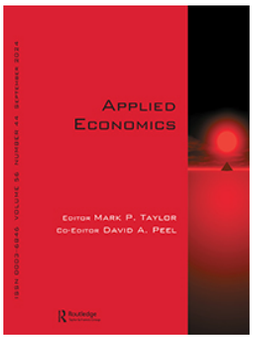

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Spillover effects of globalization using alternative spatial approaches

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ABSTRACT

Globalization's ramifications extend beyond borders, impacting local and global economies through intricate spatial connections, ultimately influencing economic growth trajectories. This study examines globalization's spillover impact on economic growth across 158 countries from 1990 to 2019, integrating geographical and non-geographical factors through spatial econometric techniques. The Spatial Durbin Model (SDM) based on CPSLHT (cultural, political, social, linguistic, and historical group memberships and international trade agreements) emerged as the best model compared to other spatial models. It finds expected direct positive associations between factors like initial GDP per capita, capital formation, labour force participation, economic globalization, health spending, urbanization, life insurance, poverty reduction, labour productivity, and rule of law with economic growth. However, the spillover effect of neighbouring countries on economic growth is significant and negative. The Fixed Effects SDM also identifies indirect influences on economic growth, including health spending, the age dependency ratio, and the population growth rates. Global negative effects are prevalent, especially in regions with low GDP per capita, reduced health spending, and a high age dependency ratio. Countries can enhance globalization's benefits and mitigate drawbacks by investing in healthcare, boosting labour force participation, reducing age dependency, promoting urban development, and upholding the rule of law.

KEYWORDS
Growth; globalization; spatial; spillover

JEL CLASSIFICATION
R12; R19; R11

I. Introduction

Globalization occupies a vital role in economic growth. Globalization integrates different economies, cultures, technology, and governance. Globalization produces a system of mutual interdependence across countries. It enables the diffusion of technology and innovation and allocates resources efficiently. There are several arguments about the impacts of globalization. Globalization creates both positive and negative effects. Globalization is often associated with bolstering economic growth through a variety of channels. These channels encompass knowledge transfer across borders, economies benefiting from scale advantages, specialization and innovation, efficient resource utilization, the spread of technology, enhanced factor productivity, and increased capital accumulation (Ahmad 2019).

Globalization within a country stimulates economic growth by facilitating access to advanced production and distribution technologies while optimizing resource allocation. Greater globalization fosters heightened competition among firms, thereby contributing to increased economic growth. Additionally, globalization generates externalities in neighbouring and related countries, influenced by the membership of cultural, political, social, linguistic, and historical groups and international trade agreements. These externalities are also observed in neighbouring countries due to geographical proximity.

The spillover effect of globalization on economic growth suggests that globalization, which involves the interconnectedness of economies worldwide through trade, investment, and other forms of exchange, has indirect consequences on the growth of economies. These consequences extend beyond the immediate participants in globalization to influence other economies, creating a ripple effect or 'spillover' that can either enhance or hinder economic growth. Understanding and analysing this spillover effect is crucial for comprehending the broader implications of globalization on the global economy and individual nations' economic performance.

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The implications of the spillover effect of globalization on economic growth are significant and multifaceted. The spillover effect underscores the interconnected nature of the global economy. Economic actions and policies in one country can have far-reaching consequences on other economies through various channels such as trade, finance, and technology transfer. While globalization can create opportunities for economic growth through increased trade, investment, and technological advancements, it also poses challenges such as heightened competition, vulnerability to external shocks, and the potential for unequal distribution of benefits. Given the transnational nature of the spillover effect, policymakers need to coordinate their efforts to manage and mitigate its impact effectively. This may involve collaboration on trade agreements, financial regulation, and macroeconomic policies to ensure stability and sustainable growth.

Globalization's spillover effect can exacerbate income inequality within and among countries. While some regions or social groups may benefit from increased economic integration, others may experience displacement of industries, job losses, and widening income disparities. Globalization's impact on economic growth can also have environmental implications, such as increased resource extraction, pollution, and greenhouse gas emissions. Addressing these challenges requires international cooperation and sustainable development initiatives. Overall, understanding the implications of the spillover effect of globalization on economic growth is essential for policymakers, businesses, and civil society to navigate the complexities of an increasingly interconnected world economy.

Divergent viewpoints mark the literature on the relationship between globalization and economic growth. Some scholars (Dollar 1992, Alesina and Perotti 1994; Sachs, Warner, Aslund, and Fischer 1995; Edwards 1998, Rodrik 1998, and Stiglitz 2004; Dreher 2006) support the notion of positive effects stemming from globalization on economic growth, while others (Majidi 2017; Radulović and Kostić 2020) contend that globalization can have adverse consequences on economic growth. Majidi's (2017) study on 100 developing nations from 1970 to 2014 revealed a negative impact of political globalization on economic growth in upper-middle-income countries, while economic and social globalization showed no significant effects. Lower-middle-income nations experienced positive growth effects from total and political globalization, with economic and social globalization remaining insignificant. Radulović and Kostić's (2020) study on 19 Eurozone economies from 1970 to 2016, using economic, social, and political measures, found that short-term effects showed economic and social globalization boosting growth while political globalization hindered it. Economic globalization significantly promoted growth in the long term, while social and political globalization limited it. There are several studies related to globalization's impact on economic growth. However, there is a clear absence of literature discussing the spillover effect of globalization on economic growth.

The variability in research outcomes can be attributed to diverse factors, including variations in country selection, periods, statistical methods, and the potential influence of unobservable country-specific factors that might skew the results. As Samimi and Jenatabadi (2014) pointed out, a significant portion of the literature on globalization primarily relies on trade and foreign capital volume as standard measures for assessing their impact on economic growth. However, these de facto indicators do not comprehensively account for trade and financial globalization policies. In addition to trade and capital flow measurements, it is crucial to consider policy-related variables like protection rates and tariffs, which can provide insights into a country's trade restrictions.

This article re-examines the link between globalization and economic growth by incorporating a spatial perspective through spatial econometric analysis. Our study incorporates spatial weight matrices encompassing geographical and non-geographical aspects. Including geographical matrices is straightforward, as globalization often involves countries within the same geographic clusters, regions, or economic associations. Additionally, geographic distance frequently serves as a proxy for factors such as transportation costs and technology transfers, which are essential in globalization.

The article examines the impact of globalization on economic growth and its associated spillover

effects across 158 countries during the period spanning from 1990 to 2019. This study seeks answers to a series of pivotal research questions in light of this context. Firstly, it endeavours to gauge the degree to which globalization significantly influences economic growth. Secondly, it explores the potential for globalization to trigger spillover effects on the economic growth of neighbouring nations. Additionally, the study delves into the intricate dynamics involving institutional development, financial systems, and demographic factors in shaping the intricate relationship between globalization and economic growth. Moreover, it scrutinizes whether globalization extends its ripple effects to countries with commonalities in culture, society, politics, language, and international trade agreements. While the initial query remains straightforward, the subsequent inquiries venture deeper into the potential implications of globalization, transcending geographical proximity to encompass a diverse array of non-geographical factors among the countries under investigation.

In summary, this study aims to enrich our understanding of globalization. It does so through spatial econometric analysis, with the primary objective of uncovering how globalization influences economic growth and generates spillover effects. This research contributes significantly to the existing literature on the relationship between globalization and growth. In addition to considering geographical distance as a measure of globalization spillovers, this study introduces the concept of non-geographical proximity, allowing for an investigation of potential spillover effects among countries that share similar non-geographical characteristics. Moreover, the study's extensive use of panel data, spanning 158 countries from 1990 to 2019, strengthens its capacity to provide robust insights into the questions raised.

Utilizing non-geographical matrices encompassing variables such as culture, politics, language, history, and international trade agreements (CPSLHT) marks a novel advancement in spatial analysis in this paper. These matrices have been deployed to study the relationship between globalization and economic growth. By considering these non-geographical factors, researchers can identify clusters of countries that share commonalities in CPSLHT. These clusters encompass regions such as South Asia, East Asia, ASEAN, Central Asia, the Middle East, Oceania, East Europe, West Europe, Africa, South America, North America, and pre-2000 international trade agreements.

Examining globalization's impact on economic growth has adopted a refined approach in this study, employing explicit spatial econometrics methodology. Furthermore, it considers various factors, including cultural, political, social, linguistic, and historical group memberships and international trade agreements. This article aims to enrich the existing literature in this area. Free international trade agreements have the potential to generate opportunities for increased trade and investment, consequently fuelling economic growth among the participating nations based on the gains from specialization and trade. What distinguishes this article is its application of spatial modelling, utilizing two different types of weight matrices. The study aims to assess the spillover impact of globalization on economic growth by examining data spanning 30 years from 158 countries. These weight matrices are created based on geographical proximity or non-geographical factors, including cultural, political, social, linguistic, and historical group memberships and international trade agreements (CPSLHT). The utilization of CPSLHT weight matrices in this study is pioneering. The research re-evaluates the spillover effects of globalization on economic growth through the utilization of spatial panel methods. It employs the spatial Durbin model (SDM) to scrutinize these spillover effects. One limitation of this study is that the scope of this study did not include the spillover impact of globalization on income inequality and environmental quality.

