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

DOCTORAL DISSERTATION (SUMMARY)

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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 study 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 a spatial weight matrix enables the identification of spatial spillover effects and investigation of the influence exerted by the geographical proximity of countries. The findings of our analysis suggest that foreign public debt and foreign direct investment exert a considerable short-run and long-run spatial spillover effect on regional economic growth in Sub-Saharan Africa. The application of spatial econometric methods reveals a positive correlation between the fiscal fundamentals of a given country and those of neighboring countries. Consequently, a change in economic growth fundamentals in a particular country has ripple effects that extend beyond the borders of that country, affecting neighboring countries as well. Moreover, the results substantiate the 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.

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1. 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 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).

1.2. 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). 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).

1.2.1. 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 (Rev 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). Despite the importance of spillovers for regional economic growth, spillovers occur both within and across countries. However, in sub-Saharan Africa they are limited by tariff and non-tariff barriers.

1.2.2. Development Financing Challenges in Sub-Saharan Africa

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 regional Development Goals. To address this deficit, most Sub-Saharan 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 (UNECA, 2011). Particularly in Sub-Saharan Africa, low-income economies face a range of economic challenges associated with foreign capital inflows. Among these are the funding constraints imposed by tighter global financial conditions and reduced concessional financing from international financial institutions. In these countries, policymakers face a complex landscape in which they need to balance addressing urgent financing needs in areas such as health, education, and social programs with managing rising public debt, debt service obligations, and the need to generate domestic revenues. 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.

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

- **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:

- H_01 : 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.
- H_03 : 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.
- H_05 :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.

- H_0 7: Controlling for governance and institutional framework, gross fixed capital formation has a positive significant effect on regional economic growth in Sub-Saharan Africa.
- H_08 : Controlling for governance and institutional framework, foreign public debt has indirect positive significant spatial spillover effect on regional economic growth in Sub-Saharan Africa.
- H_09 : 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. By employing spatial econometrics, researchers can quantify these spillovers through the examination of the simultaneous co-movement of international financial flows (Perović, 2018). 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. The Research Gap

A review of the literature reveals that researchers have employed a diverse array of philosophical paradigms, estimation techniques, and methodologies in developing, emerging and developed economies. 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 Sub-Saharan African regions. This study addresses the aforementioned gap by incorporating a spatial econometric model to examine the relationship between foreign capital and regional economic growth. The interplay between geography, financial economics, and spatial analysis in Sub-Saharan Africa is 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. Previous researchers in Sub-Saharan Africa have predominantly concentrated on establishing the causal relationship between foreign capital 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, this study addressed the aforementioned gap by integrating concepts from financial geography, economic geography, and spatial econometrics.

3. Methodology

3.1. Spatial Model Specification and Estimation Techniques

The general specification of spatial panel model is given as follows:

$$y_{it} = \propto +\tau y_{it-1} + \rho \sum_{j=1}^{n} W_{ij} y_{jt} + \sum_{k=1}^{K} x_{itk} \beta_{K} + \sum_{k=1}^{K} \sum_{j=1}^{n} W_{ij} X_{jtk} \theta_{k} + \mu_{i} + y_{t} + V_{it}$$
$$+ V_{it}$$
$$V_{it} = \lambda \sum_{j=1}^{n} M_{ij} V_{it} + \varepsilon_{it} \qquad i = 1, \dots, n; t = 1, \dots, \dots, T$$

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, ..., r) at time (t = 1, 2, 3, ..., 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 macroregional 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. 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. $W_{i,i}$ is an nxn symmetric non-negative spatial weight matrix describing geographical proximity of countries in the sample, 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. $\rho w_{ii} y_{it}$ this denotes interaction effects of the response variable in the host country (i) and the neighboring country (j) at time t. β is a kx1 regression co-efficient vector of the covariates. μ_t is nx1 vector matrix of idiosyncratic stochastic term. The effect of α_i is either fixed (FE) or random probability distribution (RE).

