, investing in education, health, skill enhancement, training, research, and development can positively impact economic growth in the Sub-Saharan African region.

This research contributes to the Sustainable Development Goals (SDGs) by focusing on regional economic growth and productivity (SDG 8). It also promotes human capital development (SDG 4), advocating for equal opportunities for men and women in employment, education, and skill-building to support sustainable regional progress. The study examines the dynamic relationship between human capital and regional economic growth, emphasizing its crucial role in driving economic progress. Research increasingly suggests that education, skills, and knowledge contribute to economic spillovers, productivity, and innovation. The Human Development Index (HDI) integrates life expectancy, education, and income to measure global socio-economic progress. Despite economic advancements in the region, human capital development hasn't progressed proportionately. To improve human capital development, the regions must prioritize policies addressing healthcare, such as combating diseases and enhancing education and skills development to reduce illiteracy rates and foster innovation and job creation. Capacity building is essential for transforming employment indicators and outcomes. Moreover, the governments must prioritize the pursuit of sustainable development within their respective regions. The attainment of sustainable forms of local and regional development has emerged as an instrumental objective for national, regional, and local governing bodies. Development sustainability should aim to understand enduring, less detrimental approaches for local and regional development, encompassing economic and social considerations within the regions in the long term. The region's member countries encounter similar regional economic growth obstacles and share a collective concern regarding the potential shortfall in achieving Sustainable Development Goals (SDGs). The sluggish pace of economic progress primarily stem from the sluggishness of global economy. The vulnerability of the region's economy to current global shocks varies based on their exposure levels and the resilience of specific commodities. Prioritizing macro-economic and sectoral strategies is crucial for sustainable growth and development. Improving infrastructure within the region will enhance communication and facilitate movement of goods and people. Developing cost-effective belt and road projects, especially inter-country railways will boost industrial development in the region. Policy responses should underscore the pivotal role of infrastructure in economic transformation.

4.4.4. Regional economic Growth and population growth Nexus

RQ6: What is the impact of population growth on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

H06: Controlling for governance and institutional framework, population growth has a positive significant effect on regional economic growth in Sub-Saharan Africa.

The study further explored the impact of population growth density on regional development disparities. Results revealed a significant and statistically meaningful relationship between population density and economic growth across all the four regions. As shown in [Table 13](#), an increase of one unit in population density corresponds to a 1.313% increase in economic growth in central African countries, 1.632% in SADC, 1.024% in ECOWAS, and 1.667% in eastern African countries. The research output from low- and middle-income countries indicates that the positive growth effects of population are notably pronounced in rural areas and regions with higher levels of education. Additionally, these effects are more pronounced in countries with lower levels of corruption ([Crombach and Smits, 2022](#)). These results are further in consonance with theories of new economic geography. Throughout history, high population agglomeration has played a crucial role in fostering growth. Agglomerated regions have traditionally exerted a positive influence on neighboring non-agglomerated regions, particularly at lower income levels. However, this impact tends to turn negative as the agglomerated regions experiences economic growth ([Islam, 2020](#)). There is a widespread consensus among scholars that the dynamic nature of large cities and regions, serving as pivotal hubs of economic growth, stems from the beneficial externalities generated by increased agglomeration ([Duranton and Puga, 2001](#); [Fujita et al., 1999](#)). [Lammarino \(2005\)](#) argue that agglomeration fosters innovation and diminishes obstacles to the exchange and dissemination of knowledge. The New Economic Geography models provide insight into the favourable effects of agglomeration externalities on economic growth rates. Within these models, population density serves as a proxy for such externalities, representing the concentration of economic activities within regions. It is anticipated that local population

density is expected to capture the agglomeration effects within a region ([Baldwin and Forslid, 2000](#)). Increased concentrations of economic activities result in stronger agglomeration effects and heightened levels of economic growth within these regions. Regions with high concentrations attract private sector investments, thereby amplifying growth. Population growth has significant implications for urbanization and local communities, directly aligning with SDG Goal - 11 on sustainable cities and communities. Moreover, population growth influences demographic transition and population aging, which are pertinent to SDG Goal- 3 on good health and well-being. Additionally, the adverse effects of population growth in developed regions are in line with SDG Goal- 4 on quality education and SDG Goal- 8 on decent work and economic growth.

Our research further underscores the pivotal role of governance and institutional frameworks in shaping economic growth in the Sub-Saharan African region. The analysis presented in Table **13** underscore the critical influence of factors such as political stability, government effectiveness, adherence to the rule of law, regulatory quality, and control of corruption on economic growth trajectories of southern and eastern African regions. Conversely, economic growth in west and central African states is impeded by poor governance and institutional quality, characterized by corruption, government ineffectiveness, weak regulatory standards, political instability, deficient rule of law, and a lack of accountability. These factors collectively undermine the region's potential for sustainable development. As the quality of the institutional framework improves, the influence of governance on growth becomes more pronounced, underscoring the significance of tackling governance challenges in the region ([Feyisa et al., 2022](#)).

4.4.5. Regional economic Growth and Gross Fixed Capital Formation Nexus

RQ7: What is the impact of gross fixed capital formation on regional economic growth in Sub-Saharan Africa when governance and institutional frameworks are taken into account?

H07: Controlling for governance and institutional framework, gross fixed capital formation has a positive significant effect on regional economic growth in Sub-Saharan Africa.

The findings presented in Table 13 further provides interesting insights into the relationship between gross fixed capital formation and economic growth in the region. The results indicate positive impact of gross fixed capital formation on economic growth, a unit increase in gross fixed capital formation in the region, significantly increases regional economic growth in Southern, Eastern and West Africa. There is no significant impact of *gfcf* observed in Central African region. These results indicate the importance of capital investment in driving economic development in these regions. Differences in regional capital formation contributes to regional growth disparities among countries in the region. According to the neo-classical growth theory, differences in regional growth are considered temporary as spatial inequalities trigger corrective shifts in labour, capital, wages, and prices. These adjustments support the eventual alignment of social and economic conditions among regions. The diffusion of technology across regions facilitates a catching-up process, leading to a more balanced distribution of technological progress (Martin and Sunley, 1998). The results further address sustainable development goal (SDG 10) which imperatively aim to direct the regional governments to prioritize the promotion of savings and investments, ultimately fostering capital accumulation, to boost the income growth of the bottom 40 percent of the population above the national average and secure their social, economic, and political integration. The Sub-Saharan African regions should establish legislation fostering greater regional openness and mobility of production factors. This initiative would facilitate the outflow of capital from countries with a surplus to those with a deficit in capital. Arguing within the framework of neo-classical growth model, capital and labour tend to move in opposing directions. Regions with high wages

experience capital outflows but attract labour, whereas regions with low capital-to-labour ratio have lower wages and higher returns on investments. Such regions lose labour but attract capital. Through increased openness and favorable trade laws, this market adjustment mechanism is expected to gradually alleviate regional disparities in the capital-to-labour ratio and spur regional growth in the long term. Regions with lower capital per unit of labour typically exhibit higher relative rates of return and initial growth compared to regions with higher capital levels per worker ([Barro and Sala-i-Martin, 1995](#)).

The findings are further supported by [Gibescu \(2010\)](#) who found a strong positive correlation between gross fixed capital formation and regional economic growth in Czech Republic, Hungary, Bulgaria, Romania, and Poland. [Zhang et al. \(2017\)](#) show spatial spillover effect of gross fixed capital formation and regional economic growth among other variables in western China. Additionally, the observed positive relationship aligns with the Solow-Swan model of economic growth, which underscores the significance of capital accumulation in fostering sustained economic development. According to [Solow's \(1988\)](#) growth theory, capital accumulation and economic growth are positively correlated in the short run. Capital accumulation through total factor productivity (TFP) is believed to be an endogenous source of economic growth through technological capital investment ([Romer, 1986](#); [Woo & Kumar, 2015](#); [Barro, 1990](#)). Thus, policymakers should set priority to increase capital accumulation. Hence, the study recommends increasing the effective mobilization of capital into productive sectors of these countries in order to stimulate economic growth. The relationship between foreign direct investment (FDI) and domestic capital formation remains a subject of debate among scholars. Some argue that FDI complements domestic capital formation, implying that foreign investment can stimulate domestic investment and contribute to economic growth ([Obwona, 2001](#); [Naudé and Krugell, 2007](#); [Clegg and Scott-Green, 1999](#); [Pasara and Garidzirai, 2020](#)). On the other hand, there are those who believe that FDI substitutes or crowds out domestic capital formation, the decrease in domestic investment may be caused by an increase in foreign investment ([Yasmeen et al. 2021](#)). The ongoing debate on this topic stems from the mixed empirical evidence observed across different countries. The domestic capital formation

and FDI remain a contentious issue, with conflicting views and mixed empirical results observed across different countries.

Dissertation Thesis III

Foreign Public Debt (fpd): Various factors can be attributed to the negative impact of foreign public debt on economic growth observed across three Sub-Saharan African regions, including potential welfare loss stemming from heightened borrowing, increased taxation, corruption, and capital flight. As a result, expanding borrowing from overseas sources could erode the welfare of the population and negatively impact economic growth (Ampah and Kiss, 2021). Furthermore, the negative impact of foreign public debt results in high interest rates through the implementation of contractionary monetary policy. The payment of high interest rates on debt servicing has the effect of reducing private investment by increasing the cost of capital, which in turn leads to a reduction in economic growth over time. The findings demonstrate that foreign public debt exerts a significantly adverse effect on regional economic growth. This is consistent with the view that, like other developing countries around the world, foreign public debt in the Sub-Saharan African region has the effect of crowding out economic activities, thereby discouraging capital formation and reducing the amount of future revenue needed for public investment in the region (Aizenman et al., 2007). Furthermore, a high level of foreign public debt may constrain the scope for countercyclical fiscal policies, potentially leading to increased volatility and a reduction in economic growth (Aghion and Kharroubi, 2007; Woo, 2009). The long-run negative relationship between foreign public debt and economic growth also validates the theoretical effect of foreign public debt on economic growth, as postulated by Krugman (1988). Additionally, capital flight through debt service has been shown to deplete a country's revenue to the extent that a swift return to an economic growth trajectory is impeded (Levy-Livermore and Chowdhury, 1998).

Foreign Direct Investment (fdi): The results of this study suggest that FDI tends to impact growth positively and significantly in resource-scarce regions in Sub-Saharan Africa, whereas no significant effect is observed in resource-rich regions, these results

align with the findings of [Yimer \(2023\)](#) and [Odhiambo \(2022\)](#). A body of research has identified a phenomenon known as the 'natural resource curse'. This is the observation that countries with a high natural resource base often experience economic growth rates that are stagnant, negative, or slower in comparison to countries with less natural resources ([Ploeg, 2011](#); [Zallé, 2019](#); [Nzié & Pepeat, 2022](#); [Ajide, 2022](#)). Additionally, in resource rich countries, foreign direct investment may exert a detrimental influence on economic growth. The growth of the host economy may be impeded if foreign firms displace domestic companies ([Herzer et al., 2008](#)). Furthermore, foreign direct investment may have an adverse effect on economic growth of the host country if it results in a substantial capital outflow through the repatriation of profits ([Akinlo, 2004](#); [Ramírez, 2000](#)). We can therefore infer that inflow of foreign capital into resource poor Sub-Saharan African economies has a beneficial impact on economic growth. The injection of capital into the domestic economy has the effect of increasing savings, which in turn contributes to higher levels of capital accumulation. Furthermore, the transfer of managerial expertise and technology associated with foreign direct investment has the additional effect of stimulating growth. The advocates for the inflow of foreign capital into developing countries argue that unrestricted capital flows encourage macroeconomic discipline. This is because they increase the incentives for sound policy decisions and the costs of poor policy choices, thereby reducing the occurrence of policy mistakes ([Bosworth et al., 1999](#)). Some researchers underscore the significance of governance in bolstering economic freedom and its influence on FDI. Economic freedom acts as a mediator in the relationship between FDI and economic growth in Sub-Saharan Africa. FDI distinctly fuels growth in nations with higher economic freedom, while its impact on overall economic growth is negligible in countries with lower economic freedom ([Aluko et al., 2023](#)). Moreover, FDI impact on economic growth is dependent on a country classification. African economies are categorized into fragile, investment-driven, or factor-driven types, with the determinants of FDI differing considerably across these classifications ([Geda and Yimer, 2023](#)).

4.5 Analysis of Foreign Capital Spillover Effects on Regional Economic Growth

The increasing interdependence among countries results from globalization, where nations engage more frequently in multilateral and bilateral economic activities, including trade and investment, regional economic, governance and institutional cooperation, and socio-cultural integration ([Ahmad & Law 2023](#)). In this study we argue that in most Sub-Saharan African regions, there is lack of studies on the fusion between financial geography, economics geography and spatial econometrics. Research that evaluates spatial dimensions of global financial variables such as foreign public debt and foreign direct investment among others are rare. There are significant spillover effects from international financial globalization in a world where financial integration is increasing. Consequently, growth is significantly impacted not just in the investing country, but also in the neighboring regions. The ongoing public debt crisis in many Sub-Saharan African nations has sparked concerns that an economic decline in one country might have a contagion effect on neighboring countries. This argument is particularly evident among countries with comparable debt levels. The International Monetary Fund (IMF) and the World Bank (WB) have categorized numerous Sub-Saharan African countries as highly indebted. Furthermore, the majority of these countries exceed the debt-to-GDP ratio threshold of 60% as stipulated by the Maastricht Treaty. As a result, if the fiscal fundamentals of one country change, the fiscal positions of another neighboring country would be likely to change as well, depending on the degree of interconnectedness and geographical proximity between the countries. [Balaguer-Coll & Toneva \(2019\)](#) have explored spatial interactions among geographically adjacent regions, revealing that the indebtedness of a particular region could be influenced by the indebtedness levels observed in its neighboring regions. The extent of these spillovers can be quantified by employing a spatial econometric approach to account for the concurrent co-movement of international financial flows ([Perović, 2018](#)). We examine the impact of public debt and foreign direct investment on regional economic growth in Sub-Saharan Africa. Our study make contribution to the existing literature by employing both economic and geographical proximity approaches to evaluate the presence and extent of interregional foreign capital spillovers.

This chapter employs spatial econometric techniques as outlined in the methodology

section (Chapter Three). In stochastic processes, neighbors are those spatial units that are in close geographical proximity enough to allow for interaction. Interdependence between FDI and foreign public debt host countries arises due to geographical proximity. In spatial econometrics, geographical proximity is utilized as a binary measure of neighborhood, identifying countries that share a common border. These geographical characteristics are used to construct a spatial contiguity weight matrix, which facilitates the measurement of the degree of interdependence among countries (Alamá-Sabater et al., 2016). The spatial growth specifications presented in this study encompass spatial dimension models (see chapter three). These models incorporate a contiguous weight matrix to capture geographical component, facilitating the assessment of geographical spillovers among neighboring countries.

In spatial econometrics, neighborhood effects are typically characterized by means of a non-negative symmetric spatial weight matrix W_{ij} . These weights are constructed based on the Sub-Saharan Africa Shapefile. The formal outline of the weight matrix is given as follows: $W_{ij} = W_{ji} = 0$ if $(i = j)$ implying that they are not neighbors; $W_{ij} = W_{ji} = 0$ if $(i \neq j)$ and therefore (i) and (j) are not neighbors; $W_{ij} = W_{ji} = 1$ if $(i \neq j)$ and therefore (i) and (j) are considered as neighbors. More concepts supporting this objective is further outlined in results section 4.3.1. The weight matrix shows the strength of potential interaction between region (i) and (j) . It is an exogenous specification and based on contiguity or geographical proximity. The diagonal elements of W_{ij} matrix is set at (0) (see methodology section 3.6.2) indicating that an observation is not a neighbor to itself. Spatial lag operator assumes that $W = W_{ij}$, W_{ij} is a time invariant symmetric $n \times n$ spatial weight matrix. Spatial lag operator of $k_t = k_{1t}, k_{2t}, \dots, k_{nt}$ this is well represented by Wk_t . Moreover, $w_i'k_t = \sum_{j=1}^N W_{ij} Z_{jt}$, indicates the weighted average of the neighboring observations implying the distance between the regions. The degree of spillovers occurring between region (i) and (j) is contingent upon both the contiguous weight matrix, denoted as W_{ij} and spatial rho (ρ) factor. Incorporating the spatial weighting matrix in the model allows us to explicitly consider the impact of distance on spillover processes. This spatial interdependence weakens as the distance between the regions increases. As the number of countries in one region increases, there is need to manage geographical dependencies, as

correlation between the countries converges to zero when the geographical proximity increases to infinity. This study applied geographical distance matrices (Queen contiguity) for the four Sub-Saharan Africa regions investigated. This strategy, in general, assumes that second-order neighbors are first-order neighbors. It is feasible to find the neighborhood of a specific spatial unit using such a method by establishing a maximum neighborhood lag order that allows just for the maximum supported number of neighbors to be covered without allowing cycles.

$$W_{i,j} = \begin{cases} \frac{y_{i,j}}{d_{i,j}^2}, & W_{i,j}^* = \frac{W_{i,j}}{\sum W_{i,j}}, i \neq j \\ 0, & i = j \end{cases}$$

The spatial queen contiguity weight matrix $W_{i,j}$ is a square non-negative matrix of dimension $n \times n$ (LeSage and Pace, 2009). The matrices were constructed corresponding to each of the four regions; Economic Community of West African States (ECCAS); Southern Africa Development Community (SADC); Economic Community of West African States (ECOWAS) and Eastern Africa Development Community (EADC).

Response to Research Questions 8 and 9 and corresponding Hypotheses

RQ8: Do geographical proximity and spatial spillover effects of foreign public debt matter on regional economic growth when governance and institutional factors are considered?

RQ9: Do geographical proximity and spatial spillover effects of foreign direct investment matter on regional economic growth when governance and institutional factors are considered?

H₀₈: Controlling for governance and institutional framework, foreign public debt has indirect positive significant spatial spillover effect on regional economic growth in Sub-Saharan Africa.

H₀₉: Controlling for governance and institutional framework, foreign direct investment has indirect positive significant spatial spillover effect on regional economic growth in Sub-Saharan Africa.

Table 14: Analysis of Regional Growth Spillover Effects

Analysis of Regional Growth Spillover Effects				
	ECCAS	SADC	ECOWAS	EADC
Lagged Variables	(1)	(2)	(3)	(4)
	SDM-FE	SDM-FE	SDM-FE	SDM-FE
<i>Wx:lngfpd</i>	-0.242*** (0.044)	0.067 (0.062)	-0.126*** (0.024)	-0.004 (0.033)
<i>Wx:lnfdi1</i>	0.255*** (0.039)	-0.072*** (0.010)	-0.194*** (0.038)	-0.044** (0.022)
<i>Wx:lnwser</i>	0.102*** (0.013)	0.033* (0.017)	0.149*** (0.013)	-0.100*** (0.026)
<i>Wx:lngfcf</i>	0.012 (0.041)	-0.229*** (0.063)	0.376*** (0.077)	-0.195* (0.108)
<i>Wx:lnpop</i>	-2.886** (1.330)	-3.923*** (0.473)	4.607*** (0.400)	2.027 (1.672)
<i>Wx:trade</i>	0.003 (0.002)	0.007*** (0.001)	0.007*** (0.001)	0.008** (0.004)
<i>Wx:infl</i>	0.003 (0.002)	0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
<i>Wx:bcd</i>	8.694** (3.507)	9.720*** (2.064)	2.790*** (0.487)	3.633*** (1.357)
<i>Wx:pol_stab</i>	0.001 (0.003)	0.004** (0.002)	-0.012*** (0.002)	-0.004 (0.004)
<i>Wx:gov_eff</i>	-0.026*** (0.009)	-0.010** (0.004)	0.003* (0.002)	0.002 (0.004)
<i>Wx:reg_qual</i>	0.000 (0.002)	0.006 (0.005)	-0.012*** (0.003)	-0.003 (0.003)
<i>Wx:r_law</i>	-0.002 (0.006)	-0.007*** (0.002)	0.013*** (0.003)	-0.001 (0.001)
<i>Wx:cont_corr</i>	0.027*** (0.005)	0.002 (0.004)	0.011*** (0.001)	-0.000 (0.002)
<i>Obs</i>	95	95	162	95
<i>R-squared</i>	0.606	0.655	0.896	0.606

*** $p < .01$, ** $p < .05$, * $p < .1$; Source: Author's Estimation, 2024.

After a Leontief expansion of the inverse matrix (see methodology section 3.3.2), it becomes challenging to directly evaluate the coefficients or point estimates in spatial analysis. To interpret the spatial lags effectively, one must consider the responses caused by the dependency relationship. Hence, utilizing the matrix of effect estimates (LeSage & Pace, 2009) allows us to perceive point estimates as an initial step towards calculating total effects, direct effects (own regional effect), and indirect effects (spatial spillovers or cross-regional effects). Our model computes the average direct effect of foreign public debt,

human capital development, population and foreign direct investment. This calculation is based on the average impact of changes in these variables on the regional economic growth. Alterations in these covariates possess the potential to significantly influence the regional economic growth rate. Therefore, the average direct effect gauges the impact of these variables on the region's economic growth rate in both the short and long-run periods, as illustrated in [Table 15](#) and [Table 16](#). [Table 15](#) summarizes how changes in these explanatory variables affect regions spatially in the short run. [Table 14](#) presents the interplay between governance and institutional frameworks and regional growth among other variables across the four regions. Southern African regions report positive spillovers of political stability, whereas west African regions exhibit negative spillovers. Controlling corruption positively spillover in central and west African regions, with no significant effect observed in Southern and Eastern Africa.

After conducting Monte Carlo simulations, we present the results in [Table 15](#) and [Table 16](#). Our goal is to interpret the sign and significance of the off-diagonal elements in the weight matrix, which represent the indirect impact of foreign capital (FDI and public debt), in order to evaluate the degree of spillovers. The aim of this investigation is to examine whether there is significant impact of the levels of foreign public debt and foreign direct investment, on economic growth in the target region and in its neighbouring countries.

Table 15: Short-Run Marginal Effects Using Monte Carlo (MC) Simulation: Dynamic SDM –FE.

Region	Variables	Average Direct Impact	Average Indirect Impact	Average Total Impact
<i>ECCAS</i>	<i>lngfpd</i>	-0.165*** (0.046)	-0.080 (0.086)	-0.245*** (0.090)
	<i>lnfdi</i>	0.018* (0.036)	0.198*** (0.047)	0.216*** (0.035)
	<i>lnpop</i>	1.432*** (0.506)	(-3.160)*** (0.949)	-1.728 (1.115)
	<i>hcd</i>	9.683*** (1.680)	-0.456 (2.675)	9.227*** (2.679)
<i>SADC</i>	<i>lngfpd</i>	-0.045 (0.041)	0.269*** (0.078)	0.224*** (0.089)
	<i>lnfdi</i>	-0.001 (0.014)	-0.107*** (0.025)	-0.108*** (0.025)
	<i>lnpop</i>	0.882 (0.550)	-4.329*** (0.804)	-3.447*** (0.802)
	<i>hcd</i>	5.196*** (0.951)	4.372*** (1.685)	9.568*** (1.866)
<i>ECOWAS</i>	<i>lngfpd</i>	-0.032 (0.794)	0.006 (0.793)	-0.027*** (0.006)
	<i>lnfdi</i>	0.019 (1.013)	-0.090 (1.014)	-0.070*** (0.013)
	<i>lnpop</i>	0.631 (28.787)	0.127 (28.797)	0.758*** (0.113)
	<i>hcd</i>	-0.571 (3.616)	1.595 (3.613)	1.024*** (0.170)
<i>EADC</i>	<i>lngfpd</i>	0.032 (0.032)	0.074** (0.033)	0.106*** (0.008)
	<i>lnfdi</i>	0.019 (0.012)	0.075*** (0.012)	0.095*** (0.006)
	<i>lnpop</i>	0.155 (0.680)	-2.512*** (0.697)	-2.357*** (0.154)
	<i>hcd</i>	3.831** (1.590)	8.800*** (1.593)	12.631*** (0.396)

Levels of significance *** $p < .01$, ** $p < .05$, * $p < .1$. (The significance of the degree of indirect effect shows the existence of spatial spillover or feedback effect); The dependent variable is Real GDP Per-Capita; Standard errors are given in parentheses; Source: Author's Estimation, 2024.

Previous empirical studies demonstrate that growth spillovers are constrained between neighbouring developing countries, especially those in Sub-Saharan Africa. Sub-Saharan Africa's regional growth has been demonstrated to influence their own growth rate, but

also on that of neighbouring regions. This study has identified a number of factors contributing to this influence, including fiscal policy shocks, investment levels and international trade flows. This study highlights the existence of spatial spillover effects as depicted in [Table 15](#) and [Table 16](#), which suggests neighbouring regions with similar macroeconomic framework contribute positively to economic growth in the Sub-Saharan Africa. To accurately interpret the spatial Durbin (SDM) model, it is crucial to calculate the direct, indirect, and total effects of predictors on the estimated variable ([LeSage and Pace, 2009](#)). Due to the spatial dependence inherent in the model, changes in predictors within one spatial region directly influence the estimated variable in that region and could indirectly influence the estimated variables in other regions *ceteris paribus*.

We decomposed the spatial effect of the SDM – FE model using Monte Carlo (MC) simulation approach to provide a better understanding of the direct, indirect, and total impacts of each influencing factor on regional GDP per capita, and spatial spillover effects between the regions. The direct effects depict the influence of each predictor variable within a region on its own GDP per-capita, indirect effects are attributed to changes in local as well as geographically nearby predictors. According to [Table 15](#) and [Table 16](#), indirect effects and direct estimates show notable differences. This disparity arises from spillover effects stemming from impacts passing through neighbouring contiguous countries and returning to the host countries. Such effects are attributed to the coefficients of spatially lagged estimate variables and spatially lagged estimators. The total effect is the aggregate of both effects. The findings in [Table 15](#) and [Table 16](#) highlight statistically significant direct relationship that exists between human capital development and population growth in the Central Africa region. Conversely, foreign public debt demonstrates a negative and statistically significant direct effect coefficient in both short-run and long-run periods in the region. This demonstrates the adverse impact of foreign borrowing on regional development of central African countries. On the other hand, in the Southern African region, the direct effect of human capital is positive and statistically significant in both short-run and long-run periods. In the West African region, only the coefficient of population is positive and significant in the long run. Additionally, in the Eastern African region, the direct effect of human capital is significant only in the short run. The direct impact reveals that a 1% increase in human capital development in the focal

country would lead to a 5.3% rise in GDP per capita in Central Africa and a 2.6% increase in Southern Africa region. Additionally, regional growth would respond by 0.27% due to population growth in West African states.

Table 16: Long – Run Marginal Effects Using Monte Carlo (MC) Simulation and Dynamic SDM – FE Model.

Region	Variables	Average Direct Impact	Average Indirect Impact	Average Total Impact
<i>ECCAS</i>	<i>lngfpd</i>	-0.097*** (0.025)	-0.100 (0.061)	-0.197*** (0.071)
	<i>lnfdi</i>	0.022 (0.018)	0.151*** (0.029)	0.173*** (0.027)
	<i>lnpop</i>	0.599** (0.280)	(-1.987)*** (0.725)	-1.388 (0.890)
	<i>bcd</i>	5.346*** (0.839)	2.077 (1.843)	7.423*** (2.144)
<i>SADC</i>	<i>lngfpd</i>	-0.007 (0.019)	0.160*** (0.048)	0.153*** (0.057)
	<i>lnfdi</i>	-0.006 (0.006)	-0.068*** (0.015)	-0.074*** (0.018)
	<i>lnpop</i>	0.188 (0.234)	-2.557*** (0.476)	-2.369*** (0.539)
	<i>bcd</i>	2.699*** (0.434)	3.893*** (1.099)	6.593*** (1.334)
<i>ECOWAS</i>	<i>lngfpd</i>	-0.009 (0.007)	-0.015* (0.008)	-0.024*** (0.005)
	<i>lnfdi</i>	-0.002 (0.005)	-0.060*** (0.011)	-0.063*** (0.011)
	<i>lnpop</i>	0.265*** (0.125)	0.410*** (0.157)	0.676*** (0.103)
	<i>bcd</i>	0.031 (0.043)	0.881*** (0.138)	0.911*** (0.149)
<i>EADC</i>	<i>lngfpd</i>	0.731 (21.022)	-0.628 (21.022)	0.102*** (0.008)
	<i>lnfdi</i>	-0.021 (0.835)	0.112 (0.835)	0.092*** (0.005)
	<i>lnpop</i>	16.466 (457.163)	-18.754 (457.164)	-2.288*** (0.148)
	<i>bcd</i>	40.311 (1079.45)	-28.050 (1079.453)	12.261*** (0.375)

Levels of significance *** $p < .01$, ** $p < .05$, * $p < .1$. (The significance of the degree of indirect effect shows the existence of spatial spillover or feedback effect); The dependent variable is Real GDP Per-Capita; Standard errors are given in parentheses; Source: Author's Estimation, 2024.

Conversely, indirect effects are observed on the predictors across all regions, in columns (2) through (5) of [Table 15](#) and [Table 16](#). These tables present the estimation results of geographical spillovers from foreign capital inflows (foreign public debt and foreign direct investment) into the region. Column (4) of both [Table 15](#) and [Table 16](#) highlights the spatial spillovers, indicated by the indirect impact of the variables in the model. The impact of foreign public debt on regional growth exhibits considerable variation across regions. The positive spillover effect of foreign public debt is evident in Southern Africa, while negative spillover effect is observed in West Africa in the long run. The spillover effects are present in Central and Eastern Africa in the long run. Furthermore, in the short term, there are positive spillover effects in Eastern and Southern African regions. No short-term feedback effects of foreign public debt are observed in Central and West African regions.

These observations further align with similar findings reported in various empirical studies conducted elsewhere. [Daud and Podivinsky \(2011\)](#) applied spatial analysis in evaluating external public debt incorporating the neighborhood effect in the debt – growth model, they argued that foreign public debt has a negative effect on economic growth in the Asia-Pacific and Latin America-Caribbean regions. Additionally, their study sheds light on the spillover effects of economic growth among the neighbouring countries. Furthermore, [Suma \(2007\)](#) investigated the impact of spatial interactions and spatial dependence among West African countries utilizing spatial autoregressive (SAR) growth and investment models. The findings indicated that external public debt and regional economic growth in West Africa are spatially dependent, exhibiting both positive and negative relationships. [Yildiz and Tuncer \(2021\)](#) employed a spatial analysis to investigate the relationship between debt and growth in the European Union. The study indicates that an increasing public debt burden may have a detrimental impact on economic growth, potentially leading to spillover effects across regions. This study contributes to the existing literature on regional growth and spatial externalities, building upon the findings of previous studies such as those by [Broersma and Oosterhaven \(2009\)](#), [Fingleton and Lopez-Bazo \(2006\)](#), and [Vaya et al. \(2004\)](#).

Additionally, regarding foreign direct investment (FDI), the results presented in [Table 15](#) and [Table 16](#) column (4) reveals notable variations in spatial spillover patterns. Negative significant spillover effects are observed in both the short-run and long-run periods in Southern Africa, while West African regions exhibit a negative significant spillover effect only in the long-run. This suggests that foreign direct investment diffuses from countries in Southern and West Africa to their neighbouring states. Furthermore, the findings indicate a positive significant indirect effect of FDI on GDP Per Capita in both the long-run and short-run periods in Central Africa. In the Eastern Africa region, FDI demonstrates a positive feedback effect only in the short-run period. This consequently implies that states in Central and Eastern Africa are the recipients of foreign direct investment from their neighbouring regions. These results are consistent with the findings of [Yimer \(2023\)](#) and [Odhiambo \(2022\)](#), who observed a positive influence of foreign direct investment (FDI) on economic growth in nations with limited resources and a negative effect in resource-abundant countries. In comparison to the southern and western African regions, the Central and Eastern African regions are characterised by a relatively limited endowment of natural resources. It can be observed that the greater the level of foreign direct investment (FDI) received by countries in sub-Saharan Africa, the more pronounced the spillover effects in neighbouring regions that are similarly constrained in terms of their natural resources. These findings underscore the significance of foreign direct investment as a driver of regional economic growth. Therefore, policies that draw foreign direct investment to a specific Sub-Saharan African nation can generate positive spillovers in neighboring contiguous countries. This situation can create an external benefit challenge, where countries gain from policy changes in adjacent nations that enhance the investment climate and attract more FDI. Additionally, it suggests that a sudden decline in the appeal of an FDI host country will not only decrease FDI in that country but also in its neighboring countries. Moreover, incorporating the economic conditions of neighboring countries into the analysis of foreign capital flows is crucial for the formulation of regional investment and trade agreements ([Blanco, 2012](#)). Consequently, the clustering of regional economies can have a significant impact on the growth of resource-deficient regions. Thus, fostering increased regional agglomeration, especially through the establishment of key economic zones, can lead to enhanced economic growth in neighboring regions due to spillover

effects generated by regional economic activities. Accordingly, regions should implement fiscal, monetary, and trade policies aimed at attracting and facilitating capital flow from neighboring countries, alongside bolstering domestic investment capital. The implementation of this approach has the potential to facilitate enhanced spatial connectivity in economic activities across neighbouring regions. The findings of research studies have indicated that the role of institutions and financial sector liberalization as a potential determinant of FDI inflows ([Campos and Kinoshita, 2008](#); [Montero, 2008](#); [Al Nasser & Garza, 2009](#)) and of economic freedom and privatization ([Bengoa-Calvo & Sanchez-Robles, 2003](#)) merits further investigation.

Furthermore, the study responds to sustainable development goals (SDG 17) which advocates for achieving a fair and rule-based multilateral trade system, encouraging more international collaboration, promoting the adoption of environmentally friendly technologies, strengthening support for developing countries on the international stage, promoting global economic stability, and formulating coherent sustainable development policies. These results are in consonance with previous empirical studies done with a focus on spatial analysis. [Fraga \(2016\)](#) used spatial analysis with panel data and spatial weights to establish a positive spillover effect of FDI on regional economies of Brazilian states. [Mitze & Ozyurt \(2014\)](#) found that regions that are in close geographical proximity to high-productivity regions have higher productivity and growth rates, for instance in terms of infrastructure and international economic linkages. However, the relative impact varies with spatial regime. Additionally, other studies reveal that the spatial distribution of foreign direct investment in less developed regions of China had a positive impact on the regional economic growth ([Jiang, 2014](#)). Contrary to studies that support FDI-regional growth nexus, [Hoang et al. \(2022\)](#) found that Foreign Direct Investment in adjacent provinces of Vietnam exhibits no impact on the growth of the host province. This highlights the confined influence of FDI on each province independently, indicating a limited spatial spillover effect of FDI at the regional level in Vietnam. Several notable studies have investigated the interdependence of foreign direct investment (FDI) among host countries using spatial econometric methods [Alamá-Sabater et al. \(2016\)](#); [Leibrecht and Riedl \(2014\)](#); [Blanco \(2012\)](#); and [Chou et al. \(2011\)](#).