Furthermore, other spatial models are estimated and compared to determine the most suitable model for the analysis. The study also calculates the marginal effects of globalization to assess both direct and indirect influences. These represent the primary contributions of our paper to the existing body of literature.

The remainder of this article is organized as follows. In the following section, we briefly review the literature. The third section presents the empirical model, econometric methods, and the dataset used for analysis. The fourth section

presents statistical evidence on the impact of globalization on economic growth and presents the main results of the Spatial panel statistical methods. Finally, the last section concludes the paper.

II. Literature review

Recent advancements in spatial literature are prominently showcased across various studies outlined below. Extended examinations of spatial econometrics encompass the following topics. While these studies may not explicitly address the spatial ramifications of globalization on economic expansion, they are included here as the most pertinent articles from a spatial literature perspective, elucidating the breadth and depth of contemporary spatial research.

Mahmood (2023) uses the spatial Durbin model to explore the impact of FDI, exports, and imports on emissions in 18 Latin American countries (1970–2019). Mahmood's study (Mahmood 2022b) examines trade and FDI's impact on CO2 emissions in GCC(Gulf Cooperation Council) countries (1990–2019) using the spatial Durbin model. Mahmood's (2022b) research examines trade, renewable energy consumption (REC), and industry value-added in South America from 1990–2018. Mahmood, Alkhateeb, and Furqan's study (Mahmood, Alkhateeb, and Furqan 2020) examines how income, trade, energy consumption, and FDI influence CO2 emissions in five North African countries from 1990 to 2014, considering spatial dependency and the Environmental Kuznets Curve (EKC) hypothesis. Mahmood, Furqan, and Bagais's study (Mahmood, Furqan, and Bagais 2018) explores the environmental impacts of financial market development (FMD), foreign direct investment (FDI), and trade openness on per capita CO2 emissions in six East Asian countries from 1991–2014, considering spillover effects from neighbouring countries.

This research centres on the role of globalization in influencing economic growth. The beneficial impacts of globalization on economic growth have been documented in several studies, including those conducted by (Dollar 1992, Sachs, Warner, Aslund, and Fischer 1995, and Edwards 1998. Dollar's 1992) investigation employs linear regression techniques, employing de facto globalization indicators such as trade openness and foreign capital inflows. Meanwhile, Sachs, Warner, Aslund, and Fischer (1995) utilize regression analysis and the concept of primary export intensity (the ratio of primary exports to total exports) across a dataset encompassing 135 countries. Dreher (2006), in his study covering 123 countries from 1970 to 2000 using ordinary least squares and generalized method of moments, finds that globalization positively affects growth.

In contrast, Rodriguez and Rodrik (2000) challenge the conclusions drawn by Dollar, Sachs, Aslund, and Fischer due to perceived weaknesses in their evidence. These shortcomings include omitting crucial growth indicators and using trade openness indices that are considered questionable. On the other hand, proponents of the globalization-growth relationship, such as (Alesina and Perotti 1994, Rodrik 1998, and Stiglitz 2004), contend that globalization can indeed facilitate potential improvements in growth. They posit that this improvement is driven by mechanisms intricately linked to globalization.

Certain studies suggest that the positive impacts of globalization may only materialize when specific complementary conditions are met. Using cross-country regression, Borensztein, De Gregorio, and Lee (1998) analyse how foreign direct investment (FDI) impacts economic growth. This study uses data on FDI flows from industrialized nations to 69 developing countries over two decades, and the findings highlight FDI's significant role in technology transfer and its greater contribution to growth than domestic investment. However, the study contends that the benefits of globalization become evident when there is an ample supply of human capital.

Calderon and Poggioa (2010) analyse trade's impact on growth in DR-CAFTA (Dominican Republic – Central America Free Trade Agreement) countries, considering policy complementarities and trade's relationship with factors like human capital, finance, institutions, infrastructure, openness, innovation, and regulations. Key findings link trade to growth, varying by country conditions. It spurs growth in nations with higher human capital, developed financial markets, strong institutions, advanced infrastructure, global integration, increased R&D, and less regulation.

Rao and Vadlamannati's (2011) study using extreme bound analysis for 21 low-income African countries from 1970 to 2005 shows that globalization has small but significant positive permanent growth effects. Gurgul and Lach (2014) supported the positive effect of globalization on growth for 10 CEE economies. This positive impact was robust for the social and economic aspects of globalization. On the other hand, the empirical results provided solid evidence against any impact of political globalization.

The study of Samimi and Jenatabadi (2014), covering the years 1980 to 2008 and spanning 33 Organization of Islamic Cooperation (OIC) countries using the generalized method of moments, reveals three key findings. Firstly, it shows that economic globalization has a positive and significant impact on the economic growth of OIC nations, suggesting a favourable influence. Secondly, this positive effect is more pronounced in countries with higher human capital and advanced financial systems. Lastly, the study highlights that the impact of economic globalization on growth varies based on income levels, underscoring the nuanced relationship between globalization and economic growth in different economic contexts.

Majidi's (2017) study covering 1970–2014 for 100 developing countries observed the negative impact of political globalization on growth in upper-middle-income countries. The study did not observe any significant economic and social globalization effect on growth. Moreover, the study indicates that total and political globalization positively and significantly impact economic growth in developing countries with lower-middle-income levels. However, economic and social globalization factors do not exhibit statistical significance in their effects on growth.

The study by Ahmad (2019) examines the globalization-growth link using a less common spatial econometric approach, investigating potential spillover effects on neighbouring countries. Analysing 83 countries over three decades, it utilizes spatial autoregressive panel data methods to enhance a growth model, considering globalization indices. Findings reveal a positive impact of economic globalization, contingent on political factors, with observed spillover effects among neighbours.

The study by Radulović and Kostić (2020) explores globalization's impact on growth in 19 Eurozone economies during 1970–2016, using economic, social, and political measures. It employs the Pooled Mean Group estimator (PMG) for short- and long-term analysis. Findings indicate that short-term, economic, and social globalization enhances growth, while political globalization hinders it. Long-term economic globalization significantly boosts growth, whereas social and political globalization constrains it.

The study of Li and Li (2018), using spatial econometrics for counties in China from 1992–2013, investigated the agglomeration versus economic inequality trade-offs and measured the spillover effects. It observed a trade-off between economic growth and agglomeration and found a positive spillover effect on China's economic growth. The East and South East Asian economies, characterized by rapid growth and industrialization, have reaped significantly greater advantages when compared to the regions of Sub-Saharan Africa and South Asia (Cook and Kirkpatrick 2010). The role of trade openness, foreign direct investment, and high-technology exports in transitioning from middle-income to high-income were observed (Jayadevan, Hoang, and Yarram 2023).

Variations in research outcomes arise from factors like country selection, timeframes, methods, and unobservable country-specific influences. Samimi and Jenatabadi (2014) emphasize the need to consider policy-related variables, not just trade and capital flows, to comprehensively analyse globalization's impact on economic growth. This article reassesses globalization's impact on economic growth using spatial econometric analysis with weight matrices covering geographic and non-geographic factors, including culture, politics, language, history, and trade agreements. This study explores globalization's impact on economic growth, spillover effects on neighbouring nations, and the role of institutions, finance, and demographics.

III. Estimation approach

Model specification

The data of clustered units based on the membership of cultural, political, social, linguistic, and historical groups and international trade agreements are not independent but somewhat spatially

correlated. A wide range of spatial panel models can be estimated. According to Elhorst (2014), three different types of interaction effects can be estimated- endogenous interaction effects among the dependent variable (Y), exogenous interaction effects among the independent variables (X), and interaction effects among the error terms (ε). The basic equation for these models can be written below (Belotti, Hughes, and Mortari 2013, 2017; Elhorst 2014; J. P. LeSage 1999).

SDM (Spatial Durbin Model) generalizes the Spatial autoregressive (SAR) model and implies global spatial spillovers. This model's explanatory variables also include spatially weighted independent variables. The SDM incorporates endogenous and exogenous interaction effects. The endogenous effects of this model can capture how the value of the dependent variable Y for a spatial unit might also be affected by the dependent variable of other spatial units. The exogenous effect can capture how the value of the dependent variable Y for a spatial unit might also be affected by some independent variables of other spatial units. The spatial dependence of economic growth in a country on economic growth in other countries and on globalization in other countries is estimated with the SDM.

