The impact of governance on economic growth: spatial econometric approach

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Abstract

Purpose – This paper investigates the impact of governance on economic growth, considering the spatial dependence between countries.

Design/methodology/approach – The study employs spatial regression models to estimate the impact of governance on economic growth in a sample of 116 countries worldwide in 2017.

Findings – The findings imply that the influence of governance on economic growth is statistically significant. Moreover, if all other economic control variables are constant, 1% increase in governance raises the economic growth on average by 1% at 10%, 5% and 1% significance levels, respectively. Furthermore, each country's rise in economic growth favorably and substantially influences the economic growth of its bordering nations. The unobserved characteristics or similar unobserved environments in adjacent countries also affect its economic growth.

Originality/value – This study adds to the discussion and investigation of the influence of governance on economic growth by considering the spatial dependence between countries, which is lacking in the literature.

Keywords Economic growth, Governance, Principal components analysis, Spatial regression models

Paper type Research paper

1. Introduction

Governance is a broad concept. This concept has many definitions provided by scholars, researchers and policymakers. USAID (2002) describes governance as a complex interaction system between the structures, features and processes characterized by transparency, responsibility and involvement. UNDP (1997) defines governance as the executive, economic and political authority to regulate the affairs of a country at every level. It includes the complex processes, regulations and organizations through which people articulate their thoughts and exercise their duties and civil liberties (Awan *et al.*, 2018).

Kaufmann *et al.* (1999) have had a prominent role in developing a concept covering all governance components. They describe governance as a combination of traditions and institutions practiced by governments within any nation. This concept includes the ability of the authorities to adequately identify and implement effective policies and procedures in selecting, monitoring and changing the governments, alongside respect for state and citizens for economic and community interaction institutions.

The broad concept of governance consists of three parts, namely a procedure for selecting, monitoring and replacing systems; the ability of governments to manage and execute specified effective policies and the social and economic connection between the state and its

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citizens that ensures laws and institutions are respected (Kaufmann *et al.*, 2011). Since 1996, the World Bank has published six indicators measuring governance in countries as part of the governance indicators project, namely the Worldwide Governance Indicators (WGI). The WGI are Voice and Accountability, Political Stability, Government Effectiveness, Rule of Law, Regulatory Quality and Control of Corruption.

This paper aims to explore the influence of governance on economic growth using spatial econometrics models. The reason for utilizing spatial econometrics models is that when collecting data from neighboring countries, the dependent variable may appear high in some neighboring countries and low in some other neighboring countries, which is known as spatial dependence. Indeed, any country's gross domestic product (GDP) is not just determined by its GDP per capita but is also influenced by variables prevalent in other countries, particularly those in its close surroundings. Furthermore, with increasing distance, the spatial influence of other places diminishes. A faraway country's effect is thought to be less significant than that of a close one. Therefore, spatial dependence may weaken or produce biased estimators of the ordinary least square (OLS) method (Lesage and Pace, 2009).

The paper is outlined in seven sections. In section 2, we cover the literature review. Section 3 provides the research hypotheses. Section 4 describes the data. In section 5, we introduce the research methodology. Section 6 discusses the empirical results. In the last section, we present some conclusions and suggest policy implications.

2. Literature review

Since the 1990s, considerable literature has empirically examined the governance impact on economic growth, particularly with the emergence of new governance indicators. Despite the large literature developed recently on this topic, most of them did not highlight the importance of the spatial dependence of economic growth when studying this relationship. In this regard, we present a literature review exploring the governance impact on economic growth. Then, we consider the literature examining economic growth's spatial dependence.

2.1 Governance and economic growth literature

In the literature, there has been extensive discussion about the relationship between economic growth and governance. Singh (2022) employed the panel cointegration technique to examine the relationship between growth and the six governance indicators. He concluded that development and governance are complementary. This means that growth is necessary for enhancing good governance, whereas governance promotes growth in the Brazil, Russia, India, China, and South Africa (BRICS) nations. In the same vein, using Two-Stage Least Squares (2SLS) and Generalized method of moments (GMM) regression, Ogbuabor *et al.* (2020c) concluded that corruption, government ineffectiveness, the rule of law, poor regulatory quality and political instability play a prominent role in hindering growth in 13 countries in West Africa. Beyene (2022) studied the impact of governance on growth in 22 African countries by exploring the effects of each dimension of governance individually and then creating a composite index of governance. The findings revealed that the composite governance index positively impacted growth despite the negative impacts of corruption and government effectiveness separately.