As depicted in [Table 15](#) and [Table 16](#) column (4), the average indirect effect of human capital is positive and statistically significant in the Central, Southern, and Eastern African regions in the SR but insignificant in the West African region. In the long-run period, the findings indicate a positive spillover effect in Central and Southern African regions, while no significant feedback effects are observed in West and Eastern Africa. Investing in human capital in a specific region positively impacts not only its economic growth but also that of its neighbouring regions. This effect is notably stronger in the central and southern African regions as demonstrated by the spatial lags in [Table 14](#). Therefore, it can be inferred that the increase in human capital in one region is primarily driven by the migration of educated individuals between neighbouring regions. Additionally, as illustrated in [Table 14](#) and [Table 16](#), regional disparities are apparent in the impact of population dynamics on regional GDP per capita growth. Negative spillover effects of population agglomeration are observed in both the long-run and short-run periods in Central and Southern Africa, while positive spillover effects are evident only in the long-run period in West African states. In the Eastern Africa region, population growth does not have a significant effect on GDP per capita in the long-run period, but its coefficient is positive and significant in the short-run period. Historically, regions characterized by high population agglomeration have served as significant growth centres, with studies indicating that the growth of such agglomerated regions influences neighbouring regions ([Islam, 2020](#)). The concentration of high population agglomeration and urbanization in Sub-Saharan Africa is poised to exert a notable influence on the spatial pattern of economic growth. This phenomenon may result in concentrated growth within densely populated areas, consequently affecting neighbouring regions ([Henderson, 2021](#)), this is the situation manifested in west and eastern African regions. The negative impact in central and southern African regions might be attributed to negative pressure of population on food, energy, water and other natural resources in the region, this result echoes the observations of ([Atoyebi and Anuodo, 2017](#)). The study provides further evidence that growth co-moves across countries in the short and long run periods, driven by both fiscal policy fundamentals and regional trade spillovers. This is indicated by the indirect significance of trade variables in all four regions of Sub-Saharan Africa, as demonstrated in [Table 29](#)

to Table 29 in the appendix. This observation is supported by Furceri et al. (2016). Furthermore, cross-regional growth spillovers have been observed in both developing and developed countries by several other researchers, including Sly and Weber (2013) and Yang and Samake (2011).

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The extent of spillovers between two regions is significantly influenced by their geographical proximity, facilitating the movement of goods, ideas, people, and knowledge. Such close regional proximity fosters innovation and growth across the regions. Balaguer-Coll & Toneva (2019) suggest that observed spatial spillover effects on debt may form the basis for future decisions regarding interstate cooperation, since such cooperation may reduce debt costs by reducing public service provision costs. The identification of collaborative areas is essential to enhancing regional economic growth and competitiveness. Additionally, the findings of this study have a number of policy implications, regional growth strategies should account for the spatial spillovers of foreign capital among geographically adjacent countries. Consequently, coordinated policies that prioritize prudent fiscal and monetary management should be emphasized, considering regional synergies. Harmonizing fiscal policies across Sub-Saharan Africa should include developing long-term strategies for public debt sustainability. These policies will optimize growth and help in establishing sound macroeconomic fundamentals crucial for fostering sustainable and inclusive growth. The spatial feedback effects observed in the results underscores the significance of linking prosperous dynamic regions with other lagging regions to enhance their growth potential. Alternatively, from another perspective, a shock occurring in one region or alterations in its fundamental growth factors will not solely impact the host region but will also have repercussions on its neighbouring regions. This interpretation emphasizes the necessity of synchronized regional economic policies to achieve the desired results. Without synergy in regional policy formulation and coordination, shocks or economic policies implemented by neighbouring regions might counteract the efforts made in another region. The importance of spatial interactions among African countries cannot be overstated, as demonstrated by the significant impact of macro-regional factors, governance, and institutional factors. This highlights the crucial need for strengthening political and economic relationships and partnerships across the Sub-Saharan African countries. The findings also emphasize the importance of implementing a more cohesive approach to regional development policies in order to address spatial disparities within the economic landscape observed in the Sub-Saharan African regions. A more robust regional integration is required within the Sub-Saharan African context. This is to challenge the prevailing perception that these nations operate as isolated entities, more connected globally than with each other. An important step toward greater regional

integration is already taking shape with the creation of the African Continental Free Trade Area (AfCFTA). The AfCFTA was launched on 1 January 2021 and has established the world's largest free trade area, uniting a market of 1.2 billion people and becoming the eighth largest economic bloc globally with a combined GDP of \$3 trillion (UNDP, 2022). It is projected that this figure will more than double by 2050. To foster sustained growth and stability, sub-Saharan regions should establish financial reserves and implement strategies to regulate cross-border interactions. Additionally, tariffs and non-tariff barriers can be reduced, business regulations improved, and infrastructure investments made to increase trade between countries and regions (Francisco et al., 2019). Moreover, the findings of this research contribute to addressing sustainable development goals (SDGs 10 and 16) that emphasize the necessity for improved financial markets and strong institutional regulations, developing transparent financial institutions, advocating for legitimate institutions that represent developing countries in global decision-making processes such as crafting of foreign public debt contracts with bilateral partners and multilateral institutions.

4.6. Economic Growth Response to Fiscal and Monetary Policy Shocks

RQ10: What is the response of real GDP Per Capita to fiscal and monetary policy shocks in selected Sub-Saharan African countries?

H010: There is a positive significant impact of fiscal and monetary policy shocks on real GDP Per Capita in selected Sub-Saharan African countries.

4.6.1. Stationarity test of the variables at level and first difference

Macroeconomic observations gradually emerge from different distributions, posing difficult problems for empirical modeling. When non-stationary variables are estimated, the error term is likely to be non-stationary. This implies that μ_t is heteroscedastic because $var(\mu_t)$ increases with time t , u_t is not independent of u_j for $j = 0$. Therefore, the autocorrelation function of an $I(1)$ does not decay rapidly to zero. The $cov(xt, \mu_t) = 0$, because the covariance between any two non-stationary variables is non-zero. This violates the three assumptions of classical linear regression model estimators, giving rise to spurious regression problems. The non-stationarity of variables arises from the inertia of economic time series. All variables must be stationary as a necessary condition for the application of SVAR. The study uses ADF-Fisher Chi-square tests to confirm the stationarity of the variables before evaluating the model. The results confirmed the non-

stationarity of the variables at the level and stationarity at the first difference, as shown in [Table 17](#).

Table 17: Test for stationarity of the variables

Var./Country	Test statistic		Kenya	Nigeria	Malawi	Botswana	Lesotho
<i>logyt</i>	ADF	level	-1.129	0.187	0.326	-3.510**	-2.887**
		1st diff	-6.623***	-3.269***	-8.250***	-5.748***	-6.120***
<i>logfd</i>	ADF	level	-2.296	-2.769	-1.778	-1.706	-3.527**
		1st diff	-4.247***	-5.669***	-5.462***	-5.463***	-4.977***
<i>logpi</i>	ADF	level	-1.899	-1.337	-1.390	-1.423	-2.490
		1st diff	-4.055***	-4.277***	-3.375***	-3.016**	-5.818***
<i>logr</i>	ADF	level	-5.687***	-6.724***	-6.788***	-4.186***	-16.573***
		1st diff	-9.413***	-11.92***	-7.470***	-8.508***	-12.248***
<i>logxr</i>	ADF	level	-1.107	0.388	-0.941	-2.006	-2.085
		1st diff	-5.520***	-5.799***	-4.117**	-5.320***	-4.717***

*Notes: We apply Augmented Dickey–Fuller (ADF) to test for stationarity with Mackinnon Critical Values at 1%, 5% and 10% levels of significance. ***, **, and * denotes significance at 1% ($t = 3.605593$), 5% ($t = -2.936942$), and 10% ($t = -2.606857$) levels of significance, respectively. Lag length (SIC = 1) level. H0: Non-Stationarity / Unit Root.*

4.6.2. Johansen Cointegration Analysis

Two time-series variables are cointegrated if they are bound together in a long-run equilibrium relationship. [Johansen \(1988\)](#) has demonstrated that cointegration can be modeled within a modified VAR framework. This study applies the Johansen unrestricted cointegration rank test, consisting of trace and maximum eigenvalues, to evaluate the long-run relationship between external public debt and economic growth. The results presented in [Table 18](#) suggest that there is no cointegrating relationship between economic growth and external public debt in the five selected countries. VAR is applied when there is no cointegration between or among the variables under study. The results in [Table 13](#) show no cointegration between public external debt and economic growth in all five countries studied, implying that the two variables do not have a stable long-run relationship. Given the absence of a long-run relationship, we use the VAR impulse response function and variance decomposition (VD) to examine the impact of shocks from macroeconomic variables on the dynamics of economic growth in the selected Sub-Saharan African

countries.

Table 18: Johansen cointegration test

Country/ Tests	Unrestricted cointegration rank test (Trace)				Prob.**
	Hypothesized No. of CE(s)	Eigen Val.	Trace statistic	0.05 Critical value	
Nigeria	None	0.378	41.267	47.856	0.180
	At most 1	0.145	17.507	29.797	0.602
Kenya	None	0.290	22.332	29.797	0.280
	At most 1	0.0927	5.188	15.494	0.788
Malawi	None	0.402	28.663	29.797	0.067
	At most 1	0.212	9.086	15.494	0.357
Botswana	None	0.276	27.849	29.797	0.082
	At most 1	0.226	14.593	15.494	0.068
Lesotho	None	0.526	46.486	47.856	0.066
	At most 1	0.264	17.314	29.797	0.616

Notes: H_0 : No cointegrating equation; H_1 : H_0 is not true; Trace test indicates no cointegration at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level **MacKinnon-Haug-Michelis (1999) p -values. Lag interval Kenya (1,1), Nigeria (1, 1), Malawi (1,1), Botswana (1,3) and Lesotho (1,3). Source: Authors Estimation, 2024.

4.6.3. Lag Order Selection

Table 19: Lag Order Selection

	Lag	LogL	LR	FPE	AIC	SC	HQ
Kenya	0	107.80	NA	8.66E-09	-4.37	-4.17	-4.30
	1	246.05	241.19*	7.05e-11*	-9.19*	-8.01*	-8.74*
	2	269.35	35.69	7.86E-11	-9.12	-6.95	-8.30
	3	288.65	25.46	1.10E-10	-8.87	-5.72	-7.69
	4	320.40	35.127	1.01E-10	-9.16	-5.03	-7.61
	Lag	LogL	LR	FPE	AIC	SC	HQ
Nigeria	0	53.34	NA	8.79E-08	-2.05	-1.86*	-1.98
	1	90.26	64.41	5.33E-08	-2.56	-1.38	-2.12*
	2	116.05	39.51	5.35E-08	-2.59	-0.43	-1.78
	3	146.33	39.93*	4.71e-08*	-2.82	0.32	-1.63
	4	174.52	31.18	5.01E-08	-2.95*	1.17	-1.40
	Lag	LogL	LR	FPE	AIC	SC	HQ
Malawi	0	64.88	NA	2.47E-08	-3.32	-3.10*	-3.25
	1	101.29	60.69	1.33E-08	-3.96	-2.64	-3.50*
	2	115.00	19.03	2.71E-08	-3.33	-0.91	-2.48
	3	158.20	47.99*	1.25e-08*	-4.34*	-0.82	-3.11
	Lag	LogL	LR	FPE	AIC	SC	HQ
Botswana	0	143.32	NA	5.71E-10	-7.09	-6.88*	-7.01
	1	177.21	57.34*	3.67e-10*	-7.54*	-6.26	-7.09*
	2	193.97	24.06	5.98E-10	-7.12	-4.78	-6.28
	3	217.39	27.61	7.75E-10	-7.04	-3.63	-5.82
	Lag	LogL	LR	FPE	AIC	SC	HQ
Lesotho	0	159.13	NA*	1.66e-10*	-8.33*	-8.11*	-8.25*
	1	181.14	36.88	1.98E-10	-8.16	-6.86	-7.70
	2	202.56	30.11	2.59E-10	-7.97	-5.58	-7.13
	3	217.33	16.76	5.57E-10	-7.42	-3.94	-6.19

Hannan-Quinn Criterion (HQ); Akaike Information Criterion (AIC); Schwarz Information Criterion (SC); Final Prediction Error (FPE); Source: Authors Estimation, 2024.

In the context of vector autoregression (VAR) econometric analysis, the procedure typically begins with a cointegration test, which is followed by the selection of the appropriate lag order. In this study, the Hannan-Quinn criterion (HQC), the Akaike information criterion (AIC), the Schwarz information criterion (SIC), and the final prediction error (FPE) were employed for the determination of the lag order. As illustrated in Table 19, the SIC and HQC indicated optimal lag lengths of zero and one, respectively.

However, the AIC suggested a minimum lag length of one to four for different countries, which was subsequently employed in estimating the structural vector autoregression (SVAR) and structural impulse response function (IRF) within the model.

4.6. Structural Variance Decomposition

Table 20: The short-run economic growth (yt) response to foreign public debt shocks

<i>Country</i>	<i>Period</i>	<i>S.E.</i>	<i>Shock1</i>	<i>Shock2</i>	<i>Shock3</i>	<i>Shock4</i>	<i>Shock5</i>
Kenya	2	0.82	2.75	34.24	13.33	0.65	49.04
	4	0.84	2.71	35.73	13.93	0.63	47.00
	6	0.84	2.70	35.88	13.96	0.63	46.84
	8	0.84	2.70	35.89	13.96	0.63	46.82
	10	0.84	2.70	35.89	13.96	0.63	46.82
Nigeria	2	0.90	21.52	9.59	7.56	10.09	51.24
	4	0.92	24.62	11.59	11.72	10.37	41.71
	6	1.06	16.81	36.10	7.75	9.42	29.93
	8	1.10	16.42	36.54	7.63	11.50	27.91
	10	1.11	16.61	35.53	8.51	11.76	27.59
Malawi	2	1.18	10.48	14.56	21.07	8.53	45.35
	4	1.31	10.56	14.75	16.80	16.31	41.58
	6	1.33	16.60	13.61	15.94	14.62	39.23
	8	1.33	18.13	13.25	15.67	14.86	38.09
	10	1.33	18.17	13.17	15.59	15.25	37.82
Botswana	2	0.71	0.22	21.19	1.10	4.97	72.51
	4	0.71	0.39	21.07	1.24	5.68	71.62
	6	0.72	0.39	21.00	1.25	5.94	71.42
	8	0.72	0.39	20.99	1.25	6.00	71.37
	10	0.72	0.39	20.98	1.25	6.02	71.36
Lesotho	2	0.32	3.39	0.85	0.75	2.32	92.69
	4	0.32	3.44	0.86	0.80	2.47	92.43
	6	0.32	3.44	0.86	0.80	2.47	92.43
	8	0.32	3.44	0.86	0.80	2.47	92.43
	10	0.32	3.44	0.86	0.80	2.47	92.43

Factorization; Cholesky Ordering of VAR: Shock 1 (interest rate - ir), Shock 2(foreign public debt -fd), Shock 3(exchange rate - xr) Shock 4 (inflation - pi) Shock 5(output growth - yt). Source: Authors' estimation, 2024.

The structural VAR in this study was ordered as follows; $\log ir$, $\log f_d$, $\log xr$, $\log pi$ and $\log y_t$. Foreign public debt (f_d) enters before the real GDP (y_t) in order to capture the impact of fiscal deficit shock through foreign public debt channel. Following extensive literature on monetary policy VAR models, the interest rate variable (ir) is typically prioritized ahead of the credit variable (foreign public debt) in VAR ordering ([Christiano](#)

et al., 1998). This structural ordering acknowledges that ongoing fiscal consolidation measures can lead to a reduction in a country's long-term interest rates, subsequently mitigating fiscal risks. This, in turn, stimulates credit flow from both domestic and foreign sources, thereby facilitating economic recovery. Further the ordering is informed by standard literature on fiscal policy which assumes that government expenditures are not immediately affected by current output levels. This is attributed to information delays and the implementation lag inherent in fiscal policy. (Deleidi et al., 2020, 2021b, Auerbach and Gorodnichenko, 2012 and Blanchard and Perotti, 2002). Specifically, GDP data typically becomes available several quarters after the reference period, while discretionary fiscal policy decisions often require more than one quarter for deliberation, approval, and implementation (Kilian and Lütkepohl, 2017).

The results in Table 20 indicate that a unit shock in foreign public debt has a positive short-run impact on economic growth in Nigeria, Botswana, and Lesotho. Conversely, a one-unit increase in the foreign public debt shock is associated with a decline in economic growth in Kenya and Malawi in the short run, as evidenced by the results presented in column (5) of Table 20. Conventional economic theory describes positive economic shocks as Keynesian in nature, stimulating short-term growth. Conversely, negative economic shocks are classified as classical, which lead to a contraction of the economy. When a macroeconomic policy finances a budget deficit externally through foreign public debt, household disposable income increases, as long as the tax system is maintained. Purchasing power parity is stimulated by an increase in household disposable income if the government is pursuing a constrained fiscal policy with external borrowing. The existence of sticky prices and wages increases the aggregate demand for goods and services in the economy. The shifting aggregate demand forces domestic firms to reallocate their production factors, leading to higher national incomes and, consequently, economic growth in the short term. On the other hand, foreign public debt reduces short-term crowding out of the private sector by expanding the economy's resource envelope. Considering an unconstrained tax adjustment policy scenario with external public debt, it may be difficult to expand the resource envelope, as the tax increase is a transfer from the private sector to the government in order to cover the fiscal gap, which ultimately results

in a crowding-out effect in the long-run. The relationship between foreign public debt and economic growth in Nigeria, Botswana, and Lesotho is consistent with the findings of Adegbite et al. According to [Bamidele and Joseph \(2013\)](#) and other researchers, foreign public debt significantly influences short-term economic growth.

Table 21: Long-run structural variance decomposition (SVAR) of economic growth

<i>Country</i>	<i>Period</i> (2)	<i>S.E.</i> (3)	<i>Shock1</i> (4)	<i>Shock2</i> (5)	<i>Shock3</i> (6)	<i>Shock4</i> (7)	<i>Shock5</i> (8)
Kenya	2	0.82	2.75	34.23	13.33	0.65	49.04
	4	0.84	2.71	35.72	13.93	0.63	46.99
	6	0.84	2.70	35.88	13.95	0.63	46.84
	8	0.84	2.70	35.89	13.96	0.63	46.82
	10	0.84	2.70	35.89	13.96	0.63	46.82
Nigeria	2	0.90	0.90	18.39	1.43	32.37	4.30
	4	0.92	0.92	17.92	7.20	28.65	8.39
	6	1.06	1.06	19.91	10.43	33.49	9.50
	8	1.10	1.10	20.20	10.60	32.06	13.12
	10	1.11	1.11	20.60	11.75	31.57	12.80
Malawi	2	1.18	45.64	3.44	18.34	2.48	30.11
	4	1.31	44.74	4.75	14.21	13.01	23.29
	6	1.33	49.74	4.62	13.47	11.47	20.70
	8	1.33	49.25	4.52	13.30	11.71	21.22
	10	1.33	48.61	4.52	13.26	12.64	20.98
Botswana	2	0.71	1.67	5.58	8.80	25.56	58.39
	4	0.71	1.71	6.02	9.13	25.46	57.68
	6	0.72	1.71	6.13	9.14	25.52	57.51
	8	0.72	1.71	6.16	9.14	25.53	57.46
	10	0.72	1.71	6.17	9.14	25.53	57.45
Lesotho	2	0.32	0.69	10.90	9.52	0.44	78.45
	4	0.32	0.71	11.02	9.39	0.52	78.36
	6	0.32	0.71	11.02	9.39	0.52	78.35
	8	0.32	0.71	11.02	9.39	0.52	78.35
	10	0.32	0.71	11.02	9.39	0.52	78.35

Factorization: Structural Ordering of SVAR: Shock 1 (interest rate - ir), Shock 2(foreign public debt -fd), Shock 3(exchange rate - xr) Shock 4 (inflation - pi) Shock 5(output growth - yt). Source: Author's estimation, 2024.

4.6.1. Long-run economic growth (ln yt) to foreign public debt shocks

The study utilized structural decomposition of the impulse response functions (IRFs) to impose a recursive structure, addressing the contemporaneous correlation of shocks (e_t) ([Abrigo and Love 2016](#)). This recursive framework allows for the isolation of the impact

of a shock to one variable on another, holding other factors constant. The SVAR ordering presented in [Table 20](#) illustrates the percentage of forecast error variance for selected variables attributed to shocks within the SVAR system over ten periods. The variables are ordered in accordance with their influence on economic growth, in a manner that is consistent with economic intuition. The results demonstrate that foreign public debt shocks exert a considerable significant influence on positive variations in economic growth across all countries under examination. This is demonstrated by the positive magnitude and impact of these shocks in the long run, as illustrated in column (5) of [Table 20](#). The magnitude of these shocks differs among the five countries under consideration. A notable increase in long-term economic growth is evident in Kenya and Nigeria in comparison to Malawi, Botswana, and Lesotho. Even though foreign public debt creates short run aggregate demand stimulating economic growth, in the long run, the debt policy reduces capital stock through higher distortionary income tax and higher interest payments. Per capita tax increase reduces household consumption by the same amount as tax, as a result consumption falls reducing aggregate demand, crowding out private investment in the long run.

Furthermore, high public debt triggers high interest rates through contractionary monetary policy. High interest rates crowd out private investment by increasing the cost of capital leading to a reduction in economic growth in the long run. Results suggest that foreign public debt has a negative effect on economic growth in Malawi, Botswana, and Lesotho in the long run. This is consistent with the view that, like other developing countries around the world, external public debt in Malawi, Botswana, and Lesotho, tends to crowd out economic activities, discouraging capital formation and reducing the amount of future revenue needed for public investment in the country ([Aizenman et al. 2007](#)). In addition to constraining the scope for countercyclical fiscal policies, a high level of foreign public debt may also raise volatility and reduce economic growth further ([Aghion and Kharroubi, 2007](#); [Woo, 2009](#)). The long run negative foreign public debt growth relationship also confirms the debt overhang theoretical effect of foreign public debt on economic growth ([Krugman 1988](#)). Furthermore, capital flight through debt service, depletes a country's revenue to the point that a quick return to economic growth path is affected ([Levy-Livemore and Chowdhury, 1998](#)). Several studies have provided evidence that supports

debt overhang hypothesis; [Chowdhury \(2001\)](#) and [Clements et al. \(2003\)](#). This study also found support from [Ramzan and Ahmad \(2014\)](#); [Silva \(2020\)](#); [Irfan et al., \(2020\)](#); [Moh'd al-Tamimi and Jaradat \(2019\)](#) who found negative relationship between foreign public debt and economic growth.

4.6.2. Economic growth (yt) response to interest rate (r) shocks

Conversely, interest rates are observed to increase from period (2) to period (10) in all countries except Nigeria, as illustrated by column (4) of [Table 20](#) and [Table 21](#). This phenomenon is attributed to the government's contractionary monetary policy, which aims to stabilize prices. However, interest rate variability affects aggregate output in economies by crowding out of private investment. The interest rate is crucial to transmission of monetary policy to economic growth activities ([Maiga, 2017](#)). For the Central Bank to conduct monetary policy, interest rate is one of the most important instruments. Interest rates play a vital role at both the microeconomic and macroeconomic levels. In addition to playing an essential role in the efficient resource allocation, they also serve as a technique for managing aggregate demand and facilitating growth. To boost economic development, interest rates mobilize deposits and create credit to achieve internal and external balance ([Maiga, 2017](#)). Macroeconomic theory indicates that, interest rates are negatively correlated with economic growth. Low interest rates crowds in private investment leading to economic growth, while high interest rates crowd out private investment, shrinking economic growth. By investing the funds obtained from foreign borrowing in productive sectors of the economy, the government can play a significant role in stimulating the economy by ensuring crowding-in effect on private investment and providing social goods to citizens.

The impact of foreign public debt on economic growth can be understood through two primary shock mechanisms: the crowding-in and crowding-out effects on private demand. These effects operate through two opposing channels, as outlined below. The impact of crowding-in and crowding-out is contingent upon a number of variables. Typically, during the initial years of public capital investment, crowding-out may prevail due to the immediate fiscal adjustments that reallocate resources away from private agents. Nevertheless, over the long term, if public capital is invested in high-quality projects, crowding-in effects may become the dominant phenomenon. This is due to the fact that the gradual accumulation of private capital can result in increased productivity and higher incomes, which in turn support greater levels of private consumption. (i) The accumulation of public capital, in conjunction with more productive private inputs, labor, and private capital, serves to enhance private investment. An increase in household income that is sufficiently significant will also result in an increase in private consumption. This process, which results in an increase in private demand, is referred to as the crowding-in phenomenon. (ii) When the government chooses to issue foreign public debt, increase taxes, and reduce expenditures with the intention of financing a surge in public investment, resources are reallocated from the private sector to the public sector. This reallocation of resources results in a reduction in private investment and consumption. Consequently, private demand declines in response to the surge in public investment, a phenomenon known as crowding out.

Chapter5

CONCLUSION AND POLICY RECOMMENDATIONS

5.1. Introduction

This study constitutes a notable contribution to the existing theoretical and empirical literature. The employment of a spatial econometrics approach based on [Anselin\(1988\)](#) methodology enabled the drawing of intriguing conclusions and the offering of policy recommendations specifically tailored for the Sub-Saharan Africa convergence clubs. The study concentrated on examining the impact of geographical proximity, spatial spillover effects and macroeconomic shocks of foreign capital inflows, along with other macro-regional factors, on regional economic growth in Sub-Saharan Africa. It proceeded by analyzing the theoretical and empirical aspects of development convergence and conditional convergence. The study contributes to the existing body of literature by providing insights into the status of development convergence in the four Sub-Saharan African regions. A review of the empirical literature reveals that no previous studies have directly investigated the factors contributing to economic growth disparities among Sub-Saharan African countries. Nevertheless, insights of considerable value were derived from research that examined individual elements, including policy distortions, institutional weaknesses, structural transformations, external shocks, political stability, slow convergence, and export dependency. Subsequently, four weight matrices were created in accordance with the geographical proximity of countries within the region. Subsequently, maximum likelihood estimators were employed to ascertain the existence of spatial dependence. Furthermore, β -convergence and the factors influencing regional growth were investigated through the utilization of spatial models. Additionally, the SDM-FE model was decomposed using Monte Carlo simulation to assess the short-run and long-run regional growth spillover effects. Ultimately, we developed policy recommendations by synthesizing our findings with those of previous empirical studies and the objectives set out in the Sustainable Development Goals (SDGs). In order to address the regional development disparities in sub-Saharan Africa, it is proposed that policy best practices from Europe and East Asia be adopted. In particular, we propose the incorporation of

strategies derived from the European Union's Cohesion Policy, the implementation of place-based development approaches, and the application of the principles associated with the East Asian developmental state.

5.2. Foreign Capital and Development Challenges

In order to respond to the challenges of development, countries in sub-Saharan Africa must reduce their debt burden by mobilizing their domestic financial resources. Given the considerable financial resource deficit, the majority of African economies resort to external borrowing in order to fund infrastructure development projects that fail to stimulate economic growth in the near term. A crucial aspect of facilitating development prospects for countries in the Sub-Saharan African region is the allocation of public debt towards economically productive sectors, including energy, industrialization and agriculture, in the short term. In addition to the inherent unsustainability of such an approach, any increase in debt should be accompanied by a corresponding increase in economic growth and employment opportunities. In the majority of African countries, the governments lack the requisite policies and legal frameworks to safeguard themselves from external shocks and crises precipitated by public debt. In order to facilitate regional economic growth initiatives, it is imperative that policymaker's endeavor to exercise prudent management of foreign public debt. The realization of these challenges necessitates fiscal responsibility, fundamental reforms in the public sector and adequate institutional capacity-building initiatives. In order to maintain a stable and macroprudential fiscal policy environment in the region, it is necessary to pursue regional monetary integration. This will help to address structural rigidities, control the multiplicity of lenders in the debt market and intervene in the fiscal and monetary policy framework of the majority of African economies. The establishment of regional monetary institutions will facilitate the efficient provision of money supply, responsible financing of fiscal deficits and the creation of credit.

It would be prudent for developing countries in the region to reconsider their economic, financial, and trade architecture. This should be done by leveraging private financing and financial instruments, while avoiding the externalization of the burden of resource

mobilization through public debt. In the event that public debt is deemed necessary, it should be carefully managed by replacing domestic debt with sustainable foreign debt, thereby freeing up resources for the private sector to drive economic growth and channel foreign resources, such as remittances, into development projects that stimulate growth. This represents a stark warning to African governments that the burden of foreign public debt is reaching unsustainable levels, with economies devoting an ever-increasing proportion of their revenue to debt servicing, rather than investing in vital economic sectors. It is imperative that Sub-Saharan African countries guarantee parliamentary examination of borrowing strategies. It is the responsibility of lawmakers to intensify their scrutiny of the amount of debt being incurred and its utilization in the development agendas of these countries. It is recommended that individual countries undertake a review of their fiscal legislation with a view to establishing a framework for the governance and assessment of external borrowing. It would be prudent for the majority of countries in the region to consider the establishment of independent debt management offices. These offices would be responsible for formulating borrowing plans, conducting debt sustainability analyses, and evaluating the costs and risks associated with the various sources of credit.

Furthermore, the Sub-Saharan African countries require a macroeconomic policy landscape that is characterized by transparency, accountability and participation. It is essential to examine the transparency of borrowing practices. Loan agreements should be accessible to civil society organizations and other entities that serve as a check and balance on the government's actions. Furthermore, it is imperative that these countries foster an environment conducive to innovation and engagement, particularly in forums or platforms that facilitate interaction between community and non-governmental organizations and the government. Lenders must also assume responsibility for their actions when dealing with African countries, ensuring that they engage in responsible lending practices. Moreover, there is a need for effective measures to be taken in order to prevent illicit capital flight from Africa. It is imperative that the leakage be plugged to ensure that Africa does not lose the much-needed development resources that are vital for its growth and prosperity. It is similarly important to enhance the efficiency of spending by borrowing from sources that

provide loans at lower interest rates with longer maturity terms. Another strategy for enhancing fiscal discipline is to link debt relief with sustainable development goals and climate change objectives, and to pursue an inward-looking approach by financing development priorities through public-private sector partnerships.

It is crucial for frontier markets and low-income countries to reconsider the institutional framework that constitutes their debt ecosystem. The sovereign debt ecosystem comprises the institutional framework within which governments borrow and has become more diverse than it was 10–15 years ago. The creditor base is considerably more diverse, comprising not only traditional lenders but also emerging powers such as China, Gulf states, India and Russia. Furthermore, the instruments employed by countries to borrow are quite different. A significant proportion of these new lenders originate from economies that are markedly dissimilar in their organizational structures when compared to those of the traditional G7 countries. Consequently, there are numerous institutions that are engaged in lending activities, yet they do not align with the traditional definitions of either public or private entities. These institutions often exhibit characteristics that are not fully compatible with the existing debt architecture, which originated in the late 20th century.

The types of contracts that countries utilize and the manner in which they borrow vary considerably. This renders it challenging to ascertain whether a specific debt obligation constitutes a genuine debt, and consequently, to interpret debt data accurately. This represents a significant source of risk. Diversity does not align with the healthy institutional architecture that we inhabit, and thus, when a shock such as the advent of the Coronavirus occurs, a multitude of factors emerge. These include the potential for hidden debts, debts that may or may not be considered valid, debts that may be more or less amenable to restructuring, and collateralized debts, which point to governance issues and corruption. The majority of debt contracts are employed in ways that are not initially apparent, serving to expand the scope of their application. Furthermore, the Sub-Saharan Africa regions must identify alternative sources of revenue, including public-private partnerships (PPPs) and measures to address illicit financial flows, in order to bridge the gap and achieve the 2030 Sustainable Development Goals (SDGs).

The objective is to gain an understanding of the new debt ecosystem and the diverse actors, instruments and dynamics that play a role in frontier markets during macroeconomic shocks. The SARS-CoV-2 pandemic revealed significant deficiencies in the management of debt, including shortcomings in the transparency and coordination of debt information. There is no consensus on the definition of debt, let alone on the criteria for sustainable sovereign debt in a context where countries apply different accounting standards. The equal treatment of diverse creditors must be coordinated and negotiated during a period of immense stress, when the bandwidth of every country is overtaxed, to say the least, and trust is not at its highest. Furthermore, the advent of the global pandemic has brought to light a number of encouraging developments and promising avenues for institutional growth and advancement. The heterogeneous group of creditors and obligations has proved instrumental in broadening the perspectives of scholars and policymakers engaged in this field. To consider a broader set of factors and pose more penetrating questions not only about how to rectify a specific contract clause but also about how to establish institutions that can provide relief to developing countries and treat creditors and other stakeholders equitably when there is insufficient food to go around.

The establishment of a common framework represents a crucial step in the process of bringing new kinds of government creditors to the table. This common framework can be conceptualized as an institutional platform that facilitates dialogue and collaboration between diverse actors, including countries such as China, India, Saudi Arabia, and other non-G20 members. All creditors, including those in the private sector, would be required to contribute to the effort of restoring the country to a sustainable financial footing. The process of debt acquisition is not always transparent; however, there are some promising instances of institutional experimentation. The global health crisis precipitated by the SARS-CoV-2 virus has refocused our attention on the underlying issues, confirming the necessity for interdisciplinary inquiry in this field. Lawyers must engage with economists on matters pertaining to sustainability, while also consulting with political scientists on related issues. Similarly, economists and political scientists can benefit from the input of lawyers on matters such as contracts, bankruptcy, and the broader institutional structures within which these markets operate.