The globalization-economic growth nexus has been revisited by applying spatial panel econometric methods using the Spatial-Durbin model. We must consider this when using the spatial correlation approach because the actual space, border, or neighbourhood usually does not present strong correlations. However, there would be strong correlations for different patterns, such as a group of countries based on the membership of cultural, political, social, linguistic, and historical groups and international trade agreements. We can consider different approaches to decide on the spatial weighted matrix W based on different causes of correlations.

Explaining the spillover effect of globalization on economic growth using the Spatial Durbin model involves breaking down how globalization, which refers to the increasing interconnectedness of economies and societies worldwide, influences economic growth across different geographical areas or regions. The Spatial Durbin model is a statistical tool used in econometrics to analyse spatial data and understand how the behaviour of one area affects neighbouring areas. By applying this model, researchers can examine how changes in globalization variables impact economic growth within a specific region and how these effects spill over to adjacent or interconnected regions. By employing the Spatial Durbin model, we can elucidate the intricate relationships and transmission channels through which globalization influences economic growth, shedding light on both direct effects within a region and indirect effects that propagate across space.

The SDM is the most appropriate model if there are spatially correlated omitted variables in the model that correlate with an included explanatory variable (J. LeSage and Pace 2009). The spatial dependence of economic growth in a country on economic growth in other countries and on globalization in other countries is estimated with the SDM model.

$$Y_t = \rho WY_t + X_t\beta + WZ_t\theta + \mu + \varepsilon_t \qquad (1)$$

The dependent variable y_t denotes the n×1 column vector of the dependent variable; X_t denotes the nxk matrix of regressors, where $t = 1, \ldots,$ T indicates time series periods; Z_t denotes the nxk matrix of regressors used for the interaction effect between spatial weights and regressors;β is the regression coefficient; ρ is the spatial autoregressive parameter reflecting the strength of the spatial dependencies; and ε is the unobserved error term. W is the nxn matrix indicating the spatial arrangement of the n units, and each entry w_{ij} ε W represents the spatial weight associated with units i and j, where i is the i^{th} country and j is the related country. Self-neighbours are excluded by conventionally setting the diagonal elements w_{ij} equal to zero (Belotti, Hughes, and Mortari 2017). The details of the variables used in the study are reported in Table 1.

We also assessed the SDM with the other spatial models. The SAR (spatial autoregressive) model can be specified as below:

$$Y_t = \rho WY_t + X_t\beta + \mu + \varepsilon_t \qquad (2)$$

The SAC (SAR with spatially autocorrelated errors) can be specified as below:

Table 1. Key variables and their description.

Variables	Definition	Source
GDPC	GDP per capita, PPP (constant 2017 international $)	World Bank
GDPC(−1) or GDPC_1	First lag of GDPC Calculated	Calculated
EGLOBI	Economic Globalisation Index	Valev
SGLOBI	Social Globalisation Index	Valev
PGLOBI	Political Globalisation Index	Valev
EFI	Economic freedom, overall index (0–100)	Valev
GFCF	Gross fixed capital formation – % of GDP	World Bank
LFPT	Labour force participation rate, total	World Bank
EEXP	Government Education Expenditure (% of GDP)	World Bank
EEXP(−1),	EEXP_1 First lag of EEXP	Calculated
DGGHE	Domestic general government health expenditure (% of GDP)	World Bank
URBP	Share of the urban population (%)	World Bank
ADR	Age Dependency Ratio (% of working age population)	World Bank
LIP	Premiums volume - Life insurance (as % of GDP)	Valev
NLIP	Premium volume - Non-life insurance (as % of GDP)	Valev
PHR	Poverty Head Count Ratio	World Bank
EMPP	LabourProductivity (constant 2017 PPP$ per person)	World Bank
INFL	Inflation rate, Consumer Prices (Annual %)	World Bank
POGR	Population growth rate (Annual %)	World Bank
RLI	Rule of Law Index	Valev
CTY	Number of Countries	Calculated

Source: World Bank (2020) and TheGlobalEconomy (2020).

$$Y_t = \rho W Y_t + X_t\beta + \mu + v_t \tag{3}$$

$$v_t = \lambda M v_t + \varepsilon_t \tag{4}$$

M is the spatial weights matrix that may or may not equal W. The following equations can estimate the spatial error model (SEM). SEM focuses on SAC in the error term.

$$Y_t = X_t\beta + \mu + v_t \tag{5}$$

$$v_t = \lambda M v_t + \varepsilon_t \tag{6}$$

The estimation of the spatial model would be sensitive to the format of the weight matrix W. W is the row-standardized spatial weights matrix, whose elements are defined as follows: $W_{ij}^{std} = \frac{W_{ij}}{\sum_{j=1}^{N} W_{ij}}$ (Pisati 2012).

We may need a clear rule for establishing the W matrix in addition to the neighbourhood. A trade pact would be one of the criteria, but it is not convincing if we use some trade pacts and leave out others. After careful thinking, we have constructed an alternative weight matrix for a group of countries in geographical locations with similar membership of cultural, political, social, linguistic, and historical groups and international trade agreements that could be considered the following: South Asia, East Asia, ASEAN, Central Asia, Middle East, Oceania, East Europe, West Europe, Africa, South America, and North America. We can then use this pattern with the pre-2000 trade agreements to see if the estimation result makes sense. The second weight matrix is constructed based on the geographical distance or neighbourhood.

The following trade pacts were included in the weight matrix: Central American Integration System, Central European Free Trade Agreement, Common Market for Eastern and Southern Africa, Council of Arab Economic Unity, Dominican Republic-Central America Free Trade Agreement, United States and the Central American countries, East African Community, Economic Cooperation Organization Trade Agreement, European Economic Area, European Free Trade Association, European Union Customs Union, G3 Free Trade Agreement, Gulf Cooperation Council, Organization of the Black Sea Economic Cooperation, South Asian Free Trade Area, Southern African Development Community, Southern Common Market, North American Free Trade Agreement, Arab Cooperation Council, Asia-Pacific Economic Cooperation, Black Sea Economic Cooperation Zone and Caribbean Community and Common Market.

We specify and estimate spatial econometric models for empirically verifying spatial externalities and measuring their strength and range (Anselin 2016). Spatial models require a spatial weight matrix (SWM), which shows the spatial relationships among variables in a dataset. The spatial binary

weight matrix member would take values '1' if i and j were neighbours and '0' otherwise. Similarly, if a country is a member of those cultural, political, social, linguistic, and historical groups and international trade agreements as mentioned above, the member would take a binary value of 1; otherwise, it would take a zero. The W in this study is 158X158. The spatial panel regression model is estimated using the conceptualization of spatial relations of the polygon rook contiguity. The SDM models are estimated separately for different SDM effects, namely, SDM random effects, SDM spatial fixed effects, SDM time fixed effects, and finally, SDM spatial and time fixed effects for economic growth. Quasi-maximum likelihood estimation method is used. Panel data models possess advantages over cross-sectional models due to their increased degrees of freedom, capacity to account for individual and time-fixed effects, and lower levels of collinearity among the variables in the model (Ragoubi and Harbi 2018).

The data

The data for this study come from the World Development Indicators, World Bank (2020) and Valev (2020). The dependent variable is GDP per capita. The value of Pesaran's test of cross-sectional independence is 4.82, which is significant with Pr = 0.0000. Therefore, the data is cross-sectional dependent. The spatial model estimation is performed using the techniques provided by Elhorst (2014) and Anselin, Bera, Florax, and Yoon (1996). The details of the variables used in the study are reported in Table 1.

The overall globalization index covers globalization's economic, social, and political dimensions. Higher values denote greater globalization. All three globalization indices cannot be simultaneously included in regression analysis because of political and economic globalization's high multicollinearity (Table 2). Hence, political globalization has been excluded from regression analysis.

We have chosen the control variables, namely gross fixed capital formation, labour force participation, education spending, and health spending because they are stable factors influencing economic growth. It is crucial also to consider and incorporate additional control variables that may impact economic growth. Factors such as the overall index of economic freedom and the rule of law index reflect the health of the institutional framework. Meanwhile, variables like the age dependency ratio and population growth rate represent demographic changes. Inflation is employed to signify the state of the macroeconomy. Additionally, economic control variables encompass life insurance, non-life insurance premiums, poverty headcount ratio, labour productivity, and urbanization rate.

The dependent variable is GDP per capita. Using spatial panel econometric methods, this study provides new empirical evidence concerning GDP per capita and its determinants for 158 countries from 1990 to 2019. This study will help formulate appropriate policies for managing the economic growth rate, especially for emerging countries.

Table 2. Correlations matrix for explanatory variables.