Orji *et al.* (2022) concluded that control of corruption promotes economic growth in Nigeria. Using multiple regression models, they found that increasing the corruption control rate leads to increased growth rates by 0.54% with the constants of other economic factors. According to Hamid *et al.* (2022), good governance, as represented by the control of corruption and the expansion of democracy, has a critical role in preventing carbon dioxide emissions, which is reflected in attracting foreign direct investment (FDI), which boosts economic growth. Kesar and Jena (2022) argued that the political stability of the BRICS countries in the period 2002–2018, using the ARDL model, had an upward effect on growth, while corruption

had a U-shaped impact where it upwardly affected economic growth for specific periods and then diminished in effect. Olaniyan *et al.* (2022) argue that improving the development gains of remittances depends mainly on strengthening governance institutions in ECOWAS nations.

Using the autoregressive distributed lag model based on unrestricted error correction model (ARDL-UECM) model, Anthony-Orji *et al.* (2019) concluded that institutional quality significantly impacts financial inclusion in Nigeria. Hence, they recommended creating a suitable political and judicial environment for individuals and companies to enhance growth. Similarly, using the autoregressive distributed lag (ARDL) model, Ogbuabor *et al.* (2020a) found that institutional quality has an insignificant influence on Nigerian development. In another important work, Ogbuabor *et al.* (2020b) concluded that both FDI and institutional quality adversely affect Nigerian economic growth separately. However, the interaction between both variables plays an essential role in enhancing the influence of FDI on economic growth in Nigeria, specifically after FDI was affected by the consequences of the COVID-19 pandemic. Similarly, using the ARDL technique, Shittu *et al.* (2022) indicated that aggregated institutional quality hurts growth. However, the interaction between institutional quality and FDI and natural materials is beneficial for development in the Middle East and North Africa (MENA) region.

Moreover, some researchers suggest that the direction of the governance–growth relationship varies according to countries' economic and social factors. Fawaz *et al.* (2021) categorized a sample of 11 developing nations from 1996 to 2008 according to income levels (high or low). Using fixed effect methods, they showed that, as compared to high-income nations, voice and responsibility hampered economic progress in low-income countries. The cause might be the low credibility of the media in these nations, whether free or not. They also concluded that the rule of law and corruption control significantly impacted economic development.

Using the quantile regression methods, Oanh *et al.* (2021) found that institutional quality greatly influences growth in 48 Asian nations, particularly in lower-income countries. This result is consistent with the conclusions of Abdullahi *et al.* (2019), Fikadu *et al.* (2019) and Dickson *et al.* (2021) on the positive impact of institutional quality on economic development in African countries. Moreover, Helliwell (1992) examined democracy's influence on economic growth. He found an insignificant negative impact of democracy on growth in low-income countries while positively affecting the growth of high-income countries.

Using GMM and system GMM techniques, Zhuo *et al.* (2021) utilized a data set from 31 countries from 2002 to 2018. They showed a deterioration in the growth of developed countries due to a 1% increase in government effectiveness, political stability and regulatory quality. Similarly, Gani (2011) studied a sample of 84 low and middle-income countries using panel data estimation procedure. He found that voice and accountability negatively influence growth.

Huang and Ho (2017) suggested that governance and growth linkage is related to the level of democracy in the country. They investigated if a Granger causation extends from governance to economic growth in 12 Asian nations. They found that different dimensions of governance contribute to more significant development in "Not Free" nations than in "Free" and "Partly Free" ones. In this sense, policymakers in "Not Free" nations should prioritize governance quality to stimulate future economic development.

Fraj *et al.* (2018) argued that governance is not connected to growth unless there is an interaction between governance and other effective economic channels in the country. Based on a sample of 50 countries, they concluded that governance is detrimental to economic growth. However, when they considered the interaction between exchange rate flexibility and governance; they observed that governance favors development when exchange rates are flexible. In other words, the exchange rate is a powerful channel through which governance influences economic growth. In the same context, Yahyaoui and Bouchoucha (2019) concluded that with good governance, FDI would advance the economic development process

in African countries. At the same time, the FDI will negatively affect economic growth under poor governance.

While the literature reveals essential aspects regarding the link between governance and economic growth using multiple statistical methodologies, a lack of literature considers the spatial spillovers of growth between countries when investigating the governance–growth relationship. This study tries to fill this gap in the literature.