5.3. Foreign Direct Investment and Regional Economic Growth Challenges

The findings of this study suggest that customized policies should be formulated to take into account the different income levels of countries. This approach can help minimize the negative effects of Foreign Direct Investment while maximizing its benefits. A gap exists in funding efforts to achieve the Sustainable Development Goals (SDGs) in most Sub-Saharan African countries. While Foreign Direct Investment is acknowledged as a pivotal catalyst for sustainable economic growth, there is a necessity for policies and frameworks that bridge the 2030 SDG Agenda with concrete investment opportunities for private investors (Suehrer, 2019). Several empirical studies found a negative causal relationship between FDI and sustainable development in African economies, particularly in low-income nations (Arthur et al., 2024). However, there is evidence that FDI can positively influence the achievement of Sustainable Development Goals in Africa, particularly in areas such as basic infrastructure, clean water, sanitation, and renewable energy (Aust et al., 2020). FDI has been found to have a positive effect on gross domestic product growth, welfare, and real Total Factor Productivity in Sub-Saharan African countries (Asongu et al., 2023). While the impact of FDI on sustainable development in Sub-Saharan Africa is nuanced, there is evidence of both positive and negative effects. Tailored policies and further research are recommended to maximize the benefits of FDI while addressing its potential challenges. In order to fully take advantage of FDI spillovers, a coordinated industrial policy that promotes regional complementarities must be implemented along with policies that permit free movement of production factors across regional borders. The free movement of production factors between regions can help prevent the widening of regional welfare gaps. It is imperative that regional development strategies prioritize factors that enhance a region's absorption capacity to benefit from FDI effects, while also maintaining a balance between the various driving forces for regional growth (Mitze and Ozyurt, 2014). Moreover, the findings of this study provide important insights for policymakers, suggesting that alternative methods of financing should be preferred to reduce income inequality levels, as debt financing is not pro-poor as evidenced in the three Sub-Saharan African regions.

5.4. Regional Development Divergence and Economic Growth Drivers

Our results further underscored the existence of development divergence, implying that most Sub-Saharan African countries develop following their distinct paths. The grouping of countries into convergence clubs provides a crucial framework for sustainable development initiatives, underscoring the necessity for a multifaceted approach that accounts for regional heterogeneity. The spatial methodology employed facilitates nuanced, data-driven policy development, rendering it a vital tool for policymakers involved in sustainable development planning within these regions. Understanding the distinct challenges of regional development will empower policymakers to devise strategies that are not only effective but also resonates with the fundamental development priorities of the Sub-Saharan African regions.

Moreover, the study assessed various drivers of regional development disparities in Sub-Saharan Africa. It is clear that the influence of population growth on regional development in this context is multifaceted. While there are obstacles to integrating population considerations into broader development policies, there exists potential for positive economic outcomes through demographic dividends, especially when focusing on education and rural development. Policy interventions aimed at effectively leveraging the demographic window of opportunity for fostering growth should integrate investments in education and rural development alongside improved governance ([Crombach and Smits, 2022](#)). African nations can harness demographic shifts to yield economic benefits for future development. Enhanced educational outcomes have the potential to significantly bolster the regional economy and poverty alleviation ([Ahmed et al., 2016](#)). Additionally, the level of human capital plays a significant role in driving economic growth disparities among various regions in Sub-Saharan Africa. It is imperative to invest in human capital development to bolster economic growth and productivity. Tailored policies are essential to navigate the intricate relationship between human capital and economic growth at the regional level. Policymakers are urged to prioritize sustained investments in the education and health sectors to foster human capital development. Moreover, fostering urbanized, technologically advanced cities is recommended to amplify the impact of human capital on economic growth. [Rehak \(2020\)](#) highlighted the necessity of region-specific policies to

support human capital accumulation. Investing in the development of human capital, especially in education and health sectors, is essential for achieving the Sustainable Development Goals in Sub-Saharan Africa. Such investment positively impacts economic growth sustainability, environmental sustainability, poverty reduction, and food security. The conclusions drawn from this study are consistent with SDG Goals 4, 2, 8, and 11.

5.5. Policy Recommendations

5.5.1. Lessons from European Union Cohesion Policy

Despite the varied structural, governance, and institutional frameworks in Sub-Saharan Africa, valuable lessons can be learnt from the European Union's Cohesion Policy. Cohesion Policy has effectively bridged the development gap between the more prosperous Western Europe and the lagging regions of Eastern and Central Europe. The Cohesion Policy aims to eliminate development disparities not only between countries but also among different areas and regions within the same country. Although the economic, social, and territorial conditions differ across the 274 EU regions, the main goal of the Cohesion Policy is to reduce regional development disparities. This necessitated coordinated efforts to address regional disparities in Europe, aiming to correct structural and regional imbalances within the EU that could impede the realization of economic and monetary union. The primary goal of cohesion policy is to reduce economic and social disparities among EU states and regions. This initiative was driven by significant regional imbalances evident in the EU during the 1950s. The Treaty of Rome articulated the signatory states' desire to strengthen their economic unity and ensure harmonious development by reducing regional differences and the underdevelopment of less favored areas, thereby promoting balanced economic growth within the European Economic Community ([Whitlow, 1957](#)). Sub-Saharan Africa can adopt several key policies from the EU cohesion policy to enhance continental development initiatives. These include establishing interregional trade to reduce economic and social imbalances by eliminating customs duties and facilitating the movement of goods between countries. Additionally, implementing common tariffs and a unified transport policy can further support regional integration. The EU has also focused on promoting the development and adjustment of lagging regions, specifically targeting areas where per capita GDP is less than or close to

75% of the community average. Addressing long-term unemployment is another critical aspect, with the EU targeting individuals over the age of 25 who have been unemployed for more than 12 months. Reforming agricultural policies is also essential, involving the adoption of improved production, processing, and marketing structures in agriculture and forestry, as well as developing rural areas. Furthermore, facilitating the free mobility of labor and capital is crucial for fostering economic growth and development. Addressing the numerous cross-border restrictions imposed by African countries is essential to overcoming hindrances to regional development. To reduce regional development disparities, Sub-Saharan African countries can draw valuable lessons from the report by [Sapir et al. \(2004\)](#), titled "An Agenda for a Growing Europe." This report emphasized that to promote intra-EU convergence, EU policies should primarily focus on the poorer new accession member states. Additionally, it suggests that any EU development policy should target individual member states rather than regions. In addition, the report recommends governance and institutional reforms for the new accession countries, as well as the development of ICT and other knowledge-based sectors across Europe.

5.5.2. Place-Based Approach to Regional Development

Furthermore, it is advisable for most Sub-Saharan African nations to embrace place-based approach to regional development. The place-based approach is intentionally structured to recognize and leverage existing locally derived knowledge. Concurrently, it emphasizes local values and the social cohesion while also necessitating receptiveness to external values ([Sen, 2009](#)). Social cohesion fosters stability, facilitating the implementation and maintenance of spatial policies. Thus, it serves both as a prerequisite for regional policy and as a desired objective or outcome ([Todes and Turok, 2018](#)). The shared community values acts as social capital, influencing the institutional context in which regional development occurs ([Streeck, 1991](#)). It plays a crucial role in generating consensus and trust, mobilizing resources and resolving conflicts ([Rodríguez-Pose and Storper, 2006](#)). The place-based approach acknowledges the unique development paths of various regions and emphasizes the importance of understanding and enhancing locally derived knowledge. It advocates for more responsive and cohesive economic policies aimed at fostering entrepreneurial start-up and growth dynamics across all regions, along with the

requisite institutions and policy tools to achieve these objectives (Todes and Turok, 2018). By recognizing the limitations of central governments in formulating effective community-derived regional development policies, place-based policy strategies underscore the necessity for interventions rooted in partnerships across various governance levels. This approach not only facilitates institution-building but also leverages and enhances local expertise (Pike et al., 2007). Literature on 'place-based' regional development strategies indicates that local and regional assets and expertise are fundamental to national growth. Places are 'sticky' because they attract and retain productive human capital, investments, and related resources through intensive local linkages (Hildreth & Bailey, 2014; Barca et al., 2012). In order to avoid principal-agent problems, the effectiveness of place-based policies depends on mobilizing local and regional stakeholders to take an active and leadership role in regional development initiatives. To harness the potential benefits of their positive involvement in both the formulation and execution of the policies, it is crucial to engage local actors constructively (Rodrik, 2005; Barca, 2009). These multi-tiered governance frameworks must operate both vertically and horizontally. Vertically, they must effectively bridge the conventional boundaries between local, regional, and national governments. Horizontally, they should cross jurisdictional lines and integrate efforts across the private, public, and nonprofit groups within the civic society (Barca et al., 2012). Moreover, significant endeavors are necessary to establish and uphold resilient and transparent local and regional governments, under the oversight and support of central government.

5.5.3. Policy Lessons from Japan and East-Asian Developmental State

The discourse on development across Africa highlights numerous strategies designed and implemented to foster development across the continent. According to the United Nations Economic Commission for Africa (UNECA, 2011) report, eight distinct strategies have been employed to promote development on the continent. However, these strategies have largely been unsuccessful due to various factors, including poorly implemented policies, inadequate policy design, policy discontinuity, sluggish industrialization, lack of a conducive environment for development, and the failure of governments to cultivate a robust private sector. There is a compelling need for African governments to take renewed

interest in the East-Asian developmental state paradigm. Given that previous strategies have not effectively addressed development challenges, it is essential to consider alternative approaches. The success of the Asian Tigers is attributed to their adoption of the developmental state model, suggesting that this paradigm may offer valuable insights and strategies for achieving sustainable development in Sub-Saharan Africa.

The concept of the developmental state was initially introduced by [Johnson \(1982\)](#) in his seminal book, *"MITI and the Japanese Miracle,"* and was further developed by [Amsden \(1989\)](#) and [Wade \(1990\)](#) based on the economic policies implemented by East Asian countries to achieve rapid industrialization. A developmental state can be characterized as one possessing the capacity to utilize its legitimacy, credibility and authority effectively to formulate and implement development policies and programs. These efforts aim to promote transformation and growth while expanding human capital development ([UNECA, 2011](#)). A developmental state has the ability to promote development and connect it to local, national, regional, and international actors. There are two primary schools of thought regarding the developmental state: the political school and the economic school. The political school argues that state capacity is crucial for development, asserting that the legitimacy of the state hinges on its ability to foster economic growth. Conversely, the economic school posits that a developmental state must implement economic policies and programs designed to drive development, emphasizing the importance of addressing market imperfections and building institutions capable of managing these imperfections. Both political and economic issues must be addressed within the framework of the interactions between national and international actors to achieve a successful developmental state. The developmental state paradigm is not unfamiliar to Sub-Saharan Africa. Following independence, many Sub-Saharan African leaders held a developmental vision for their nations. However, what has often been labeled as a developmental state in Sub-Saharan Africa has primarily consisted of development policies with minimal industrialization. Instead, these countries experienced patronage, rent-seeking activities, and state policies that ultimately did not promote genuine development. The mere implementation of development policies did not suffice to transform these countries into true developmental states.

Sub-Saharan African countries can benefit from adopting best practices observed in the East Asian developmental state. Key practices include political leadership with a clear developmental vision, which contrasts with the leadership in many Sub-Saharan African countries that often face several challenges, such as the inability to make difficult decisions and the prevalence of ad hoc, piecemeal, and politically motivated policies. Additionally, there is a frequent lack of policy continuity and coordination, coupled with systemic corruption, stagnating economic growth, and high debt-to-GDP ratios. The success of the developmental state model is fundamentally based on a robust fiscal foundation, which is essential for achieving sustainable development. Incentives for economic development are provided by allowing decentralized governments to retain revenue, including extrabudgetary revenue. Research indicates that fiscal decentralization contributed significantly to local economic growth in China, particularly in the expansion of the private sector (Knight, 2014). Key elements of the developmental state according to Knight (2014); Pekkanen (2004); Evans (1989) are: Policy interventions that foster economic growth are crucial, as growth sustains and legitimizes the governance system. Strengthening leadership commitment and introducing incentive system to reward performance further enhances economic growth efforts. In China, rapid economic growth was facilitated by favorable initial conditions, underscoring the importance of Sub-Saharan African countries aligning their policy interventions with a supportive environment to achieve similar economic growth outcomes. Key interventions include the establishment of a capable and autonomous bureaucracy and fostering a symbiotic relationship between the bureaucracy and the private sector. Additionally, it is crucial to align the labor market and education system with a singular focus on growth. A regionally decentralized authoritarian regime may be necessary to maintain stability and prevent factors that could undermine economic progress. Moreover, maintaining a high savings rate to facilitate investment and capital deepening is vital. Finally, adopting an export-led growth model is imperative for driving sustained economic development.

In addition to its empirical findings, this study serves as a springboard for empirical investigations. Specifically, it aims to encourage discussion among scholars about the dynamics of regional development in Sub-Saharan Africa. The research addresses a crucial

gap in empirical literature and lays the foundation for future academic studies by providing a robust, data-driven foundation for policymakers. Amid the escalating sustainable development challenges confronting the global community, which transcend both geographical and political boundaries, this study underscores the imperative of embracing a multifaceted approach to regional development in the Sub-Saharan Africa.

5.6. Study Limitations and Future Research Avenues

Many countries in Sub-Saharan Africa lacked data for certain variables, which limited the study. Furthermore, in spatial econometrics it is necessary to have balanced panels, which resulted in 25 countries being included in the sample. The study, nonetheless, provides avenues for future research, including an assessment of the efficacy of policy in relation to economic geography and SDGs within Sub-Saharan Africa. By utilizing standardized geographical distance matrices and taking foreign capital integration into account, this study evaluated geography and space's influence on regional development. There is a need for further investigation of how governance and institutional proximity affect regional development dynamics in Sub-Saharan Africa (i.e. the governance-institutions and economic growth nexus in developing Sub-Saharan African countries). A growing body of evidence suggests that economic development is significantly shaped by the quality of institutions and governance ([Seldadyo et al., 2007](#); [Rajkumar and Swaroop, 2008](#)). The spatial dimension of governance can be illustrated through the examination of resource flows and spillovers. The interconnections between policy choices ([Brueckner, 2003](#)), the spread of governance structures ([Starr, 1991](#)), and policy convergence ([Mukand and Rodrik, 2005](#)) represent a number of potential factors that contribute to the spatial dependence of governance. There is compelling evidence to suggest that institutions exert a significant influence on cross-country income disparities and growth ([Acemoglu et al., 2005](#); [Rodrik et al., 2004](#)). The impact of institutions on income disparities and economic growth in various regions has been the subject of considerable spatial analysis. The findings of such studies indicate that the quality of institutions in neighbouring countries can exert a significant influence on a nation's GDP per capita ([Bosker and Garretsen, 2009](#); [Arbia et al., 2010](#)). Therefore, given the governance and institutional challenges found in most Sub-Saharan African countries, evaluation of cross-country impacts is essential. The

findings of this study contribute substantially to the integration of academic research and practical policies in regional development. Considering that sustainable development challenges transcend geographical and political boundaries, a multilevel approach focusing on regions is essential. In addition to being conducted with great methodological rigor, the research produces actionable findings. Sub-Saharan Africa can benefit from collaborative and inclusive initiatives that advance regional development sustainability.

Appendix

Table 22: Panel SDM with Spatial Fixed Effects for the Four Sub-Saharan African Regions

lnrgdp_2015	ECCAS Coef.	SADC	ECOWAS	EADC
Main				
<i>lngfpd</i>	-0.086*** (0.003)	-0.007*** (0.000)	-0.010 (0.008)	0.070*** (0.000)
<i>lnfdi1</i>	0.001 (0.002)	0.013*** (0.000)	-0.015 (0.010)	0.008*** (0.000)
<i>lndser</i>	0.000 (0.000)	-0.005*** (0.000)	0.021*** (0.003)	0.026*** (0.000)
<i>lngfcf</i>	0.006 (0.004)	0.027*** (0.000)	0.068*** (0.023)	0.013*** (0.001)
<i>lnpop</i>	1.313*** (0.043)	1.632*** (0.005)	1.024*** (0.118)	1.667*** (0.018)
<i>trade</i>	0.001*** (0.000)	-0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
<i>infl</i>	-0.001*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
<i>bcd</i>	4.624** (0.000)	1.326*** (0.006)	0.413*** (0.112)	2.410*** (0.016)
<i>pol_stab</i>	0.000 (0.000)	0.000*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
<i>gov_eff</i>	0.001*** (0.000)	0.002*** (0.000)	-0.000 (0.001)	-0.001*** (0.000)
<i>reg_qual</i>	0.000 (0.000)	-0.003*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
<i>r_law</i>	-0.004*** (0.000)	0.001*** (0.000)	0.002*** (0.001)	0.002*** (0.000)
<i>cont_corr</i>	0.004*** (0.000)	-0.001*** (0.000)	0.002*** (0.000)	0.003*** (0.000)
<i>nxlngfpd</i>	-0.242*** (0.044)	0.067 (0.062)	-0.126*** (0.024)	-0.004 (0.033)
<i>nxlnfdi1</i>	0.255*** (0.039)	-0.072*** (0.010)	-0.194*** (0.038)	-0.044** (0.022)
<i>nxlndser</i>	0.102*** (0.013)	0.033* (0.017)	0.149*** (0.013)	-0.100*** (0.026)
<i>nxlnpop</i>	0.012 (0.041)	-0.229*** (0.063)	0.376*** (0.077)	-0.195* (0.108)
<i>nxtrade</i>	-2.886** (1.330)	-3.923*** (0.473)	4.607*** (0.400)	2.027 (1.672)
<i>nxinfl</i>	0.003 (0.002)	0.007*** (0.001)	0.007*** (0.001)	0.008** (0.004)
<i>nxbcd</i>	0.003 (0.002)	0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
<i>nx pol_stab</i>	8.694** (3.507)	9.720*** (2.064)	2.790*** (0.487)	3.633*** (1.357)
<i>nxgov_eff</i>	0.001 (0.003)	0.004** (0.002)	-0.012*** (0.002)	-0.004 (0.004)
<i>nxreg_qual</i>	-0.026*** (0.009)	-0.010** (0.004)	0.003* (0.002)	0.002 (0.004)
<i>nx r_law</i>	0.000 (0.002)	0.006 (0.005)	-0.012*** (0.003)	-0.003 (0.003)
<i>nxcont_corr</i>	-0.002 (0.006)	-0.007*** (0.002)	0.013*** (0.003)	-0.001 (0.001)
<i>Spatial rho</i>	-3.645*** (0.058)	-3.969** (0.000)	-4.634*** (0.298)	-4.886** (0.000)
<i>Variance sigma2_e</i>	0.0020 (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
<i>Log likelihood</i>	177.3533	159.2863	284.1536	169.2701
<i>SAR Vs SDM</i>				
<i>Chi2 (x)</i>	(13) 215.99	(12) 103.72	(12) 197.59	(13) 83.80
<i>Pr>Chi2</i>	0.0000	0.0000	0.0000	0.0000
<i>SEM Vs SDM</i>				
<i>Chi2 (x)</i>	(13) 274.86	(13) 147.40	88.76	198.19
<i>Pr>Chi2</i>	0.0000	0.0000	0.0000	0.0000
<i>Hausman Test</i>				
<i>Pr>Chi2</i>	0.0000	0.0000	0.0000	0.0000
<i>AIC</i>	-238.8892	-266.5726	-601.6875	-278.5402
<i>BIC</i>	-162.2729	-200.1718	-521.41	-196.4542
<i>r² Within</i>	0.9663	0.9461	0.9695	0.9671
<i>r² Between</i>	0.5942	0.6599	0.8953	0.8921
<i>r² Overall</i>	0.5933	0.6553	0.8963	0.8889
<i>Observations</i>	95	95	162	114

*** $p < .01$, ** $p < .05$, * $p < .1$; Source: Author's Estimation, 2024

Table 23: Model Estimation _Economic Community of Central African States

Model Estimation _Economic Community of Central African States					
	(1)	(2)	(3)	(4)	(5)
Variables	SAC-FE	SAR-FE	SEM-FE	SDM-FE	SDM-RE
<i>lngfpd</i>	-0.060*** (0.012)	-0.010*** (0.002)	-0.147*** (0.017)	-0.086*** (0.003)	-0.163*** (0.008)
<i>lnfdi1</i>	0.000 (0.007)	0.000 (0.001)	0.002 (0.018)	0.001 (0.002)	0.066*** (0.015)
<i>lndser</i>	0.001 (0.002)	0.000 (0.000)	0.001 (0.005)	0.000 (0.000)	0.026*** (0.005)
<i>lngfcf</i>	0.004 (0.017)	0.001 (0.003)	0.010 (0.046)	0.006 (0.004)	0.009 (0.032)
<i>lnpop</i>	0.871*** (0.177)	0.152*** (0.031)	2.255*** (0.136)	1.313*** (0.043)	0.817* (0.422)
<i>trade</i>	0.001*** (0.000)	0.000*** (0.000)	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.001)
<i>infl</i>	-0.001*** (0.000)	-0.000*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.000 (0.000)
<i>bcd</i>	3.195 (0.000)	0.550 (0.000)	7.930*** (1.185)	4.624 (0.000)	7.868*** (1.496)
<i>pol_stab</i>	-0.000 (0.001)	-0.000 (0.000)	0.000 (0.002)	0.000 (0.000)	0.000 (0.001)
<i>gov_eff</i>	0.000 (0.001)	0.000 (0.000)	0.002 (0.002)	0.001*** (0.000)	-0.005 (0.004)
<i>reg_qual</i>	-0.000 (0.001)	-0.000 (0.000)	0.000 (0.002)	0.000 (0.000)	-0.000 (0.002)
<i>r_law</i>	-0.002** (0.001)	-0.000** (0.000)	-0.006*** (0.002)	-0.004*** (0.000)	-0.005** (0.002)
<i>cont_corr</i>	0.003*** (0.001)	0.000*** (0.000)	0.007*** (0.002)	0.004*** (0.000)	0.012*** (0.002)
<i>Spatial rho_ρ</i>	-2.475*** (0.234)	-3.733*** (0.042)	- -	-3.645*** (0.058)	-1.171*** (0.112)
<i>Spatial lambda_λ</i>	-3.995*** (0.001)	- -	-3.991*** (0.001)	- -	- -
<i>Spatial phi_φ</i>	- -	- -	- -	- -	- -
<i>Variance Sigma 2_e</i>	0.000 (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.001*** (0.000)
<i>Variance: lgt_theta</i>	- -	- -	- -	- -	-5.023*** (0.480)
<i>Observations</i>	95	95	95	95	95
<i>r²</i>	0.593	0.585	0.602	0.602	0.606

*** $p < .01$, ** $p < .05$, * $p < .1$; Source: Author's Estimation, 2024

Table 24: Model Estimation - Southern Africa Development Community

Model Estimation _Southern Africa Development Community					
	(1)	(2)	(3)	(4)	(5)
Variables	SAC-FE	SAR-FE	SEM-FE	SDM-FE	SDM-RE
<i>lngfpd</i>	-0.000 (0.215)	-0.000 (0.001)	-0.012 (0.056)	-0.007*** (0.000)	0.003 (0.061)
<i>lnfdi1</i>	0.006 (0.033)	0.000*** (0.000)	0.024*** (0.004)	0.013*** (0.000)	-0.001 (0.005)
<i>lndser</i>	-0.002 (0.003)	-0.000 (0.000)	-0.009 (0.008)	-0.005*** (0.000)	0.000 (0.013)
<i>lngfcf</i>	0.013 (0.119)	0.001* (0.000)	0.051* (0.028)	0.027*** (0.000)	-0.020 (0.020)
<i>lnpop</i>	0.818 (0.000)	0.043*** (0.009)	3.014*** (0.663)	1.632*** (0.005)	1.025** (0.522)
<i>trade</i>	-0.001 (0.003)	-0.000*** (0.000)	-0.002*** (0.001)	-0.001*** (0.000)	0.000 (0.000)
<i>infl</i>	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000*** (0.000)	0.000* (0.000)
<i>bcd</i>	0.654 (3.505)	0.034*** (0.011)	2.448*** (0.767)	1.326*** (0.006)	4.124*** (0.328)
<i>pol_stab</i>	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000*** (0.000)	0.001*** (0.000)
<i>gov_eff</i>	0.001 (0.010)	0.000 (0.000)	0.004 (0.004)	0.002*** (0.000)	0.000 (0.005)
<i>reg_qual</i>	-0.001 (0.002)	-0.000* (0.000)	-0.005 (0.003)	-0.003*** (0.000)	-0.002 (0.003)
<i>r_law</i>	0.001 (0.001)	0.000 (0.000)	0.001 (0.003)	0.001*** (0.000)	-0.001 (0.003)
<i>cont_corr</i>	-0.001 (0.012)	-0.000 (0.000)	-0.002 (0.003)	-0.001*** (0.000)	-0.001 (0.004)
<i>Spatial rho_ρ</i>	-2.999 (0.000)	-3.946 (0.000)	- (0.001)	-3.969 (0.000)	-1.151*** (0.138)
<i>Spatial lambda_λ</i>	-3.989 (0.000)	- (0.000)	-3.993*** (0.001)	- (0.000)	- (0.000)
<i>Spatial phi_φ</i>	- (0.000)	- (0.000)	- (0.000)	- (0.000)	- (0.000)
<i>Variance Sigma 2_e</i>	0.000 (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.002*** (0.001)
<i>Variance:lgθ_theta</i>	- (0.152)	- (0.152)	- (0.152)	- (0.152)	-5.443*** (0.152)
<i>Observations</i>	95	95	95	95	95
<i>r²</i>	0.651	0.648	0.661	0.655	0.655

*** $p < .01$, ** $p < .05$, * $p < .1$; Source: Author's Estimation, 2024

Table 25: Model Estimation – Economic Community of West African States

Model Estimation _Economic Community of West African States					
	(1)	(2)	(3)	(4)	(5)
Variables	SAC-FE	SAR-FE	SEM-FE	SDM-FE	SDM-RE
<i>lngfpd</i>	0.001 (0.001)	0.000* (0.000)	0.028 (0.020)	0.000 (0.000)	-0.010 (0.008)
<i>lnfdi1</i>	0.001 (0.001)	0.000 (0.000)	0.017 (0.020)	0.000 (0.000)	-0.015 (0.010)
<i>lndser</i>	0.000 (0.000)	0.000 (0.000)	0.006 (0.009)	0.000 (0.000)	0.021*** (0.003)
<i>lngfcf</i>	0.002 (0.003)	0.000 (0.000)	0.033 (0.058)	0.000 (0.000)	0.068*** (0.023)
<i>lnpop</i>	0.019* (0.010)	0.000 (0.000)	0.408* (0.230)	0.001 (0.001)	1.024*** (0.118)
<i>trade</i>	0.000 (0.000)	0.000* (0.000)	0.001 (0.000)	0.000 (0.000)	0.001*** (0.000)
<i>infl</i>	0.000 (0.000)	0.000** (0.000)	0.000 (0.000)	0.000*** (0.000)	-0.000*** (0.000)
<i>bcd</i>	0.000 (0.009)	-0.000 (0.000)	0.006 (0.190)	0.000 (0.001)	0.413*** (0.112)
<i>pol_stab</i>	0.000 (0.000)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	-0.001*** (0.000)
<i>gov_eff</i>	-0.000* (0.000)	-0.000*** (0.000)	-0.003* (0.002)	-0.000 (0.000)	-0.000 (0.001)
<i>reg_qual</i>	0.000 (0.000)	0.000 (0.000)	0.001 (0.001)	0.000 (0.000)	-0.001*** (0.000)
<i>r_law</i>	0.000** (0.000)	0.000*** (0.000)	0.003** (0.001)	0.000 (0.000)	0.002*** (0.001)
<i>cont_corr</i>	0.000*** (0.000)	0.000*** (0.000)	0.002*** (0.001)	0.000 (0.000)	0.002*** (0.000)
<i>Spatial rho_ρ</i>	-7.629*** (0.029)	-7.995*** (0.001)	- (0.003)	-7.973*** (0.005)	-4.634*** (0.298)
<i>Spatial lambda_λ</i>	-7.587*** (0.032)	- (0.032)	-7.981*** (0.003)	- (0.003)	- (0.003)
<i>Spatial phi_φ</i>	- (0.032)	- (0.032)	- (0.003)	- (0.003)	- (0.003)
<i>Variance Sigma 2_e</i>	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.001)
<i>Variance:lgθ_theta</i>	- (0.527)	- (0.527)	- (0.527)	- (0.527)	-3.863*** (0.527)
<i>Observations</i>	162	162	162	162	162
<i>r²</i>	0.810	0.518	0.834	0.807	0.896

*** $p < .01$, ** $p < .05$, * $p < .1$; Source: Author's Estimation, 2024

Table 26: Model Estimation – Eastern Africa Development Community

Model Estimation _Eastern Africa Development Community					
	(1)	(2)	(3)	(4)	(5)
Variables	SAC-FE	SAR-FE	SEM-FE	SDM-FE	SDM-RE
<i>lngfpd</i>	0.006*** (0.001)	0.001*** (0.000)	0.129*** (0.017)	0.070*** (0.000)	0.068*** (0.022)
<i>lnfdi1</i>	0.001** (0.000)	0.000** (0.000)	0.015** (0.007)	0.008*** (0.000)	0.002 (0.005)
<i>lndser</i>	0.002*** (0.001)	0.000*** (0.000)	0.047*** (0.016)	0.026*** (0.000)	0.011 (0.010)
<i>lngfcf</i>	0.001 (0.002)	0.000 (0.000)	0.023 (0.053)	0.013*** (0.001)	-0.005 (0.010)
<i>lnpop</i>	0.139*** (0.034)	0.018*** (0.004)	3.078*** (0.794)	1.667*** (0.018)	1.819** (0.812)
<i>trade</i>	0.000* (0.000)	0.000* (0.000)	0.003* (0.002)	0.002*** (0.000)	0.004*** (0.001)
<i>infl</i>	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000*** (0.000)	-0.000 (0.000)
<i>bcd</i>	0.201*** (0.037)	0.025*** (0.004)	4.447*** (0.694)	2.410*** (0.016)	3.437*** (0.493)
<i>pol_stab</i>	-0.000 (0.000)	-0.000 (0.000)	-0.001 (0.001)	-0.001*** (0.000)	-0.001 (0.001)
<i>gov_eff</i>	-0.000 (0.000)	-0.000 (0.000)	-0.002 (0.002)	-0.001*** (0.000)	-0.001 (0.001)
<i>reg_qual</i>	-0.000 (0.000)	-0.000 (0.000)	-0.002 (0.002)	-0.001*** (0.000)	-0.003 (0.002)
<i>r_law</i>	0.000*** (0.000)	0.000*** (0.000)	0.004*** (0.001)	0.002*** (0.000)	0.002* (0.001)
<i>cont_corr</i>	0.000*** (0.000)	0.000*** (0.000)	0.005*** (0.002)	0.003*** (0.000)	0.003*** (0.001)
<i>Spatial rho_ρ</i>	-4.773*** (0.022)	-4.973 (0.000)	-	-4.886 (0.000)	-1.889*** (0.209)
<i>Spatial lambda_λ</i>	-4.794*** (0.015)	-	-4.995*** (0.001)	-	-
<i>Spatial phi_φ</i>	-	-	-	-	-
<i>Variance Sigma 2_e</i>	0.000*** (0.000)	0.000*** (0.000)	0.000 (0.000)	0.000*** (0.000)	0.001*** (0.001)
<i>Variance:lgθ_theta</i>	-	-	-	-	-4.127*** (1.301)
<i>Observations</i>	114	114	114	114	114
<i>r²</i>	0.852	0.852	0.885	0.886	0.889

*** $p < .01$, ** $p < .05$, * $p < .1$; Source: Author's Estimation, 2024

Table 27: Generalized Spatial Panel Random Effects (GSPRE) Model.

	ECCAS (1) GSPRE	EADC (2) GSPRE	SADC (3) GSPRE	ECOWAS (3) GSPRE
<i>lngfpd</i>	-0.006 (1.319)	0.075 (0.201)	-0.058 (0.938)	0.109 (0.835)
<i>lnfdi1</i>	0.038 (1.231)	0.018 (0.040)	0.030 (0.533)	0.094 (0.386)
<i>lndserv</i>	0.000 (1.177)	0.036 (0.139)	-0.011 (0.891)	0.031 (0.122)
<i>lngfcf</i>	-0.051 (1.705)	0.103 (0.458)	0.071 (1.314)	0.135 (0.366)
<i>lnpop</i>	0.888 (42.149)	0.877 (5.837)	1.188 (82.069)	0.393 (2.313)
<i>trade</i>	0.001 (0.038)	0.003 (0.015)	0.000 (0.088)	0.000 (0.007)
<i>infl</i>	-0.002 (0.010)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
<i>bcd</i>	3.581 (149.138)	2.049 (22.638)	1.858 (119.991)	1.454 (0.000)
<i>pol_stab</i>	0.007 (0.051)	0.000 (0.018)	-0.002 (0.131)	0.003 (0.033)
<i>gov_eff</i>	-0.001 (0.448)	-0.002 (0.017)	0.004 (0.207)	0.001 (0.011)
<i>reg_qual</i>	0.004 (0.148)	-0.002 (0.021)	-0.005 (0.020)	0.001 (0.006)
<i>r_law</i>	-0.002 (0.331)	0.001 (0.016)	-0.001 (0.119)	0.004 (0.025)
<i>cont_corr</i>	0.008 (0.078)	0.005 (0.015)	0.000 (0.122)	0.001 (0.009)
<i>_cons</i>	6.515 (552.394)	4.718 (85.554)	4.556 (1199.662)	6.329 (57.095)
<i>Spatial:rho</i>	-	-	-	-
<i>Spatial:lambda</i>	-0.553 (36.793)	-0.238 (1.173)	-0.163 (37.458)	-0.067 (0.000)
<i>Spatial:phi</i>	-4.003*** (0.017)	-4.991*** (0.009)	-4.534 (0.000)	-7.594 (8.026)
<i>Variance:sigma2_e</i>	-	-	-	-
<i>Variance:sigma_mu</i>	0.000 (0.024)	0.001 (0.002)	0.138 (10.269)	0.043 (0.732)
<i>Variance:sigma_e</i>	0.079 (0.393)	0.064 (0.115)	0.071 (0.460)	0.085 (0.246)
<i>Observations</i>	95	114	95	162
<i>R-squared</i>	0.784	0.875	0.678	0.769

Robust standard errors are in parentheses *** $p < .01$, ** $p < .05$, * $p < .1$

Table 28 : Analysis of Spatial Spillover Effects - EADC.