VariableGFCF	LFPT	EGLOBI	SGLOBI	PGLOBI	EEXP_1	DGGHE	URBP	ADR	LIP	NLIP	EFI	PHR	EMPP	INFL	POGR	G_RLI
GFCF	1.00															
LFPT	−0.06	1.00														
EGLOBI	0.06	−0.17	1.00													
SGLOBI	−0.03	0.01	0.02	1.00												
PGLOBI	0.02	−0.16	0.96	0.04	1.00											
EEXP_1	0.07	−0.01	0.01	0.06	−0.01	1.00										
DGGHE	0.10	−0.12	0.02	0.02	0.00	0.43	1.00									
URBP	0.14	−0.24	0.06	0.04	0.01	0.20	0.52	1.00								
ADR	0.04	−0.02	0.00	−0.73	−0.03	0.01	0.01	−0.01	1.00							
LIP	0.05	−0.02	−0.02	0.43	−0.03	−0.01	−0.05	0.09	−0.32	1.00						
NLIP	0.09	−0.04	−0.03	0.42	−0.01	−0.01	0.01	0.08	−0.34	0.44	1.00					
EFI	−0.03	−0.01	−0.02	0.61	0.01	0.01	0.04	0.03	−0.46	0.43	0.31	1.00				
PHR	0.02	0.05	0.00	−0.72	0.00	0.00	−0.01	−0.03	0.69	−0.32	−0.40	−0.41	1.00			
EMPP	0.20	−0.33	0.08	0.03	0.01	0.28	0.65	0.80	0.01	0.08	0.05	0.03	0.00	1.00		
INFL	0.00	0.03	−0.01	−0.32	0.00	−0.08	0.02	−0.03	0.16	−0.23	−0.05	−0.35	0.19	−0.02	1.00	
POGR	0.03	0.00	0.04	−0.42	0.00	−0.02	0.02	0.01	0.44	−0.17	−0.24	−0.15	0.44	0.02	−0.02	1.00
G_RLI	0.03	−0.01	0.00	0.70	0.00	−0.01	0.01	0.01	−0.55	0.56	0.50	0.69	−0.64	0.00	−0.31	−0.27	1.00

Source: Authors' calculations.

We analyse four categories of countries classified by the World Bank (The World Bank 2020). We classify 158 countries into four categories following the World Bank classification of countries based on GNI (Gross National Income) per capita. The thresholds for income classification are as follows: Less than US$ 1026 is a low-income country, US$ 1026 to US$ 3995 is a lower-middle-income country, US$ 3996 to US$12375 upper-middle-income country, greater than US$ 12375 is a high-income country.

The average GDP per capita for the 158 countries analysed in the current study during 1990–2019 was USD 17,557.27. The average GDP per capita was USD 45,444.57 for high-income countries and USD 16,911.05 for upper-middle-income countries, which is 2.69 times lower than the former. The average GDP per capita of lower-middle-income countries was USD 7587.62, which is 2.23 times lower than the average GDP per capita for upper-middle-income countries. Similarly, the average GDP per capita for low-income countries was USD 2325.74, which is 3.26 times lower than the average GDP per capita for lower-middle-income countries (Table 3). The GDP per capita by the level of income is presented in Figure 1. A geographical map of countries based on income level is presented in Figure 2. A list of countries included in the study is provided in Appendix 1.

The economic globalization index varies across income categories. High-income countries have the highest average index at 73.24, ranging from 33.07 to 95.29. Upper-middle-income countries have an average index of 57.78, fluctuating between 23.89 and 86.39. Lower-middle-income countries fall within a range of 15.87 to 82.02 for their average economic globalization index. Low-income countries show an index from 14.26 to 70.07 (Table 4). These variations highlight the diversity of economic globalization levels among nations based on income classifications, as shown in Figure 3.

IV. Results and discussion

The estimates of non-spatial regression are reported in Table 5. According to the Hausman test, fixed effects results are the best one. Fixed effects regression indicates that the initial GDPC, capital formation, labour force participation, economic globalization, health spending, urbanization, life insurance, poverty reduction, and the rule of law have the expected signs and are significant.

This study performs spatial panel data analysis to examine the spatial impact of globalization on economic growth. Panel models can also exhibit cross-sectional error dependence due to various factors. Cross-sectional dependence is a prevalent issue in macro-panels with long time series. Cross-sectionally, the errors should be distributed

Table 3. Descriptive statistics for average GDP per capita during 1990–2019.

Income Level	Mean	MIN	MAX	Range	STD
High-Income	45444.57	14778.87	114889.18	100110.31	18217.45
Upper-Middle-Income	16911.05	5632.09	49406.29	43774.20	6979.56
Lower-Middle-Income	7587.62	1621.74	23585.18	21963.44	3302.41
Low-Income	2325.74	436.72	21944.51	21507.79	1546.05
Overall	17557.27	436.72	114889.18	114452.46	19660.09

Source: Authors' calculations.

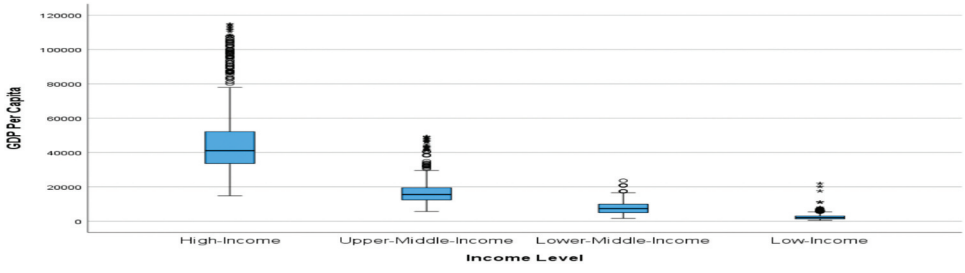

Figure 1. GDP per capita, 1990–2019.

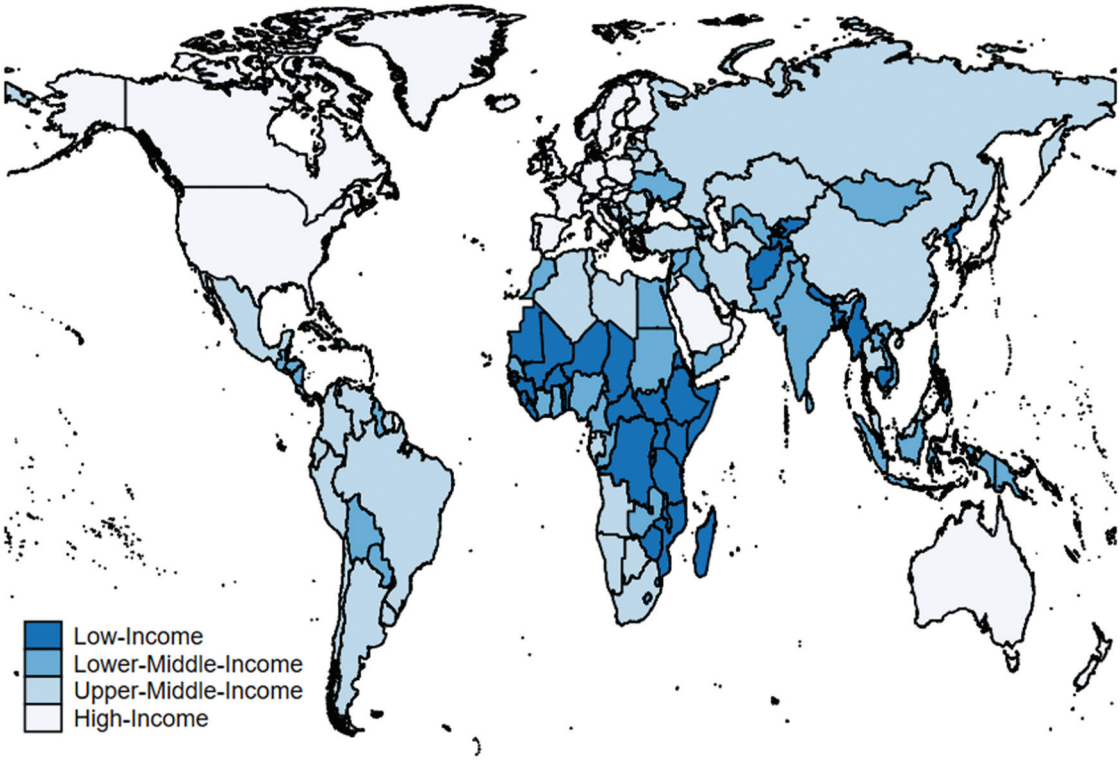

Figure 2. Income status of countries in 2019.

Table 4. Descriptive statistics for globalization index.