2.2 Spatial dependence of economic growth

Tobler's (1979) law of geography states that "everything is connected, but anything nearby will have greater connection than something far away." Observations at one site often rely on observations made at neighboring locations. This is also known as spatial dependency. Countries might engage aggressively in this environment via commerce and technological dissemination avenues. External causes may extend to national boundaries in such circumstances, which helps to explain economic development. For example, political instability in a region may play an essential role in foreign investment decisions toward a country which inevitably affects its economic growth.

Moreno and Trehan (1997) performed several tests to examine whether the location was essential for economic growth using a sample of 93 countries. They concluded that, in addition to geographical characteristics, the growth of any nation is positively impacted by the growth of nearby nations. As a result, spatial econometrics had to be used instead of treating each country as an independent unit.

In their famous study on the effect of geography on growth, Easterly and Levine (1998) argued that policy choice and growth achievement could be infectious in nations that lean on each other's policies. The estimation method of this study is compatible with spatial econometrics. Furthermore, an essential result of this research is that if one nation attempts to enhance a specific factor, such as technological progress, neighboring countries may gain from the consequences.

Rey and Montouri (1999) investigated income levels in the USA using Moran's charts and the spatial error model. They found positive and statistically significant spatial impacts. Similarly, López-Bazo *et al.* (1999) pioneered spatial effects on economic development. They explored the spatial correlation of the European Union's GDP disparities.

Using spatial economics, Ramirez and Loboguerrero (2002) explained that the study of spatial interdependence should be considered in analyzing economic growth across neighboring countries. Using data on 98 countries, they found that the country's economic growth is affected by the growth rates of its neighboring countries. They concluded that ignoring such spatial effects may lead to misleading conclusions.

Moreover, Bosker and Garretsen (2009) studied the importance of institutional geography in a dataset of 147 countries. They showed that institutional quality in a country significantly affects the economic development of neighboring countries regardless of their own institutions. Similarly, based on data from 58 countries, Ahmad and Hall (2012) found that the quality of institutions has a significant spatial impact in a country on growth in neighboring developing countries.

Roberts and Deichmann (2011) found that the spatial impacts of the investment in transport and communication enhance the growth of surrounding nations in various parts of the globe, particularly in Africa. Furthermore, Ho *et al.* (2013) used data from 26 OECD countries during 1971–2005. They concluded that the spatial effects of growth in the neighboring countries are more influential than the geographical distance.

Cartone *et al.* (2021) employed spatial regression techniques to explore the differences in economic growth determinants in 12 European countries. The results revealed that convergence rates are higher for slower-growing European regions. Arogundade *et al.* (2022)

found that improving institutional quality positively influences growth and reduces the severity of poverty among neighboring countries. Dönmez and Sugözü (2022) used spatial regression to examine the link between economic growth and unemployment in European Union member countries. They discovered a spatial dependence among European Union member states, and Okun's coefficient was significant in neighboring nations. Hazrana *et al.* (2019) investigated the influence of spatial dependence on economic growth convergence in India. They found substantial spatial interactions in economic growth led to an increase in convergence rate.

Baysoy and Altug (2021) explored the spatial influences on the economic growth of 18 countries in the Middle East and North Africa between 1970 and 2014. They observed that the economic growth of neighboring countries with similar institutional characteristics is positively correlated.

Our study differs from previous studies in two folds. First, this study depends on including a spatial variable using spatial regression models when investigating the relationship between economic growth and governance, which provides a better overview of the relationship between governance and growth. Second, this study relies on building a composite index for the six governance indicators instead of studying these indicators separately. This procedure overcomes the multicollinearity resulting from the correlation between the six indicators.

3. Research hypotheses

The hypotheses assumed by this study are the following:

(1) There is a statistically significant positive impact of governance on economic growth.

(2) There is a statistically significant spatial dependence on economic growth among countries.

4. Data description

To investigate the impact of governance on economic growth, we use a sample of 116 countries worldwide. The Appendix lists all countries and also presents sources of the variables used in the analysis. Notably, in 2020 we found that the last updated data on this site for all variables were available until 2019 except for the FDI variable, whose dataset was available until 2018 with incomplete data in some countries. Hence, to avoid losing many observations that may affect the spatial analysis results, we relied on 2017 as the appropriate year for this study. After excluding countries with no values for the study variables, we relied on the latest available data for 116 countries.