Variables	Coefficients		Std. Errors		P-Values	
Spatial Marginal Direct Effects: Dynamic SDM – FE						
	SR	LR	SR	LR	SR	LR
<i>lngfpd</i>	0.032	0.731	0.032	21.022	0.324	0.972
<i>lnfdi</i>	0.019	-0.021	0.012	0.835	0.103	0.980
<i>lngfcf</i>	0.026	0.318	0.023	5.853	0.259	0.957
<i>lnpop</i>	0.042	-0.139	0.064	15.347	0.516	0.993
<i>trade</i>	0.155	16.466	0.680	457.163	0.820	0.971
<i>infl</i>	-0.003	-0.022	0.002	0.589	0.069*	0.970
<i>bcd</i>	0.000	0.001	0.000	0.016	0.038**	0.962
<i>pol_stab</i>	3.831	40.311	1.590	1079.452	0.016**	0.970
<i>gov_eff</i>	0.001	0.009	0.002	0.179	0.466	0.960
<i>reg_qual</i>	0.002	0.038	0.002	0.843	0.466	0.964
<i>r_law</i>	-0.003	0.031	0.003	0.691	0.321	0.964
<i>cont_corr</i>	-0.000	0.039	0.002	1.008	0.844	0.969
Spatial Marginal Indirect Effects: Dynamic SDM – FE						
<i>lngfpd</i>	0.074	-0.628	0.033	21.022	0.026**	0.976
<i>lnfdi</i>	0.075	0.112	0.012	0.835	0.000***	0.893
<i>lngfcf</i>	0.063	-0.231	0.024	5.853	0.008***	0.969
<i>lnpop</i>	0.188	0.362	0.065	15.346	0.004***	0.981
<i>trade</i>	-2.512	-18.754	0.697	457.164	0.000***	0.967
<i>infl</i>	-0.015	0.004	0.002	0.589	0.000***	0.994
<i>bcd</i>	0.000	-0.000	0.000	0.016	0.000***	0.979
<i>pol_stab</i>	8.800	-28.050	1.593	1079.453	0.000***	0.979
<i>gov_eff</i>	0.006	-0.002	0.002	0.179	0.001***	0.992
<i>reg_qual</i>	0.000	-0.036	0.002	0.843	0.914	0.966
<i>r_law</i>	-0.004	-0.037	0.003	0.691	0.133	0.957
<i>cont_corr</i>	-0.008	-0.048	0.002	1.008	0.000***	0.962
Spatial Marginal Total Effects: Dynamic SDM – FE						
<i>lngfpd</i>	0.106	0.102	0.008	0.008	0.000	0.000
<i>lnfdi</i>	0.095	0.092	0.006	0.005	0.000	0.000
<i>lngfcf</i>	0.090	0.087	0.007	0.007	0.000	0.000
<i>lnpop</i>	0.230	0.223	0.018	0.018	0.000	0.000
<i>trade</i>	-2.357	-2.288	0.154	0.148	0.000	0.000
<i>infl</i>	-0.018	-0.018	0.001	0.001	0.000	0.000
<i>bcd</i>	0.000	0.000	0.000	0.000	0.000	0.000
<i>pol_stab</i>	12.631	12.261	0.396	0.375	0.000	0.000
<i>gov_eff</i>	0.007	0.007	0.001	0.001	0.000	0.000
<i>reg_qual</i>	0.002	0.002	0.000	0.000	0.000	0.000
<i>r_law</i>	-0.006	-0.006	0.000	0.000	0.000	0.000
<i>cont_corr</i>	-0.009	-0.009	0.000	0.000	0.000	0.000

Levels of significance *** $p < .01$, ** $p < .05$, * $p < .1$. (The significance of the degree of indirect effect shows the existence of spatial spillover effect)

Table 29: Analysis of Spatial Spillover Effects - SADC.

Variables	Coefficients		Std. Errors		P-Values	
Spatial Marginal Direct Effects: Dynamic SDM – FE						
	SR	LR	SR	LR	SR	LR
<i>lngfpd</i>	-0.007	-0.045	0.019	0.041	0.702	0.281
<i>lnfdi</i>	-0.006	-0.001	0.006	0.014	0.300	0.935
<i>lngfcf</i>	0.015	0.030	0.008	0.017	0.051	0.072
<i>lnpop</i>	-0.010	0.002	0.014	0.031	0.474	0.951
<i>trade</i>	0.188	0.882	0.234	0.550	0.423	0.109
<i>infl</i>	0.001	0.001	0.000	0.001	0.024	0.223
<i>bcd</i>	0.000	0.000	0.000	0.000	0.099	0.225
<i>pol_stab</i>	2.699	5.196	0.434	0.951	0.000	0.000
<i>gov_eff</i>	0.001	0.002	0.001	0.001	0.003	0.028
<i>reg_qual</i>	-0.002	-0.002	0.002	0.003	0.303	0.605
<i>r_law</i>	0.000	0.001	0.001	0.003	0.844	0.799
<i>cont_corr</i>	-0.004	-0.010	0.002	0.004	0.007	0.009
Spatial Marginal Indirect Effects: Dynamic SDM – FE						
<i>lngfpd</i>	0.160	0.269	0.048	0.078	0.001***	0.001***
<i>lnfdi</i>	-0.068	-0.107	0.015	0.025	0.000***	0.000***
<i>lngfcf</i>	0.012	0.009	0.017	0.028	0.475	0.754
<i>lnpop</i>	-0.135	-0.214	0.038	0.063	0.000***	0.001***
<i>trade</i>	-2.557	-4.329	0.476	0.804	0.000***	0.000***
<i>infl</i>	0.005	0.007	0.001	0.001	0.000***	0.000***
<i>bcd</i>	0.000	0.000	0.000	0.000	0.019**	0.051**
<i>pol_stab</i>	3.893	4.372	1.099	1.685	0.000***	0.009***
<i>gov_eff</i>	0.004	0.006	0.001	0.002	0.000***	0.001***
<i>reg_qual</i>	-0.011	-0.017	0.005	0.007	0.015**	0.016**
<i>r_law</i>	-0.001	-0.002	0.003	0.005	0.709	0.671
<i>cont_corr</i>	0.000	0.004	0.003	0.006	0.954	0.514
Spatial Marginal Total Effects: Dynamic SDM – FE						
<i>lngfpd</i>	0.153	0.224	0.057	0.089	0.007	0.012
<i>lnfdi</i>	-0.074	-0.108	0.018	0.025	0.000	0.000
<i>lngfcf</i>	0.027	0.039	0.019	0.028	0.157	0.165
<i>lnpop</i>	-0.145	-0.212	0.044	0.068	0.001	0.002
<i>trade</i>	-2.369	-3.447	0.539	0.802	0.000	0.000
<i>infl</i>	0.005	0.008	0.001	0.002	0.000	0.000
<i>bcd</i>	0.000	0.000	0.000	0.000	0.005	0.005
<i>pol_stab</i>	6.593	9.568	1.334	1.866	0.000	0.000
<i>gov_eff</i>	0.006	0.009	0.001	0.002	0.000	0.000
<i>reg_qual</i>	-0.013	-0.019	0.006	0.008	0.023	0.023
<i>r_law</i>	-0.001	-0.001	0.003	0.005	0.807	0.798
<i>cont_corr</i>	-0.004	-0.006	0.004	0.006	0.283	0.296

Levels of significance *** $p < .01$, ** $p < .05$, * $p < .1$. (The significance of the degree of indirect effect shows the existence of spatial spillover effect)

Table 30: Analysis of Spatial Spillover Effects - ECCAS

Variables	Coefficients		Std. Errors		P-Values	
Spatial Marginal Direct Effects: Dynamic SDM – FE						
	SR	LR	SR	LR	SR	LR
<i>lngfpd</i>	-0.097	-0.165	0.025	0.046	0.000	0.000
<i>lnfdi</i>	0.022	0.018	0.018	0.036	0.211	0.622
<i>lngfcf</i>	0.016	0.024	0.006	0.013	0.015	0.061
<i>lnpop</i>	0.056	0.112	0.028	0.057	0.041	0.048
<i>trade</i>	0.599	1.432	0.280	0.506	0.033	0.005
<i>infl</i>	0.002	0.003	0.000	0.001	0.001	0.002
<i>bcd</i>	-0.000	-0.001	0.000	0.001	0.446	0.102
<i>pol_stab</i>	5.346	9.683	0.839	1.680	0.000	0.000
<i>gov_eff</i>	0.001	0.001	0.002	0.003	0.652	0.601
<i>reg_qual</i>	-0.001	0.000	0.002	0.004	0.737	0.921
<i>r_law</i>	-0.004	-0.007	0.002	0.003	0.033	0.039
<i>cont_corr</i>	-0.005	-0.008	0.002	0.004	0.036	0.064
Spatial Marginal Indirect Effects: Dynamic SDM – FE						
<i>lngfpd</i>	-0.100	-0.080	0.061	0.086	0.102	0.355
<i>lnfdi</i>	0.151	0.198	0.029	0.047	0.000***	0.000***
<i>lngfcf</i>	0.034	0.038	0.013	0.020	0.010***	0.052**
<i>lnpop</i>	-0.043	-0.096	0.036	0.064	0.230	0.133
<i>trade</i>	-1.987	-3.160	0.725	0.949	0.006***	0.001***
<i>infl</i>	0.001	-0.000	0.001	0.001	0.446	0.899
<i>bcd</i>	0.002	0.003	0.001	0.002	0.059**	0.027**
<i>pol_stab</i>	2.077	-0.456	1.843	2.675	0.260	0.865
<i>gov_eff</i>	-0.000	-0.001	0.005	0.006	0.960	0.895
<i>reg_qual</i>	-0.011	-0.016	0.004	0.007	0.011***	0.017***
<i>r_law</i>	-0.001	0.001	0.004	0.005	0.731	0.890
<i>cont_corr</i>	-0.005	-0.004	0.005	0.008	0.350	0.607
Spatial Marginal Total Effects: Dynamic SDM – FE						
<i>lngfpd</i>	-0.197	-0.245	0.071	0.090	0.006	0.007
<i>lnfdi</i>	0.173	0.216	0.027	0.035	0.000	0.000
<i>lngfcf</i>	0.050	0.062	0.014	0.017	0.000	0.000
<i>lnpop</i>	0.013	0.016	0.029	0.037	0.654	0.656
<i>trade</i>	-1.388	-1.728	0.890	1.115	0.119	0.121
<i>infl</i>	0.002	0.003	0.001	0.001	0.006	0.006
<i>bcd</i>	0.002	0.003	0.002	0.002	0.181	0.184
<i>pol_stab</i>	7.423	9.227	2.144	2.679	0.001	0.001
<i>gov_eff</i>	0.000	0.001	0.006	0.007	0.931	0.932
<i>reg_qual</i>	-0.012	-0.015	0.005	0.006	0.013	0.014
<i>r_law</i>	-0.005	-0.006	0.004	0.005	0.227	0.232
<i>cont_corr</i>	-0.010	-0.012	0.006	0.008	0.099	0.104

Levels of significance *** $p < .01$, ** $p < .05$, * $p < .1$. (The significance of the degree of indirect effect shows the existence of spatial spillover effect)

Table 31: Analysis of Spatial Spillover Effects - ECOWAS.

Variables	Coefficients		Std. Errors		P-Values	
Spatial Marginal Direct Effects: Dynamic SDM – FE						
	SR	LR	SR	LR	SR	LR
<i>lngfpd</i>	-0.009	-0.032	0.007	0.794	0.196	0.967
<i>lnfdi</i>	-0.002	0.019	0.005	1.013	0.628	0.985
<i>lngfcf</i>	0.003	-0.028	0.003	0.594	0.338	0.962
<i>lnpop</i>	0.040	0.130	0.011	3.279	0.000	0.968
<i>trade</i>	0.265	0.631	0.125	28.787	0.034	0.983
<i>infl</i>	0.001	0.004	0.000	0.025	0.060	0.866
<i>bcd</i>	0.000	0.000	0.000	0.000	0.997	0.954
<i>pol_stab</i>	0.031	-0.571	0.043	3.616	0.472	0.874
<i>gov_eff</i>	0.000	0.004	0.000	0.044	0.037	0.922
<i>reg_qual</i>	0.000	-0.004	0.000	0.136	0.678	0.975
<i>r_law</i>	0.001	0.005	0.000	0.039	0.028	0.897
<i>cont_corr</i>	0.000	0.003	0.000	0.078	0.637	0.969
Spatial Marginal Indirect Effects: Dynamic SDM – FE						
<i>lngfpd</i>	-0.015	0.006	0.008	0.793	0.067*	0.994
<i>lnfdi</i>	-0.060	-0.090	0.011	1.014	0.000***	0.929
<i>lngfcf</i>	0.022	0.056	0.004	0.594	0.000***	0.924
<i>lnpop</i>	0.031	-0.051	0.016	3.278	0.052**	0.988
<i>trade</i>	0.410	0.127	0.157	28.797	0.009***	0.996
<i>infl</i>	0.001	-0.002	0.000	0.025	0.000***	0.930
<i>bcd</i>	-0.000	-0.000	0.000	0.000	0.398	0.940
<i>pol_stab</i>	0.881	1.595	0.138	3.613	0.000***	0.659
<i>gov_eff</i>	-0.002	-0.006	0.001	0.044	0.000***	0.885
<i>reg_qual</i>	0.001	0.006	0.001	0.136	0.100	0.967
<i>r_law</i>	-0.001	-0.005	0.001	0.039	0.393	0.899
<i>cont_corr</i>	0.004	0.001	0.001	0.078	0.000***	0.988
Spatial Marginal Total Effects: Dynamic SDM – FE						
<i>lngfpd</i>	-0.024	-0.027	0.005	0.006	0.000	0.000
<i>lnfdi</i>	-0.063	-0.070	0.011	0.013	0.000	0.000
<i>lngfcf</i>	0.025	0.028	0.002	0.003	0.000	0.000
<i>lnpop</i>	0.071	0.080	0.013	0.014	0.000	0.000
<i>trade</i>	0.676	0.758	0.103	0.113	0.000	0.000
<i>infl</i>	0.002	0.002	0.000	0.000	0.000	0.000
<i>bcd</i>	-0.000	-0.000	0.000	0.000	0.416	0.417
<i>pol_stab</i>	0.911	1.024	0.149	0.170	0.000	0.000
<i>gov_eff</i>	-0.002	-0.002	0.001	0.001	0.001	0.001
<i>reg_qual</i>	0.001	0.001	0.000	0.001	0.010	0.011
<i>r_law</i>	0.000	0.000	0.001	0.001	0.895	0.895
<i>cont_corr</i>	0.004	0.004	0.001	0.001	0.000	0.000

Levels of significance *** $p < .01$, ** $p < .05$, * $p < .1$. (The significance of the degree of indirect effect shows the existence of spatial spillover effect)

Table 30: SVAR residual serial correlation LM tests_Kenya

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	34.87566	25	0.09	1.45	(25, 131.5)	0.0924
2	24.50709	25	0.49	0.98	(25, 131.5)	0.4936
Null hypothesis: No serial correlation at lags 1 to h						
1	34.87566	25	0.09	1.45	(25, 131.5)	0.0924
2	64.66129	50	0.07	1.35	(50, 140.2)	0.0867

*Edgeworth expansion corrected likelihood ratio statistic.

Table 33: SVAR residual serial correlation LM tests_Nigeria

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	30.53761	25	0.2048	1.27579	(25, 64.7)	0.2152
2	35.00624	25	0.0881	1.509186	(25, 64.7)	0.0948
3	42.2454	25	0.0169	1.917591	(25, 64.7)	0.0191
4	40.69887	25	0.0247	1.827051	(25, 64.7)	0.0275
5	17.43365	25	0.8655	0.665288	(25, 64.7)	0.8704
Null hypothesis: No serial correlation at lags 1 to h						
1	30.53761	25	0.2048	1.27579	(25, 64.7)	0.2152
2	74.35965	50	0.0143	1.712472	(50, 58.1)	0.0244
3	109.4008	75	0.0059	1.693254	(75, 37.7)	0.0387
4	143.5435	100	0.0028	1.242388	(100, 14.4)	0.3347
5	1832.776	125	0	NA	(125, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Table 34: SVAR residual serial correlation LM tests_Malawi

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	39.84304	25	0.0303	1.856047	(25, 42.4)	0.0372
2	40.36502	25	0.0267	1.890622	(25, 42.4)	0.0331
3	37.71332	25	0.0493	1.718401	(25, 42.4)	0.0589
4	32.05686	25	0.1564	1.378172	(25, 42.4)	0.1752
Null hypothesis: No serial correlation at lags 1 to h						
1	39.84304	25	0.0303	1.856047	(25, 42.4)	0.0372
2	85.02478	50	0.0015	2.291326	(50, 30.7)	0.0081
3	104.0826	75	0.0148	1.062291	(75, 9.0)	0.505
4	1913.644	100	0	NA	(100, NA)	NA

*Edgeworth expansion corrected likelihood ratio statistic.

Table 315: SVAR residual serial correlation LM tests_Botswana

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	32.70987	25	0.1385	1.364636	(25, 98.1)	0.1426
2	17.5143	25	0.8623	0.679942	(25, 98.1)	0.8648
Null hypothesis: No serial correlation at lags 1 to h						
1	32.70987	25	0.1385	1.364636	(25, 98.1)	0.1426
2	43.71847	50	0.7221	0.845117	(50, 99.1)	0.7422
*Edgeworth expansion corrected likelihood ratio statistic.						

Table 326: SVAR residual serial correlation LM tests_Lesotho

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	35.18039	25	0.085	1.490794	(25, 90.7)	0.0886
2	26.85965	25	0.3629	1.090529	(25, 90.7)	0.3697
Null hypothesis: No serial correlation at lags 1 to h						
1	35.18039	25	0.085	1.490794	(25, 90.7)	0.0886
2	59.99276	50	0.1574	1.246635	(50, 90.0)	0.1807
*Edgeworth expansion corrected likelihood ratio statistic.						

References

- Abbas, Q., Junqing, L., Ramzan, M., & Fatima, S. (2021). Role of governance in debt-growth relationship: Evidence from panel data estimations. *Sustainability*, 13(11), 5954. <https://doi.org/10.3390/su13115954>.
- Abaidoo, R., Agyapong, E. K., & Boateng, K. F. (2023). Public debt, investment, and development among emerging economies in Sub-Saharan Africa. *International Journal of Public Policy*, 17(1-2), 118-138. <https://doi.org/10.1504/IJPP.2023.133623>
- Abdelkafi, I. (2018). The Relationship Between Public Debt, Economic Growth, and Monetary Policy: Empirical Evidence from Tunisia. *Journal of the Knowledge Economy*, 9(4), 1154–1167. <https://doi.org/10.1007/s13132-016-0404-6>
- Abdouli, M., & Omri, A. (2021). Exploring the Nexus Among FDI Inflows, Environmental Quality, Human Capital, and Economic Growth in the Mediterranean Region. *Journal of the Knowledge Economy*, 12(2), 788–810. <https://doi.org/10.1007/s13132-020-00641-5>.
- Abraham, F., Konings, J., & Slootmaekers, V. (2010). FDI spillovers in the Chinese manufacturing sector. *Economics of Transition*, 18, 143–182. <https://doi.org/10.1111/j.1468-0351.2009.00370.x>
- Abramovitz, M. (1986). Catching up, forging ahead, and falling behind. *The journal of economic history*, 46(2), 385-406. <https://doi.org/10.1017/S0022050700046209>.

- Abreu, M., De Groot, H., & Florax, R. (2005). Space and growth: A survey of empirical evidence and methods. *Région et Développement*, 21, 12–43. <https://dx.doi.org/10.2139/ssrn.631007>
- Abrigo, M. R., & Love, I. (2016). Estimation of panel vector autoregression in Stata. *The Stata Journal*, 16(3), 778–804. <https://doi.org/10.1177/1536867X1601600314>
- Abubakar, A. B., McCausland, W. D., & Theodossiou, I. (2024). Do debt relief and fiscal rules improve public debt sustainability? The experience of sub-Sahara African countries. *Journal of Policy Modeling*. <https://doi.org/10.1016/j.jpolmod.2024.06.007>
- Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). Institutions as a fundamental cause of long-run growth. *Handbook of Economic Growth*, 1, 385–472.
- Acharya, V. V., Rajan, R. G., & Shim, J. B. (2024). Sovereign debt and economic growth when government is myopic and self-interested. *Journal of International Economics*, 150, 103906. <https://doi.org/10.1016/j.jinteco.2024.103906>
- Adarov, A. (2021). Dynamic interactions between financial cycles, business cycles and macroeconomic imbalances: A panel VAR analysis. *International Review of Economics & Finance*, 74, 434–451. <https://doi.org/10.1016/j.iref.2021.03.021>
- Afonso, A., & Leal, F. S. (2019). Fiscal multipliers in the Eurozone: an SVAR analysis. *Applied Economics*, 51(51), 5577–5593. <https://doi.org/10.1080/00036846.2019.1616068>.
- African Development Bank, & United Nations Economic Commission for Africa. (2011). African Economic Outlook 2011 Africa and its Emerging Partners: Africa and its Emerging Partners.
- Ahmed, R., Aizenman, J., & Jinjara, Y. (2021a). Inflation and Exchange Rate Targeting Challenges Under Fiscal Dominance. *Journal of Macroeconomics*, 67. <https://doi.org/10.1016/j.jmacro.2020.103281>
- Ahmed, S. A., Cruz, M., Go, D. S., Maliszewska, M., & Osorio-Rodarte, I. (2016). How Significant Is Sub-Saharan Africa's Demographic Dividend for Its Future Growth and Poverty Reduction? *Review of Development Economics*, 20(4), 762–793. <https://doi.org/10.1111/rode.12227>
- Ahmad, M., & Hall, S. G. (2017). Economic growth and convergence: Do institutional proximity and spillovers matter? *Journal of Policy Modeling*, 39(6), 1065–1085. <https://doi.org/10.1016/j.jpolmod.2017.07.001>
- Ahmad, M., & Law, S. H. (2023). Financial development, institutions, and economic growth nexus: A spatial econometrics analysis using geographical and institutional proximities. *International Journal of Finance & Economics*. <https://doi.org/10.1002/ijfe.2791>
- Ahmad, M., & Hall, S. G. (2023). The growth effects of economic and political institutions: new evidence from spatial econometrics analysis using historical-based institutional matrix. *Economic Change and Restructuring*, 56(2), 749–780. <https://doi.org/10.1007/s10644-022-09440-1>
- Ahmed, R., Aizenman, J., & Jinjara, Y. (2021a). Inflation and Exchange Rate Targeting Challenges Under Fiscal Dominance. *Journal of Macroeconomics*, 67. <https://doi.org/10.1016/j.jmacro.2020.103281>.

- Aghion, P., Kharroubi, E., 2007. *Cyclical Macro Policy and Industry Growth: The Effect of Countercyclical Fiscal Policy*. Harvard University Working Paper.
- Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 60(2), 323–351. : <https://www.jstor.org/stable/2951599>
- Aghion, P., Howitt, P., 1998. *Endogenous Growth*. MIT Press.
- Agyeman, G., Sakyi, D., & Oteng-Abayie, E. F. (2022). External debt and economic growth in selected sub-Saharan African countries: The role of capital flight. *Research in Globalization*, 5, 100091. <https://doi.org/10.1016/j.resglo.2022.100091>
- Agergaard, J., Tacoli, C., Steel, G., & Ørtenblad, S. B. (2019). Revisiting rural–urban transformations and small-town development in sub-Saharan Africa. *The European Journal of Development Research*, 31, 2–11. <https://doi.org/10.1057/s41287-018-0182-z>.
- Aitken, B. J., & Harrison, A. E. (1999). Do domestic firms benefit from direct foreign investment? Evidence from Venezuela. *American Economic Review*, 89(3), 605–618. <https://doi.org/10.1257/aer.89.3.605>
- Aizenman, J., Kletzer, K., Pinto, B. (2007) “Economic growth with constraints on tax revenues and public debt: implications for fiscal policy and cross-country differences.” *NBER Working Paper No. 12750*.
- Ajide, K. B. (2022). Is natural resource curse thesis an empirical regularity for economic complexity in Africa? *Resources Policy*, 76, 102755. <https://doi.org/10.1016/j.resourpol.2022.102755>
- Akaike, H. (1973). Maximum likelihood identification of Gaussian autoregressive moving average models. *Biometrika*, 60(2), 255–265. <https://doi.org/10.1093/biomet/60.2.255>
- Akinlo A. (2004), “Foreign direct investment and growth in Nigeria: An empirical investigation”, *Journal of Policy Modeling*, 26, 627–639. <https://doi.org/10.1016/j.jpolmod.2004.04.011>.
- Akram, V., & Rath, B. N. (2016). Does debt convergence hold in case of India? *Journal of Economic Studies*, 46(4), 858–871. <https://doi.org/10.1108/JES-02-2018-0064>. <https://doi.org/10.1108/JES-02-2018-0064>
- Akram, N. (2011). Impact of Public Debt on the economic growth of Pakistan. *The Pakistan Development Review*, 599–615. <https://www.jstor.org/stable/23617723>
- Aksoy, Yunus, Henrique S. Basso, Ron P. Smith, and Tobias Grasl (2019) "Demographic structure and macroeconomic trends." *American Economic Journal: Macroeconomics* 11, no. 1: 193–222. 10.1257/mac.20170114
- Alamá-Sabater, L., Heid, B., Jiménez-Fernández, E., & Márquez-Ramos, L. (2016). What drives interdependence of FDI among host countries? The role of geographic proximity and similarity in public debt. *Economic Modelling*, 58, 466–474. <https://doi.org/10.1016/j.econmod.2016.06.007>
- Al Nasser, O., & Garza, X. (2009). Do well-functioning financial systems affect the FDI flows to Latin America? *International Research Journal of Finance and Economics*, 1(29), 60–75. <http://www.eurojournals.com/finance.htm>
- Aluko, O. A., Ibrahim, M., & Vo, X. V. (2023). On the foreign direct investment–economic growth relationship in Africa: does economic freedom mediate this

- relationship. *International Journal of Emerging Markets*, 18(9), 3245-3263. <https://doi.org/10.1108/IJOEM-04-2021-0568>.
- Alsamara, M., Mrabet, Z., & Mimouni, K. (2024). The threshold effects of public debt on economic growth in MENA countries: Do energy endowments matter? *International Review of Economics & Finance*, 89, 458-470. <https://doi.org/10.1016/j.iref.2023.10.015>
- Al-qalawi, U. R., & Al-Rabbaie, A. (2024). Debt Puzzle: A Comparative Analysis of Public Debt's Impact on Production Efficiency across OECD Countries. *Economies*, 12(7), 161. <https://doi.org/10.3390/economies12070161>
- Amsden, A. (1989), *Asia's Next Giant: South Korea and Late Industrialization* (New York: Oxford University Press). <https://www.jstor.org/stable/2006870>
- Ampah, I. K., & Kiss, G. D. (2021). Welfare implications of external debt and capital flight in Sub-Saharan Africa (Evidence using panel data modelling). *Acta Oeconomica*, 71(2), 347-367. <https://doi.org/10.1556/032.2021.00017>
- Andoh, F. K., Attobrah, E., Opoku, A., Armah, M. K., & Dasmani, I. (2023). When does public debt hurt inequality in Africa? *International Journal of Social Economics*, 50(11), 1501-1520. <https://doi.org/10.1108/IJSE-06-2022-0435>
- Andrade, M., Madalozzo, R., Valls Pereira, P.L., 2004. Convergence clubs among Brazilian municipalities. *Economics Letters* 83 (2), 179–184. <https://doi.org/10.1016/j.econlet.2003.11.005>
- Andreu, R., Claver, E., & Quer, D. (2017). Foreign market entry mode choice of hotel companies: Determining factors. *International Journal of Hospitality Management*, 62(3), 111–119. <https://doi.org/10.1016/j.ijhm.2016.12.008>
- Angulo, A., Mur, J., Trivez, F., (2018) Measuring resilience to economic shocks: An application to Spain. *Ann. Reg. Sci.* 60 (2), 349–373. <https://doi.org/10.1007/s00168-017-0815-8>
- Anselin, L. (2005), *Exploring Spatial Data with GeoDa: A Workbook*, <http://geodacenter.asu.edu/system/files/geodaworkbook.pdf>
- Anselin, L. (2004) “*Exploring Spatial Data with GeoDaTM: A Workbook.*” *Urbana* 51:61801.
- Anselin, L., 2003, “Spatial externalities, spatial multipliers, and spatial econometrics,” *International Regional Science Review*, Vol. 26, No. 2, pp. 153–66. <https://doi.org/10.1177/0160017602250972>
- Anselin L., 1988, *Spatial Econometrics: Methods and Models*, Kluwer Academic Publishers, Dordrecht.
- Anselin, L., & Griffith, D. A. (1988). Do spatial effects really matter in regression analysis? *Papers in Regional Science*, 65(1), 11-34. <https://doi.org/10.1111/j.1435-5597.1988.tb01155.x>.
- Anselin, L., Gallo, J. L., & Jayet, H. (2008). Spatial panel econometrics. In *Advanced studies in theoretical and applied econometrics* (pp. 625–660). Springer. https://doi.org/10.1007/978-3-540-75892-1_19.
- Anselin, L., Bera, A. K., Florax, R., & Yoon, M. J. (1996). Simple diagnostic tests for spatial dependence. *Regional science and urban economics*, 26(1), 77-104. [https://doi.org/10.1016/0166-0462\(95\)02111-6](https://doi.org/10.1016/0166-0462(95)02111-6).
- Anselin L, Florax RJGM (1995) *Small sample properties of tests for spatial dependence in regression models: Some further results*. In: Anselin L, Florax RJGM (eds) *New directions in spatial econometrics. Methodology, tools and*

- applications. Springer, Berlin Heidelberg New York, pp 21–74.
https://doi.org/10.1007/978-3-642-79877-1_2.
- Anselin L. (1999) *Interactive techniques and exploratory spatial data analysis*. In: Longley P, Goodchild M. https://researchrepository.wvu.edu/rri_pubs/200
- Anselin L, Rey S (1991) Properties of tests of spatial dependence in linear regression models. *Geogr Anal* 23:112–131. <https://doi.org/10.1111/j.1538-4632.1991.tb00228.x>
- Anselin, L. (2002). Under the hood issues in the specification and interpretation of spatial regression models. *Agricultural economics*, 27(3), 247–267.
- Anwar, S., Nguyen, L.P., 2010. Foreign direct investment and economic growth in Vietnam. *Asia Pac. Bus. Rev.* 16, 183–202.
- Anyanwu JC, Yameogo ND (2015) *What drives foreign direct investments into West Africa? An empirical investigation*. African Development Bank. <https://doi.org/10.1111/1467-8268.12141>.
- Apergis, E., & Apergis, N. (2019). New evidence on corruption and government debt from a global country panel: A non-linear panel long-run approach. *Journal of Economic Studies*, 46(5), 1009–1027. <https://doi.org/10.1108/JES-03-2018-0088>.
- Apergis, N., & Cooray, A. (2015). The dynamics of Greek public debt – evidence from simultaneous and structural VAR models. *Applied Economics*, 47(10), 967–980. <https://doi.org/10.1080/00036846.2014.985372>
- Apeti, A. E., Combes, J. L., & Edoh, E. D. (2024). Original sin: Fiscal rules and government debt in foreign currency in developing countries. *Journal of Macroeconomics*, 80, 103600. <https://doi.org/10.1016/j.jmacro.2024.103600>
- Appiah-Kubi, S. N. K., Malec, K., Phiri, J., Krivko, M., Maitah, K., Maitah, M., & Smutka, L. (2022). Key drivers of public debt levels: empirical evidence from Africa. *Sustainability*, 14(3), 1220. <https://doi.org/10.3390/su14031220>
- Arbia, G., Basile, R., & Piras, G. (2005). *Using spatial panel data in modelling regional growth and convergence*. <https://dx.doi.org/10.2139/ssrn.936321>
- Arbia G. (2005) *Introductory Spatial Econometrics with application to regional convergence*, Springer-Verlag (Advances in Spatial Sciences), Berlin
- Arbia, G. (2006) *Spatial Econometrics: Statistical Foundations and Applications to Regional Growth Convergence*. Berlin: Springer-Verlag. https://doi.org/10.1111/j.1467-9787.2007.00523_10.x
- Arbia, G., Battisti, M., & Di Vaio, G. (2010). Institutions and geography: Empirical test of spatial growth models for European regions. *Economic modelling*, 27(1), 12–21. <https://doi.org/10.1016/j.econmod.2009.07.004>
- Armstrong, H., Taylor, J., & Taylor, J. (2000). *Regional economics and policy*.
- Arthur, B., Saha, M., Sarpong, F. A., & Dutta, K. D. (2024). Unlocking Africa's potential: The transformative power of foreign direct investment for sustainable development. *Heliyon*.
- Aristizábal, J. M., & García, G. A. (2021). Regional economic growth and convergence: The role of institutions and spillover effects in Colombia. *Regional Science Policy & Practice*, 13(4), 1146–1161. <https://doi.org/10.1111/rsp3.12334>

- Ascani, A., Crescenzi, R., & Iammarino, S. (2016). Economic institutions and the location strategies of European multinationals in their geographic neighborhood. *Economic Geography*, 92(4), 401-429.
- Ashinze, J.O., Onwioduokit, E.A. (1996), Economic growth and foreign debt: A case study of Nigeria. *CBN Economic and Financial Review*, 34, 523-40
- Asongu, S., Meniago, C., & Salahodjaev, R. (2023). The role of value added across economic sectors in modulating the effects of FDI on TFP and economic growth dynamics. *International Journal of Emerging Markets*, 18(11), 5087-5108. <https://doi.org/10.1108/IJOEM-10-2018-0547>
- Assoum, F., & Alinsato, A. S. (2023). Only under good governance does public debt improve national income: Evidence from dynamic panel threshold model for Sub-Saharan African countries. *Journal of Government and Economics*, 10, 100078. <https://doi.org/10.1016/j.jge.2023.100078>
- Asiedu E (2006) Foreign direct investment in Africa: The role of natural resources, market size, government policy, institutions and political instability. *The World Economy* 29: 63–77. <https://doi.org/10.1111/j.1467-9701.2006.00758.x>
- Asiedu E, Lien D (2011) Democracy, foreign direct investment and natural resources. *Journal of International Economics* 84: 99–111. <https://doi.org/10.1016/j.jinteco.2010.12.001>.
- Aritenang, A. F. (2022). The impact of urban characteristics on the spread of Covid-19 in 2020: The case of Java Island cities, Indonesia. *Regional Statistics*, 12(3), 3–17. <https://doi.org/10.15196/RS120301>.
- Aritenang, A. F., & Chandramidi, A. N. (2023). The spatial effects of fiscal decentralization on regional convergence: The case of regions in Indonesia. *GeoJournal*, 88(2), 2011–2030. <https://doi.org/10.1007/s10708-022-10724-2>
- Asongu, S., Akpan, U. S., & Isihak, S. R. (2018). Determinants of foreign direct investment in fast-growing economies: evidence from the BRICS and MINT countries. *Financial Innovation*, 4(1), 1-17. <https://doi.org/10.1186/s40854-018-0114-0>.
- Asongu, S. A., & Odhiambo, N. M. (2020). Foreign direct investment, information technology and economic growth dynamics in Sub-Saharan Africa. *Telecommunications Policy*, 44(1). <https://doi.org/10.1016/j.telpol.2019.101838>
- Attiya, A. S., Laftah, F. M., & Kashcool, A. S. (2021). The Effect of Public Debt on Foreign Reserves in Iraq for the Period from 2003-2019: An Econometrics Analysis. *Industrial Engineering and Management Systems*, 20(4), 732–742. <https://doi.org/10.7232/iems.2021.20.4.483>
- Atoyebi, T. A., & Anuodo, O. (2017). *Demography and the future of Africa*. In *The Palgrave Handbook of African Politics, Governance and Development* (pp. 803–813). https://doi.org/10.1057/978-1-349-95232-8_49
- Auerbach, A.J., Gorodnichenko, Y., (2012) Measuring the output responses to fiscal policy. *Am. Econ. J.: Econ. Policy* 4 (2), 1–27. <https://doi.org/10.1257/pol.5.3.320>
- Auerbach, A.J., Gorodnichenko, Y., (2013b). Output spillovers from fiscal policy. *Amer. Econ. Rev.* 103 (3), 141–146. doi: 10.1257/aer.103.3.141