Income type	Mean	MIN	MAX	Range	STD
Economic Globalization					
HI	73.24	33.07	95.29	62.22	11.45
UM	57.78	23.89	86.36	62.47	12.80
LM	49.89	15.87	82.02	66.15	10.86
LI	40.29	14.26	70.07	55.81	10.80
Social Globalization					
HI	78.75	36.10	92.27	56.17	8.64
UM	63.19	21.97	83.40	61.43	10.06
LM	48.98	12.92	75.64	62.72	11.34
LI	29.85	6.54	61.27	54.73	10.75
Political Globalization					
HI	76.35	15.43	98.59	83.16	21.10
UM	66.50	17.82	94.06	76.24	18.89
LM	58.79	12.22	92.96	80.74	20.42
LI	51.91	10.64	89.83	79.19	16.28

Source: Authors' calculations.
HI = High-Income Countries, UM = Upper-Middle-Income, LM = Lower-Middle-Income, LI = Low-Income Countries

independently. We can check the data for cross-sectional dependence using the Breusch-Pagan LM test if $T > N$ and Pesaran CD test if $T < N$. Pesaran's test of cross-sectional independence value is 4.82, significant with Pr = 0.0000. So, the data is cross-sectional dependent. The results of Pesaran's CD test (Pesaran 2015) are reported in Table 6. P-values approaching zero suggest a strong correlation within the data across panel groups. This applies to all the explanatory variables except GFCF, LFPT, and DGGHE. The cross-section independence, CD ~ N(0,1), can be observed only in GFCF, LFPT, and DGGHE.

Moran's I test is used to test the presence of spatial autocorrelation in the residuals of the OLS estimation of GDP per capita as a function of globalization. The yearly Moran's I estimation is significant.

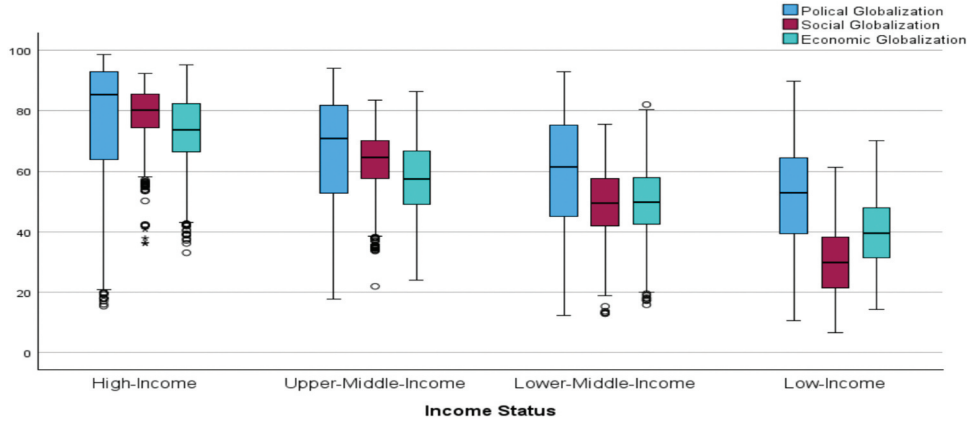

Figure 3. Globalization index, 1990–2019.

Table 5. Estimates of OLS, fixed and random effects.

VARIABLES	OLS	Fixed Effects	Random Effects
LOG(GDPC(−1))	0.0221***	0.022***	0.021***
	(0.01)	(0.001)	(0.001)
LOG(GFCF)	0.037***	0.022***	0.030***
	(0.005)	(0.004)	(0.004)
LOG(LFPT)	1.215***	1.117***	1.185***
	(0.0129)	(0.0152)	(0.0136)
LOG(EGLOBI)	0.020***	0.017***	0.019***
	(0.001)	(0.001)	(0.001)
LOG(SGLOBI)	0.002	−0.034***	−0.007
	(0.008)	(0.008)	(0.008)
LOG(EEXP(−1))	0.009	0.019	0.010
	(0.006)	(0.006)	(0.006)
LOG(DGGHE)	0.095***	0.105***	0.098***
	(0.005)	(0.006)	(0.005)
LOG(URBP)	0.046***	0.043***	0.044***
	(0.006)	(0.007)	(0.006)
LOG(ADR)	0.045***	0.013	0.038***
		(0.010)	(0.014)
LOG(LIP)	0.0001	0.002***	0.001
	(0.000)	(0.001)	(0.001)
LOG(NLIP)	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
LOG(EFI)	−0.032**	0.012	−0.023
	(0.013)	(0.018)	(0.015)
LOG(PHR)	0.002	−0.016***	−0.0004
	(0.002)	(0.004)	(0.002)
LOG(EMPP)	1.044***	1.036***	1.043***
	(0.004)	(0.004)	(0.004)
LOG(INFL)	−0.002	0.0002	−0.001
	(0.001)	(0.001)	(0.001)
LOG(POGR)	0.001	0.007*	0.004
	(1)		(1)
	(0.004)		(0.004)
LOG(G_RLI)	0.013**	0.040***	0.012*
	(0.006)	(0.011)	(0.006)
Constant	−3.062***	−2.761***	−2.972***
	(0.045)	(0.057)	(0.048)
Observations	4,740	4,740	4,740
R-squared	0.96	0.95	0.943
Number of cty	158	158	158

Source: Authors' calculations; Standard errors in parentheses.
***p<0.01, **p<0.05, *p<0.1.

Table 6. Pesaran's CD test estimates.

Variable	CD-test	p-value
GDPC_1	538.227	0.000
GFCF	1.013	0.311
LFPT	−1.012	0.312
EGLOBI	8.392	0.000
SGLOBI	582.076	0.000
EEXP_1	406.166	0.000
DGGHE	1.752	0.080
URBP	20.013	0.000
ADR	221.88	0.000
LIP	113.772	0.000
NLIP	18.172	0.000
EFI	74.291	0.000
PHR	92.235	0.000
EMPP	15.255	0.000
INFL	173.687	0.000
POGR	44.195	0.000
G_RLI	13.379	0.000

Source: Authors' Calculation.

Analysis based on spatial weights- neighbourhood

The Hausman test for SDM with neighbourhood firmly rejects random effects specifications (chi2 (35) = 48.20, Prob≥chi2 = 0.0679) at 10%. The spatial fixed effects based on neighbourhood estimates show that initial GDPC, capital formation, labour force participation, economic globalization, health spending, and labour productivity show the correct positive signs and are statistically significant. The time-fixed effects estimates show that initial GDPC, capital formation, labour force participation, economic globalization, health spending, urbanization, and labour productivity significantly impact economic growth. The spatial and time-fixed effects estimates show that initial GDPC, capital formation, labour force participation, economic globalization, health spending, and labour productivity show the correct positive signs and are statistically significant (Table 7).

Rho (ρ) for economic growth is insignificant in any spatial effects model based on neighbourhood,

Table 7. Estimates of SDM based on weight matrix - neighbourhood.