4.1 Dependent variable

According to Wong *et al.* (2005), GDP per capita is the most widely used economic growth measurement. Furthermore, GDP per capita at purchasing power parity (PPP) has been used in various studies to measure economic growth. This paper employs the natural log of GDP per capita (PPP) in the current international dollar as our dependent variable.

4.2 Explanatory variables

4.2.1 Governance. As we mentioned before, governance in a country can be measured by six different indicators. These measurements are rated on a scale as appropriate −2.5 to +2.5. These indicators are:

(1) **Voice and Accountability:** It estimates the citizen's ability to engage and join in civil and societal political life without fear of discrimination or repression and the media's independence.

(2) **Political Stability and Absence of Violence/Terrorism:** It evaluates the potential of political turmoil, including overthrowing the government and violence and terrorism for political reasons.

(3) **Government Effectiveness:** It evaluates the efficiency of public and administrative services, besides the authority's ability to develop and implement policies efficiently.

(4) **The Rule of Law:** It evaluates the level of public confidence and compliance with social rules, especially the fulfillment of contracts concluded, in addition to the quality of services provided by the police, as well as human rights, courts and the potential for crime and violence.

(5) **Regulatory Quality:** It measures the authority's capability to encourage and develop the private sector by formulating and implementing effective policies and sound regulations.

(6) **Control of Corruption:** It measures the spread of corruption in society in all its forms. In addition, it measures the takeover of state property by private interests and elites.

This study depends on the principal component analysis (PCA) to build a single index of governance of the six governance measurements rather than considering them as explanatory variables. The reason for this procedure is to avoid multicollinearity among these indicators. The composite governance index is built as follows:

(1) Using PCA, we transform the previous six governance indicators into six principal components (PCs) and then select the appropriate PC that captures the enormous amount of the total variance from the governance indicators.

(2) We rescale this component by dividing its values on its own largest value to construct a composite index for governance, i.e. $Governance = \left(\frac{PC}{max\,PC}\right) * 100$. Hence, the values of the composite governance indicator range from -100 to 100%. A value of $+100\%$ indicates perfect good governance, while -100% indicates worst governance.

4.2.2 Control variables. This paper intends to examine the influence on the economic development of governance. Thus, to control the bias caused by the omitted variable, four variables are adopted as the most frequently used variables in the literature as a proxy to economic control variables which are:

(1) **Trade Openness** is the natural log of trade as a percent of GDP for each country. Economic growth is expected to be positively affected by openness to international trade. Thus, a positive coefficient of openness to GDP is expected.

(2) **Population Growth** is the annual population growth rate for each country expressed as a percentage. More incredible population growth contributes to decreased economic growth. Thus, the negative influence of the population growth rate on GDP is expected.

(3) **Gross Capital Formation** is the natural log of gross fixed capital formation utilized as a representative for physical capital investment. More gross capital formation shares have proven to be positive for economic growth. Thus, a positive coefficient is expected.

(4) **Foreign Direct Investment** is the natural log of FDI flows in US$ as a percentage of real GDP. There is a great debate among scholars about the influence of FDI on GDP. In theory, FDI can positively affect growth because FDI, which generally moves from rich countries to economies with scarce capital, reduces capital rental levels and increases production by increasing labor productivity and implementing technology. On the other side, FDI may harm growth, exacerbating competition and distorting the country's development direction toward their interests. Thus, the predicted relationship could be vague (i.e. favorable or unfavorable) (Türkcan *et al.*, 2008).

So, our regression model is presented below:

$$LnGDPC = a_0 + b_1\, Governance + b_2\, LnTrade + b_3\, Population + b_4\, LnGross + b_5\, LnFDI + e \tag{1}$$

where LnGDPC is the natural log of GDP per capita (PPP) in the current international dollar. Governance is a composite governance index. LnTrade is the natural log of trade as a percent of GDP. Population is population growth. LnGross is the natural log of gross fixed capital formation. LnFDI is the natural log of FDI flows in US$ as a percent of real GDP.

5. Research methodology

5.1 Principal Component Analysis (PCA)

PCA is an approach that permits it possible to project the observations from p dimensional space of variables to a smaller dimensional space k, where $(k < p)$ such that a maximum of information is conserved. It converts many correlating factors to a few unrelated variables called PCs (Senna *et al.*, 2019). The first component captures the enormous variance amount among the variables, while the second component captures the second largest variance and so on.