- Augustine, B., & Rafi, O. M. (2023). Public debt-economic growth nexus in emerging and developing economies: Exploring nonlinearity. *Finance Research Letters*, 52, 103540. <https://doi.org/10.1016/j.frl.2022.103540>
- Aust, V., Morais, A. I., & Pinto, I. (2020). How does foreign direct investment contribute to Sustainable Development Goals? Evidence from African countries. *Journal of Cleaner Production*, 245, 118823. <https://doi.org/10.1016/j.jclepro.2019.118823>
- Awolusi, O. D., Adeyeye, O. P., & Pelser, T. G. (2017). Foreign direct investment and economic growth in Africa: a comparative analysis. *International Journal of Sustainable Economy*, 9(3), 183-198. <https://doi.org/10.1504/IJSE.2017.085062>
- Ayesha, K. H. A. N., & Haasis, H. D. (2020). Spatially induced effects and sustainability for special economic zones: implications for zones in Pakistan under China Pakistan Economic Corridor. *Regional Science Inquiry*, 12(2), 179-194.
- Azariadis, C., (1996) The economics of poverty traps part one: Complete markets. *J. Econ. Growth* 1, 449–486. <https://doi.org/10.1007/BF00150197>
- Azariadis, C., Drazen, A., (1990) Threshold externalities in economic development. *Q. J. Econ.* 105 (2), 501–526. <https://doi.org/10.2307/2937797>
- Azenui, N. B. (2024). Why is Labor in the SSA LDCs Moving from One Low Productivity Sector to Another? *The European Journal of Development Research*, 36(1), 216-242. <https://doi.org/10.1057/s41287-023-00599-5>.
- Aziz, O. G. (2018). Institutional quality and FDI inflows in Arab economies. *Finance Research Letters*, 25, 111–123. <https://doi.org/10.1016/j.frl.2017.10.026>
- Bamidele, T. B.–Joseph, A. I (2013): Financial crisis and external debt management in Nigeria. *International Journal of Business and Behavioural Sciences*. 3 (4): 16–24.
- Barbier-Gauchard, A., Betti, T., & Metz, T. (2023). Fiscal multipliers, public debt anchor and government credibility in a behavioral macroeconomic model. *European Journal of Political Economy*, 102457. <https://doi.org/10.1016/j.ejpoleco.2023.102457>
- Barca, F., McCann, P., & Rodríguez-Pose, A. (2012). The case for regional development intervention: place-based versus place-neutral approaches. *Journal of regional science*, 52(1), 134-152. <https://doi.org/10.1111/j.1467-9787.2011.00756.x>
- Barca, Fabrizio.(2009) “*An Agenda for A Reformed Cohesion Policy: A Place-Based Approach to Meeting European Union Challenges and Expectations*,” Independent Report, Prepared at the Request of the European Commissioner for Regional Policy, Danuta Hübner, European Commission, Brussels.
- Balcerzak, A., & Pietrzak, M. (2017). Human development and quality of institutions in highly developed countries. In M. Bilgin, H. Danis, E. Demir, & U. Can (Eds.), *Financial environment and business development* (pp. 231–241). Switzerland: Springer International Publishing. https://doi.org/10.1007/978-3-319-39919-5_18
- Baldacci, E., Dell’Erba, S., & Poghosyan, T. (2011). *Spatial spillovers in emerging market spreads*, IMF Working Paper WP/11/221, Washington: International Monetary Fund. <https://doi.org/10.1007/s00181-012-0644-7>

- Baldwin, R. E., & Forslid, R. (2000). The core–periphery model and endogenous growth: Stabilizing and destabilizing integration. *Economica*, 67(267), 307–324. <https://doi.org/10.1111/1468-0335.00211>.
- Baldwin, R., Okubo, T., (2006) Heterogeneous firms, agglomeration and economic geography: spatial selection and sorting. *Journal of Economic Geography* 6 (3), 323–346. <https://doi.org/10.1093/jeg/lbi020>.
- Baltagi, B. H., Song, S. H., & Koh, W. (2003). Testing panel data regression models with spatial error correlation. *Journal of econometrics*, 117(1), 123–150. [https://doi.org/10.1016/S0304-4076\(03\)00120-9](https://doi.org/10.1016/S0304-4076(03)00120-9)
- Baltagi, B. H., Egger, P., & Pfaffermayr, M. (2013). A generalized spatial panel data model with random effects. *Econometric reviews*, 32(5-6), 650–685. <https://doi.org/10.1080/07474938.2012.742342>
- Baller, R. D., Anselin, L., Messner, S. F., Deane, G., & Hawkins, D. F. (2001). Structural covariates of US county homicide rates: Incorporating spatial effects. *Criminology*, 39(3), 561–588. <https://doi.org/10.1111/j.1745-9125.2001.tb00933.x>
- Bal, D. P., & Rath, B. N. (2014). Public debt and economic growth in India: A reassessment. *Economic Analysis and Policy*, 44(3), 292–300. <https://doi.org/10.1016/j.eap.2014.05.007>.
- Banerjee, J. J. (2024). Inflationary oil shocks, fiscal policy, and debt dynamics: New evidence from oil-importing OECD economies. *Energy Economics*, 130, 107249. <https://doi.org/10.1016/j.eneco.2023.107249>
- Bao-shun, W. (2013). Public Expenditure, Spatial Spillover and Regional Economic Growth: Taking Wuhan City Circle for Example. *Modern Finance and Economics*–Journal of Tianjin University of Finance and Economics.
- Barucci, E., Brachetta, M., & Marazzina, D. (2023). Debt redemption fund and fiscal incentives. *Communications in Nonlinear Science and Numerical Simulation*, 119, 107094. <https://doi.org/10.1016/j.cnsns.2023.107094>
- Barro, R. J. (1990). Government Spending in a Simple Model of Endogenous Growth. *Journal of Political Economy*, 98(5), S103–S125. <http://www.jstor.org/stable/2937633>.
- Barro RJ, Sala-i-Martin X (1991) *Convergence across states and regions*. Brookings Pap Econ Act 1:107–182. <https://www.jstor.org/stable/2534639>
- Barro, R. J., & Sala, X. (1992). Martin (1992):“Convergence”. *Journal of Political Economy*, 100(2), 223–251.
- Barro, R.J., Sala-i-Martin,X.,(1995). *Economic Growth*. McGraw- Hill, New York. [https://doi.org/10.1016/S1574-0099\(05\)03023-8](https://doi.org/10.1016/S1574-0099(05)03023-8)
- Barro, R.J., (1998). *Human Capital and Growth in Cross-Country Regressions*. Harvard University Press
- Barro, R. J., & Sala-i-Martin, X. (2004). *Economic growth*, 2nd ed. Cambridge: the MIT press.
- Barro, R.J., (2001) Human capital and growth. *Amer. Econ. Rev.* 91 (2), 12–17. DOI: 10.1257/aer.91.2.12
- Barro, R. J., & Sala-i-Martin, X. (2003). *Economic growth*, 2nd ed. Cambridge: the MIT press.
- Basile, R., M. Durbán, R. Mínguez, J. M. Montero, and J. Mur (2014). Modeling regional economic dynamics: Spatial dependence, spatial heterogeneity, and

- nonlinearities. *Journal of Economic Dynamics and Control* 48, 229–245. <https://doi.org/10.1016/j.jedc.2014.06.011>
- Baum, A., & Koester, G. B. (2011). *The impact of fiscal policy on economic activity over the business cycle – Evidence from a threshold VAR analysis*. Bundesbank Discussion Paper No. 3, Series 1, Deutsche Bundesbank. <https://hdl.handle.net/10419/44961>
- Baumol, W. J. (1986). Productivity growth, convergence, and welfare: what the long-run data show. *American Economic Review*, 76(5), 1072–1085. <https://www.jstor.org/stable/1816469>
- Bartkowska, M., Riedl, A., 2012. Regional convergence clubs in Europe: Identification and conditioning factors. *Econ. Model.* 29 (1), 22–31. <https://doi.org/10.1016/j.econmod.2011.01.013>
- Barrot, L.D., C. Calderón, and L. Servén, 2018, “Openness, specialization, and the external vulnerability of developing countries”, *Journal of Development Economics*, 134, pp.201-328.
- Balaguer-Coll, M. T. B., & Toneva, M. I. (2019). The importance of spatial effects in municipal debt: La importancia de los efectos espaciales en la deuda municipal. *RC-SAR*, 22(1), 61–72. <https://doi.org/10.6018/rc-sar.22.1.354311>
- Balassone, F., & Franco, D. (2000). Assessing Fiscal Sustainability: A Review of Methods with a View to EMU (January 20, 2000). Fiscal Sustainability Conference, p. 21, Available at SSRN: <https://ssrn.com/abstract=2109377> or <https://doi.org/10.2139/ssrn.2109377>
- Balasubramanyam, V. N., Salisu, M., & Sapsford, D. (1996). Foreign direct investment and growth in EP and IS countries. *The Economic Journal*, 106(434), 92–105. <https://doi.org/10.2307/2234933>
- Bekele, W. T., & Mersha, F. G. (2023). Human capital development and economic growth nexus in Sub-Saharan Africa countries using a novel panel data analysis. *International Journal of Economic Policy in Emerging Economies*, 18(3-4), 381-397. <https://doi.org/10.1504/IJEPEE.2023.136303>
- Benos, N., Karagiannis, S., & Karkalakos, S. (2015). Proximity and growth spillovers in European regions: The role of geographical, economic and technological linkages. *Journal of Macroeconomics*, 43, 124-139. <https://doi.org/10.1016/j.jmacro.2014.10.003>
- Beenstock, M., & Felsenstein, D. (2019). *The econometric analysis of non-stationary spatial panel data*. Springer International Publishing.
- Bergstrand, J.H., Egger, P., 2004. *A theoretical and empirical model of international trade and foreign direct investment with outsourcing: Part I, developed countries*. Mimeo.
- Bernanke (1986) *Alternative Explanations of the Money-Income Correlation*, in K. Brunner, - A.H. Meltzer, «Real Business Cycles, Real Exchange Rates - Actual Policies», Carnegie-Rochester Conference Series on Public Policy, vol. 25, Amsterdam: North-Holland, pp. 49-100. DOI 10.3386/w1842
- Bélanger, A. (2021). Public debt: *Public Debt: Impact, Management and Challenges*, 1-196.

- Ben Jelili, R. (2020). Does foreign direct investment affect growth in MENA countries? A semi-parametric fixed-effects approach. *Middle East Development Journal*, 1e16. <https://doi.org/10.1080/17938120.2020.1719700>
- Bengoa-Calvo, M., & Sanchez-Robles, B. (2003). Foreign Direct Investment, economic freedom and growth: new evidence from Latin America. *European Journal of Political Economy*, 19(3), 529–545. [https://doi.org/10.1016/S0176-2680\(03\)00011-9](https://doi.org/10.1016/S0176-2680(03)00011-9)
- Berg, A.G., and Ostry, J.D. (2011), “ *Inequality and Unsustainable Growth: Two Sides of the same coin*, ” IMF Staff Discussion Note, SDN/11/08, International Monetary Fund, Washington D.C. <https://doi.org/10.1057/s41308-017-0030-8>
- Betz, T., & Pond, A. (2023). Democratic institutions and regulatory privileges for government debt. *European Journal of Political Economy*, 79, 102438. <https://doi.org/10.1016/j.ejpoleco.2023.102438>.
- Biza, R. A., Kapingura, F. M., & Tsegaye, A. (2013). *Do budget deficit crowd out private investment? An analysis of the South African economy*. Paper presented at the Financial Globalization and Sustainable Finance: Implications for Policy and Practice, Cape Town. <https://doi.org/10.1504/IJEPEE.2015.068248>
- Bittencourt, M. (2015). Determinants of government and external debt: Evidence from the young democracies of South America. *Emerging Markets Finance and Trade*, 51(3), 463–472. <https://doi.org/10.1080/1540496X.2015.1025667>
- Blanchard O, Perotti R (2002) An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *Quarterly Journal of Economics* 177:1329–1368. <https://doi.org/10.1162/003355302320935043>
- Blanchard, O. and Perotti, R. (1999) An Empirical Characterization of The Dynamic Effects of Changes In Government Spending and Taxes On Output, The *Quarterly Journal of Economics*, MIT Press, vol.117(4), pages 1329-1368, November. . <https://doi.org/10.1162/003355302320935043>
- Blanchard, O.J., Quah, D., (1989) The dynamic effects of aggregate demand and supply disturbances. *American Economic Review* 79, 655–673
- Blanchard OJ, Watson MW (1986) *Are business cycles all alike? The American business cycle*. University of Chicago Press
- Briceño, H. R., & Perote, J. (2020). Determinants of the public debt in the Eurozone and its sustainability amid the Covid-19 pandemic. *Sustainability*, 12(16), 6456. <https://doi.org/10.3390/su12166456>
- Broersma, L., Oosterhaven, J., 2009. Regional labour productivity in the Netherlands: evidence of agglomeration and congestion effects. *J. Reg. Sci.* 49 (3),483–511. <https://doi.org/10.1111/j.1467-9787.2008.00601.x>
- Boccia, R. (2018). Needed: An effective fiscal framework to restrain spending and control debt in the United States. *Heritage Foundation Backgrounder*, (3374).
- Boğa, S. (2019).Determinants of foreign direct investment: A panel data analysis for Sub-Saharan African countries. *EMAJ: Emerging Markets Journal*, 9(1), 80–87. <https://doi.org/10.5195/emaj.2019.175>
- Bökemeier, B., & Greiner, A. (2013). *On the Relation between Public Debt and Economic Growth: An Empirical Investigation* (SSRN Scholarly Paper ID

- 2362788). Social Science Research Network.
<https://doi.org/10.17811/eb1.4.4.2015.137-150>
- Bonga, W. G., Sithole, R., & Shenje, T. (2015). Export sector contribution to economic growth in Zimbabwe: A causality analysis. *The International Journal of Business & Management*, 3(10).
- Bourdin, S. (2015). National and regional trajectories of convergence and economic integration in Central and Eastern Europe. *Canadian Journal of Regional Science*, 38(1/3), 55-63.
- Bosworth, B. P., Collins, S. M., & Reinhart, C. M. (1999). Capital flows to developing economies: implications for saving and investment. *Brookings papers on economic activity*, 1999(1), 143-180.
<https://www.jstor.org/stable/2534664>
- Bosker, M., & Garretsen, H. (2009). Economic development and the geography of institutions. *Journal of Economic Geography*, 9(3), 295-328.
<https://doi.org/10.1093/jeg/lbn047>.
- Bozatli, O., Serin, S. C., & Demir, M. (2024) the causal relationship between public debt and economic growth in G7 countries: new evidence from time and frequency domain approaches. *Economic Change and Restructuring*, 57(3), 136. <https://doi.org/10.1007/s10644-024-09716-8>
- Blanc-Brude, F., Cookson, G., Piesse, J., & Strange, R. (2014). The FDI location decision: Distance and the effects of spatial dependence. *International Business Review*, 23(4), 797-810.
- Blanco, L.R., 2012. The spatial interdependence of FDI in Latin America. *World Development* 40 (7), 1337-1351.
<https://doi.org/10.1016/j.worlddev.2012.02.003>
- Blanco, L. R., & Rogers, C. L. (2014). Are tax havens good neighbours? FDI spillovers and developing countries. *Journal of Development Studies*, 50(4), 530-540.
- Blonigen, B. A., Davies, R. B., Waddell, G. R., & Naughton, H. T. (2007). FDI in space: Spatial autoregressive relationships in foreign direct investment. *European economic review*, 51(5), 1303-1325.
<https://doi.org/10.1016/j.euroecorev.2006.08.006>
- Buckley, P. J., & Casson, M. C. (1976): *The future of the multinational enterprise*, London: Holmes & Meier. <https://doi.org/10.1057/palgrave.jibs.8400024>
- Butkus, M., & Seputiene, J. (2018). Growth effect of public debt: The role of government effectiveness and trade balance. *Economies*, 6(4), 62.
<https://doi.org/10.3390/economies6040062>.
- Bhujabal, P., Sethi, N., & Padhan, P. C. (2024). Effect of institutional quality on FDI inflows in South Asian and Southeast Asian countries. *Heliyon*, 10(5).
<https://doi.org/10.1016/j.heliyon.2024.e27060>
- Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth? *Journal of International Economics*, 45(1), 115-135. [https://doi.org/10.1016/S0022-1996\(97\)00033-0](https://doi.org/10.1016/S0022-1996(97)00033-0)
- Borensztein, E. (1990), Debt overhang, credit rationing and investment. *Journal of Development Economics*, 32,315-335. [https://doi.org/10.1016/0304-3878\(90\)90041-9](https://doi.org/10.1016/0304-3878(90)90041-9)

- Buchanan, B. G., Le, Q. V., & Rishi, M. (2012). Foreign direct investment and institutional quality: Some empirical evidence. *International Review of Financial Analysis*, 21, 81–89. <https://doi.org/10.1016/j.irfa.2011.10.001>
- Buchanan, J.M. (1964). *Public debt, cost theory, and the fiscal illusion*. In *Public Debt and Future Generations*. Edited by James M. Ferguson. Chapel Hill: University of North Carolina Press, 150–63.
- Burridge P (1980) On the Cliff–Ord test for spatial autocorrelation. *J R Stat Soc, Ser B* 42(1):107–108.
- Brakman, S., & Garretsen, H. (2003). Rethinking the "New" Geographical Economics. *Regional Studies*, 37(6-7), 637–648. <https://doi.org/10.1080/0034340032000108732>
- Brakman, S., Garretsen, H., van Marrewijk, C., (2009) *The New Introduction to Geographical Economics*. Cambridge University Press, Cambridge.
- Breusch, T. S., & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica: Journal of the econometric society*, 1287–1294. <https://www.jstor.org/stable/1911963>
- Brueckner JK (2003) Strategic interaction among governments, an overview of empirical studies. *International Regional Science Review* 26: 175–188. <https://doi.org/10.1177/0160017602250974>.
- Brida, J. G., Risso, W. A., Sanchez Carrera, E. J., & Segarra, V. (2021). Growth and inequality in the Mexican states: Regimes, thresholds, and traps. *Papers in Regional Science*, 100(5), 1295–1322. <https://doi.org/10.1111/pirs.12616>
- Cabral, R., del Castillo, E., & Hernández-Trillo, F. (2022). The sustainability of subnational public debt: Evidence from Mexican states. *Regional & Federal Studies*, 32(5), 593–615. <https://doi.org/10.1080/13597566.2021.1912739>
- Calderón, C., & Fuentes, J. R. (2013). *Government debt and economic growth* (No. IDB-WP-424). IDB working paper series.
- Campos, N., & Kinoshita, Y. (2008). Foreign Direct Investment and structural reforms: Evidence from Eastern Europe and Latin America. *IMF Working Paper*, No.26. <https://dx.doi.org/10.2139/ssrn.1141849>
- Campos, E. L., & Cysne, R. P. (2021). Estimating debt limits for emerging countries. *International Review of Economics & Finance*, 76, 836–855. <https://doi.org/10.1016/j.iref.2021.07.014>
- Camarero, M., Montolio, L., & Tamarit, C. (2019). What drives German foreign direct investment? New evidence using Bayesian statistical techniques. *Economic Modelling*, 83, 326–345. <https://doi.org/10.1016/j.econmod.2019.08.017>
- Cantwell, J., & Iammarino, S. (2000). Multinational corporations and the location of technological innovation in the UK regions. *Regional Studies*, 34(4), 317–332. <https://doi.org/10.1080/00343400050078105>
- Cao Z, Zhao J (2021) *Impact of innovative human capital on total factor productivity: based on the provincial panel data from 2009 to 2018*. J Xuzhou Inst Technol (social Sciences Edition) 36:35–44.
- Cartone, A., Postiglione, P., & Hewings, G. J. (2021). Does economic convergence hold? A spatial quantile analysis on European regions. *Economic Modelling*, 95, 408–417. <https://doi.org/10.1016/j.econmod.2020.03.008>.

- Carvalho, V. M., & Harvey, A. V. (2005). Convergence in the trends and cycles of Euro-zone income. *Journal of Applied Econometrics*, 20(2), 275–289. <https://doi.org/10.1002/jae.820>
- Casi, L., & Resmini, L. (2014). Spatial complexity and interactions in the FDI attractiveness of regions. *Papers in Regional Science*, 93, S51–S78.
- Cavalcanti, M. A. F. H., Vereda, L., Doctors, R., de B., Lima, F. C., & Maynard, L. (2018). The macroeconomic effects of monetary policy shocks under fiscal rules constrained by public debt sustainability. *Economic Modeling*, 71, 184–201. <https://doi.org/10.1016/j.econmod.2017.12.010>
- Cibulskiene, D., & Butkus, M. (2007). The influence of cumulative causation process on regional divergence in Lithuania during 1995–2003. *Jahrbuch Fur Regionalwissenschaft*, 27(1), 59–87. <https://doi.org/10.1007/s10037-006-0011-2>
- Cieřlik, A., Ryan, M. (2004) Explaining Japanese direct investment flows into an enlarged Europe: a comparison of gravity and economic potential approaches. *Journal of the Japanese and International Economies* 18 (1), 12–37. <https://doi.org/10.1016/j.jjie.2003.09.009>
- Cieřlik, A., & Hamza, S. (2023). Institutional quality and inward FDI: empirical evidence from GCC economies. *Middle East Development Journal*, 15(2), 261–290. <https://doi.org/10.1080/17938120.2023.2254188>
- Citaristi, I. (2022). International Monetary Fund—IMF. In *The Europa Directory of International Organizations 2022* (pp. 353–360). Routledge.
- Chang, Z., Liu, S., Wu, Y., & Shi, K. (2022). The Regional Disparity of Urban Spatial Expansion Is Greater than That of Urban Socioeconomic Expansion in China: A New Perspective from Nighttime Light Remotely Sensed Data and Urban Land Datasets. *Remote Sensing*, 14(17). <https://doi.org/10.3390/rs14174348>
- Chen, C., Yao, S., Hu, P., & Lin, Y. (2017a). Optimal government investment and public debt in an economic growth model. *China Economic Review*, 45, 257–278. <https://doi.org/10.1016/j.chieco.2016.08.005>
- Chirwa, T. G., & Odhiambo, N. M. (2020). Public debt and economic growth nexus in the Euro area: A dynamic panel ARDL approach. *Scientific Annals of Economics and Business*, 67(3), 291–310.
- Chiu, Yi-Bin, and Chien-Chiang Lee (2017) "On the impact of public debt on economic growth: does country risk matter?" *Contemporary Economic Policy* 35.4: 751–766. <https://doi.org/10.1111/coep.12228>
- Chowdhury, A.R. (2001), *External debt and growth in developing countries: A sensitivity and causal analysis*. Discussion Paper 95. World Institute for Development Economics Research (WIDER), United Nations University, Helsinki. https://epublications.marquette.edu/econ_fac/489
- Chowdhury, M. A. F., Prince, E. R., Shoyeb, M., & Abdullah, M. (2024). The threshold effect of institutional quality on sovereign debt and economic stability. *Journal of Policy Modeling*, 46(1), 39–59. <https://doi.org/10.1016/j.jpolmod.2023.12.001>
- Christiano, L., Eichenbaum, M., Evans, C., 1998. *Monetary policy shocks: what have we learned and to what end?* In: NBER Working Papers No. 6400.
- Cliff A, Ord JK (1972) Testing for spatial autocorrelation among regression residuals. *Geogr Anal* 4:267–284. <https://doi.org/10.1111/j.1538-4632.1972.tb00475.x>

- Caldara, D., & Kamps, C. (2008). What are the effects of fiscal policy shocks? A VAR-based comparative analysis. *ECB Working Papers series* no 877. <https://dx.doi.org/10.2139/ssrn.1102338>
- Capello, R., Fratesi, U., & Resmini, L. (2011). *Globalization and regional growth in Europe. Past trends and future scenarios*. Berlin Heidelberg: Springer-Verlag. <https://doi.org/10.1111/jors.12039>
- Carrington, S. J., & Jiménez-Ayora, P. (2021). Shedding light on the convergence debate: Using luminosity data to investigate economic convergence in Ecuador. *Review of Development Economics*, 25(1), 200–227. <https://doi.org/10.1111/rode.12712>
- Casi, L., & Resmini, L. (2010). Evidence on the determinants of foreign direct investment: The case of EU regions. *Eastern Journal of European Studies*, 1(2), 93–118.
- Ciaffi, G., Deleidi, M., & Di Domenico, L. (2024). Fiscal policy and public debt: Government investment is most effective to promote sustainability. *Journal of Policy Modeling*. <https://doi.org/10.1016/j.jpolmod.2024.07.002>
- Cieřlik, A., & Ryan, M. (2004). Explaining Japanese direct investment flows into an enlarged Europe: A comparison of gravity and economic potential approaches. *Journal of the Japanese and International Economies*, 18(1), 12–37.
- Çiftçioğlu, S., & Sokhanvar, A. (2018). External debt-economic growth nexus in selected CEE countries. *Romanian Journal of Economic Forecasting*, 21(4), 85–100.
- Chanda & Kabiraj (2020). Shedding light on regional growth and convergence in India. *World Development*, 133, 104961. <https://doi.org/10.1016/j.worlddev.2020.104961>
- Cheung, Y.W., Qian, X.W., 2009. The empirics of China's outward direct investment. *Pacific Economic Review* 14 (3), 312–341. <https://doi.org/10.1111/j.1468-0106.2009.00451.x>
- Chou, K.H., Chen, C.H., Mai, C.C., 2011. The impact of third-country effects and economic integration on China's outward FDI. *Economic Modelling* 28 (5), 2154–2163. <https://doi.org/10.1016/j.econmod.2011.05.012>
- Choi, J., & Son, M. (2016). A note on the effects of government spending on economic growth in Korea. *Journal of the Asia Pacific Economy*, 21(4), 651–663. <https://doi.org/10.1080/13547860.2016.1204746>
- Churchman, N. (2001). *David Ricardo on public debt*. Palgrave. New York.
- Claeys, P., Moreno, R., & Suriñach, J. (2012). Debt, interest rates, and integration of financial markets. *Economic Modelling*, 29(1), 48–59. [doi:10.1016/j.econmod.2011.05.009](https://doi.org/10.1016/j.econmod.2011.05.009).
- Claessens, S., Detragiache, E., Kanbur, R., Wickham, P. (1996), *Analytical Aspects of the Debt Problems of Heavily Indebted Poor Countries*. Washington, DC: World Bank Policy Research Working Paper No. 1618, World Bank.
- Clegg, J., & Scott-Green, S. (1999). The determinants of new FDI capital flows into the EC: a statistical comparison of the USA and Japan. *Journal of Common Market Studies*, 37, 597–616. <http://dx.doi.org/10.1111/1468-5965.00198>.

- Clements, B., Gupta, S., Inchauste, G. (2003), *Fiscal policy for economic development: An overview*. Available from: <http://www.imf.org/external/pubs/nft/2004/hcd/ch01.pdf>
- Corrado, L. & Fingleton, B. (2012) Where is the economics in spatial econometrics? *Journal of Regional Science*, 52, 210–239. <https://doi.org/10.1111/j.1467-9787.2011.00726.x>
- Cooke, P. and Morgan, K. (1994) Growth regions under duress: renewal strategies in BadenWürttemberg and Emilia Romagna. In: *Globalization, institutions, and regional development in Europe*, 91–117.
- Cooray, A., Tamazian, A., & Vadlamannati, K. C. (2014). What drives FDI policy liberalization? An empirical investigation. *Regional Science and Urban Economics*, 49, 179–189. <https://doi.org/10.1016/j.regsciurbeco.2014.06.008>
- Cooray, A., Dzhumashev, R., & Schneider, F. (2017). How Does Corruption Affect Public Debt? An Empirical Analysis. *World Development*, 90, 115–127. <https://doi.org/10.1016/j.worlddev.2016.08.020>
- Cooray, A., & Özmen, I. (2024). The role of institutions on public debt: A quantile regression approach. *International Review of Economics & Finance*, 93, 912–928. <https://doi.org/10.1016/j.iref.2024.03.065>
- Collard, F., Habib, M., & Rochet, J.-C. (2015a). Sovereign Debt Sustainability in Advanced Economies. *Journal of the European Economic Association*, 13(3), 381–420. <https://doi.org/10.1111/jeea.12135>.
- Coulibaly, I., Gnimassoun, B., Mighri, H., & Saadaoui, J. (2024). International reserves, currency depreciation and public debt: new evidence of buffer effects in Africa. *Emerging Markets Review*, 60, 101130. <https://doi.org/10.1016/j.ememar.2024.101130>.
- Cressie, N. (2015). *Statistics for spatial data*. John Wiley & Sons.
- Crombach, L., & Smits, J. (2022). The demographic window of opportunity and economic growth at sub-national level in 91 developing countries. *Social Indicators Research*, 161(1), 171–189. <https://doi.org/10.1007/s11205-021-02802-8>
- Cuaresma, J. C., Doppelhofer, G., & Feldkircher, M. (2014). The determinants of economic growth in European regions. *Regional Studies*, 48(1), 44–67. <https://doi.org/10.1080/00343404.2012.678824>
- Cuervo-Cazurra, A. (2006). Who cares about corruption? *Journal of International Business Studies*, 37(6), 807–822. <https://doi.org/10.1057/palgrave.jibs.8400223>
- Cutrini E (2019) Economic integration, structural change, and uneven development in the European union. *Struct Change Econ Dyn* 50:102–113. <https://doi.org/10.1016/j.strueco.2019.06.007>
- Cutrini, E., & Mendez, C. (2023). Convergence clubs and spatial structural change in the European Union. *Structural Change and Economic Dynamics*, 67, 167–181. <https://doi.org/10.1016/j.strueco.2023.07.009>.
- Dall'Erba, S., & Le Gallo, J. (2008). Regional convergence and the impact of European structural funds over 1989–1999: A spatial econometric analysis. *Papers in Regional Science*, 87(2), 219–244. <https://doi.org/10.1111/j.1435-5957.2008.00184.x>

- Dall'erba, S., & Llamosas-Rosas, I. (2015). The impact of private, public and human capital on the US states' economies: theory, extensions and evidence. In *Handbook of research methods and applications in economic geography* (pp. 436-467). Edward Elgar Publishing.
- Damijan, J. P., Rojec, M., Majcen, B., & Knell, M. (2013). Impact of firm heterogeneity on direct and spillover effects of FDI: Micro-evidence from ten transition countries. *Journal of Comparative Economics*, 41, 895–922. <https://doi.org/10.1016/j.jce.2012.12.001>
- Dat, P. M., Van Tuong, N., Hong, N. T. P., Huy, D. T. N., & Anh, P. T. (2020). Using An Expansion Econometric Model with Five Factors to Improve Quality of Measuring Impacts of Public Debt on Macro Economic Factors-Case In Vietnam. *International Journal for Quality Research*, 14(3).
- Daud, S.N.M., Podivinsky, J.M. Debt–Growth Nexus: A Spatial Econometrics Approach for Developing Countries. *Transit Stud Rev* 18, 1–15 (2011). <https://doi.org/10.1007/s11300-011-0190-6>
- Davenant, C. (1999). Finance And State-Formation. *City of Capital: Politics and Markets in the English Financial Revolution*, 53.
- Dawood, M., Feng, Z. R., Ilyas, M., & Abbas, G. (2024). External Debt, Transmission Channels, and Economic Growth: Evidence of Debt Overhang and Crowding-Out Effect. *SAGE Open*, 14(3), <https://doi.org/10.1177/21582440241263626>
- Debarys, N. and J. LeSage (2018). Flexible dependence modeling using convex combinations of different types of connectivity structures. *Regional Science and Urban Economics* 69, 48–68. <https://doi.org/10.1016/j.regsciurbeco.2018.01.001>
- Debarys, N., Dossougoin, C., Ertur, C., & Gnabo, J.-Y. (2016). *Measuring sovereign risk spillovers and assessing the role of transmission channels: A spatial econometrics approach*, CORE Discussion Paper no. 53, Center for operations research and econometrics Université catholique de Louvain. <https://doi.org/10.1016/j.jedc.2017.11.005>
- De la Fuente A, Vives X (1995) Infrastructure and education as instruments of regional policy: Evidence from Spain. *Economic Policy* 20: 11–54. <https://doi.org/10.2307/1344537>.
- Desbordes, R., Koop, G., Vicard, V., 2018. One size does not fit all... panel data: Bayesian model averaging and data poolability. *Econ. Modell.* 75, 364–376. <https://doi.org/10.1016/j.econmod.2018.07.009>
- De Broeck, M., End, N., Marinkov, M., and Miryugin, F. (2015). *Forthcoming working paper on interwar database and financial linkages*. Washington, DC: IMF.
- Djimeu, E. W. (2018). The impact of the Heavily Indebted Poor Countries initiative on growth and investment in Africa. *World Development*, 104, 108–127. <https://doi.org/10.1016/j.worlddev.2017.11.002>
- Deleidi, M., Iafrate, F., Levrero, E.S., (2020) Public investment fiscal multipliers: An empirical assessment for European countries. *Struct. Change Econ. Dyn.* 52, 354–365. <https://doi.org/10.1016/j.strueco.2019.12.004>
- Deleidi, M., Romaniello, D., Tosi, F., (2021b) Quantifying fiscal multipliers in Italy: A panel SVAR Analysis Using Regional data. *Pap. Reg. Sci.* 100 (5), 1158–1177. <https://doi.org/10.1111/pirs.12620>

- Della Posta, P. (2018b). Central bank intervention, public debt, and interest rate target zones. *Journal of Macroeconomics*, 56, 311–323. <https://doi.org/10.1016/j.jmacro.2018.04.001>
- Dell’Erba, S., Hausmann, R., & Panizza, U. (2013). *Debt Levels, debt composition, and sovereign spreads in emerging and advanced economies*, CID Working Paper No. 263, Center for International Development at Harvard University, <https://doi.org/10.1093/oxrep/grt026>
- del Castillo, E., Cabral, R., & Saucedo, E. (2022). The Sustainability of Mexican Municipal Public Debt. *Sustainability*, 14(11), 6558. <https://doi.org/10.3390/su14116558>
- De Mello, L. R. (1997). Foreign direct investment in developing countries and growth: A selective survey. *Journal of Development Studies*, 34, 1–34. <http://dx.doi.org/10.1080/00220389708422501>.
- Demirci, I., Huang, J., & Sialm, C. (2019). Government debt and corporate leverage: International evidence. *Journal of Financial Economics*, 133(2), 337–356. <https://doi.org/10.1016/j.jfineco.2019.03.009>
- Diamond, P. (1965). National debt in a neoclassical growth model. *American Economic Review*, 55(5), 1126–1150.
- Diemer, A., Iammarino, S., Rodríguez-Pose, A., & Storper, M. (2022). The Regional Development Trap in Europe. *Economic Geography*, 98(5), 487–509. <https://doi.org/10.1080/00130095.2022.2080655>
- Dixon, R.J., Thirlawall, A.P. (1975): A model of regional growth rate differences on Kaldorian lines. *Oxford Economic Papers* 27(2), 201–214. <https://doi.org/10.1093/oxfordjournals.oep.a041312>
- Doğan, İ., & Bilgili, F. (2014). The non-linear impact of high and growing government external debt on economic growth: A Markov Regime-switching approach. *Economic Modelling*, 39, 213–220. <https://doi.org/10.1016/j.econmod.2014.02.032>
- Doytch, N., & Uctum, M. (2019). Spillovers from foreign direct investment in services: Evidence at sub-sectoral level for the Asia-Pacific. *Journal of Asian Economics*, 60, 33e44. <https://doi.org/10.1016/j.asieco.2018.10.003>
- Domar, E. D. (1944). The burden of the debt and the national income. *American Economic Review*, 34, 798–827. <https://www.jstor.org/stable/1807397>
- Dolado, Juan, Goria, Alessandra, Ichino, Andrea, (1994) Immigration, human capital and growth in the host country. *J. Popul. Econ.* 7 (2), 193–215. <https://doi.org/10.1007/BF00173619>
- Dray, S., Legendre, P., & Peres-Neto, P. R. (2006). Spatial modelling: A comprehensive framework for principal coordinate analysis of neighbor matrices (PCNM). *Ecological Modelling*, 196(3–4), 483–493. <https://doi.org/10.1016/j.ecolmodel.2006.02.015>
- Dufour, J.M. and E. Renault (1998). Short run and long run causality in time series: theory. *Econometrica* 66, 1099–1126. <https://www.jstor.org/stable/2999631>
- Durlauf S.N., and Quah D., 1999, *The New Empirics of Economic Growth*, in J.B. Taylor e M. Woodford (eds.), *Handbook of Macroeconomics*, vol. IA, Cap. 4, North-Holland, Amsterdam.