Variables	Spatial Random Effects	Spatial Fixed Effects	Time Fixed Effects	Spatial & Time Fixed Effects
LOG(GDPC(−1))	0.074***	0.071***	0.262***	0.146***
	-(0.024)	(0.023)	(0.028)	(0.021)
LOG(GFCF)	0.023**	0.022**	0.027***	0.019**
	(0.010)	(0.010)	(0.010)	(0.009)
LOG(LFPT)	1.068***	1.057***	0.937***	0.979***
	(0.056)	(0.058)	(0.047)	(0.053)
LOG(EGLOBI)	0.016***	0.016***	0.016***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)
LOG(SGLOBI)	−0.032	−0.033	−0.007	−0.060*
	(0.028)	(0.032)	(0.021)	(0.033)
LOG(EEXP(−1))	−0.001	−0.001	−0.006	−0.009
	(0.027)	(0.027)	(0.024)	(0.024)
LOG(DGGHE)	0.096***	0.097***	0.068***	0.091***
	(0.022)	(0.023)	(0.015)	(0.021)
LOG(URBP)	0.041	0.039	0.041**	0.035
	(0.028)	(0.030)	(0.017)	(0.027)
LOG(ADR)	0.015	−0.001	0.025	0.007
	(0.054)	(0.062)	(0.024)	(0.055)
LOG(LIP)	0.001	0.002	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
LOG(NLIP)	0.0001	0.000	0.011	0.000
	(0.002)	(0.002)	(0.001)	(0.002)
LOG(EFI)	−0.0001	0.000	−0.029	0.001
	(0.044)	(0.047)	(0.032)	(0.043)
LOG(PHR)	−0.009	−0.015*	0.001	−0.012
	(0.007)	(0.009)	(0.005)	(0.008)
LOG(EMPP)	0.984***	0.986***	0.797***	0.910***
	(0.030)	(0.031)	(0.031)	(0.031)
LOG(INFL)	−0.0002	−0.0002	−0.001	0.001
	(0.002)	(0.003)	(0.003)	(0.002)
LOG(POGR)	0.007	0.005	−0.003	0.003
	(0.005)	(0.006)	(0.007)	(0.006)
LOG(G_RLI)	0.0198	0.037	0.014	0.0418*
	(0.019)	(0.024)	(0.015)	(0.022)
W*LOG(GDPC(−1))	−0.058**	−0.057**	−0.014	−0.001
	(0.023)	(0.023)	(0.020)	(0.020)
W*LOG(GFCF)	0.001	0.004	−0.011	0.008
	(0.017)	(0.017)	(0.022)	(0.015)
W*LOG(LFPT)	−0.053	0.022	−0.032	0.020
	(0.053)	(0.060)	(0.051)	(0.060)
W*LOG(EGLOBI)	−0.003	−0.002	−0.002	−0.001
	(0.001)	(0.002)	(0.002)	(0.002)
W*LOG(SGLOBI)	0.013	0.018	0.061	−0.062
	(0.034)	(0.039)	(0.042)	(0.049)
W*LOG(EEXP(−1))	0.0198	0.023	−0.012	0.025
	(0.021)	(0.022)	(0.023)	(0.020)
W*LOG(DGGHE)	−0.015	−0.016	−0.012	−0.002
	(0.018)	(0.020)	(0.019)	(0.020)
W*LOG(URBP)	0.007	0.005	0.0275	−0.005
	(0.023)	(0.023)	(0.020)	(0.023)
W*LOG(ADR)	−0.027	0.043	0.033	0.039
	(0.048)	(0.076)	(0.040)	(0.074)
W*LOG(LIP)	−0.003	−0.004	−0.003*	−0.005
	(0.002)	(0.004)	(0.002)	(0.003)
W*LOG(NLIP)	0.002	0.002	−0.003	0.001
	(0.003)	(0.006)	(0.005)	(0.006)
W*LOG(EFI)	0.086	0.165**	0.057	0.139*
	(0.061)	(0.082)	(0.058)	(0.079)
W*LOG(PHR)	0.0141	0.012	0.011	0.014
	(0.016)	(0.020)	(0.009)	(0.019)
W*LOG(EMPP)	−0.005	0.043	−0.037	0.042
	(0.038)	(0.032)	(0.024)	(0.031)
W*LOG(INFL)	0.003	0.005	0.004	0.008**
	(0.003)	(0.003)	(0.004)	(0.004)
W*LOG(POGR)	0.002	0.003	0.005	0.005
	(0.009)	(0.010)	(0.014)	(0.009)
W*LOG(G_RLI)	−0.010	−0.038	0.007	−0.011
	(0.031)	(0.052)	(0.026)	(0.049)
rho	0.058	0.017	0.049	−0.037
	(0.038)	(0.029)	(0)	(0.028)
lgt_theta	−1.511***			

(*Continued*)

Table 7. (Continued).

Variables	Spatial Random Effects	Spatial Fixed Effects	Time Fixed Effects	Spatial & Time Fixed Effects
			(0.120)	
sigma2_e	0.001***	0.001***	0.002***	0.001***
	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Constant	−2.673***			
	(0.198)			
Observations	4,740	4,740	4,740	4,740
R-squared	0.989	0.969	0.890	0.960
Number of cty	158	158	158	158
AIC	−16408.36	−17144.1	−14886.05	−17582.76
BIC	−16162.73	−16911.4	−14659.82	−17350.06

Source: Authors' calculation.
Standard errors in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

meaning that the related countries' spillover effect on the local country's economic growth is insignificant. With fixed effects, we can observe a significant positive exogenous spatial effect of overall economic freedom on economic growth in the spatial fixed effects (Table 7).

Analysis based on spatial weights – CPSLHT

The Hausman test for SDM based on culture, language, social, political reasons, and trade pacts firmly rejects random effects specifications (chi2(35) = 51.89 Prob≥chi2 = 0.0329) at 5%. The spatial fixed effects estimates show that initial GDP per capita, labour force participation, economic globalization, health spending, and labour productivity show the correct positive sign and are statistically significant. The time-fixed effects estimates show that initial GDP per capita, capital formation, labour force participation, economic globalization, health spending, urbanization, and labour productivity significantly impact economic growth (Table 8). The spatial and time-fixed effects estimates show that initial GDP per capita, labour force participation, economic globalization, health spending, poverty reduction, and labour productivity show the correct positive sign and are statistically significant.

The endogenous spatial effect can be observed in the spatial lag of the dependent variable (ρ). The spatially lagged growth coefficient, rho(ρ), the endogenous effect, indicates the size of spillovers from related countries. Rho (ρ) for the spatial fixed effects and the spatial and time fixed effects for economic growth are significant, meaning that the related countries' spillover effect on the local country's economic growth is significant. Rho is negative and significant at the 5% level for the model using the weight matrix based on CPSLHT. The proposition of negative spillovers across the countries in this study got convincing support from the Wald test for the null hypotheses of rho = 0 being rejected.

We can observe the significant positive exogenous spatial effect of labour force participation, economic globalization, urbanization, labour productivity, and the rule of law index on economic growth in the spatial and time-fixed effects. The exogenous spatial effects of health spending are negatively significant in the spatial and time-fixed effects. The exogenous spatial effects of the age dependency ratio are positive and significant in spatial fixed and spatial and time fixed effects. The AIC and BIC are the lowest for the spatial and time-fixed effects, followed by the spatial fixed effects.

Best spatial model

We have fitted SDM but would like to know whether it is the best model for the data. This procedure is described in (LeSage and Pace 2009, Elhorst 2010, and Belotti et al 2017). We can observe that initial GDP per capita, labour force participation, economic globalization, health spending, and labour productivity are significant variables in SAR, SEM, and SAC models based on the weights of 1) neighbourhood and CPSLHT (Table 9). Based on the testing, SDM is the best model compared to SAR, SEM, and SAC. Rho is not significant in any of the SAR, SEM, and SEM models based on either weight.

Table 8. Estimates of SDM based on weight matrix– CPSLHT.

Variable	Spatial Random Effects	Spatial Fixed Effects	Time Fixed Effects	Spatial & Time Fixed Effects
LOG(GDPC_1)	0.134***	0.130***	0.256***	0.144***
	(0.020)	(0.020)	(0.027)	(0.021)
LOG(GFCF)	0.017*	0.016*	0.022**	0.017*
	(0.009)	(0.009)	(0.009)	(0.009)
LOG(LFPT)	1.009***	1.006***	0.924***	0.994***
	(0.051)	(0.053)	(0.044)	(0.053)
LOG(EGLOBI)	0.016***	0.016***	0.015***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)
LOG(SGLOBI)	−0.012	−0.007	−0.014	−0.022
	(0.028)	(0.031)	(0.020)	(0.031)
LOG(EEXP_1)	−0.008	−0.010	−0.0071	−0.009
	(0.025)	(0.025)	(0.023)	(0.024)
LOG (DGGHE)	0.085***	0.087***	0.072***	0.087***
	(0.021)	(0.022)	(0.015)	(0.021)
LOG(URBP)	0.038	0.037	0.038**	0.040
	(0.026)	(0.027)	(0.017)	(0.027)
LOG(ADR)	−0.021	−0.031	0.002	−0.031
	(0.050)	(0.058)	(0.027)	(0.055)
LOG(LIP)	0.002	0.002	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)
LOG(NLIP)	−0.001	−0.001	0.001	−0.001
	(0.002)	(0.002)	(0.001)	(0.002)
LOG(EFI)	−0.018	−0.015	−0.039	−0.032
	(0.042)	(0.044)	(0.035)	(0.044)
LOG(PHR)	−0.010	−0.015*	−0.001	−0.015**
	(0.006)	(0.007)	(0.005)	(0.007)
LOG(EMPP)	0.925***	0.929***	0.800***	0.912***
	(0.029)	(0.029)	(0.030)	(0.030)
LOG(INFL)	0.001	0.001	−0.002	0.002
	(0.002)	(0.002)	(0.003)	(0.002)
LOG(POGR)	0.006	0.005	0.002	0.004
	(0.005)	(0.005)	(0.008)	(0.005)
LOG(G_RLI)	0.005	0.021	0.008	0.022
	(0.018)	(0.022)	(0.014)	(0.022)
W*LOG(GDPC_1)	−0.114***	−0.109***	0.007	−0.004
	(0.020)	(0.019)	(0.054)	(0.034)
W*LOG(GFCF)	0.011	0.010	0.012	0.021
	(0.019)	(0.019)	(0.021)	(0.020)
W*LOG(LFPT)	0.146*	0.166**	0.009	0.189**
	(0.076)	(0.078)	(0.094)	(0.080)
W*LOG(EGLOBI)	0.005	0.006*	0.001	0.010**
	(0.003)	(0.003)	(0.004)	(0.004)
W*LOG(SGLOBI)	0.057	0.046	0.030	−0.067
	(0.043)	(0.050)	(0.048)	(0.066)
W*LOG(EEXP_1)	−0.023	−0.023	−0.029	0.002
	(0.023)	(0.024)	(0.035)	(0.023)
W*LOG(DGGHE)	−0.057*	−0.060*	0.009	−0.065**
	(0.034)	(0.035)	(0.035)	(0.032)
W*LOG(URBP)	0.080**	0.071**	0.033	0.081**
	(0.031)	(0.032)	(0.031)	(0.031)
W*LOG(ADR)	0.236***	0.259***	0.129*	0.291***
	(0.081)	(0.088)	(0.071)	(0.089)
W*LOG(LIP)	−0.001	−0.0011	−0.003	−0.003
	(0.003)	(0.004)	(0.002)	(0.003)
W*LOG(NLIP)	0.002	0.003	0.009*	0.003
	(0.006)	(0.006)	(0.004)	(0.006)
W*LOG(EFI)	0.063	0.045	0.024	−0.062
	(0.081)	(0.088)	(0.078)	(0.089)
W*LOG(PHR)	0.008	−0.001	0.020	−0.001
	(0.015)	(0.018)	(0.021)	(0.024)
W*LOG(EMPP)	0.171***	0.185***	0.156**	0.160***
	(0.058)	(0.060)	(0.061)	(0.057)
W*LOG(INFL)	−0.005	−0.004	0.010*	0.0001
	(0.003)1	(0.003)	(0.005)	(0.004)
W*LOG(POGR)	−0.022	−0.025	−0.046**	−0.033*
	(0.015)	(0.017)	(0.020)	(0.018)
W*LOG(G_RLI)	0.060*	0.108**	0.035	0.131***
	(0.035)	(0.051)	(0.029)	(0.049)
rho	−0.061	−0.075	−0.168**	−0.152**
	(0.058)	(0.059)	(0.069)	(0.059)
lgt_theta	−1.472***			