3.2. The Regional Growth Convergence 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 real GDP Per Capita 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 prerequisite 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 convergence speed, 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 $lny_{0,i}$. It is further assumed that $\{\varepsilon_1, \varepsilon_2, \varepsilon_3, \dots, \varepsilon_n\}$ 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:

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

where i(i = 1, ..., 4) denoting the four Sub-Saharan African regions, t(t = 1, 2, ..., 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:

$$ln[growth] = \alpha_i + \rho \sum_{i}^{n} W_{ii} ln[growth] + \beta lny_{t,i} + X'\beta + \varepsilon_i$$

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 in the model and additional control factors. 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.

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

LeSage and Pace(2009) argue that 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).

3.4. Structural Vector Autoregressive (SVAR) Model

The SVAR Model with Control Predictors

The VAR framework $x_1 = A_0 + A_1 x_{t-1} + e_t$ 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:

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

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 5x1vector of explained variable, ω_0 is 5x1 vector of constants, μ_t is a 5x1 vector of structural disturbances or innovations and p indicates the number of lags. The square matrix A_0 (5x5) is described as follows:

$$Matrix \ A_{0} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \end{pmatrix} Matrix \ \mu_{t} = \begin{pmatrix} \mu_{t}^{y_{t}} \\ \mu_{t}^{f_{d}} \\ \mu_{t}^{tr} \\ \mu_{t}^{yr} \\ \mu_{t}^{yi} \end{pmatrix}$$

The equation (8), $A_0y_t = \omega_0 + Z(L)y_{t-p} + \mu_t$ 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 $\mu_t = A_0\varepsilon_t$; $Z(L) = A_0^{-1}A(L) = l_n - A_1W - A_2W^2...A_pW^p$. 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.

3.5. Data Sources and Variable Description

The four main Sub-Saharan Africa regions were subjected to investigation: **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. **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.

#	Variable	Description	Source
1	rgdp	Real GDP (constant 2015 international USD)	WDI ^a
2	fdi	Foreign direct investment, net inflows (BoP, current USD)	WDI ^a
3	fpd	Foreign Public Debt stock, Total (constant 2015 international USD).	WDI ^a
4	gfcf	Gross Fixed Capital Formation (Constant 2015 International USD)	WDI ^a
5	hcd	Human Capital Development	HDR ^ь
6	dser	Foreign debt service as a percentage of GDP	WDI ^a
7	inf	Inflation - Consumer Price Index $(2010 = 100)$	WDI ^a
8	xr	Exchange Rate	WDI ^a
9	ir	Interest Rate	WDI ^a
10	trade	Trade as a percentage of GDP	WDI ^a
11	рор	Total population	UNPD ^d
12	pol_stab	Political stability and absence of violence	WGI°
13	gov eff	Government Effectiveness	WGI ^c
14	reg qual	Regulatory Quality	WGI ^c
15	r law	Rule of Law	WGIc
16	\overline{Cont}_{corr}	Control of Corruption	WGIc

Table 1: Data Sources and Variable Description

 World Development Indicators (https://databank.worldbank.org/source/worlddevelopment-indicators)

b. Human Development Report, UNDP. (HDR) <u>https://hdr.undp.org/data-center/documentation-and-downloads</u>

c. World Governance Indicators (WGI)

d. United Nations Population Division (UNPD)

4. Results and Discussions

4.1. Geographical Proximity and Regional Economic Growth

H_01 : 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. 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). We explore a wide range of different weight configurations (W) since this is a crucial component of spatial econometric models (Corrado & Fingleton, 2012). According to our methodology, we use geographical weight matrices, which are 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 $w_{ii} = 0$ 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 $w_{ij} = \frac{1}{d^{\alpha}}$ for $\alpha =$

 $1.25, \alpha = 1.50 \dots \alpha = 3.0$, 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).

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

 $w_{ij} = d_{ij}^{-2} / \sum_j d_{ij}^{-2}$ if $d_{ij}^{-2} \le \overline{d^{-2}}$ and $w_{ij} = 0$ otherwise. The variable d_{ij} represent the great circle distance between capital cities of country *i* and *j*, while \overline{d} denotes the critical distance threshold beyond which spatial effect are deemed negligible such that $w_{ij} = 0$ if $d_{ij}^{-2} > \overline{d^{-2}}$. In order to facilitate comparison and interpretation, the rows are

standardized to ensure that $0 \le w_{ij} \le 1$. 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 ..., 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).