- Dunning, J. H. (2001). The eclectic (OLI) paradigm of international production: Past, present and future. *International Journal of the Economics of Business*, 8(2), 173–190. <https://doi.org/10.1080/13571510110051441>
- Dunning, J.H., Lundan, S.M., (2008) *Multinational Enterprises and the Global Economy*. Edward Elgar Publishing. <https://doi.org/10.1057/palgrave.jibs.8400426>
- Dunning, J. H., & Lundan, S. (2008). Institutions and the OLI paradigm of the multinational enterprise. *Asia Pacific Journal of Management*, 25, 573–593. <https://doi.org/10.1007/s10490-007-9074-z>.
- Dunning, J. H. (1981b). Explaining the international direct investment position of countries: towards a dynamic or developmental approach. *Weltwirtschaftliches Archiv*, 117, 30–64.
- Duranton G. and Puga, D. (2001) Nursery cities: urban diversity, process innovation, and the life cycle of products. *American Economic Review*, 91(5), 1454–1477. DOI: 10.1257/aer.91.5.1454.
- Eberhardt, M., & Presbitero, A. F. (2015). Public debt and growth: Heterogeneity and non-linearity. *Journal of international Economics*, 97(1), 45–58. <https://doi.org/10.1016/j.jinteco.2015.04.005>
- Edo, S.E. (2002), The external debt problem in Africa: A comparative study of Nigeria and Morocco. *Africa Development Review*, 14(2), 221–236. <https://doi.org/10.1111/1467-8268.00052>
- Egger, P., & Pfaffermayr, M. (2006). Spatial convergence. *Papers in Regional Science*, 85(2), 199–215. <https://doi.org/10.1111/j.1435-5957.2006.00084.x>
- Egger, P., & Winner, H. (2006). How corruption influences foreign direct investment: A panel data study. *Economic Development and Cultural Change*, 54(2), 459–486.
- Elbadawi, I.A., Ndulu, B.J., Ndung'u, N. (1997), *Debt overhang and economic growth in Sub-Saharan Africa*. In: Iqbal, Z., Kanbur, R., editors. External Finance for Low-income Countries. Washington, DC: International Monetary Fund. <https://doi.org/10.5089/9781451957198.071>
- Elhorst J.P., (2003) Specification and Estimation of Spatial Panel Data Models, *International Regional Sciences Review*, 26, 244–268. <https://doi.org/10.1177/0160017603253791>
- Elhorst, J. P., & Fréret, S. (2009). Evidence of political yardstick competition in France using a two-regime spatial Durbin model with fixed effects. *Journal of Regional Science*, 49(5), 931–951.
- Elhorst, J. P. (2009). Spatial panel data models. In M. M. Fischer & A. Getis (Eds.), *Handbook of applied spatial analysis* (pp. 377–407). Springer. https://doi.org/10.1007/978-3-642-03647-7_19.
- Elhorst, J. P. (2010). Applied spatial econometrics: raising the bar. *Spatial economic analysis*, 5(1), 9–28. <https://doi.org/10.1080/17421770903541772>
- Elhorst, J. P. (2014) “Matlab Software for Spatial Panels.” *International Regional Science Review* 37:389–405. <https://doi.org/10.1177/0160017612452429>
- Elhorst, J.P., Zandberg E. & De Haan, J. (2013) The impact of interaction effects among neighbouring countries on financial liberalization and reform: a dynamic spatial panel data approach, *Spatial Economic Analysis*, 8, 293–313. <https://doi.org/10.1080/17421772.2012.760136>.

- Elkhalfi, O., Chaabita, R., Benboubker, M., Ghoujdam, M., Zahraoui, K., El Alaoui, H., & Hammouch, H. (2024). The impact of external debt on economic growth: The case of emerging countries. *Research in Globalization*, 100248. <https://doi.org/10.1016/j.resglo.2024.100248>
- Ellison, G., Glaeser, E., & Kerr, W. (2010). What causes industry agglomeration? Evidence from co-agglomeration patterns. *American Economic Review*, 100, 1195–1213
- Ekholm, K., Forslid, R., 2001. Trade and location with horizontal and vertical multiregional firms. *Scandinavian Journal of Economics* 103 (1), 101–118. <https://doi.org/10.1111/1467-9442.00232>.
- Eminidou, S., Geiger, M., & Zachariadis, M. (2023). Public debt and state-dependent effects of fiscal policy in the euro area. *Journal of International Money and Finance*, 130, 102746. <https://doi.org/10.1016/j.jimonfin.2022.102746>
- Enders, W., (2004) *Applied Econometrics Time Series*. 2nd Edition. New York: John Wiley.
- Ertur, C., & Koch, W. (2007). Growth, technological interdependence, and spatial externalities: Theory and evidence. *Journal of Applied Econometrics*, 22, 1033–1062. <https://doi.org/10.1002/jae.963>.
- Ertur, C., Le Gallo, J., & Baumont, C. (2006). The European regional convergence process, 1980–1995: Do spatial regimes and spatial dependence matter? *International Regional Science Review*, 29(1), 3–34. <https://doi.org/10.1177/0160017605279453>
- Ertur, C., Le Gallo, J., & Lesage, J. P. (2007). Local versus global convergence in Europe: A Bayesian spatial econometric approach. *The Review of Regional Studies*, 37(1), 82–108.
- Eyraud, L., Batini, N., Forni, L., & Weber, A. (2014). Fiscal Multipliers: Size, Determinants, and Use in Macroeconomic Projections. *Technical Notes and Manuals*, 14.
- Evans, P. (1989). Predatory, developmental, and other apparatus: A comparative political economy perspective on the Third World state. *Sociological Forum* (Special Issue: Comparative National Development: Theory and Facts for the 1990s), 4(4): 561-587. <https://doi.org/10.1007/BF01115064>
- Eva, M., Cehan, A., Corodescu-Roșca, E., & Bourdin, S. (2022). Spatial patterns of regional inequalities: Empirical evidence from a large panel of countries. *Applied Geography*, 140, 102638. <https://doi.org/10.1016/j.apgeog.2022.102638>
- Faeth, I. (2009). Determinants of foreign direct investment. A tale of nine theoretical models. *Journal of Economic Surveys*, 23(1), 165–196. <https://doi.org/10.1111/j.1467-6419.2008.00560.x>
- Faggian, A., Gemmiti, R., Jaquet, T., Santini, I., 2018. Regional economic resilience: The experience of the Italian local labor systems. *Ann. Reg. Sci.* 60 (2), 393–410. <https://doi.org/10.1007/s00168-017-0822-9>
- Falk, M., and Sinabell, F. (2009). A spatial econometric analysis of the regional growth and volatility in Europe. *Empirica*, 36(2), 193–207. <https://doi.org/10.1007/s10663-008-9078-z>

- Fan, C. C., & Sun, M. (2008). Regional inequality in China, 1978-2006. *Eurasian Geography and Economics*, 49(1), 1–18. <https://doi.org/10.2747/1539-7216.49.1.1>
- Fayzullokh, S., Barnogul, S., Dinara, A., & Sardor, K. (2023). Analyzing the Relationship Between Public Debt and Poverty Reduction in Developing Countries: An Empirical Study. *Revista de Gestão Social e Ambiental*, 17(7), e03257-e03257. <https://doi.org/10.24857/rgsa.v17n7-001>
- Feyisa, H. L., Ayen, D. D., Abdulahi, S. M., & Tefera, F. T. (2022). The three-dimensional impacts of governance on economic growth: Panel data evidence from the emerging market. *Corporate Governance and Organizational Behavior Review*, 6(1), 42-55. <https://doi.org/10.22495/cgobrv6i1p3>
- Fincke, B., & Greiner, A. (2015). Public Debt and Economic Growth in Emerging Market Economies. *South African Journal of Economics*, 83(3), 357–370. <https://doi.org/10.1111/saje.12079>
- Fingleton, B., Lopez-Bazo, E., 2006. Empirical growth models with spatial effects. *Papers Reg. Sci.* 85 (2), 177–198. <https://doi.org/10.1111/j.1435-5957.2006.00074.x>
- Fingleton, B., Lòpez-Bazo, E., 2007. Empirical growth models with spatial effects. *Papers in Regional Science* 85, 177–198. <https://doi.org/10.1111/j.1435-5957.2006.00074.x>
- Fingleton, B. (2001). Equilibrium and economic growth: spatial econometric models and simulations. *Journal of regional Science*, 41(1), 117-147.5-34. <https://doi.org/10.1177/016001769902200102>
- Fischer, M.M., (2011) A spatial Mankiw-Romer-Weil model: theory and evidence. *Ann. Reg. Sci.* 47, 419–436. <https://doi.org/10.1007/s00168-010-0384-6>
- Fischer, M.M. (2018) Spatial externalities and growth in a Mankiw-Romer-Weil world: theory and evidence. *Int. Reg. Sci. Rev.* 41 (1), 45–61. <https://doi.org/10.1177/0160017616628602>
- Florax RJ, Folmer H, Rey RJ (2003) Specification searches in spatial econometrics: The relevance of Hendry’s methodology. *Regional Science and Urban Economics* 33: 557–579. [https://doi.org/10.1016/S0166-0462\(03\)00002-4](https://doi.org/10.1016/S0166-0462(03)00002-4)
- Fotopolos, G., 2006. Nonparametric analysis of regional income dynamics: the case of Greece. *Economics Letters* 91 (3), 450–457. <https://doi.org/10.1016/j.econlet.2006.01.002>
- Forte, R., Moura, R., 2013. The effects of Foreign direct investment on the host country’s economic growth: theory and empirical evidence. *Singap. Econ. Rev.* 58, 1350017. <https://doi.org/10.1142/S0217590813500173>
- Fortanier, F., Miao, G., Kolk, A., & Pisani, N. (2020). Accounting for firm heterogeneity in global value chains. *Journal of International Business Studies*, 51(3), 432–453. <https://doi.org/10.1057/s41267-019-00282-0>
- Fosfuri, A., & Motta, M. (1999). Multinationals without advantages. *The Scandinavian Journal of Economics*, 101(4), 617–630. <https://doi.org/10.1111/1467-9442.00176>
- Fossen, F.M., Freier, R., & Martin, T. (2014). Race to the Debt Trap? - Spatial Econometric Evidence on Debt in German Municipalities. *Political Economy: Budget*. <https://doi.org/10.1016/j.regsciurbeco.2015.04.003>

- Fraga, GJ, Parré, JL, & Silva, RR da. (2016). Direct Foreign Investment in Brazil: Direct and Spatial Effects on Economic Growth. *Economic Analysis* , 34 (66). <https://doi.org/10.22456/2176-5456.45778>
- Francisco Arizala, Matthieu Bellon and Margaux MacDonald (2019) *Regional Growth Spillovers in Sub-Saharan Africa*. IMF Working Paper.
- Freytag, A., & Pehnelt, G. (2009). Debt relief and governance quality in developing countries. *World Development*, 37(1), 62-80. <https://doi.org/10.1016/j.worlddev.2008.01.004>
- Friedmann, J. (1966). *Regional development policy: A case study of Venezuela*. MIT Press. <https://www.jstor.org/stable/23587561>
- Fujita, M., Krugman, P., & Venables, A. (1999). *The spatial economy: cities, regions and international trade*. The MIT Press. <https://www.jstor.org/stable/3697891>
- Fujita, M., & Thisse, J. F. (2002). *Economics of agglomeration: Cities, industrial location, and regional growth*. Cambridge University Press. <https://doi.org/10.1093/jnlecg/lbh024>
- Furceri, D., J.T. Jalles, and A. Zdzienicka. 2016. “China Spillovers: New Evidence from Time-Varying Estimates”. IMF Spillover Note. International Monetary Fund, Washington, DC.
- Galor, O., 1996. Convergence? Inferences from theoretical models. *Econ. J.* 106 (437), 1056–1069. <https://doi.org/10.2307/2235378>
- Galstyan, V., & Velic, A. (2017b). Debt thresholds and real exchange rates: An emerging markets perspective. *Journal of International Money and Finance*, 70, 452–470. <https://doi.org/10.1016/j.jimonfin.2016.06.012>
- Gambe, T. R., Tsoriyo, W. W., & Moffat, F. (2023). Rethinking the efficacy of spatial development plans in Zimbabwe: A case of Masvingo Province. *Cogent Social Sciences*, 9(1), 2160583. <https://doi.org/10.1080/23311886.2022.2160583>
- Gani, A., & Al-Abri, A. S. (2013). Indicators of business environment, institutional quality and foreign direct investment in gulf cooperation council (GCC) countries. *International Review of Applied Economics*, 27(4), 515–530. <https://doi.org/10.1080/02692171.2012.760066>.
- Garang, A. P. M., & Erkekoglu, H. (2021). Convergence Triggers in Africa: Evidence from Convergence Clubs and Panel Models. *South African Journal of Economics*, 89(2), 218–245. <https://doi.org/10.1111/saje.12282>
- Geda, A., & Yimer, A. (2023). What Drives Foreign Direct Investment into Africa? Insights from a New Analytical Classification of Countries as Fragile, Factor-Driven, or Investment-Driven. *Journal of the Knowledge Economy*, 1-36. <https://doi.org/10.1007/s13132-023-01639-5>
- Geda, A., & Yimer, A. (2018). Determinants of foreign direct investment inflows to Africa: A panel cointegration evidence using new analytical country classification. In A. Heshmati (Ed.), *Determinants of economic growth in Africa* (pp. 55–94). Palgrave Macmillan.
- Geda, A. (2012). *Applied Time Series Econometrics: a practical guide for macroeconomic researchers with a focus on Africa*. African Books Collective.

- Goedl, M., & Zwick, C. (2018). Assessing the stochastic stability of public debt: The case of Austria. *Empirica*, 45(3), 559–585. <https://doi.org/10.1007/s10663-017-9376-4>.
- Goodchild, M.F., 1992. Geographical information science. *International Journal of Geographical Information Systems* 6 (1), 31–45. <https://doi.org/10.1080/02693799208901893>
- Gomez Gonzalez, P. (2019a). Inflation linked public debt in emerging economies. *Journal of International Money and Finance*, 93, 313–334. <https://doi.org/10.1016/j.jimonfin.2019.02.008>
- Guei, K. M. (2019) External debt and growth in emerging economies *International Economic Journal* 33 (2): 236–251. <https://doi.org/10.1080/10168737.2019.1590727>
- Gutiérrez-Portilla, P., Maza, A., & Villaverde, J. (2019). A spatial approach to the FDI-growth nexus in Spain: Dealing with the headquarters effect. *International Business Review*, 28(6), 101597. <https://doi.org/10.1016/j.ibusrev.2019.101597>
- Giarratani Soeroso, F. (1985). A neoclassical model of regional growth in Indonesia. *Journal of Regional Science*, 25(3), 373–382. <https://doi.org/10.1111/j.1467-9787.1985.tb00307.x>
- Ghali, M., Akiyama, M., & Fujiwara, J. (1978). Factor mobility and regional growth. *The Review of Economics and Statistics*, 60(1), 78–84. <https://doi.org/10.2307/1924335>
- Gherghina, S. C., Simionescu, L. N., & Hudea, O. S. (2019). Exploring foreign direct investment-economic growth nexus-empirical evidence from Central and Eastern European countries. *Sustainability*, 11(19), 1–33. <https://doi.org/10.3390/su11195421>
- Ghosh, M., Ghoshray, A., & Malki, I. (2013). Regional divergence and club convergence in India. *Economic Modelling*, 30, 733–742. <https://doi.org/10.1016/j.econmod.2012.10.008>
- Glaeser, E.L. (2008) *Cities, Agglomeration, and Spatial Equilibrium*. Oxford: Oxford University Press.
- Gnangnon, S. K. (2021). Tax reform and public debt instability in developing countries: The trade openness and public revenue instability channels. *Economic Analysis and Policy*, 69, 54–67. <https://doi.org/10.1016/j.eap.2020.11.005>
- Granger, C.W.J.(1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica* 37, 424 – 438. <https://www.jstor.org/stable/1912791>
- Granger, C.W.J., and Newbold, P., (1974). “Spurious Regressions in Econometrics,” *Journal of Econometrics*, Vol.2, 111 -120.
- Gräbner, C., Heimberger, P., Kapeller, J., & Schütz, B. (2020). Is the Eurozone disintegrating? Macroeconomic divergence, structural polarization, trade and fragility. *Cambridge Journal of Economics*, 44(3), 647–669. Scopus. <https://doi.org/10.1093/cje/bez059>
- Greene, J., Villanueva, D. (1991), *Private investment in developing*. IMF Staff Papers, 38, 33–58. <https://doi.org/10.2307/3867034>

- Gibescu, O. (2010). *Does the gross fixed capital formation represent a factor for supporting the economic growth?* <https://mpra.ub.uni-muenchen.de/id/eprint/50135>
- Grossman, G.M., Helpman, E., 1991. Quality ladders in the theory of growth. *Rev. Econ. Stud.* 58 (1), 43–61. <https://doi.org/10.2307/2298044>
- Habib, M., & Zurawicki, L. (2002). Corruption and foreign direct investment. *Journal of International Business Studies*, 33(2), 291–307. <https://doi.org/10.1057/palgrave.jibs.8491017>
- Hall, S. G., Tavlás, G. S., & Gefang, D. (2023). A test to select between spatial weighting matrices. *Journal of Spatial Econometrics*, 4, 1. <https://doi.org/10.1007/s43071-022-00032-9>.
- Hayat, A. (2018). FDI and economic growth: The role of natural resources? *Journal of Economic Studies*, 45(2), 283–295. <https://doi.org/10.1108/JES-05-2015-0082>
- Hale, G., & Long, C. (2011). Are there productivity spillovers from foreign direct investment in China? *Pacific Economic Review*, 16, 135–153. <https://doi.org/10.1111/j.1468-0106.2011.00539.x>
- Harrison, J., & Turok, I. (2017). Universities, knowledge and regional development. *Regional Studies*, 51(7), 977–981. <https://doi.org/10.1080/00343404.2017.1328189>
- Harris, C. (1954) The market as a factor in the localization of industry in the United States. *Annals of the Association of American Geographers* 44 (4), 315–348. <https://doi.org/10.1080/00045605409352140>
- Harris, R., Moffat J. & Kravtsova, V. (2011) In search of ‘W’, *Spatial Economic Analysis*, 6, 249–270. <https://doi.org/10.1080/17421772.2011.586721>
- Hassan, A. S. and Meyer, D. F. (2021) Nonlinear effect of external debt on economic growth: Evidence from Sub-Saharan African countries *International Journal of Economics & Management* 14 (3): 447–460. <http://www.ijem.upm.edu.my/>
- Head, K., & Mayer, T. (2004). Market potential and the location of Japanese investment in the European Union. *Review of Economics and Statistics*, 86(4), 959–972.
- Helpman, E., 1984. A simple theory of international trade with multinational corporations. *Journal of Political Economy* 92 (3), 451–471. <https://doi.org/10.1086/261236>
- Hendry, D.F., (1995). *Dynamic Econometrics*, Oxford University Press.
- Henderson, J. V., Nigmatulina, D., & Kriticos, S. (2021). Measuring urban economic density. *Journal of Urban Economics*, 125, 103188. <https://doi.org/10.1016/j.jue.2019.103188>
- Herzer, D., Klasen, S., & Nowak-Lehmann, F. (2008). In search of FDI-led growth in developing countries: The way forward. *Economic Modelling*, 25, 793–810. <https://doi.org/10.1016/j.econmod.2007.11.005>.
- Hildreth, P., & Bailey, D. (2014). Place-based economic development strategy in England: Filling the missing space. *Local economy*, 29(4-5), 363–377.
- Hintosova, A. B., Bruothova, M., Kubíková, Z., & Rucinský, R. (2018). Determinants of foreign direct investment inflows: A case of the Visegrad countries. *Journal of International Studies*, 11(2), 222–235. <https://doi.org/10.14254/2071-8330.2018/11-2/15>

- Hirschman, A. O. (1958). *The Strategy for Economic Development*. New Haven, Yale University Press.
- Hoang, H. H., Huynh, C. M., Duong, N. M. H., & Chau, N. H. (2022). Determinants of foreign direct investment in Southern Central Coast of Vietnam: A spatial econometric analysis. *Economic Change and Restructuring*, 55(1), 285–310. <https://doi.org/10.1007/s10644-020-09315-3>.
- Hoffmann, A.N., Markusen, J.R., 2008. *Investment liberalization and the geography of firm location*. In: Brakman, S., Garretsen, H. (Eds.), *Foreign Direct Investment and the Multinational Enterprise*. MIT Press, Cambridge, pp. 39–67. <https://doi.org/10.7551/mitpress/9780262026451.003.0006>
- Hong, G., Hu, H., & Li, X. (2010). Analysis of regional growth convergence with spatial econometrics in China. *Dili Xuebao/Acta Geographica Sinica*, 65(12), 1548–1558.
- Hoorn, A. V., & Maseland, R. (2016). How institutions matter for international business: Institutional distance effects vs institutional profile effects. *Journal of International Business Studies*, 47(3), 374–381. <https://doi.org/10.1057/jibs.2016.2>
- Hong Hiep, H., Quang, B. N., & Minh, H. C. (2023). The impact of fdi and regional factors on economic growth in Vietnamese provinces: A spatial econometric analysis. *Post-Communist Economies*, 35(5), 454–474. <https://doi.org/10.1080/14631377.2023.2196869>
- Hory, M. P., Levieuge, G., & Onori, D. (2023). The fiscal multiplier when debt is denominated in foreign currency. *International Economics*, 176, 100458. <https://doi.org/10.1016/j.inteco.2023.100458>
- Hoskisson, R. E., Wright, M., Filatotchev, I., & Peng, M. W. (2013). Emerging multinationals from midrange economies: The influence of institutions and factor markets. *Journal of Management Studies*, 50(7), 1295–1321. <https://doi.org/10.1111/j.1467-6486.2012.01085.x>
- Hurić-Bjelan, J., & Hadžiahmetović, A. (2020). External Debt in Bosnia and Herzegovina. An Empirical Analysis. *Southeast European Journal of Economics and Business*, 15(2), 70–82. <https://doi.org/10.2478/jeb-2020-0016>
- Hutcheson, A. (1718). *Some Calculations and Remarks Relating to the Present State of the Publick Debts and Funds. And a Proposal for the Intire Discharge of the National Debt and Incumbrance in Thirty Years Time* by Archibald Hutcheson. Henry Clements. <http://hdl.handle.net/11150/5115>
- Hymer, S., 1970. The efficiency (contradictions) of multinational corporations. *Am. Econ. Rev.* 60 (2), 441–448. <https://www.jstor.org/stable/1815843>
- Hymer, S.H., (1976) *The International Operations of National Firms*. A Study of Direct Foreign Investment (1960). MIT Monographs in Economics, Cambridge, Massachusetts.
- Hsu, C., & Wu, J. (2006). *FDI and economic growth: Revisiting the role of financial market development*. Working Paper, Department of Economics, National Central University, Taiwan.

- Ibourk, A., & Elouaourti, Z. (2023). Regional convergence and catching up process in Africa: A tale of three clubs. *Regional Science Policy & Practice*, 15(6), 1339-1372.
- Iamsiraroj, S. (2016). The foreign direct investment-economic growth nexus. *International Review of Economics and Finance*, 42, 116–133. <https://doi.org/10.1016/j.iref.2015.10.044>
- Ighodalo Ehikioya, B., Omankhanlen, A. E., Osagie Osuma, G., & Iwiysi Inua, O. (2020). Dynamic relations between public external debt and economic growth in African countries: a curse or blessing? *Journal of Open Innovation: Technology, Market, and Complexity*, 6(3), 88.
- Imam, P., & Salinas, G. (2015). Explaining episodes of growth accelerations, decelerations, and collapses in Western Africa. *Journal of International Commerce, Economics and Policy*, 6(01), 1550003. <https://doi.org/10.1142/S1793993315500039>
- International Monetary Fund. Research Dept. (2018). *World economic outlook, April 2018: Cyclical upswing, structural change*. International Monetary Fund.
- Forecasts, A. G. (2021). International Monetary Fund. *Africa Confidential*, 29, 4.
- Incaltarau, C., Pascariu, G. C., Duarte, A., & Nijkamp, P. (2021). Migration, regional growth, and convergence: A spatial econometric study on Romania. *Annals of Regional Science*, 66(3), 497–532. <https://doi.org/10.1007/s00168-020-01019>.
- Islam, N. (1995). Growth empirics: A panel data approach. *Quarterly Journal of Economics*, 110, 1127–1170. <http://dx.doi.org/10.2307/2946651>.
- Islam, T. T. (2020). The impact of population agglomeration of an area on its neighbors: evidence from the USA. *The Annals of Regional Science*, 65(1), 1-26. <https://doi.org/10.1007/s00168-019-00971-6>
- Irfan, M., Rao, M.W., Akbar, J., Younis, I., (2020) Impact of external debt on stock market performance and economic growth: Moderating role of Capital formation. *J. Finance. Account. Res.* <https://doi.org/10.32350/JFAR/0201/01>
- Iyoha, M. (2000), *An econometric analysis of external debt and economic growth on Sub-Saharan African countries*. In: Ajayi, S.I., Khan, M.S., editors. External Debt and Capital Flight in Sub-Saharan Africa. Washington, DC: International Monetary Fund.
- Jarque CM, Bera AK (1980) Efficient tests for normality, homoscedasticity and serial independence of regression residuals. *Econ Lett* 6(3):255–259. [https://doi.org/10.1016/0165-1765\(80\)90024-5](https://doi.org/10.1016/0165-1765(80)90024-5)
- Jenish, N. (2016). Spatial semiparametric model with endogenous regressors. *Econometric Theory*, 32(3), 714-739.
- Jiang, Y. (2014). Spatial distribution of foreign direct investment and productivity growth in less developed regions of China. *American Journal of Industrial and Business Management*, 4(11), 644. <http://dx.doi.org/10.4236/ajibm.2014.411070>
- Johansen, Soren, 1988. "Statistical analysis of cointegration vectors," *Journal of Economic Dynamics and Control*. Vol. 12(2-3), pages 231-254. [https://doi.org/10.1016/0165-1889\(88\)90041-3](https://doi.org/10.1016/0165-1889(88)90041-3)

- Johnson, P., & Papageorgiou, C. (2020). What remains of cross-country convergence? *Journal of Economic Literature* 58(1), 129–175. DOI: 10.1257/jel.20181207
- Johnson, C. (1982), *MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925–1975* (Stanford, CA: Stanford University Press). <https://www.jstor.org/stable/132271>
- Johnston, A., Hancké, B., & Pant, S. (2014). Comparative institutional advantage in the European sovereign debt crisis. *Comparative political studies*, 47(13), 1771–1800. <https://doi.org/10.1177/0010414013516917>
- Jordà, O., 2005. Estimation and inference of impulse responses by local projections. *Amer. Econ. Rev.* 161–182. DOI: 10.1257/0002828053828518
- Kaldor, N. (1970). The case for regional policies. *Scottish Journal of Political Economy*, 17(3), 337–347. <https://doi.org/10.1111/j.1467-9485.1970.tb00712.x>
- Kang, Y., & And Jiang, F. (2012). FDI location choice of Chinese multinationals in East and Southeast Asia: Traditional economic factors and institutional perspective. *Journal of World Business*, 47(1), 45–53. <https://doi.org/10.1016/j.jwb.2010.10.019>
- Kano, L., Tsang, E. W., & Yeung, H. W. C. (2020). Global value chains: A review of the multi-disciplinary literature. *Journal of International Business Studies*, 51(4), 577–622. <https://doi.org/10.1057/s41267-020-00304-2>
- Kant, C. (2019). Income convergence and the catch-up index. *North American Journal of economics and Finance*, 48(March), 613 - 627. <https://doi.org/10.1016/j.najef.2018.07.017>
- Kapoor, M., Kelejian, H. H., & Prucha, I. R. (2007). Panel data models with spatially correlated error components. *Journal of econometrics*, 140(1), 97–130. <https://doi.org/10.1016/j.jeconom.2006.09.004>
- Karadam, D. Y. (2018). An investigation of nonlinear effects of debt on growth. *The Journal of Economic Asymmetries*, 18, e00097. <https://doi.org/10.1016/j.jeca.2018.e00097>
- Kassouri, Y., & Okunlola, O. A. (2022). Analysis of spatio-temporal drivers and convergence characteristics of urban development in Africa. *Land Use Policy*, 112, 105868.
- Kassouri, Y., & Altıntaş, H. (2021). Cyclical drivers of fiscal policy in sub-Saharan Africa: new insights from the time-varying heterogeneity approach. *Economic Analysis and Policy*, 70, 51–67.
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2009). Governance matters VIII: Aggregate and individual governance indicators, 1996–2008. *World Bank Policy Research Working Paper*, 4978. <https://ssrn.com/abstract=1424591>
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2010). The worldwide governance indicators: Methodology and analytical issues. *World Bank Policy Research Working Paper*, 5430. <https://doi.org/10.1017/S1876404511200046>
- Keita, L. (2016) Models of economic growth and development in the context of human capital investment—The way forward for Africa. *Africa Development*, 41(1), 23–48.
- Kelejian, H. H., & Prucha, I. R. (2010). Specification and estimation of spatial autoregressive models with autoregressive and heteroskedastic disturbances.