(*Continued*)

Table 8. (Continued).

Variable	Spatial Random Effects	Spatial Fixed Effects	Time Fixed Effects	Spatial & Time Fixed Effects
	(0.134)			
sigma2_e	0.001***	0.001***	0.002***	0.001***
	(0.0001)	(0.0001)	(0.0002)	(0.0001)
Constant	−3.491***			
	(0.304)			
Observations	4,740	4,740	4,740	4,740
R-squared	0.990	0.989	0.919	0.960
Number of cty	158	158	158	158
AIC	−16862.71	−17573.71	−15010.98	−17713.45
BIC	−16617.09	−17341.01	−14778.28	−17480.75

Source: Authors' calculation; Standard errors in parentheses.
***p<0.01, **p<0.05, *p<0.1.

Table 9. Estimates of SAR, SEM, and SAC.

	Neighbourhood			CPSLHT		
Variables	SAR	SEM	SAC	SAR	SEM	SAC
LOG(GDPC_1)	0.148***	0.147***	0.147***	0.148***	0.147***	0.147***
	(0.021)	(0.022)	(0.022)	(0.021)	(0.022)	(0.022)
LOG(GFCF)	0.018*	0.018*	0.018*	0.0187	0.018	0.018*
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
LOG(LFPT)	0.987***	0.987***	0.987***	0.987***	0.985***	0.986***
	(0.054)	(0.053)	(0.053)	(0.054)	(0.053)	(0.053)
LOG(EGLOBI)	0.016***	0.016***	0.016***	0.016***	0.016***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LOG(SGLOBI)	−0.058*	−0.059*	−0.0591*	−0.058*	−0.060*	−0.060*
	(0.032)	(0.032)	(0.032)	(0.032)	(0.031)	(0.031)
LOG(EEXP_1)	−0.009	−0.009	−0.009	−0.009	−0.009	−0.009
	(0.025)	(0.025)	(0.025)	(0.025)	(0.024)	(0.024)
LOG(DGGHE)	0.086***	0.086***	0.086***	0.086***	0.085***	0.085***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
LOG(URBP)	0.037	0.036	0.037	0.037	0.040	0.039
	(0.027)	(0.027)	(0.027)	(0.027)	(0.028)	(0.028)
LOG(ADR)	0.020	0.021	0.021	0.020	0.031	0.031
	(0.053)	(0.052)	(0.052)	(0.053)	(0.052)	(0.052)
LOG(LIP)	0.001	0.001	0.001	0.001	0.001	0.001
	(0.01)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
LOG(NLIP)	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003
	(0.02)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LOG(EFI)	0.007	0.008	0.008	0.006	0.007	0.006
	(0.046)	(0.046)	(0.046)	(0.046)	(0.045)	(0.046)
LOG(PHR)	−0.014	−0.014	−0.013	−0.014	−0.013	−0.014
	(0.009)	(0.008)	(0.009)	(0.008)	(0.009)	(0.009)
LOG(EMPP)	0.910***	0.911***	0.911***	0.910***	0.911***	0.911***
	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)	(0.031)
LOG(INFL)	0.001	0.001	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LOG(POGR)	0.003	0.004	0.004	0.004	0.002	0.002
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
LOG(G_RLI)	0.0381*	0.038*	0.038*	0.0382*	0.040*	0.040*
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
rho	−0.001		−0.001		0.0002	0.002
	(0.006)		(0.006)		(0.009)	(0.008)
sigma2_e	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
lambda		−0.016	−0.016		−0.0991	−0.103
		(0.027)	(0.027)		(0.069)	(0.066)
Observations	4,740	4,740	4,740	4,740	4,740	4,740
R-squared	0.960	0.960	0.960	0.960	0.961	0.961
Number of cty	158	158	158	158	158	158
AIC	−17524.52	−17524.52	−17522.55	−17523.74	−17532.4	−17530.72
BIC	−17401.71	−17401.71	−17393.27	−17400.92	−17409.59	−17401.44

Source: Authors' Calculation;Robust standard errors in parentheses.
***p < 0.01, **p < 0.05, *p < 0.1.

Table 10. Information Criteria for SDM and SAC.

	Geography	CPSLHT
SDM spatial and time-fixed effects		
AIC	−17582.76	−17713.45
BIC	−17350.06	−17480.75
SAC Spatial and time fixed Effects		
AIC	−17522.55	−17530.72
BIC	−17393.27	−17401.44

Source: Authors' calculations.

SDM is the best model between SAR and SDM, SEM and SDM, and SAC and SDM. Formal ways of testing between the models are shown below.

Testing for best model between SDM and SAR

The chi-square(8) is 18.77, with a p-value (Prob > chi2 = 0.3417) greater than one percent, so SDM based on geography cannot be used. The best model between SDM and SAR based on CPSLHT is tested, and the results indicate that the chi-square (8) is 2279.02, with a p-value less than one percent, so the SDM based on the CPSLHT can be used, and it is appropriate.

Testing for best model between SDM and SEM

Testing for the best model between SDM and SEM based on geography is conducted, and the chi-square(17) is 16.59, with a p-value greater than one percent, so the SDM based on geography can not be used. Testing for the best model between SDM and SEM based on CPSLHT is conducted, and the results indicate that the chi-square(17) is 48.98, with a p-value (Prob > chi2 = 0.0001) less than one percent; we strongly reject the null hypothesis, so the SDM based on geography can be used.

Testing for best model between SDM and SAC

Information criteria such as AIC (Akaike Information Criterion) and BIC (Bayesian information criterion) are used to test the most appropriate model between SDM and SAC (Table 10).

Marginal effects

Marginal effects within spatially correlated units allow for estimating direct, indirect, and total effects. When employing Fixed Effects Spatial Durbin Model (SDM) estimates with CPSLHT weights, we observe significant direct effects on the economic growth of initial GDP per capita, capital formation, labour force participation, economic globalization, health spending, urbanization, life insurance, poverty reduction, labour productivity, and the rule of law (Table 11). Additionally, using Fixed Effects SDM with CPSLHT weights reveals noteworthy indirect effects on economic growth, particularly in cases involving negative initial GDP per capita, reduced health spending, higher age dependency ratios, and slower population growth rates. On the other hand, there are positive indirect effects associated with labour force participation, economic globalization, social globalization, urbanization, labour productivity, and the rule of law on economic growth, all based on CPSLHT analysis (Table 11). The study of Ahmad (2019) confirms that indirect globalization spillover effects come through validating a crucial economic globalization factor alongside the growth variable lagged spatially.