The algorithm to derive the PCs relies on the analysis of the data matrix X_{ij}. The variance-covariance matrix Σ may be broken down into its eigen structure as follows (Jolliffe, 2003):

$$\Sigma = V\, \Lambda\, V^t \tag{2}$$

where Λ is the diagonal matrix of eigenvalues; V is the corresponding matrix of the loadings and t indicates the transpose. The eigenvalues in Λ provide the variance of the PC, PC_r specified as:

$$PC_r = X\, V_r \tag{3}$$

where V_r represents the contribution of each variable in X to the rth PC. The extracting components are ordered according to the amount of the total variance explained from the variables. We retain the first component, which explains most of the variation present in all variables.

5.2 Spatial regression models

The most basic linear regression specification assumes that outcomes are independent of different observations. This assumption may not always be satisfied in practice. There may be many reasons why observations are not independent, mainly when the dependent variable's values are clustered in different locations. For instance, GDP may be high in some neighboring countries and, at the same time, low in other neighboring countries, so-called spatial dependence or spatial autocorrelation. Therefore, spatial dependence may weaken or

produce biased estimators of the OLS method (Lesage and Pace, 2009). In this regard, the first step when working with data collected on a geographical scale is to examine the spatial dependency in the data.

The spatial regression model captures the spatial dependence through three parameters given by: the spatial autoregression coefficient (ρ), which indicates the presence of spatial autocorrelation among the dependent variables; the autoregressive factor (λ), which demonstrates the presence of spatial autocorrelation among residuals, and the influence of explanatory variables (θ) from neighboring locations. Hence, spatial regression models vary according to its spatial dependence parameters.

In spatial econometrics, the neighbor structure between n countries can be described by a $n \times n$ matrix w in which the components w_{ij} of the matrix are the spatial weights:

$$w_{ij} = \begin{bmatrix} w_{11} & w_{12} & \cdots & w_{1n} \\ w_{21} & w_{22} & \cdots & w_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1} & w_{n2} & \cdots & w_{nn} \end{bmatrix}$$

The spatial weights w_{ij} are non-zero when i and j are neighbors and zero otherwise. We employ row-standardization matrix, which divides the given weights w_{ij} by the row sum.

$$w_{ij}(s) = w_{ij} \Big/ \sum_{j} w_{ij} \tag{4}$$

As a result, the sum of each row is equal to unity. In addition, the sum of all weights equals n countries, $n = S_0 = \sum_i \sum_j w_{ij}$.

Our empirical work performs in the following fashion: First, the governance variable is constructed using PCA. Second, spatial independence is detected using the appropriate tests. Third, the fit spatial regression model is selected. Appendix presents the spatial dependence tests and detailed regression models.

6. Empirical results

6.1 Principal Component Analysis results

Table 1 reports the loadings of the six PCs. The eigenvalues of the first loading (L_1) are greater than one (5.081). Therefore, it should be retained. Besides, it captures about 84.7% of the total variance from governance indicators.

Table 1. Loadings of PCs for the composite governance index

Governance indicators	Loadings of PCs					
	L_1	L_2	L_3	L_4	L_5	L_6
Voice and Accountability	0.848	0.230	0.476	0.012	0.035	0.013
Political Stability	0.815	0.507	−0.280	−0.003	−0.008	−0.004
Government Effectiveness	0.956	−0.189	−0.134	0.077	0.139	0.087
Regulatory Quality	0.961	−0.140	−0.004	0.200	−0.132	−0.004
Control of Corruption	0.958	−0.144	−0.012	−0.226	−0.081	0.066
Rule of Law	0.972	−0.159	−0.033	−0.057	0.050	−0.154
Proportion of Variance	0.847	0.069	0.054	0.017	0.008	0.006
Cumulative Proportion of Variance	0.847	0.916	0.970	0.986	0.994	1.000
Eigenvalues	5.081	0.412	0.324	0.100	0.047	0.036

After choosing L_1, we proceed to construct a single index of governance as follows:

$$\mathrm{PC} = \mathrm{X} * L_1 \tag{5}$$

where X is the matrix of the six governance indicators. Hence, the governance index can be described as follows:

$$\text{Governance} = \left(\frac{\mathrm{PC}}{\max \mathrm{PC}}\right) * 100 \tag{6}$$

The composite governance measure has values ranging from −100 to 100%. A rating of +100% represents flawless good governance, whereas a value of −100% denotes the worst governance.