- Journal of econometrics*, 157(1), 53-67.
<https://doi.org/10.1016/j.jeconom.2009.10.025>
- Keller, W. & Shiue, C. H. (2007) The origin of spatial interaction, *Journal of Econometrics*, 140, 304–332. <https://doi.org/10.1016/j.jeconom.2006.09.011>
- Kengdo, A. A. N. (2023). Military spending, public debt, and economic growth in Cameroon. *Sustainable Futures*, 6, 100131.
<https://doi.org/10.1016/j.sft.2023.100131>
- Kilinc, Z. A., & Kilinc, M. (2023). Non-linearities in the relationship between public debt and inequality. *Applied Economics Letters*, 1-5.
<https://doi.org/10.1080/13504851.2023.2187018>
- Kilian, L., & Lütkepohl, H. (2017). *Structural vector autoregressive analysis*. Cambridge University Press.
- Kim, Y. J., & Zhang, J. (2021). The Relationship Between Debt and Output. *IMF Economic Review*, 69(1), 230–257. <https://doi.org/10.1057/s41308-020-00132-2>
- Kinoshita, Y., & Lu, C. H. (2006). *On the role of absorptive capacity: FDI matters to growth*. William Davidson Institute Working Paper No. 845.
<https://dx.doi.org/10.2139/ssrn.944580>
- Kheng, V., Sun, S., & Anwar, S. (2017). Foreign direct investment and human capital in developing countries: A panel data approach. *Economic Change and Restructuring*, 50(4), 341–365. <https://doi.org/10.1007/s10644-016-9191-0>.
- Kharusi, S. A., & Ada, M. S. (2018). External debt and economic growth: The case of emerging economy. *Journal of economic integration*, 33(1), 1141-1157.
<https://www.jstor.org/stable/26418778>
- Khémiri, W., & Noubbigh, H. (2021). Joint analysis of the non-linear debt-growth nexus and capital account liberalization: New evidence from Sub Saharan region. *The Quarterly Review of Economics and Finance*, 80, 614–626.
<https://doi.org/10.1016/j.qref.2021.04.009>
- Klaassen, L. H., & Paelinck, J. H. (1979). The future of large towns. *Environment and Planning A*, 11(10), 1095-1104. <https://doi.org/10.1068/a111095>
- Klutse, S. K., Kiss, G. D. and Sági, J. (2022) Exchange market pressure in Sub-Saharan African countries – The role of imports and short-term external debt, 2002–2017 *Regional Statistics* 12 (4): 92–111.
<https://doi.org/10.15196/RS120404>
- Knight, J. B. (2014). China as a developmental state. *The world economy*, 37(10), 1335-1347. <https://doi.org/10.1111/twec.12215>
- Koh, W. C. (2017). Fiscal multipliers: New evidence from a large panel of countries. *Oxford Economic Papers*, 69(3), 569–590.
<https://doi.org/10.1093/oep/afw066>
- Koop, G., Pesaran, M. H., & Potter, S. M. (1996). Impulse response analysis in nonlinear multivariate models. *Journal of econometrics*, 74(1), 119-147.
[https://doi.org/10.1016/0304-4076\(95\)01753-4](https://doi.org/10.1016/0304-4076(95)01753-4)
- Koopmans, T., 1965. *On the concept of optimal growth, the econometric approach to development planning*. In: *Econometric Approach to Development Planning*, first ed. North Holland, Amsterdam, pp. 225–287.
- Kose, M. A.–Nagle, P.–Ohnsorge, F.–Sugawara, N. (2019): *Global Waves of Debt* World Bank, Washington, DC. Kottman, S. E. (1992). *Regional employment*

- by industry: Do returns to capital matter? *Economic Review*, 77(4), 13–25.
<https://www.proquest.com/scholarly-journals/regional-employment-industry-do-returns-capital/docview/200417987/se-2?accountid=16746>
- Kourtellos, A., Stengos, T., & Tan, C. M. (2013). The effect of public debt on growth in multiple regimes. *Journal of Macroeconomics*, 38, 35–43.
<https://doi.org/10.1016/j.jmacro.2013.08.023>
- Kugler, M., & Rapaport, H. (2007). International labor and capital flows: Complements or substitutes? *Journal of Economic Letters*, 94, 15–162.
<https://doi.org/10.1016/j.econlet.2006.06.023>.
- Kukić, L. (2020). Origins of regional divergence: Economic growth in socialist Yugoslavia. *Economic History Review*, 73(4), 1097–1127.
<https://doi.org/10.1111/ehr.12967>
- Kumar, S.M. and Woo, J. (2010). *Public debt and growth*. IMF Working Paper.
<https://doi.org/10.1111/ecca.12138>
- Krugman, P., & Venables, A. J. (1995). Globalization and the inequality of nations. *Quarterly Journal of Economics*, 110(4), 857–880.
<https://doi.org/10.2307/2946642>
- Krugman, P., & Livas, E. (1996). Trade policy and the Third World metropolis. *Journal of Development Economics*, 49(1), 137–150.
[https://doi.org/10.1016/0304-3878\(95\)00055-0](https://doi.org/10.1016/0304-3878(95)00055-0)
- Krugman, P. (1988). Financing vs. forgiving a debt overhang: Some analytical notes. *Journal of Development Economics*, 29, 253–268
- Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy*, 99(3), 483–499. <https://doi.org/10.1086/261763>
- Krugman, P., (1992). *A dynamic spatial model*. NBER Working Paper No. 4219. DOI 10.3386/w4219
- Krugman, P. (1983). New theories of trade among industrial countries. *The American Economic Review*, 73(2), 343–347.
- Labidi, M. A. (2019). Development policy and regional economic convergence: The case of Tunisia. *Regional Science Policy & Practice*, 11(3), 583–595.
<https://doi.org/10.1111/rsp3.12206>
- Lammarino, S. (2005) An evolutionary integrated view of regional systems of innovation. Concepts, measures, and historical perspectives. *European Planning Studies*, 13(4), 495–517.
<https://doi.org/10.1080/09654310500107084>
- Lammarino, S., Rodriguez-Pose, A., & Storper, M. (2019). Regional inequality in Europe: Evidence, theory and policy implications. *Journal of Economic Geography*, 19(2), 273–298. <https://doi.org/10.1093/jeg/lby021>
- Landau, L. (2011). *Contemporary migration to South Africa: a regional development issue*. World Bank Publications.
- Law, S. H., Ng, C. H., Kutan, A. M., & Law, Z. K. (2021). Public debt and economic growth in developing countries: Nonlinearity and threshold analysis. *Economic Modelling*, 98, 26–40.
<https://doi.org/10.1016/j.econmod.2021.02.004>
- Le Gallo J., Ertur C., and Baoumont C. (2003) A spatial Econometric Analysis of Convergence Across European Regions, 1980–1995, in Fingleton, B (ed.),

- European Regional Growth*, Springer-Verlag (Advances in Spatial Sciences), Berlin. https://doi.org/10.1007/978-3-662-07136-6_4
- Le Gallo, J. (2004). Space-time analysis of GDP disparities among European regions: A Markov chains approach. *International Regional Science Review*, 27(2), 138–163. <https://doi.org/10.1177/0160017603262402>
- Le Gallo, J., Dall'Erba, S., & Guillaing, R. (2011) The local versus global dilemma of the effects of structural funds. *Growth and Change*, 42(4), 466-490. <https://doi.org/10.1111/j.1468-2257.2011.00564.x>
- Lee, L.-F. (2004) Asymptotic distribution of quasi-maximum likelihood estimators for spatial autoregressive models, *Econometrica*, 72, 1899-1925. <https://doi.org/10.1111/j.1468-0262.2004.00558.x>
- Lee, L., & Yu, J. (2010). Some recent developments in spatial panel data models. *Regional Science and Urban Economics*, 40(5), 255–271. <https://doi.org/10.1016/j.regsciurbeco.2009.09.002>
- Lee S, Pesaran H and Smith R (2017) Growth and convergence in a multi-country empirical stochastic Solow model. *Journal of Applied Econometrics* 12(4): 357-392. [https://doi.org/10.1002/\(SICI\)1099-1255\(199707\)12:4%3C357::AID-JAE441%3E3.0.CO;2-T](https://doi.org/10.1002/(SICI)1099-1255(199707)12:4%3C357::AID-JAE441%3E3.0.CO;2-T).
- Lee, S. J., Kang, S. J., & Lee, S. (2024). Economic, Social and Institutional Determinants of FDI Inflows: A Comparative Analysis of Developed and Developing Economies. *Transnational Corporations Review*, 200074. <https://doi.org/10.1016/j.tncr.2024.200074>
- Leibrecht, M., Riedl, A., 2014. Modeling FDI based on a spatially augmented gravity model: evidence for central and eastern European countries. *J. Int. Trade Econ. Dev.* 23 (8), 1206–1237. <https://doi.org/10.1080/09638199.2013.861006>
- Levy-Livernore, A., Chowdhury, K. (1998), *Handbook on Globalization of the World Economy*. Cheltenham, UK: Edward Elgar Publishing Limited.
- LeSage, J.P., Fischer, M.M., (2008) Spatial growth regressions: model specification, estimation and interpretation. *Spatial Economic Analysis* 3, 275–304. <https://doi.org/10.1080/17421770802353758>
- LeSage, J. P. and R. K. Pace (2009). *Introduction to Spatial Econometrics*. Boca Raton London New York: CRC Press. <https://doi.org/10.1201/9781420064254>
- LeSage, J., & Pace, R. K. (2010). *Introduction to spatial econometrics* (1st ed.). Boca Raton, FL: CRC Press. URL: <https://journals.openedition.org/rei/3887>. DOI: 10.4000/rei.3887.
- Li, G., & Fang, C. (2018). Spatial Econometric Analysis of Urban and County-level Economic Growth Convergence in China. *International Regional Science Review*, 41(4), 410–447. <https://doi.org/10.1177/0160017616653446>.
- Lin, M., & Kwan, Y. K. (2016). FDI technology spillovers, geography, and spatial diffusion. *International Review of Economics & Finance*, 43, 257-274. <https://doi.org/10.1016/j.iref.2016.02.014>
- Lipsey, R.E., 1999. *The location and characteristics of US affiliates in Asia*. NBER Working Paper No. 6876. DOI 10.3386/w6876

- Liu, X., Lu, J., & Chizema, A. (2014). Top executive compensation, regional institutions and Chinese OFDI. *Journal of World Business*, 49(1), 143–155. <https://doi.org/10.1016/j.jwb.2013.04.004>
- Liu, D., Zheng, X., & Yu, Y. (2022). Public debt competition in local China: Evidence and mechanism of spatial interactions. *Regional Science Policy & Practice*, 14, 91-105. <https://doi.org/10.1111/rsp3.12509>
- Liu, Z., Jiang, F., Zhu, Y., Li, F., & Jin, G. (2018). Spatial heterogeneity of leaf area index in a temperate old-growth forest: Spatial autocorrelation dominates over biotic and abiotic factors. *Science of the Total Environment*, 634, 287-295.
- López-Bazo, E., Vayá, E., Mora, A. J., & Suriñach, J. (1999). Regional economic dynamics and convergence in the European Union. *Annals of Regional Science*, 33(3), 343–370. Scopus. <https://doi.org/10.1007/s001680050109>
- López-Bazo, E., E. Vayá, and M. Artis (2004). Regional externalities and growth: Evidence from European regions. *Journal of Regional Science* 44 (1), 43–73. <https://doi.org/10.1111/j.1085-9489.2004.00327.x>
- Lopes, C., Hamdok, A., & Elhiraika, A. (Eds.). (2017). *Macroeconomic policy framework for Africa's structural transformation*. Springer.
- Lucas Jr, R. E. (1988). On the mechanics of economic development. *Journal of monetary economics*, 22(1), 3-42.
- Lucas, R.E. (2000), “Some macroeconomics for the 21st century”, *Journal of Economic Perspectives*, Vol. 14 No. 1, pp. 159-168.
- Lundberg, J. (2006). Using spatial econometrics to analyze local growth in Sweden. *Regional Studies*, 40(3), 303–316. <https://doi.org/10.1080/00343400600631566>
- Lütkepohl, H. – Kratzig, M. (2004): *Applied Time Series Econometrics*. Cambridge University Press, Cambridge. <https://doi.org/10.1017/CBO9780511606885>.
- Luu, H. N., Luu, N. H., & Phung, H. T. T.(2024) Would external debts promote sustainable development in emerging and low-income countries? *Journal of International Development*. <https://doi.org/10.1002/jid.3840>.
- Ma, J., & Jia, H. (2015). The Role of Foreign Direct Investment on Income Convergence in China after Early 1990s from a Spatial Econometric Perspective. *Review of Development Economics*, 19(4), 829-842. <https://doi.org/10.1111/rode.12187>.
- Machmud, S., & Sidharta, I. (2023). The relationship between regional development, human development, and poverty: A perspective from the Indonesian province. *Nurture*, 17(3), 157-165. <https://doi.org/10.55951/nurture.v17i3.283>.
- Madariaga, N., & Poncet, S. (2007). FDI in Chinese cities: Spillovers and impact on growth. *The World Economy*, 30, 837–862. <https://doi.org/10.1111/j.1467-9701.2007.01025.x>
- Makun, K. (2021). External debt and economic growth in Pacific Island countries: A linear and nonlinear analysis of Fiji Islands. *The Journal of Economic Asymmetries*, 23, e00197. <https://doi.org/10.1016/j.jeca.2021.e00197>
- Malecki, E. J. (2002). Creating and sustaining competitiveness: local knowledge and economic geography. In *Knowledge, space, economy* (pp. 103-119). Routledge.

- Mankiw G., Romer D., and Well D. (1992), “A contribution to the empirics of economic growth”, *The Quarterly Journal of Economics*, 107(2), 407-437. <https://doi.org/10.2307/2118477>
- Markusen, J.R., 1984. Multinationals, multi-plant economies, and the gains from trade. *Journal of International Economics* 16 (3-4), 205-226. [https://doi.org/10.1016/S0022-1996\(84\)80001-X](https://doi.org/10.1016/S0022-1996(84)80001-X).
- Markusen, J. R., & Venables, A. J. (2000). The theory of endowment, intra-industry and multi-national trade. *Journal of International Economics*, 52(2), 209-234. [https://doi.org/10.1016/S0022-1996\(99\)00055-0](https://doi.org/10.1016/S0022-1996(99)00055-0).
- McCoy, Daniel(1997) “*How useful is Structural VAR Analysis for Irish economies?*” Paper presented at an internal seminar of the Central Bank of Ireland, February 6th, 1997, and at the Eleventh Annual Conference of the Irish Economic Association in Athlone, April 4 – 6.
- Maiga, F. K.(2017) Impact of Interest Rate on Economic Growth in Nigeria, “*Journal of Business and Finance Management Research*, Vol 3, p. 2. <http://www.pyrexjournals.org/pjbfmr>
- Malamud, B., & Assane, D. (2013). Slow growth and slow convergence in sub-Saharan Africa. *Applied Economics Letters*, 20(4), 377-381. <https://doi.org/10.1080/13504851.2012.707767>
- Malikane, C., & Chitambara, P. (2017). Foreign direct investment, democracy, and economic growth in southern Africa. *African Development Review*, 29(1), 92e102. <https://doi.org/10.1111/1467-8268.12242>
- Malthus T.R. (1886). *Principles of Political Economy*, second edition, Cambridge: Cambridge University Press, London.
- Mamingi, N., & Martin, K. (2018). Foreign direct investment and growth in developing countries: Evidence from the countries of the Organization of Eastern Caribbean States. *CEPAL Review*, 124, 79-98. <https://doi.org/10.18356/e270b670-en>
- Mankiw G., Romer D., and Well D. (1992), “A contribution to the empirics of economic growth”, *The Quarterly Journal of Economics*, 107(2), 407-437. <https://doi.org/10.2307/2118477>
- Mankiw, N. G. (2000). The savers–spenders theory of fiscal policy. *American economic review*, 90(2), 120-125.
- Mattes, J. (2012). Dimensions of proximity and knowledge bases: Innovation between spatial and non-spatial factors. *Regional Studies* 46 (8), 1085-1099. <https://doi.org/10.1080/00343404.2011.552493>
- Martin, R. and Sunley, P. (1998) “Slow Convergence? Post neo-classical endogenous growth theory and regional development”, *Economic Geography* 74(3): 201 – 227.
- Marshall, A. (1920). *Industrial organization, continued. The concentration of specialized industries in particular localities*. In *Principles of economics* (pp. 222-231). London: Palgrave Macmillan UK.
- Mara, E. R., & Maran, R. (2024). Are fiscal rules efficient on public debt restraint in the presence of shadow economy? *Finance Research Letters*, 64, 105495. <https://doi.org/10.1016/j.frl.2024.105495>.

- Martínez-Carrión, J. M., & María-Dolores, R. (2017). Regional inequality and convergence in Southern Europe. Evidence from height in Italy and Spain, 1850-2000. *Revista de Economía Aplicada*, 25(74), 75–103.
- Maasoumi, E., & Wang, L. (2008). Economic reform, growth, and convergence in China. *Econometrics Journal*, 11, 128–154. <https://doi.org/10.1111/j.1368-423X.2008.00233.x>
- Meardon, S. J. (2000). Eclecticism, inconsistency, and innovation in the history of geographical economics. *History of Political Economy*, 32(Suppl_1), 325–360. https://doi.org/10.1215/00182702-32-Suppl_1-325
- Meliciani, V., Savona, M., 2015. The determinants of regional specialization in business services: Agglomeration economies, vertical linkages and innovation. *J. Econ. Geogr.* 15 (2), 387–416. <https://doi.org/10.1093/jeg/lbt038>
- Melina, G., Yang, S.-C. S., & Zanna, L.-F. (2016). Debt sustainability, public investment, and natural resources in developing countries: The DIGNAR model. *Economic Modelling*, 52, 630–649. <https://doi.org/10.1016/j.econmod.2015.10.007>
- Mencinger, J., Aristovnik, A., & Verbic, M. (2015). Revisiting the Role of Public Debt in Economic Growth: The Case of OECD Countries. *Inzinerine Ekonomika-Engineering Economics*, 26(1), 61–66. <https://doi.org/10.5755/j01.ee.26.1.4551>
- Meniago, C., & Lartey, E. K. (2021). Does FDI Affect Productivity and Growth in Sub-Saharan Africa? *Journal of African Business*, 22(2), 274–292. <https://doi.org/10.1080/15228916.2020.1745011>
- Mendez, C., & Santos-Marquez, F. (2021). Regional convergence and spatial dependence across subnational regions of ASEAN: Evidence from satellite nighttime light data. *Regional Science Policy & Practice*, 13(6), 1750–1777. <https://doi.org/10.1111/rsp3.12335>
- Mendieta Muñoz, R., & Pontarollo, N. (2016). Cantonal convergence in Ecuador: A spatial econometric perspective. *Journal of Applied Economic Science*, 1, 107–126.
- Mitze, T., & Özyurt, S. (2014). The spatial dimension of trade and FDI driven productivity growth in Chinese provinces: A global cointegration approach. *Growth and Change*, 45, 263–291. <https://doi.org/10.1111/grow.12042>
- Mirdala, R., & Kamenik, M. (2017). Effects of fiscal policy shocks in CE3 countries (TVAR approach). *EpM Ekonomie a Management*, 2, 46–64. doi:10.15240/tul/001/2017-2-004.
- Mbaku, J. M. (2010). *Corruption in Africa: Causes, consequences, and cleanups*. Lexington Books.
- Modigliani, F. (1961). Long-run implications of alternative fiscal policies and the burden of the national debt. *Economic Journal*, 71(4), 730–755. <https://doi.org/10.2307/2228247>
- Moh'd AL-Tamimi, K.A., Jaradat, M.S., (2019) Impact of external debt on economic growth in Jordan for the period (2010–2017). *Int. J. Econ. Finance*. DOI:10.5539/IJEF.V11N4P114
- Mohsin, M., Ullah, H., Iqbal, N., Iqbal, W., & Taghizadeh-Hesary, F. (2021). How external debt led to economic growth in South Asia: A policy perspective

- analysis from quantile regression. *Economic Analysis and Policy*, 72, 423–437. <https://doi.org/10.1016/j.eap.2021.09.012>.
- Mohanty, S., & Sethi, N. (2019). Outward FDI, human capital and economic growth in BRICS countries: An empirical insight. *Transnational Corporations Review*, 11(3), 235–249. <https://doi.org/10.1080/19186444.2019.1657347>
- Mohanty, R. K., & Panda, S. (2020). How does public debt affect the Indian macroeconomy? A structural VAR Approach. *Margin: The Journal of Applied Economic Research*, 14(3), 253–284. <https://doi.org/10.1177/0973801020920092>
- Monastiriotis, V., & Jordaan, J. A. (2010). Does FDI promote regional development? Evidence from local and regional productivity spillovers in Greece. *Eastern Journal of European Studies*, 1, 139–164.
- Montero, A. (2008). Macroeconomic deeds, not reform words: The determinants of Foreign Direct Investment in Latin America. *Latin American Research Review*, 43(1), 55–83. <https://doi.org/10.1353/lar.2008.0008>
- Morlin, G. S. (2022). Growth led by government expenditure and exports: Public and external debt stability in a supermultiplier model. *Structural Change and Economic Dynamics*, 62, 586–598. <https://doi.org/10.1016/j.strueco.2022.03.009>
- Mountford, A., Uhlig, H., 2009. What are the effects of fiscal policy shocks? *J. Appl. Econometrics* 24 (6), 960–992. <https://doi.org/10.1002/jae.1079>
- Mukand SW, Rodrik D (2005) In search of the holy grail, policy convergence, experimentation, and economic performance. *American Economic Review* 95: 374–383. DOI: 10.1257/0002828053828707.
- Munir, K., & Mehmood, N. R. (2018). Exploring the channels and impact of debt on economic growth: Evidence from South Asia. *South Asia Economic Journal*, 19(2), 171–191. <https://doi.org/10.1177/1391561418794692>
- Mumuni, S., & Abille, A. B. (2023). Do trade liberalization and external debt offset income inequality? New evidence from selected African countries. *Cogent Economics & Finance*, 11(2), 2241228. <https://doi.org/10.1080/23322039.2023.2241228>
- Musibau, H. O., Yusuf, A. H., & Gold, K. L. (2019). Endogenous specification of foreign capital inflows, human capital development and economic growth: A study of pool mean group. *International Journal of Social Economics*, 46(3), 454–472. <https://doi.org/10.1108/IJSE-04-2018-0168>.
- Muštra, V., Šimundić, B., Kuliš, Z., 2020. Does innovation matter for regional labour resilience? The case of EU regions. *Reg. Sci. Policy Pract.* 12 (5), 955–970. <https://doi.org/10.1111/rsp3.12348>
- Mutai, N. C., Cuong, N. M., Dervishaj, V., Kiarie, J. W., Misango, P., Ibeh, L., ... & Lallmahamood, M. (2024). Examining the sustainability of African debt owed to China in the context of debt-trap diplomacy. *Scientific African*, 24, e02164. <https://doi.org/10.1016/j.sciaf.2024.e02164>
- Myrdal, G. (1957). *Economic theory and underdeveloped regions*. Gerald Duckworth and Co. Ltd. <https://doi.org/10.1080/00343404.2017.1278973>
- Myrdal, G. (1965). *The political element in the development of economic theory*. Harvard University Press. <https://doi.org/10.4159/harvard.9780674863361>

- Nagou, M., Bayale, N., & Kouassi, B. K. (2021). On the robust drivers of public debt in Africa: Fresh evidence from Bayesian model averaging approach. *Cogent Economics & Finance*, 9(1), 1860282. <https://doi.org/10.1080/23322039.2020.1860282>
- Naudé, W. A., & Krugell, W. F. (2007). Investigating geography and institutions as determinants of foreign direct investment in Africa using panel data. *Applied Economics*, 39, 1223–1233. <https://doi.org/10.1080/00036840600567686>
- Narula, R., & Pineli, A. (2019). Improving the development impact of multinational enterprises: Policy and research challenges. *Economia E Politica Industriale/Journal of Industrial and Business Economics*, 46(1), 1–24. <https://doi.org/10.1007/s40812-018-0104-2>
- Neaime, S., Gayssset, I., & Badra, N. (2018a). The eurozone debt crisis: A structural VAR approach. *Research in International Business and Finance*, 43, 22–33. <https://doi.org/10.1016/j.ribaf.2017.08.002>
- Ndulu, B.J., and S.A. O’Connell (2021). ‘Africa’s Development Debts’. *Journal of African Economies*, 30: Issue Supplement_1: i33–i73. <https://doi.org/10.1093/jae/ejab021>
- Nguyen, B. (2022). The crowding-out effect of public debt on private investment in developing economies and the role of institutional quality. *Seoul Journal of Economics*, 35(4).
- Nijkamp, P., & Poot, J. (1998). Spatial perspectives on new theories of economic growth. *The annals of regional science*, 32, 7-37. <https://doi.org/10.1007/s001680050061>
- Nzié, J. R. M., & Pepeah, A. T. (2022). Are natural resources an impetus for economic growth in Africa? *Natural Resources Forum*, 46(1), 136–153. <https://doi.org/10.1111/1477-8947.12247>
- Obwona, M. B. (2001). Determinants of FDI and their impact on economic growth in Uganda. *African Development Review*, 13, 46–81. <http://dx.doi.org/10.1111/1467-8268.00030>.
- Odero, K. (2001). *Review of Zimbabwe's experience with regional development planning*. Working Paper. <https://doi.org/10.13140/RG.2.1.1144.1042>.
- Odhiambo, N. M. (2022). Does foreign direct investment spur economic growth? New empirical evidence from Sub-Saharan African countries. *Economic Annals*, 67(233), 61-83. <https://doi.org/10.2298/EKA2233061O>
- Olaoye, O. O., & Olomola, P. A. (2022). Empirical analysis of asymmetry phenomenon in the public debt structure of Sub-Saharan Africa's five biggest economies: A Markov-Switching model. *The Journal of Economic Asymmetries*, 25, e00242. <https://doi.org/10.1016/j.jeca.2022.e00242>
- Olofin, O. P., Aiyegbusi, O. O., & Adebayo, A. A. (2019). Analysis of Foreign direct investment and economic growth in Nigeria: Application of spatial econometrics and Fully Modified Ordinary Least Square (FMOLS). *Foreign Trade Review*, 54(3), 159–176. <https://doi.org/10.1177/0015732519851631>
- Ogun, O. (2014). Modeling Africa’s economic growth. *Journal of Economics and Economic Education Research*, 15(2), 143-163. <https://www.jstor.org/stable/26622881>

- Okombi, I. F., & Mampieme, V. B. (2024). Cyclicalities of public debt in developing countries: Does dependence on natural resources matter? *Resources Policy*, 96, 105231. <https://doi.org/10.1016/j.resourpol.2024.105231>
- Onafowora, O., & Owoye, O. (2019). Impact of external debt shocks on economic growth in Nigeria: A SVAR analysis. *Economic Change and Restructuring*, 52(2), 157–179. <https://doi.org/10.1007/s10644-017-9222-5>
- Oshchepkov, A., Lehmann, H., & Silvagni, M. G. (2023). Regional convergence in Russia: Estimating an augmented Solow model. *Economic Systems*, 47(4), 101128. <https://doi.org/10.1016/j.ecosys.2023.101128>
- Owyang, M.T., Ramey, V.A., Zubairy, S., 2013. Are government spending multipliers greater during periods of slack? Evidence from twentieth-century historical data. *Amer. Econ. Rev.* 103 (3), 129–134. DOI: 10.1257/aer.103.3.129
- Ozgen, Ceren, Nijkamp, Peter, Poot, Jacques, 2010. The effect of migration on income growth and convergence: meta-analytic evidence. *Pap. Reg. Sci.* 89 (3), 537–561. <https://doi.org/10.1111/j.1435-5957.2010.00313.x>
- Ozturk, I. (2007). Foreign direct investment-growth nexus: a review of the recent literature. *International Journal of Applied Econometrics and Quantitative Studies*, 4(2). <https://ssrn.com/abstract=1127314>
- Pace, R.K., LeSage, J.P., 2008. *Biases of OLS and spatial lag models in the presence of an omitted variable and spatially dependent variables*. Paper available at <http://ssrn.com/abstract=1133438>.
- Pagan, A. R. and M.H. Pesaran (2008). Econometric analysis of structural systems with permanent and transitory shocks and exogenous variables. *Journal of Economic Dynamics and Control* 32, 3376–3395. <https://doi.org/10.1016/j.jedc.2008.01.006>
- Panizza, U. and Presbitero, A.F. (2014). Public debt and economic growth: Is there a causal effect? *Journal of Macroeconomics*, 41: 21–41. <https://doi.org/10.1016/j.jmacro.2014.03.009>
- Pasara, M. T., & Garidzirai, R. (2020). Causality effects among gross capital formation, unemployment, and economic growth in South Africa. *Economies*, 8(2). <https://doi.org/10.3390/ECONOMIES8020026>
- Patenio, J.A.S., Agustina, T. (2007), *Economic growth and external debt servicing of the Philippines: 1981-2005*: 10th National Convention on Statistics (NCS), October 1-2.
- Paul, A., Popovici, O. C., & Călin, A. C. (2014). The attractiveness of central and eastern European countries for FDI. A Public Policy Approach Using the TOPSIS Method, *Transylvanian Review of Administrative Sciences*, 42(10), 156–180.
- Pekkanen, R. (2004). After the developmental state: Civil society in Japan. *Journal of East Asian Studies*, 4(2004): 363–388. <https://doi.org/10.1017/S1598240800006019>
- Perotti, R. (2002) *Estimating the Effects of Fiscal Policy in OECD Countries*, ECB Working Paper, no. 168/2002 Frankfurt am Main, European Central Bank, 63 p. <https://ssrn.com/abstract=717561>.
- Perotti, R. (2005). *Estimating the effects of fiscal policy in OECD countries*. CEPR Discussion Paper No. 4842. <https://ssrn.com/abstract=717561>

- Perroux, F. (1955). Note sur la nation de pôle de croissance. *Economie Appliquée*, 7(1/2), 307–320. <http://www.jstor.org/stable/23587872>
- Perroux, F. (1964). *L'Économie du XXe siècle*. Presses universitaires de France.
- Perović, L.M. (2018). Public debts, deficits and interest rates in CEECs: Are there spatial spillovers? *Post-communist Economies*, 30, 675–692. <https://doi.org/10.1080/14631377.2018.1443244>
- Petrakos, G., Kallioras, D., & Anagnostou, A. (2011). Regional convergence and growth in Europe: understanding patterns and determinants. *European Urban and Regional Studies*, 18(4), 375–391. <https://doi.org/10.1177/0969776411407809>
- Pike, A., Rodríguez-Pose, A., & Tomaney, J. (2006). *Local and regional development* (1st ed.). London: Routledge. <https://doi.org/10.4324/9781315767673>
- Pike, Andy (2007) “What Kind of Local and Regional Development and for Whom?” *Regional Studies*, 41(9), 1253–1269. <https://doi.org/10.1080/00343400701543355>
- Pike, A., Rodríguez-Pose, A., & Tomaney, J. (2016). Local and regional development. Routledge. <https://doi.org/10.4324/9781315767673>
- Pike, A., Lee, N., MacKinnon, D., Kempton, L., & Iddawela, Y. (2017). Job creation for inclusive growth in cities. York: Joseph Rowntree Foundation.
- Pineli, A., & Narula, R. (2023). Industrial policy matters: The co-evolution of economic structure, trade, and FDI in Brazil and Mexico, Industrial policy matters: The co-evolution of economic structure, trade, and FDI in Brazil and Mexico. *Journal of Industrial and Business Economics*, 50, 399–444. <https://doi.org/10.1007/s40812-023-00262-4>
- Pittau, M., Zelli, R., 2006. Empirical evidence of income dynamics across EU regions. *Journal of Applied Econometrics* 21 (5), 605–628. <https://doi.org/10.1002/jae.855>
- Piribauer, P., Crespo Cuaresma, J., 2016. Bayesian variable selection in spatial autoregressive models. *Spatial Econ. Anal.* 11 (4), 457–479. <https://doi.org/10.1080/17421772.2016.1227468>
- Pfeiffer, P., Roeger, W., & Vogel, L. (2021). Optimal fiscal policy with low interest rates for government debt. *Journal of Economic Dynamics and Control*, 132, 104210. <https://doi.org/10.1016/j.jedc.2021.104210>
- Pradhan, Jaya Prakash (2005) *Outward Foreign Direct Investment from India: Recent Trends and Patterns*, Gujarat Institute of Development Research, Working Paper No. 153, February. <https://doi.org/10.1080/19186444.2018.1436659>
- Puga, D. (1999). The rise and fall of regional inequalities. *European Economic Review*, 43(2), 303–334. [https://doi.org/10.1016/S0014-2921\(98\)00061-0](https://doi.org/10.1016/S0014-2921(98)00061-0)
- Piętak, Ł. (2022). Regional disparities, transmission channels and country's economic growth. *Journal of Regional Science*, 62(1), 270–306. <https://doi.org/10.1111/jors.12564>
- Pham, T.H.H., 2017. Impacts of globalization on the informal sector: empirical evidence from developing countries. *Econ. Modell.* 62, 207–218. <https://doi.org/10.1016/j.econmod.2017.01.001>
- Ploeg, F. (2011). Natural resources: Curse or blessing? *Journal of Economic Literature*, 49, 366–420. DOI: 10.1257/jel.49.2.366

- Putnam, R. (1993), *Making Democracy Work: Civic Traditions in Modern Italy*, Princeton University Press, Princeton, NJ. <http://digital.casalini.it/9781400820740>
- Putnam, R. (1996) *Bowling Alone: The Collapse and Revival of American Community*, Simon and Schuster, New York.
- Presbitero, A. F. (2012). Total Public Debt and Growth in Developing Countries. *European Journal of Development Research*, 24(4), 606–626. <https://doi.org/10.1057/ejdr.2011.62>
- Qayyum, U., Din, M. U., & Haider, A. (2014). Foreign aid, external debt and governance. *Economic Modelling*, 37, 41–52. <https://doi.org/10.1016/j.econmod.2013.08.045>
- Qian, X., & Steiner, A. (2017). International reserves and the maturity of external debt. *Journal of International Money and Finance*, 73, 399–418. <https://doi.org/10.1016/j.jimonfin.2017.02.015>
- Quah, D. T. (1997). Empirics for growth and distribution: stratification, polarization, and convergence clubs. *Journal of economic growth*, 2, 27–59. <https://doi.org/10.1023/A:1009781613339>
- Quah, D. (1996). Empirics for economic growth and convergence. *European Economic Review*, 40(6), 1353–1375. [https://doi.org/10.1016/0014-2921\(95\)00051-8](https://doi.org/10.1016/0014-2921(95)00051-8)
- Quatraro, F. and S. Usai (2017). Are knowledge flows all alike? Evidence from European regions. *Regional Studies* 51 (8), 1246–1258. <https://doi.org/10.1080/00343404.2016.1240867>.
- Qureshi, I., & Liaqat, Z. (2020). The long-term consequences of external debt: Revisiting the evidence and inspecting the mechanism using panel VARs. *Journal of Macroeconomics*, 63, 103184. <https://doi.org/10.1016/j.jmacro.2019.103184>
- Rajkumar AS, Swaroop V (2008) Public spending and outcomes: Does governance matter? *Journal of Development Economics* 86: 96–111. <https://doi.org/10.1016/j.jdeveco.2007.08.003>
- Ramzan, M., & Ahmad, E. (2014). External debt growth nexus: Role of macroeconomic policies. *Economic Modelling*, 38, 204 – 210. <https://doi.org/10.1016/j.econmod.2013.12.014>
- Ramzan, M., HongXing, Y., Abbas, Q., Fatima, S., & Hussain, R. Y. (2023). Role of institutional quality in debt-growth relationship in Pakistan: An econometric inquiry. *Heliyon*, 9(8).
- Ramajo, J., Hewings, G.J., 2018. Modelling regional productivity performance across Western Europe. *Reg. Stud.* 52 (10), 1372–1387. <https://doi.org/10.1080/00343404.2017.1390219>
- Ramey, V. A., & Shapiro, M. D. (1998). Costly capital reallocation and the effects of government spending. In *Carnegie-Rochester conference series on public policy* (Vol. 48, pp. 145–194). North-Holland. [https://doi.org/10.1016/S0167-2231\(98\)00020-7](https://doi.org/10.1016/S0167-2231(98)00020-7)
- Ramey, V.A.(2011a). Can government purchases stimulate the economy? *Journal of Economic Literature* 49 (3), 673–685. DOI: 10.1257/jel.49.3.673