V. Conclusion

This study delves into the correlation between globalization and economic growth, employing a refined methodology through explicit spatial econometrics. Moreover, it considers various factors, including cultural, political, social, linguistic, and historical group memberships, alongside international trade agreements. This article aims to contribute to the existing literature in this field. Using spatial econometric analysis, the article explores globalization's spillover impact on economic growth across 158 countries from 1990 to 2019. It incorporates both geographical and non-geographical factors. Geographical matrices consider country proximity and distance, reflecting transportation costs and technology transfers. Non-geographical matrices include cultural, political, linguistic, historical, and trade agreement aspects. They identify regions like South Asia, East Asia, ASEAN, Central Asia, the Middle East, Oceania, East Europe, West Europe, Africa, South America, and North America. This approach aims to deepen understanding of globalization's spillover influence on economic growth.

Estimates with spatial and time-fixed effects, using neighbourhood as a basis, indicate that several factors, including initial GDP per capita, capital formation, labour force participation,

Table 11. Estimates of fixed effects sdm – by direct, indirect, and total- based on geography and CPSLHT.

	Geography			CPSLHT		
Variables	Direct	Indirect	Total	Direct	Indirect	Total
LOG(GDPC_1)	0.071***	−0.055***	0.016***	0.130***	−0.111***	0.019***
	(0.03)	(0.004)	(0.002)	(0.005)	(0.005)	(0.002)
LOG(GFCF)	0.022***	0.005	0.027***	0.016***	0.008	0.024**
	(0.04)	(0.008)	(0.009)	(0.003)	(0.011)	(0.011)
LOG(LFPT)	1.058***	0.0420*	1.100***	1.007***	0.0867**	1.094***
	(0.014)	(0.024)	(0.028)	(0.014)	(0.035)	(0.036)
LOG(EGLOBI)	0.016***	−0.002	0.014***	0.016***	0.005**	0.0211***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
LOG(SGLOBI)	−0.033***	0.0180	−0.015	−0.007	0.043***	0.036***
	(0.010)	(0.013)	(0.013)	(0.011)	(0.015)	(0.012)
LOG(EEXP_1)	0.010	0.002	0.008	0.009	0.001	0.001
	(0.006)	(0.010)	(0.012)	(0.006)	(0.014)	(0.015)
LOG(DGGHE)	0.097***	−0.014*	0.082***	0.087***	−0.063***	0.023
	(0.006)	(0.008)	(0.010)	(0.005)	(0.014)	(0.016)
LOG(URBP)	0.039***	0.005	0.044***	0.036***	0.063***	0.100***
	(0.006)	(0.010)	(0.012)	(0.006)	(0.016)	(0.017)
LOG(ADR)	0.0001	0.042*	0.043	−0.031**	0.244***	0.212***
	(0.015)	(0.024)	(0.026)	(0.015)	(0.028)	(0.028)
LOG(LIP)	0.002***	−0.004***	−0.002	0.002***	−0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
LOG(NLIP)	0.0001	0.002	0.002	−0.001	0.003	0.002
	(0.001)	(0.002)	(0.002)	(0.001)	(0.003)	(0.003)
LOG(EFI)	0.002	0.165***	0.167***	−0.014	0.044	0.029
	(0.019)	(0.031)	(0.036)	(0.018)	(0.037)	(0.040)
LOG(PHR)	−0.015***	0.013**	−0.003	−0.016***	0.001	−0.014
	(0.004)	(0.006)	(0.007)	(0.003)	(0.009)	(0.009)
LOG(EMPP)	0.986***	0.060***	1.046***	0.929***	0.108***	1.037***
	(0.005)	(0.007)	(0.007)	(0.006)	(0.012)	(0.011)
LOG(INFL)	−0.0001	0.005**	0.004**	0.001	−0.004*	−0.003
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
LOG(POGR)	0.005	0.003	0.009	0.005	−0.024***	−0.018**
	(0.004)	(0.006)	(0.007)	(0.004)	(0.008)	(0.009)
LOG(G_RLI)	0.038***	−0.038**	0.0001	0.021**	0.098***	0.119***
	(0.010)	(0.015)	(0.019)	(0.010)	(0.022)	(0.024)
Observations	4,740			4,740		
R-squared	0.969			0.989		
Number of cty	158			158		
AIC	−17144.1			−17573.71		
BIC	−16911.4			−17341.01		

Source: Authors' calculations.
Standard errors in parentheses, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

economic globalization, health spending, and labour productivity, exhibit the expected positive associations and are statistically significant. However, in the spatial effects model based on neighbourhood, the parameter Rho (ρ) for economic growth does not reach statistical significance. This suggests that the spillover effect of neighbouring countries on the local country's economic growth is not statistically significant. Similarly, there is a lack of significant exogenous effects for most spatial variables in the spatial and time-fixed effects model based on neighbourhood, except inflation.

The estimates with spatial and time-fixed effects based on CPSLHT reveal several significant findings. Specifically, initial GDP per capita, labour force participation, economic globalization, health spending, poverty reduction, and labour productivity exhibit the expected positive relationships and achieve statistical significance. Furthermore, Rho (ρ) in both the spatial fixed effects and spatial and time fixed effects models for economic growth are negative and statistically significant. This signifies that the spillover effect of neighbouring countries on the local country's economic growth is negative and significant.

We can discern noteworthy exogenous spatial effects in the spatial and time-fixed effects model based on CPSLHT. Specifically, significant positive spatial effects are associated with labour force participation, economic globalization, urbanization, labour productivity, and the rule of law index, all contributing positively to economic growth. However, the exogenous spatial effect of health

spending is found to be negatively significant, indicating that decreased health spending in some related countries may have a negative impact on local economic growth. Additionally, the exogenous spatial effect of the age dependency ratio is positive and significant in both the spatial fixed effects and spatial and time fixed effects models, suggesting that a higher age dependency ratio is associated with increased economic growth in these settings. However, the high age dependency ratio reduces the warranted economic growth.

The SDM based on CPSLHT emerged as the best model compared to SAR, SEM, and SAC. Marginal effects within units exhibiting spatial correlations offer a means to estimate a range of effects, encompassing direct, indirect, and overall impacts. We uncover significant direct influences on economic growth when applying the Fixed Effects Spatial Durbin Model (SDM) with CPSLHT weights. These influences are evident in initial GDP per capita, capital formation, labour force participation, economic globalization, health spending, urbanization, life insurance, poverty reduction, labour productivity, and the rule of law.

The above statement highlights key influences on economic growth identified using the Fixed Effects of the Spatial Durbin Model (SDM) with CPSLHT weights. Factors include initial GDP per capita, capital investments, workforce engagement, cross-border economic integration, healthcare investment, urban development, life insurance services, poverty reduction efforts, labour efficiency, and legal frameworks. These findings suggest significant direct impacts on economic growth within a spatial framework weighted by CPSLHT.

Applying Fixed Effects SDM with CPSLHT weights reveals significant indirect impacts on economic growth. Positive effects are found in variables like labour force participation, economic and social globalization, urbanization, labour productivity, and the rule of law. Ahmad's study (Ahmad 2019) suggests a positive spatial spillover effect of economic globalization. This implies that higher global workforce engagement indirectly contributes to local economic growth, as does increased integration of economies across borders. Moreover, cultural exchange and social connectivity foster economic expansion. However, the literature on globalization's spillover effect on economic growth remains limited.

Urban development and population concentration indirectly boost economic growth globally, benefiting local expansion. Increased workforce productivity drives indirect economic growth, particularly in countries with efficient labour forces. Strong global legal frameworks positively impact local economies indirectly, fostering confidence and stability. These findings stress the complex nature of economic growth factors and highlight the significance of considering indirect global effects within a spatial framework.

Conversely, marginal indirect effects show global effects are prominent in low initial GDP per capita, reduced health spending, higher age dependency ratios, and slower population growth rates. Globalization has a greater impact on economic growth in less-developed economies. Reduced healthcare spending correlates with lower economic growth, suggesting global health investments could counteract globalization's negative impacts. Regions with larger elderly populations face heightened susceptibility to global economic effects, emphasizing the need to address demographic challenges in a global context. Economies with slower population growth are more vulnerable to global influences, highlighting the role of demographic trends in globalization's impact on economic performance.

Strong capital formation fosters sustainable economic growth by providing resources for investment. Labour force participation maximizes productivity and output, ensuring active contribution to the economy. Adequate health spending maintains a healthy workforce, preventing resource drain from illness and disability. Urbanization and economic globalization concentrate resources, fostering innovation. Life insurance encourages investment and risk-taking. High labour productivity boosts competitiveness and growth. The rule of law ensures stability for investors, facilitating economic activity. Reducing age dependency, the ratio of dependents to the working-age population requires addressing demographic trends and socioeconomic factors through a multifaceted approach.

One study limitation is the neglect of economic globalization components. Deregulating capital flows and trade policies can lead to diverse spatial outcomes. Future research should dissect economic

globalization, including foreign direct investment and trade volumes, to clarify their impacts on growth. Additionally, the study overlooked globalization's spillover effects on income inequality and the environment. Future research should explore these effects to understand globalization's broader influence.

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