Moran's I and Robust LM tests statistics Using Different Weight Matrices							
	ECCAS	SADC	ECOWAS	EADC			
w_contg							
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***			
w_knn							
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***			
w_invsq							
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***			

Table	2:	Moran	's I	and	Ro	bust	L	М	tests	statisti	cs	Using	We	eight	Matri	ces

*** p<.01, ** p<.05, * p<.1; LM - Lagrangian Multiplier; w_contig, contiguity matrix; ; w_invsq, inversed squared distance matrix; w_knn, 5-nearest neighbors' matrix; Source -Author's Estimation, 2024.

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 1% level of significance 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. 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.

Dissertation Thesis I

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 when geographical proximity is considered in the analysis. 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.

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

 $H_{\theta}2$: 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.

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			
Wlnrgdp_2015	-0.198***	0.5340***	0.026***	0.549***			
	(0.058)	(0.023)	(0.000)	(0.055)			
W_lnpop	1.313***	1.632***	1.024***	1.667***			
	(0.043)	(0.005)	(0.118)	(0.018)			
Spatial rho $ ho$	3.726***	1.363***	0.219***	0.342***			
	(0.137)	(0.058)	(0.101)	(0.118)			
Variance Sigma 2_e	0.0020	0.002	0.001	0.003			
0	(0.000)	(0.000)	(0.000)	(0.000)			
Obs.	95	95	162	114			

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

The objective was to ascertain whether the disparities between countries in Sub-Saharan Africa are diminishing or increasing. This study differs from previous investigations of convergence in Sub-Saharan African countries in that it places particular emphasis on the spillover effects of foreign capital, including foreign public debt and foreign direct investment. Furthermore, the study underscores the significance of geographical location. Rather than viewing Sub-Saharan African countries as isolated entities, the analysis posits that they are more accurately understood as interconnected spatial units. Secondly, the hypothesis investigates whether lower-income countries are catching up with richer countries in the region. Wlnrgdp_2015, which is spatially lagged, is the variable of interest in regional growth convergence analysis. 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. 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 rho (ρ) reflects the magnitude of economic growth spatial spillovers. The results offer compelling evidence that countries with similar growth rates tend to form clusters, as indicated by positive spatial ρ (rho) in all the regions. The growth of a region is therefore contingent upon a complex interplay of internal and external factors. The growth rate of real GDP per capita in any given area is determined by two key factors: the initial growth level of the region in question and the average growth rate of neighbouring regions. The presence of convergence is demonstrated by the observation that poor regions tend to experience more rapid growth compared to wealthier 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 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, 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).

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 can primarily be attributed to the differing technological profiles of various countries.

4.3. The Impact of Foreign Capital on Regional Economic Growth

H_{b} 3: 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.

The findings demonstrate a notable detrimental influence of foreign public debt on economic growth. In particular, an increase in foreign public debt is associated with a significant reduction in regional economic growth, with a decline of 8.6% observed in central African nations. Subsequently, a marginal decline of 0.7% was observed in Southern Africa, while a 1% reduction was noted in West Africa. Conversely, the Eastern African region exhibited a notable 0.7% growth. Furthermore, the results indicated that there was no statistically significant correlation between economic growth and foreign direct investment (FDI) in the West and Central African regions. Conversely, a clear and statistically significant relationship was identified between FDI and economic growth in the southern and eastern African regions. In particular, for each additional unit of FDI, economic growth increases by 1.3% and 0.8% in the southern and eastern African regions, respectively. The process of globalization has resulted in a notable increase in the interconnectedness of the global economy. This transition is attributed to the implementation of diverse policies and initiatives in the trade, technology, and investment sectors. The presence of regulatory obstacles has enabled multinational corporations to expand their operations into developing countries (Pradhan, 2005). The existing literature indicates that foreign direct investment (FDI) exerts a negative and, on occasion, a mixed influence on economic growth in the Sub-Saharan African region. A number of studies indicate 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 impact of FDI on economic growth is contingent upon a country's resource endowment.