- Ramey, V.A. (2011b). Identifying government spending shocks: It's all in the timing. *Quarterly Journal of Economics*. 126 (1), 1–50. <https://doi.org/10.1093/qje/qjq008>.
- Ramey, V. (2016) In: Taylor, J.B., Uhlig, H. (Eds.), *Macroeconomic shocks and their propagation*. In: Handbook of Macroeconomics, vol. 2, pp. 71–162. <https://doi.org/10.1016/bs.hesmac.2016.03.003>
- Ramey, V.A., Zubairy, S. (2018) Government spending multipliers in good times and in bad: Evidence from US historical data. *J. Polit. Econ.* 126 (2), 850–901. <https://doi.org/10.1086/696277>
- Ramirez M. (2000), “Foreign direct investment in Mexico: A cointegration analysis”, *The Journal of Development Studies*, 37(1), 138–162. <https://doi.org/10.1080/713600062>
- Ramos-Herrera, M. D. C., & Sosvilla-Rivero, S. (2017). An empirical characterization of the effects of public debt on economic growth. *Applied Economics*, 49(35), 3495–3508.
- Ray, S., and B. Montouri (1999), “U.S. Regional Convergence: A Spatial Econometric Perspective,” *Regional Studies*, 33, 143–156. <https://doi.org/10.1080/00343409950122945>
- Rathnayake, A. S. K. (2020). Sustainability of the fiscal imbalance and public debt under fiscal policy asymmetries in Sri Lanka. *Journal of Asian Economics*, 66, 101161. <https://doi.org/10.1016/j.asieco.2019.101161>
- Regelink, M., & Paul Elhorst, J. (2015). The spatial econometrics of FDI and third country effects. *Letters in Spatial and Resource Sciences*, 8, 1–13.
- Reinhart, C. M., & Rogoff, K. S. (2009). The aftermath of financial crises. *American Economic Review*, 99(2), 466–472.
- Reinhart, C. M., & Rogoff, K. S. (2011). From financial crash to debt crisis. *American economic review*, 101(5), 1676–1706.
- Rehak, S. (2020). Regional Dimensions of Human Capital and Economic Growth: A Review of Empirical Research. *Scientific Papers of the University of Pardubice*. Series D. Faculty of Economics and Administration, 28(4).
- Resende, G., de Carvalho, A., Sakowski, P., & Cravo, T. (2016). Evaluating multiple spatial dimensions of economic growth in Brazil using spatial panel data models. *The Annals of Regional Science*, 56(1), 1–31. <https://doi.org/10.1007/s00168-015-0706-9>
- Richardson, H. W. (1978). *Regional and urban economics*. Penguin Books.
- Ripley, B. D. (2005). *Spatial statistics*. John Wiley & Sons.
- Rivera-Batiz, L.A. and P.M. Romer (1991) Economic Integration and Endogenous Growth. *Quarterly Journal of Economics* 106, 531 – 555. <https://doi.org/10.2307/2937946>
- Rivas Valdivia, J. C. (2021). Sostenibilidad de la deuda pública en México, antes y después del COVID-19, 018–2024. *Estudios Economicos* (México, DF), 36(1), 57–87.
- Rodríguez-Pose, A. (2001). Is R&D investment in lagging areas of Europe worthwhile? Theory and empirical evidence. *Papers in regional science*, 80(3), 275–295. <https://doi.org/10.1007/PL00013631>

- Rodríguez-Pose, A., & Cols, G. (2017). The determinants of foreign direct investment in sub-Saharan Africa: What role for governance? *Regional Science Policy & Practice*, 9(2), 63–81. <https://doi.org/10.1111/rsp3.12093>
- Rodríguez-Pose A (2013) Do institutions matter for regional development? *Regional Studies* 47: 1034–1047. <https://doi.org/10.1080/00343404.2012.748978>
- Rodríguez-Pose, Andrés and Michael Storper. (2006) “Better Rules or Stronger Communities? On the Social Foundations of Institutional Change and Its Economic Effects,” *Economic Geography*, 82(1), 1–25. <https://doi.org/10.1111/j.1944-8287.2006.tb00286.x>
- Rodríguez-Pose A, Fratesi U (2002) Unbalanced development strategies and the lack of regional convergence in the EU. *Research Papers in Environmental and Spatial Analysis* 76, London School of Economics, London
- Rodrik, Dani. (2005) “Growth Strategies,” in Philippe Aghion and Steven Durlauf (eds.), *Handbook of Economic Growth*. North Holland: Elsevier Academic Press, Vol. 1A, pp. 967–1014. [https://doi.org/10.1016/S1574-0684\(05\)01014-2](https://doi.org/10.1016/S1574-0684(05)01014-2)
- Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: The primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131–165. <https://doi.org/10.1023/B:JOEG.0000031425.72248.85>.
- Romer, D. (2018). *Macroeconomic theory*. University of California, Berkeley.
- Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002–1037. <https://doi.org/10.1086/261420>
- Romer, P. M. (1990). Endogenous technological change. *Journal of political Economy*, 98(5, Part 2), S71–S102.
- Rostow, W.W. (1959), “The Stages of Economic Growth” *Economic History Review*, 12.1, 1–17. <https://www.jstor.org/stable/2591077>
- Royuela, V., & García, G. A. (2015). Economic and social convergence in Colombia. *Regional Studies*, 49(2), 219–239. <https://doi.org/10.1080/00343404.2012.762086>
- Sabir, S., Rafique, A., & Abbas, K. (2019). Institutions and FDI: Evidence from developed and developing countries. *Financial Innovation*, 5(1), 1–20. <https://doi.org/10.1186/s40854-019-0123-7>.
- Sachs, J.D. (1989). *The debt overhang of developing countries, in Debt, stabilization and development*, ed. by Calvo, G.A., Findlay, R., Kouri, P., and De Macedo, J.B. Basil Blackwell, Oxford.
- Sáez, L. (2016). The political budget cycle and subnational debt expenditures in federations: panel data evidence from India. *Governance*, 29(1), 47–65. <https://doi.org/10.1111/gove.12130>
- Sahar Amidi & Ali Fagheh Majidi (2020) Geographic proximity, trade, and economic growth: a spatial econometrics approach, *Annals of GIS*, 26:1, 49–63, DOI:10.1080/19475683.2020.1714727
- Saint-Paul, G. (1992). Fiscal policy in an endogenous growth model. *Quarterly Journal of Economics*, 1243–1259. <https://doi.org/10.2307/2118387>
- Sala-i-Martin, X. (1996b). Regional cohesion: Evidence and theories of regional growth and convergence. *European Economic Review*, 40, 1325–1352. [https://doi.org/10.1016/0014-2921\(95\)00029-1](https://doi.org/10.1016/0014-2921(95)00029-1)

- Sala-i-Martin X (1996a) The classical approach to convergence analysis. *Econ J* 106:1019–1036. <https://doi.org/10.2307/2235375>
- Sapir, A., Aghion, P., Bertola, G., Hellwig, M., Pisani-Ferry, J., Rosati, D., Vinals, J., and Wallace, H., (2004), *An Agenda for a Growing Europe: The Sapir Report*, Oxford University Press, Oxford.
- Saat, M. (2020). Public debt management reforms in turkey. *Accounting, Finance, Sustainability, Governance and Fraud*, 21–39. https://doi.org/10.1007/978-981-15-4226-8_2
- Say, J. B. (1880). *A treatise on political economy on the production, distribution and consumption of wealth*. (C. R. Prnsep, Ed). Philadelphia: Claxton, Remsen and Haffelfinger.
- Seldadyo H, Pandu Nugroho E, De Haan J (2007) *Governance and growth revisited*. *Kyklos* 60: 279–290. <https://doi.org/10.1111/j.1467-6435.2007.00372.x>.
- Sen, Amartya. (2009) *The Idea of Justice*. London: Allen Lane. <https://doi.org/10.1080/14649880802236540>
- Serven, L. (1997). Theory, Evidence, and Lessons for Africa.
- Schwarz, G. (1978) Estimating the dimension of a model. *The Annals of Statistics*, 6(2):461–464. <https://www.jstor.org/stable/2958889>
- Siddique, A., Selvanathan, E. A., Selvanathan, S. (2016): The impact of external debt on growth: Evidence from highly indebted poor countries *Journal of Policy Modeling* 38 (5): 874–894. <https://doi.org/10.1016/j.jpolmod.2016.03.011>
- Silva, J. (2020). Impact of public and private sector external debt on economic growth: The case of Portugal. *Eurasian Economic Review*, 10(4), 607–634. <https://doi.org/10.1007/s40822-020-00153-2>
- Sims, C. A. (1980) Macroeconomics and reality. *Econometrica* 49. 1-48. <https://doi.org/10.2307/1912017>
- Sims, C. A. (1986). Are forecasting models usable for policy analysis? *Quarterly Review*, 10(Win), 2-16.
- Simionescu, M., & Naroş, M. S. (2019). The role of foreign direct investment in human capital formation for a competitive labour market. *Management Research and Practice*, 11(1), 5-14.
- Simionescu, M., & Cifuentes-Faura, J. (2023). Analyzing public debt in the Mexican states: Spatial convergence, regional drivers, and policy recommendations. *Papers in Regional Science*, 102(4), 737–760. <https://doi.org/10.1111/pirs.12748>
- Shahbaz, M., Balsalobre-Lorente, D., & Sinha, A. (2019). Foreign direct Investment–CO 2 emissions nexus in Middle East and North African countries: Importance of biomass energy consumption. *Journal of Cleaner Production*, 217, 603–614. <https://doi.org/10.1016/j.jclepro.2019.01.282>
- Sheng, Y., and J. LeSage (2021). A spatial regression methodology for exploring the role of regional connectivity in knowledge production: Evidence from Chinese regions. *Papers in Regional Science* 100 (4), 847–874. <https://doi.org/10.1111/pirs.12601>
- Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Stahan, W., and Cadell, T (eds): London. DOI:10.1002/9780470755679
- Solow, R. M. (1988). Growth theory and after. *The American Economic Review*, 78(3), 307-317. <https://www.jstor.org/stable/1809135>

- Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70, 65–94. <https://doi.org/10.2307/1884513>
- Sly, N. and Weber, C. (2013) *International Fiscal Policy Coordination and GDP comovement*. CESifo Working Paper, No. 4358, Center for Economic Studies and Ifo Institute (CESifo), Munich
- Soukiazis, E., Cerqueira, P. A., & Antunes, M. (2014). Explaining Italy's economic growth: A balance-of-payments approach with internal and external imbalances and non-natural relative prices. *Economic Modelling*, 40, 334–34. <https://doi.org/10.1016/j.econmod.2014.04.014>.
- Spence, Michael. (2011) "The Impact of Globalization on Income and Employment: The Downside of Integrating Markets," *Foreign Affairs*, 90, 28–41.
- Spencer, J. W. (2008). The impact of multinational enterprise strategy on indigenous enterprises: Horizontal spillovers and crowding out in developing countries. *Academy of Management Review*, 33(2), 341–361. <https://doi.org/10.5465/amr.2008.31193230>
- Starr H (1991) Democratic dominoes: Diffusion approaches to the spread of democracy in the international system. *Journal of Conflict Resolution* 35: 356–381.
- Stetzer, F., 1982. Specifying weights in spatial forecasting models: the results of some experiments. *Environment and Planning A* 14, 571–584. <https://doi.org/10.1068/a140571>
- Stiglitz, J. E., & Rosengard, J. K. (2015). *Economics of the public sector: Fourth international student edition*. WW Norton & Company.
- Streeck-Wolfgang. (1991) "On the Institutional Conditions of Diversified Quality Production," in Egon Matzner and Wolfgang Streeck (eds.), *Beyond Keynesianism: Socioeconomics of Production and Full Employment*. Aldershot: Edward Elgar, pp. 21–61.
- Stock, James H., and Mark W. Watson. (1996) "Evidence on Structural Instability in Macroeconomic Time Series Relations." *Journal of Business and Economic Statistics*. January 14:1, pp. 11–30.
- Storper, M. and Venables, A.J. (2004) Buzz: face-to-face contact and the urban economy. *Journal of Economic Geography*, 4: 351–370. <https://doi.org/10.1093/jnlecg/lbh027>
- Sultana, T., Dey, S. R., & Tareque, M. (2022). Exploring the linkage between human capital and economic growth: A look at 141 developing and developed countries. *Economic Systems*, 46(3), 101017. <https://doi.org/10.1016/j.ecosys.2022.101017>
- Suehrer, J. (2019). The future of FDI: achieving the sustainable development goals 2030 through impact investment. *Global policy*, 10(3), 413–415. <https://doi.org/10.1111/1758-5899.12714>
- Suma, D.F. (2007). *The external debt crisis and its impact on economic growth and investment in Sub-Saharan Africa. A regional econometric approach of ECOWAS countries*.
- Sun, X., Chen, F., & Hewings, G. J. (2017). Spatial perspective on regional growth in China: Evidence from an extended neoclassic growth model. *Emerging Markets Finance and Trade*, 53(9), 2063–2081. doi:10.1080/1540496X.2016.1275554.

- Sun, Y., Lu, Z., Bao, Q., Li, Y., & Li, H. (2022). The Belt & Road Initiative and the public and private debts of participating countries: The role of China's economic policy uncertainty. *Structural Change and Economic Dynamics*, 60, 179-193. <https://doi.org/10.1016/j.strueco.2021.11.014>
- Suryandaru, R. A. (2023). The Relationship Between Public Debt, Trade Openness, and Economic Growth in Indonesia: Symmetric and Asymmetric Analysis. *Thailand and The World Economy*, 41(1), 35-60. <https://so05.tcithaijo.org/index.php/TER/article/view/263114>
- Swan, T. (1956). Economic growth and capital accumulation. *Economic Record*, 32(2), 334-361. https://doi.org/10.1007/978-1-349-08452-4_10
- Shkolnyk, I., & Koilo, V. (2018). The relationship between external debt and economic growth: Empirical evidence from Ukraine and other emerging economies. *Investment Management and Financial Innovations*, 15(1).
- Taymaz, E. (2022). Regional Convergence or Polarization: The Case of the Russian Federation. *Regional Research of Russia*, 12(4), 469-482. <https://doi.org/10.1134/S2079970522700198>
- Tanaka, K., & Hashiguchi, Y. (2015). Spatial spillovers from foreign direct investment: Evidence from the Yangtze River Delta in China. *China & World Economy*, 23(2), 40-60. <https://doi.org/10.1111/cwe.12106>
- Tan, B. W., Goh, S. K., & Wong, K. N. (2016). The effects of inward and outward FDI on domestic investment: Evidence using panel data of ASEAN-8 countries. *Journal of Business Economics and Management*, 17(5), 717-733. <https://doi.org/10.3846/16111699.2015.1114515>
- Tao, M., Poletti, S., Wen, L., & Sheng, M. S. (2024). Modelling the role of industrial structure adjustment on China's energy efficiency: Insights from technology innovation. *Journal of Cleaner Production*, 441, 140861.
- Tarek, B. A., & Ahmed, Z. (2017). Institutional quality and public debt accumulation: An empirical analysis. *International Economic Journal*, 31(3), 415-435. <https://doi.org/10.1080/10168737.2017.1354906>
- Teixeira, A. A., & Guimaraes, L. (2015). Corruption and FDI: Does the Use of Distinct Proxies for Corruption Matter? *Journal of African Business*, 16(1-2), 159-179. <https://doi.org/10.1080/15228916.2015.1027881>
- Tian, X. (2010). Managing FDI technology spillovers: A challenge to TNCs in emerging markets. *Journal of World Business*, 45(3), 276-284. <https://doi.org/10.1016/j.jwb.2009.09.001>
- Tian, L., Wang, H. H., & Chen, Y. (2010). Spatial externalities in China regional economic growth. *China Economic Review*, 21, S20-S31. <https://doi.org/10.1016/j.chieco.2010.05.006>
- Tihanyi, L., Devinney, T. M., & Pedersen, T. (2012). *Introduction to Part II: Institutional Theory in International Business and Management*. In L. Tihanyi, T. M. Devinney, & T. Pedersen (Eds.), *Institutional Theory in International Business and Management* (pp. 33-42). Emerald Group Publishing. *Advances in International Management*. [https://doi.org/10.1108/S1571-5027\(2012\)0000025009](https://doi.org/10.1108/S1571-5027(2012)0000025009)
- Tintin, C. (2013). The determinants of foreign direct investment inflows in the central and eastern European countries: The importance of institutions. *Communist*

- and Post-Communist Studies*, 46 (2), 287–298.
<https://doi.org/10.1016/j.postcomstud.2013.03.006>
- Tobler, W. 1979. “Cellular geography”. In *Philosophy in geography*, Edited by: Gale, S. and Olsson, G. 379 – 86. Dordrecht : Riedel.
- Todes, A., & Turok, I. (2018). Spatial inequalities and policies in South Africa: Place-based or people-centred? *Progress in Planning*, 123, 1-31.
<https://doi.org/10.1016/j.progress.2017.03.001>
- Udoh, E. and Rafik, R. A. M. (2017) Determinants and transmission channel of external debt: Evidence from Malaysia *Asian Journal of Economics, Business and Accounting* 4 (1): 1–10. <https://doi.org/10.9734/AJEBA/2017/35031>
- Ejigu, M. (2011). UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA (UNECA).
- UNCTAD(2022) *Handbook of Statistics*. https://unctad.org/system/files/official_document/tdstat47_FS09_en.pdf
- UNCTAD. (2018). *World investment report: Investment and new industrial policies*. United Nations.
- UNDP (2022) African Continental Free Trade Area (AfCFTA) Report.
- Valdez, R. (2019). Spatial diffusion of economic growth and externalities in Mexico. *Investigaciones Regionales*, 45, 139–160.
- Venables, Anthony J. (2010) “Economic Geography and African Development,” *Papers in Regional Science*, 89(3), 469–483. <https://doi.org/10.1111/j.1435-5957.2010.00312.x>.
- Vaya, E., Lopez-Baso, E., Moreno, R., Surinach, J. (2004) *Growth and externalities across economies: an empirical analysis using spatial econometrics*. In: Anselin, L., Florax, R.J.G.M., Rey, S.J. (Eds.), *Advances in Spatial Econometrics: Methodology, Tools and Applications*. Springer-Verlag, pp. 433–453. https://doi.org/10.1007/978-3-662-05617-2_20
- Vega, S. H. & Elhorst, P. (2013) Modelling regional labour market dynamics in space and time, *Papers in Regional Science*, 93, 819–841.
<https://doi.org/10.1111/pirs.12018>
- Villaverde, J., & Maza, A. (2015). The determinants of inward foreign direct investment: Evidence from the European regions. *International business review*, 24(2), 209-223. <https://doi.org/10.1016/j.ibusrev.2014.07.008>
- Visagie, J., & Turok, I. (2022). Firing on all cylinders: Decomposing regional growth dynamics in South Africa. *South African Journal of Economics*, 90(1), 57–74.
<https://doi.org/10.1111/saje.12303>
- Von Lyncker K, Thoennessen R (2017) Regional club convergence in the EU: evidence from a panel data analysis. *Empir Econ* 52(2):525–553.
<https://doi.org/10.1007/s00181-016-1096-2>
- Von Zedtwitz, M., Corsi, S., Søberg, P.V., Frega, R., 2014. A typology of reverse innovation. *J. Prod. Innov. Manag.* 32 (1), 12–28.
<https://doi.org/10.1111/jpim.12181>
- Vujanović, N., Stojčić, N., & Hashi, I. (2021). FDI spillovers and firm productivity during crisis: Empirical evidence from transition economies. *Economic Systems*, 45(2), 100865. <https://doi.org/10.1016/j.ecosys.2021.100865>

- Wade, R. (1990), *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization* (Princeton, NJ: Princeton University Press). doi:10.2307/2059053
- Wang, C., Liu, S., Wei, Y. (2004) Impact of openness on growth in different country group. *World Economy* 27 (4), 567–585. <https://doi.org/10.1111/j.0378-5920.2004.00614.x>
- Wang, Y., & Han, W. (2013). Research on potential human capital and the regional economic growth: Based on the perspective of higher education. 2013 Suzhou-Silicon Valley-Beijing International Innovation Conference, 166-169. <https://doi.org/10.1109/SIIC.2013.6624185>
- Wang, Lei, Muhammad Hafeez, Sana Ullah, and Izzet Ulvi Yonter (2023). "Cross-sectional dependence in financial openness and its influence on renewable energy consumption in Asia." *Energy & Environment*: 0958305X231219786. <https://doi.org/10.1177/0958305X231219786>
- Wang, R., Xue, Y., & Zheng, W. (2021). Does high external debt predict lower economic growth? Role of sovereign spreads and institutional quality. *Economic Modelling*, 103, 105591. <https://doi.org/10.1016/j.econmod.2021.105591>
- Wang, E. Y., & Kafourous, M. (2020). Location still matters! How does geographic configuration influence the performance-enhancing advantages of FDI spillovers? *Journal of International Management*, 26(3), 100777. <https://doi.org/10.1016/j.intman.2020.100777>
- Wang, R., Xue, Y., & Zheng, W. (2021). Does high external debt predict lower economic growth? Role of sovereign spreads and institutional quality. *Economic Modelling*, 103, 105591. <https://doi.org/10.1016/j.econmod.2021.105591>
- Wei, S.J., Shleifer, A. (2000) Local corruption and global capital flows. *Brookings Papers on Economic Activity* 2000 (2), 303–354. <https://www.jstor.org/stable/2667361>
- Wei, Y., Cao, Y. (2017) Forecasting house prices using dynamic model averaging approach: evidence from China. *Econ. Modell.* 61, 147–155. <https://doi.org/10.1016/j.econmod.2016.12.002>
- Wei, Y. D. (2015). Spatiality of regional inequality. *Applied Geography*, 61, 1-10.
- Wen, Y. (2014). The spillover effect of FDI and its impact on productivity in high economic output regions: A comparative analysis of the Yangtze River Delta and the Pearl River Delta, China. *Papers in Regional Science*, 93(2), 341–366.
- Woo, J., 2009. Why do more polarized countries run more procyclical fiscal policy? *Rev. Econ. Stat.* 91 (4), 850– 870. <https://doi.org/10.1162/rest.91.4.850>
- Woo, J., & Kumar, M. (2015). Public debt and growth. *Economica*, 82(328), 705–739. <https://ssrn.com/abstract=1653188>
- Wen, Y., Kourtit, K., Nijkamp, P., & Liu, Y. (2024). FDI and industrial development in a mega-city region: a modelling study on the Pearl River Delta. *Area Development and Policy*, 1-30. <https://doi.org/10.1080/23792949.2024.2351358>.
- Were, M. (2024). *Emerging public debt challenges in sub-Saharan Africa* (No. 2024/36). WIDER Working Paper. <https://hdl.handle.net/10419/298086>

- Whajah, J., Bokpin, G. A., & Kuttu, S. (2019). Government size, public debt and inclusive growth in Africa. *Research in International Business and Finance*, 49, 225–240. <https://doi.org/10.1016/j.ribaf.2019.03.008>
- Wheeler, D., Mody, A. (1992) International investment location decisions: the case of U.S. firms. *Journal of International Economics* 33 (1–2), 57–76. [https://doi.org/10.1016/0022-1996\(92\)90050-T](https://doi.org/10.1016/0022-1996(92)90050-T)
- Whitlow, R. S. (1957). The European Economic Community. *Bus. Law.*, 13, 813.
- World Bank (2009), Doing Business 2009: Comparing Regulations in 181 Countries, Washington DC.
- World Bank Publications. (2015). Global Economic Prospects, January 2015: Having Fiscal Space and Using It (Vol. 10). World Bank Publications.
- Woodward, R. (2009). The organization for economic co-operation and development (OECD). Routledge.
- Wu, W., Yuan, L., Wang, X., Cao, X., & Zhou, S. (2020). Does FDI drive economic growth? Evidence from city data in China. *Emerging Markets Finance and Trade*, 56(11), 2594–2607. <https://doi.org/10.1080/1540496X.2019.1644621>.
- Xia, C., Qamruzzaman, M., & Adow, A. H. (2022). An Asymmetric Nexus: Remittance-Led Human Capital Development in the Top 10 Remittance-Receiving Countries: Are FDI and Gross Capital Formation Critical for a Road to Sustainability? *Sustainability (Switzerland)*, 14(6). <https://doi.org/10.3390/su14063703>.
- Xia-hai, W. (2010). Human Capital, Spatial Spillovers and Inter-provincial TFP Growth: Evidence from Three Spatial Weight Measurement. *Journal of finance and economics*.
- Xu, Y., & Li, A. (2020). The relationship between innovative human capital and interprovincial economic growth based on panel data model and spatial econometrics. *Journal of Computational and Applied Mathematics*, 365, 112381. <https://doi.org/10.1016/j.cam.2019.112381>
- Xu, X., & Sheng, Y. (2012). Productivity spillovers from foreign direct investment: Firm level evidence from China. *World Development*, 40, 62–74. <https://doi.org/10.1016/j.worlddev.2011.05.006>
- Xu, B. (2000). Multinational enterprises, technology diffusion, and host country productivity growth. *Journal of Development Economics*, 62(2), 477–493. [https://doi.org/10.1016/S0304-3878\(00\)00093-6](https://doi.org/10.1016/S0304-3878(00)00093-6)
- Yasmeen, H., Tan, Q., Zameer, H., Vo, X. V., & Shahbaz, M. (2021). Discovering the relationship between natural resources, energy consumption, gross capital formation with economic growth: Can lower financial openness change the curse into blessing. *Resources Policy*, 71. <https://doi.org/10.1016/j.resourpol.2021.102013>.
- Yeboua, K. (2019). Foreign direct investment, financial development, and economic growth in Africa: Evidence from threshold modeling. *Transnational Corporations Review*, 11(3), 179e189. <https://doi.org/10.1080/19186444.2019.1640014>
- Yildiz, F., & Tuncer, G. (2021). Avrupa Birliği Üyesi Ülkelerde Kamu Borcu ve Ekonomik Büyümenin Mekânsal Analizi. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, (69), 232-251.

- Yimer, A. (2023). When does FDI make a difference for growth? A comparative analysis of resource-rich and resource-scarce African economies. *International Finance*, 26(1), 82-110. <https://doi.org/10.1111/inf.12423>
- Yang, Y. and Samaké, I., 2011. *Low-Income Countries' BRIC Linkage: Are There Growth Spillovers?* IMF Working Paper 11/267
- Young, A., Higgins, M., & Levy, D. (2008). Sigma convergence versus beta convergence: Evidence from U.S. county-level data. *Journal of Money, Credit and Banking*, 40(5), 1083–1093. <https://doi.org/10.1111/j.1538-4616.2008.00148.x>
- Yeaple, S.R., 2003. The complex integration strategies of multinationals and cross country dependencies in the structure of foreign direct investment. *Journal of International Economics* 60 (2), 293–314. [https://doi.org/10.1016/S0022-1996\(02\)00051-X](https://doi.org/10.1016/S0022-1996(02)00051-X)
- Yu, J., de Jong, R., and Lee, L.-F. (2008). Quasi-maximum likelihood estimators for spatial dynamic panel data with fixed effects when both n and t are large. *Journal of Econometrics*, 146:118–134. <https://doi.org/10.1016/j.jeconom.2008.08.002>
- Yusuf, A., & Mohd, S. (2023). Investigating the Asymmetric Impact of Public Debt on Economic Growth in Nigeria. *Journal of the Knowledge Economy*, 1-30. <https://doi.org/10.1007/s13132-023-01362-1>
- Zallé, O. (2019). Natural resources and economic growth in Africa: The role of institutional quality and human capital. *Resources Policy*, 62, 616–624. <https://doi.org/10.1016/j.resourpol.2018.11.009>
- Zamani, Z., & Tayebi, S. K. (2022). Spillover effects of trade and foreign direct investment on economic growth: An implication for sustainable development. *Environment, Development and Sustainability*, 24(3), 3967–3981. <https://doi.org/10.1007/s10668-021-01597-5>
- Zestos, G., Jiang, Y., Hamed, A., & Raymond, S. (2023). Public debt, current account, and economic growth in Germany: Evidence from a nonlinear ARDL model. *The Journal of Economic Asymmetries*, 28, e00335. <https://doi.org/10.1016/j.jeca.2023.e00335>
- Zhang, J., Liu, Q., Wang, C., & Li, H. (2017). Spatial-temporal modeling for regional economic development: A quantitative analysis with panel data from western China. *Sustainability (Switzerland)*, 9(11). Scopus. <https://doi.org/10.3390/su9111955>.
- Zhang W, Xu W, Wang X (2019) Regional convergence clubs in China: identification and conditioning factors. *Ann Reg Sci* 62(2):327–350. <https://doi.org/10.1007/s00168-019-00898-y>
- Zeng, S., & Zhou, Y. (2021). Foreign direct investment's impact on China's economic growth, technological innovation, and pollution. *International Journal of Environmental Research and Public Health*, 18(6), 2839. <https://doi.org/10.3390/ijerph18062839>
- Zhu, S., He, C., & Zhou, Y. (2017). How to jump further and catch up? Path-breaking in an uneven industry space. *Journal of Economic Geography*, 17(3), 521–545. <https://doi.org/10.1093/jeg/lbw047>

- Zouhaier, H., & Fatma, M. (2014). Debt and economic growth. *International Journal of Economics and Financial Issues*, 4(2), 440–44. <https://doi.org/10.1016/j.jmacro.2014.03.009>.
- Szymańska, A. (2019). Comparison of the stabilizing effects of government spending shocks in the Czech Republic, Hungary and Poland. *Economic research-Ekonomska istraživanja*, 32(1), 2899-2923. <https://doi.org/10.1080/1331677X.2019.1653783>

List of Publications and Conference Participation

Conference Participation

1. BUNDE, Aggrey Otieno (2023) A Critical Review of Digital Entrepreneurship Ecosystem in Kenya: Evidence from The Digital Platform Economy Index. ***In the Proceedings of European Union Erasmus + PROSPER Project, International Scientific Conference "Empowering Change: Fostering Social Entrepreneurship for a Sustainable Future"***, held on 7th – 8th September 2023 by the Faculty of Economics and Business, **University of Zagreb, Croatia**. Published in Feb 2024: ISBN: 978-953-346-224-0. Link: <https://prosperconference.net.efzg.hr/proceedings>.
2. BUNDE, Aggrey Otieno (2023) Financial Globalization, Investment and Economic Growth: Empirical Evidence from Selected Sub-Saharan African Economies: ***In the Proceedings of Economic, Diplomatic and Cultural Challenges International Conference; Central European Regional Science Research Group***, held on 2nd June 2023, by the **Budapest Business School, Hungary**. ISBN 978-963-625-023-2. Final revision done in March 2024. The proceedings was published in June 2024 in a book titled ***"Economic, Diplomatic and Cultural Challenges"*** Link: https://aposztrf.hu/images/stories/ebook/Economic_Diplomatic_and_Cultural_Challenges_final.pdf.
3. BUNDE, Aggrey Otieno (2023) Public Debt, Investment and Economic Growth: Understanding East Africa Regional Growth Dynamics Through the Lens of Spatial Econometrics. ***In the proceedings of Hungarian Regional Science (HRS) Association Conference (The Role of FDI and Alternative Growth Models)*** held on 2nd - 3rd November 2023, by the Faculty of Business and Economics, **University of Pécs, Hungary**. Link: <https://www.mrtt.hu/vandorgyules2023pecs.html>
4. BUNDE, Aggrey Otieno (2023) Convergence or Divergence? Using Spatial Econometrics in Evaluating Regional Growth Dynamics in Kenya, ***In the Proceedings of Central, East, and South-East European PhD Network (CESEENet PhD Workshop)*** held on 9th – 10th June 2023, Faculty of Economics and Business, University of Rijeka, Croatia. Link: <https://ceseephd.net/>.
5. BUNDE, Aggrey Otieno (2023) Nexus Between Foreign Public Debt Shocks and Economic Growth Dynamics in Kenya: A Structural VAR Approach.: ***In the***

proceedings of Decades of crises: From competitiveness to resilience – Via the bumpy road of sustainability - The 5th Conference in cooperation with the European Association for Comparative Economic Studies held on 14-15 April 2023, University of Szeged, Hungary. Link: <https://eco.u-szeged.hu/english/research/conferences-workshops/2023/decades-of-crises/decades-of-crises>.

6. BUNDE, Aggrey Otieno (2023) External Public Debt and Economic Growth Relationship: Evidence from Developing Sub-Saharan African Countries: ***In the Proceedings of the 11Th PhD Workshop held on 14th – 15th April 2023 by the Hungarian Society of Economics***, Faculty of Business and Economics, University of Pécs, Hungary. Link: <https://www.mktudegy.hu/phd-muhely/felhivas-a-xi-pecsi-mke-doktorandusz-muhelyen-valo-reszvetelre/38429/>
7. BUNDE, Aggrey Otieno (2023) Public Debt and Macroeconomic Policy Environment: A Systematic Literature Review. ***In the proceedings of the International Multidisciplinary Scientific Research Conference*** held on 15Th - 16Th January 2023 by the Institute of Economic Development and Social Research (IKSAD), Istanbul, Turkey. ISBN: 978 – 625 6404 45. Link: <https://www.iksadkongre.com/>

List of Publications

- Bunde, Aggrey Otieno (2024).** Public debt, investment and economic growth dynamics: Do geographical proximity and spatial spillover effects matter? ***Regional Science Policy & Practice. Volume 16(6)*** 100059.
- Bunde, Aggrey Otieno (2023)** External Public Debt and Economic Growth Relationship: Evidence from Developing Sub-Saharan African Countries. ***Regional Statistics***. Hungarian Central Statistics Office Vol. (13) Issue No. 5. DOI: 10.15196/RS130503. Link: <https://www.regionalscience.org/index.php/news/journals/item/3275-the-new-issue-of-regional-statistics-is-already-available-2023,-vol-13,-no-5.html>.
- Bunde Aggrey Otieno (2023)** "Governance and Regional Development Disparities in Kenya," ***Regional and Sectoral Economic Studies***, Euro-American Association of Economic Development Studies, Vol. 23(1), pages 51-72. Link: https://econpapers.repec.org/article/eaeeerese/v_3a23_3ay2023_3ai_3a1_5f4.htm.
- Bunde Aggrey Otieno and Kehl Dániel (2024)** Regional and Spatial Development Perspectives: Shedding Light on Growth and Regional Development Convergence in Sub-Saharan Africa (Accepted for Publication with *minor corrections* by ***Area Development and Policy***. Third round of review); Journal of the Regional Studies Association.