6.2 Ordinary Least Squares (OLS) model estimates

Table 2 provides OLS estimates and companion diagnostics. As shown in the table, the influence of governance on economic growth (0.011) is statistically significant. If all other variables are constant, a 1% increase in governance raises the economic growth by 1.1% at 10, 5 and 1% significance levels. Moreover, trade openness and gross capital formation had statistically significant positive impacts on GDP. In contrast, the negative effects of population growth and FDI on GDP were statistically significant and theoretically expected. The Jarque–Bera test is insignificant, indicating that the error term is normally distributed. In addition, all tests of the existence of heteroskedasticity are also insignificant. The proportion of the variance in the GDP that is predictable from the explanatory variables is 81.5%.

6.3 Spatial regression models estimates

6.3.1 Exploring the spatial dependence. We use a binary polygon rook contiguity matrix (w_{ij}), which is 116 × 116 with row-standardized with zero diagonal factors. The data were analyzed using R and GeoDa packages. Figure 1 depicts the box map of the LnGDP by zone in 2017.

OLS estimates		OLS diagnostics			
Variables	Coefficient	Test	Value	Goodness of fit	
Constant	2.758**	Normality of Errors		R-squared	0.815
Governance	0.011***	Jarque–Bera	0.794	Akaike Info Criterion (AIC)	177.895
LnTrade	0.412***	Heteroskedasticity			
Population	−0.253***	Breusch–Pagan	6.538		
LnGross	0.220***	Koenker–Basset	6.670		
LnFDI	−0.144**	Specification Robust Test			
		White	30.682		

Note(s): *, ** and *** represent 10, 5 and 1% significance level, respectively

Table 2.
OLS estimates and corresponding diagnostics

Figure 1.
Box map of the LnGDP by country in 2017

A box map is a quartile map expanded to six bins to detect the outliers. The outliers are defined as multiple of the interquartile range. It is the ideal tool for quickly and effectively identifying outliers and spatial patterns in a data set (Anselin, 1994). As shown in Figure 1, the box map of economic growth does not contain lower outliers or upper outliers. Visually, the GDP levels tend to cluster together in adjacent locations. The high GDP values are located near the other high values, while low GDP values are located near the other low values, indicating spatial dependence. In other words, this shows the convergence of economic growth in many different regions.

Moreover, the spatial dependence can be divided into four specific quadrants Local Spatial Autocorrelation (LISA) scatters plot. The high-high quadrant displayed weighted values of GDP of countries with high GDP and at the same time, surrounded by countries with high values of GDP of neighboring countries. The low-low quadrant is related to the low values of the neighboring countries and is the opposite case of the high-high quadrant. In the high-low quadrant, the high values of GDP are close to the low values of neighboring countries. The low-high quadrant displays the case where the high values of neighboring countries surround GDP.

Figure 2 displays that the high-high quadrant comprises 13 European countries. In contrast, the low-low quadrant includes 22 African countries, including India. The high-low quadrant includes one country, whereas no nation is represented in the low-high quadrant. The spatial dependence of the remaining countries (80 countries) is not significant. Appendix lists countries' classification by LISA cluster criteria.

Additionally, Figure 3 displays the Moran map of LnGDP. This graph is a useful tool to indicate the existence of spatial dependence in the data. It correlates the observed value of economic growth of a country with that observed in neighborhood countries. We find a linear positive spatial relationship of economic growth within the sample countries which means that this relationship is not homogeneous across locations.

According to the spatial dependence diagnostic tests, as shown in Table 3, all tests are statistically significant, except for the robust lag test, which requires using the spatial regression models when modeling the link of governance to economic growth based on

Figure 2.
LISA map of the LnGDP by country in 2017

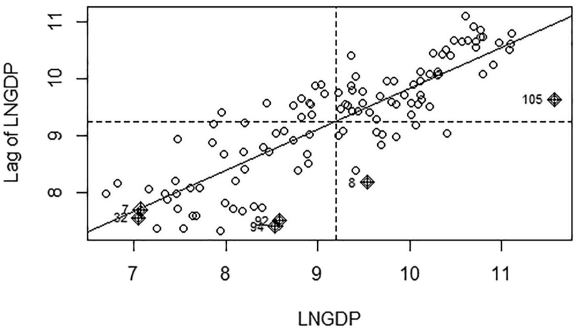

Figure 3.
Moran map of the LnGDP

neighboring countries' datasets. Besides, relying on models that include the error term is preferable.