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.

The results show a statistically significant positive correlation between human capital development and economic growth in all four regions. Specifically, the impact of human capital development on economic growth is highest in Central African countries

with an increase of 4.624%, followed closely by East African countries with an impact of 2.410%. Southern African countries with a moderate impact of 1.326% and West African countries with the lowest impact of 0.413%, all other things being equal. The study also examined the impact of population growth density on regional development disparities. The results showed a significant and statistically meaningful relationship between population density and economic growth in all four regions. As shown in Table 13, an increase of one unit in population density corresponds to an increase in economic growth of 1.313% in Central African countries, 1.632% in SADC, 1.024% in ECOWAS and 1.667% in East African countries. Research from low- and middle-income countries suggests that the positive growth effects of population growth are particularly pronounced in rural areas and regions with higher levels of education. Moreover, these effects are more pronounced in countries with lower corruption levels (Crombach and Smits, 2022). These findings are also consistent with new economic geography theories. Throughout history, high population agglomeration has played a crucial role in promoting growth. Agglomerated regions have traditionally influenced neighbouring non-agglomerated regions, especially at lower income levels. However, this impact tends to turn negative as agglomerated regions experience economic growth (Islam, 2020). There is a broad consensus among scholars that the dynamism of large cities and regions as central hubs of economic growth is due to the positive externalities generated by increased agglomeration (Duranton and Puga, 2001; Fujita et al., 1999). In addition, the study provides further evidence of the positive impact of gross fixed capital formation in the four regions.

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). In addition, foreign public debt has a negative impact on interest rates as a result of contractionary monetary policy. The high cost of capital associated with debt servicing reduces private investment, which in turn reduces economic growth over time. There is strong evidence that external public debt has a negative impact on regional economic growth. Similar to other developing countries, external public debt in sub-Saharan Africa tends to crowd out economic activity. As a result, capital formation is discouraged and future revenues to finance public investment in the region are reduced (Aizenman et al., 2007). In addition, high levels of external debt limit the scope for countercyclical fiscal policy (Aghion and Kharroubi, 2007; Woo, 2009), which may lead to increased economic volatility. Krugman (1988) also postulated that external public debt has a negative impact on economic growth in the long run. In addition, capital flight due to debt servicing reduces a country's revenues to such an extent that a rapid return to economic growth is impossible (Levy-Livermore and Chowdhury, 1998).

The findings of this study indicate that foreign direct investment (FDI) exerts a considerable influence on economic growth in resource-scarce regions within Sub-Saharan Africa. Conversely, FDI has a less pronounced impact on growth in regions endowed with abundant natural resources. This finding is consistent with those of Yimer and Odhiambo (2023). The term 'natural resource curse' describes a phenomenon observed in several studies. It has been observed that countries with a high natural resource base are more likely to experience stagnant or negative economic growth compared to those with fewer natural resources (Ploeg, 2011). The displacement of domestic firms by foreign firms may impede the host economy's growth (Herzer et al., 2008). Furthermore, the repatriation of profits from foreign direct investment may have a detrimental impact on the economic growth of the host country (Akinlo, 2004). 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.

4.4. Analysis of Foreign Capital Spillovers

 H_0 8: Controlling for governance and institutional framework, foreign public debt has indirect significant spatial spillover effect on regional economic growth in Sub-Saharan Africa.

H_09 : Controlling for governance and institutional framework, foreign direct investment has indirect significant spatial spillover effect on regional economic growth in Sub-Saharan Africa.

The increasing interdependence among countries results from globalization, where nations engage more frequently in multilateral and bilateral economic activities, including trade and investment, regional economics, governance and institutional cooperation, and socio-cultural integration (Ahmad & Law 2023). 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. This section employs a spatial econometric approach, which is

outlined in greater detail in the methodology section. In this context, a stochastic process is defined as a set of variables dependent on neighbouring spatial units. The aforementioned spatial units are thus defined as those situated in close proximity geographically, enabling interaction between them. 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. These models incorporate a contiguous weight matrix to capture geographical component, facilitating the assessment of geographical spillovers among neighboring countries.

Region	Variables	Average	Average	Average Total
		Direct	Indirect	Impact
		Impact	Impact	
ECCAS	lngfpd	-0.165***	-0.080	-0.245***
		(0.046)	(0.086)	(0.090)
	lnfdi	0.018*	0.198***	0.216***
	-	(0.036)	(0.047)	(0.035)
SADC	lngfpd	-0.045	0.269***	0.224***
		(0.041)	(0.078)	(0.089)
	lnfdi	-0.001	-0.107***	-0.108***
	5	(0.014)	(0.025)	(0.025)
ECOWAS	lngfpd	-0.032	0.006	-0.027***
		(0.794)	(0.793)	(0.006)
	lnfdi	0.019	-0.090	-0.070***
	-	(1.013)	(1.014)	(0.013)
EADC	lngfpd	0.032	0.074**	0.106***
		(0.032)	(0.033)	(0.008)
	lnfdi	0.019 [°]	0.075***	0.095***
	-	(0.012)	(0.012)	(0.006)

Table 4: Short-Run Marginal Effects Using Monte Carlo (MC)Simulation: Dynamic SDM –FE.

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.

This study demonstrates the existence of spatial spillover effects, as illustrated in Table 4 and Table 5. These findings suggest that neighbouring regions with similar macroeconomic frameworks contribute positively to economic growth in sub-Saharan Africa. Given the spatial dependence intrinsic to the model, changes in predictors within a given spatial region exert a direct influence on the estimated variable in that region and may also exert an indirect influence on the estimated variables in other regions,

provided that all other variables remain constant. As can be seen in Tables 4 and Table 5, there are significant disparities between the indirect effects and direct estimates. This disparity can be attributed to the existence of spillover effects, which manifest as a consequence of impacts traversing contiguous neighbouring countries. As evidenced in Tables 4, the results demonstrate that foreign public debt exerts a negative and statistically significant direct effect in the Central African region, both in the short and long term. The results demonstrate that external borrowing has a detrimental effect on regional development in Central Africa. The indirect effects of foreign public debt are observed in Southern and Eastern Africa in the short run, as evidenced in columns (2) through (5) of Tables 4. In contrast, the indirect effect of foreign direct investment (FDI) on regional economic growth exhibits significant variability across regions. The positive spillover effect of FDI is evident in Southern Africa, Central Africa, and Eastern Africa, whereas no such effect is observed in West Africa in the short term.

Region	Variables	Average	Average	Average Total
		Direct	Indirect	Impact
		Impact	Impact	-
ECCAS	lngfpd	-0.097***	-0.100	-0.197***
		(0.025)	(0.061)	(0.071)
	lnfdi	0.022	0.151***	0.173***
		(0.018)	(0.029)	(0.027)
SADC	lngfpd	-0.007	0.160***	0.153***
		(0.019)	(0.048)	(0.057)
	lnfdi	-0.006	-0.068***	-0.074***
		(0.006)	(0.015)	(0.018)
ECOWAS	lngfpd	-0.009	-0.015*	-0.024***
		(0.007)	(0.008)	(0.005)
	lnfdi	-0.002	-0.060***	-0.063***
		(0.005)	(0.011)	(0.011)
EADC	lngfpd	0.731	-0.628	0.102***
		(21.022)	(21.022)	(0.008)
	lnfdi	-0.021	0.112	0.092***
	-	(0.835)	(0.835)	(0.005)

Table 5: Long – Run Marginal Effects Using Monte Carlo (MC)Simulation and Dynamic SDM – FE Model.

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.