6.3.2 Selection and model estimation. Exploring the AIC criterion scheme is the simplest way to select a suitable spatial regression model. As shown in Figure 4, the appropriate model is the SAC model with the lowest AIC value.

Table 4 displays the estimates of the spatial regression models. The five spatial models (SEM, SAR, SDM, SAC and SDEM) confirm the hypothesis of positive spatial dependence of economic growth since the coefficients of ρ for SAR, SDM and SAC and λ for SEM, SAC and SDEM are significant and have a positive sign.

The positive and significant value of the spatial dependence coefficients implies that each explored country's economic growth is through the spatial effect of neighboring countries' growth. In other words, GDP per capita in each country is not only related to its GDP per capita but is also impacted by variables prevalent in other countries, particularly those in its neighborhood. The impact of a distant country is assumed to be less important than that of a nearby country. As we see, in the SAR model, the parameter ρ indicates that a 1% increase in the average neighbor growth rates increases a country's economic growth by 0.321%.

Regarding the choice of model, we eliminate the Manski model because the coefficients of lag and error ($\rho = 0.053$ and $\lambda = 0.442$) are insignificant. Also, we eliminate SLX, SDM and SDEM models since most of the estimated coefficients of the spatially lagging independent variables in these models are insignificant. This is consistent with the insignificant coefficient ($\theta = 6.243$) in the likelihood-ratio (LR) test. As a result, we had to select amongst SAR, SEM and SAC models.

The R^2 (85.6%) for the SAC is higher than both SEM (85.5%) and SAR (84.7%) models, which is consistent with the AIC criteria of spatial regression models, where the SAC model has the lowest AIC. Thus, SAC can be considered a suitable model for modeling the link of governance to economic growth.

Diagnostics tests of spatial dependence

Test	Value
Moran test	4.587***
LM_λ-Error test	17.04***
LM_ρ- Lag test	14.67***
Robust LM_λ-Error test	4.382**
Robust LM_ρ-Lag test	2.012
SARMA	19.053***

Note(s): *, ** and *** represent 10, 5 and 1% significance level, respectively

Table 3.
Diagnostics tests of spatial dependence

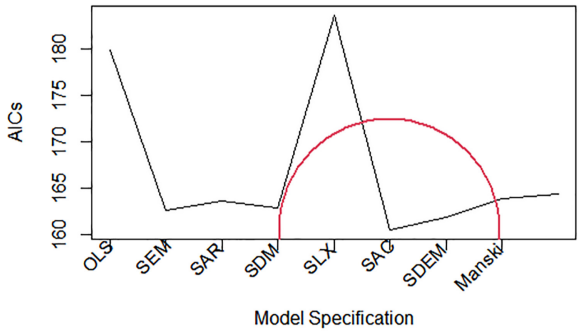

Figure 4.
AIC criteria of spatial regression models

Table 4.
Spatial regression models estimates

	SEM	SAR	SDM	SLX	SAC	SDEM	Manski
Intercept	2.960***	0.944	0.684	2.824	1.538	1.302	1.253
Governance	0.012***	0.009***	0.011***	0.011***	0.010***	0.011***	0.011***
Trade openness	0.452***	0.283**	0.348***	0.376**	0.374***	0.333***	0.332***
Population growth	−0.167***	−0.139***	−0.057	−0.129	−0.141**	−0.087	−0.083
Gross capital formation	0.201***	0.186***	0.203***	0.218***	0.198***	0.216***	0.214***
FDI	−0.162***	−0.107**	−0.139***	−0.134**	−0.138***	−0.130**	−0.131**
$\widehat{\rho}$		0.321***	0.469***		0.191**		0.053
$\widehat{\lambda}$	0.467***				0.314**	0.482***	0.442
$\widehat{\theta}$, Governance			−0.007***	−0.001		−0.002	−0.002
$\widehat{\theta}$, Trade openness			−0.159	−0.092		0.039	0.015
$\widehat{\theta}$, Population growth			−0.111	−0.186*		−0.203**	−0.195
$\widehat{\theta}$, Gross capital formation			−0.048	0.023		0.071	0.058
$\widehat{\theta}$, FDI			0.102	0.020		0.048	0.056
Observation	116	116	116	116	116	116	116
AIC	162.61	163.66	162.89	183.65	160.47	161.88	163.68
R^2	0.855	0.847	0.867	0.824	0.856	0.869	0.867
Log-likelihood	−73.305	−73.830	−68.443	−79.826	−71.237	−67.940	−67.928
LM residual auto-test		5.268**	0.771				
LR test $\widehat{\theta}$			10.775*	6.243		10.729*	6.618

Note(s): *, ** and *** indicate 10, 5 and 1% significance level, respectively

According to SAC model findings, we conclude that both the spatial error and the spatial lag coefficients are statistically significant, indicating that each country's economic growth positively and significantly affects the economic growth in its neighboring countries. Additionally, the unobserved characteristics of each country may also affect its economic growth and that of neighboring countries.