The long-term spillover effects of foreign public debt are evident in Southern and West Africa. It can be observed that there are no significant spillover effects of public debt in Central Africa or Eastern Africa. Furthermore, the results indicate a positive and statistically significant indirect effect of FDI on GDP per capita in Central Africa, while a negative and statistically significant effect is observed in Southern and West Africa. In the case of the Eastern Africa region, foreign direct investment (FDI) demonstrates

a positive feedback effect exclusively in the short-term, but not in the longer term. 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 those of Yimer (2023) 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 characterized 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. The results highlight the pivotal role foreign direct investment plays in stimulating regional economic growth. Consequently, the implementation of policies designed to attract foreign direct investment to a particular nation within the broader context of Sub-Saharan Africa can result in positive externalities in neighbouring countries. This situation can create an external benefit challenge, whereby countries gain from policy changes in neighbouring countries that enhance the investment climate and attract more foreign direct investment (FDI). Furthermore, it suggests that a sudden decline in the appeal of an FDI host country will not only result in a decrease in FDI in that country but also in its neighbouring countries. Additionally, it is crucial to incorporate neighbouring countries' economic conditions into the analysis of foreign capital flows when formulating regional investment and trade agreements (Blanco, 2012).

Dissertation Thesis IV

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). 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 should be reduced, business regulations improved, and infrastructure investments made to increase trade between countries and regions (Francisco et al., 2019).

4.5. Economic Growth Response to Fiscal and Monetary Policy Shocks

H_010 : There is a positive significant impact of fiscal and monetary policy shocks on real GDP Per Capita in selected Sub-Saharan African countries.

Structural Variance Decomposition

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

The structural VAR in this study was ordered as follows; logir, log f_d , log xr, log pi and $logy_t$. 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. (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 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. 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.

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

Long-run economic growth (In 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 illustrates the percentage of forecast error variance for selected variables attributed to shocks within the SVAR system over ten periods illustrated in this study. 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. The magnitude of these shocks differs among the five countries under consideration. A notable increase in longterm 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.

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

Conversely, interest rates are observed to increase in all countries except Nigeria. 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.

Dissertation Thesis V

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, crowdingout 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.

5. Policy Implications, Study Limitations and Future Research Avenues

Our findings revealed the existence of development divergence, indicating that the majority of Sub-Saharan African countries follow distinctive developmental pathways. The classification of countries into convergence clubs offers a vital framework for sustainable development initiatives, emphasizing the necessity for a multifaceted approach that accounts for regional heterogeneity. The spatial methodology employed enables the development of nuanced, data-driven policies, thereby rendering it a vital tool for policymakers engaged in development planning within these regions. An understanding of the specific challenges associated with regional development will enable policymakers to develop strategies that are not only effective but also align with the fundamental development priorities of the Sub-Saharan African regions.

Moreover, in order to respond to development financing challenges, Sub-Saharan African countries 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 short-run period. 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. 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. The realization of development financing 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 regions.

Additionally, the ongoing process of globalization has resulted in a notable increase in interconnectedness within the global economy. This phenomenon is a consequence of the implementation of diverse policies and initiatives in areas such as trade, technology, and investment. The removal of regulatory impediments has enabled global enterprises to expand their operations into novel markets while concomitantly curbing their transactional expenses. The findings of this study indicate a need for the formulation of customized policies that consider the divergent income levels of countries. This approach can help mitigate the adverse effects of foreign direct investment while enhancing its positive outcomes. A funding gap exists with regard to the achievement of the Sustainable Development Goals (SDGs) in most Sub-Saharan African countries. Although foreign direct investment is recognized as a crucial driver of sustainable Development Goals (SDGs) with tangible investment opportunities for private investors (Suehrer, 2019).

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 (Rajkumar and Swaroop, 2008).

6. References

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7. List of Publications and Conference Papers

Published Articles

- 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). Journal of Regional Studies Association International. https://doi.org/10.1016/j.rspp.2024.100059.
- 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.regio nalscience.org/index.php/news/journals/item/3275-the-new-issue-of-regional-statistics-isalready-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), Pg 5172. Link:https://econpapers.repec.org/article/eaaee rese/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*. Journal of the Regional Studies Association.

Conference Papers

- 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. The proceedings was published in June 2024 in a book titled "Economic, Diplomatic and Cultural Challenges" Link:https://aposztrof.hu/images/stories/ebo ok/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 (HRSA) 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.uszeged.hu/english/research/conferences-workshops/2023/decades-of-crises/decades-of-crises.
- 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/phdmuhely/felhivas-a-xi-pecsi-mke-doktorandusz-muhelyen-valo-reszvetelre/38429/
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