Governance has a statistically significant positive favorable on GDP per capita (p-value < 0.05). Furthermore, if all other variables are constant, 1% increase in governance raises the economic growth on average by 1%. The results also indicate that all control variables are statistically significant, and their signs align with the economic growth literature.

7. Conclusion and policy implications

This paper employs spatial econometrics models to explore the influence of governance on economic growth, considering the spatial dependence of growth. This paper finds some interesting results based on a dataset of 116 countries worldwide. First, spatial growth interactions among sample countries are significant and should be considered. Two main growth dependencies have been detected: high economic growth (composed of 13 European countries) and low growth (formed by 22 African countries, including India). Furthermore, Asia, North America, North America, the Caribbean and Central America seem to be individually disconnected in economic growth (the spatial dependence is not significant).

According to the above result, we emphasize that promoting regional integration among the countries of the same region will enhance its economic growth. For instance, the trade and commodity exchange level for Southeast Asian countries within the Association of Southeast Asian Nations framework has reduced inflation and tariff barriers associated with external markets, which led to booming growth in the region. Indeed, regional integration may improve economic ties, remove barriers to free trade in the area, exchange information and technical developments, enrich technological collaboration and facilitate communication.

Moreover, the experience of integration and unity in Europe is considered the most important and most successful regional integration experience. This experience has confirmed, and with conclusive evidence derived from practice, the transfer of the relationship pattern between neighboring and culturally heterogeneous countries from a state of dispersion and conflict to a form of cooperation and integration.

Second, the results indicate that governance is one of the main economic growth factors. Furthermore, if all other economic control variables are constant, 1% increases in governance raise economic growth on average by 1%. The results are similar to the previous studies of Helliwell (1992), Huang and Ho (2017), Fraj *et al.* (2018), Yahyaoui and Bouchoucha (2019), Fawaz *et al.* (2021) and Zhuo *et al.* (2021) in terms of the positive impact of all dimensions of governance on growth.

As a policy recommendation, governments or policymakers should widen their focus from only economic variables to including political and economic variables that affect economic growth. They should make every effort to achieve good governance and enhance economic growth. This may require a set of political measures; we recommend the following:

(1) Besides good policies, the country must strictly enforce laws and regulations. Undoubtedly, the rule of law is a crucial feature of governance that supports economic growth since it is closely associated with property rights and corruption control.

(2) It is necessary to reinforce the cornerstones of democracy by increasing citizens' ability to join and participate in civic and social-political life without fear of discrimination or oppression.

(3) Governments should put a strict anti-corruption policy. Absent corruption will increase consumer and investor confidence and increase society's institutional efficiency. Therefore, policymakers must take constructive policies to curb corruption, such as improving wages.

(4) Governments should create a better environment for investment by ensuring political stability. The political instability may motivate people to spend more because their savings may become worthless; hence saving rates would plummet. On the other side, investors' demand for fixed capital would also drop with increasing political uncertainty. Consequently, political instability negatively influences two crucial components that encourage economic growth: investment and savings.

(5) The ability of policymakers to make successful policy decisions to encourage private sector development is reflected in the good regulatory quality.

Finally, it is essential to emphasize the importance of regional cooperation in promoting good governance. Undoubtedly, reducing political conflicts between neighboring countries in any area will benefit their economic growth because it will encourage investment and, thus, prosperity in those countries. We also conclude from the results of spatial dependence in Africa that commitment to good governance and regional integration by removing barriers that hinder regional integration on the continent will inevitably lead to significant progress in economic, social, cultural and political development.

This study has a limitation represented in the unavailable data for some countries, particularly regarding governance. Therefore, making this data available will inevitably lead to improved results in the future.

In the same context, we employed spatial regression methods to investigate the impact of governance on economic growth using sample data from a single year. Hence, we advise future researchers to do more research on this topic utilizing time series data and spatial panel models.

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Appendix

The Appendix for this article can be found online.

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