



Regular Article

Five decades of globalisation and growth: a cross-country causal analysis of low-income economies

Danushi Rathnayake^a, Irushi Sandanayaka^a, Piyara Wijesuriya^a, Dinithi Athalage^a,
Ruwan Jayathilaka^{b,*}

^a SLIIT Business School, Sri Lanka Institute of Information Technology, New Kandy Road, Malabe, Sri Lanka

^b Department of Information Management, SLIIT Business School, Sri Lanka Institute of Information Technology, New Kandy Road, Malabe, Sri Lanka

ARTICLE INFO

Keywords:

Global integration
Economic growth
Low-income nations
United nations sustainable development goals

ABSTRACT

Comprehending the dynamic between globalisation and economic growth in low-income nations is vital to understanding how they navigate growth trajectories whilst addressing global concerns. This study examined the nexus between globalisation and its financial, social, and political facets in relation to growth in fourteen low-income nations. The analysis spanned over five decades and the Wavelet Coherence and Granger Causality methodologies. The findings revealed a bidirectional causal relationship between globalisation and growth in Rwanda, unidirectional causal flows in Burundi, Sierra Leone, Sudan, and Uganda. A bidirectional relationship between economic integration and growth was identified in Burkina Faso. Possible policy actions aligned with the United Nations Sustainable Development Goals have been developed, focusing on the country-specific dynamics of each nation. These policy recommendations comprise introducing incentives for foreign investments in Rwanda and liberalising trade in Burkina Faso to reinforce economic globalisation. The study also recommends the expansion of digital infrastructure and global educational avenues in Burundi and Uganda to strengthen social integration, and the reinforcement of governance mechanisms in Chad and Togo to encourage political integration. This study contributes to the globalisation-growth literature by offering time-sensitive insights into the growth trajectories of low-income economies.

1. Introduction

Globalisation is a prominent attribute of today's world, driving interdependence among nations (Mominur Rahman et al., 2024). It is a multidimensional phenomenon with wide-ranging impacts that reshape global engagement (Traore, 2023). The Konjunkturforschungsstelle (KOF) Globalisation Index (Dreher, 2006), gauges this multifaceted nature of globalisation under three extents of economic, social, and political integration.

Economic globalisation is the amalgamation of trade globalisation-foreign trade in a nation and associated trade policies, and financial globalisation-flows of foreign financial capital and related investment regulations. The integration enabled through international mobility (interpersonal globalisation), access to communication and technology (informational globalisation), and cultural exchanges and development of human capital worldwide (cultural globalisation) form the social facet of globalisation. Political integration embeds nations to the global

political system through the synthesis of global diplomacy endeavours and international relations agreements. With the unification of nations to form an interconnected global society (Akusta, 2024), these sub-dimensions provide a comprehensive understanding on the process of global integration.

Economic growth engendered by the accumulation and deployment of capital to augment a nation's production potential (Elfaki & Ahmed, 2024), is critical in driving development and stability at both national and international levels. The nexus between economic growth and globalisation has long been a subject of scholarly research and policy discourse.

Analysis of globalisation-economic growth dynamics has become vital, especially in the contemporary landscape, where realignments to global ecosystems are heightening. Fig. 1 demonstrates the degree of global integration documented by the four country income classifications specified by the World Bank over a 52-year period.

It is evident that the low-income sector has ranked the lowest in the

* Corresponding author. <https://www.sliit.lk/faculty-of-business/staff/ruwan.j/>

E-mail addresses: danushirathnayake01@gmail.com (D. Rathnayake), irushisandanayaka20@gmail.com (I. Sandanayaka), piyarawijesuriya@gmail.com (P. Wijesuriya), dinithiathalage@gmail.com (D. Athalage), ruwan.j@sliit.lk (R. Jayathilaka).

<https://doi.org/10.1016/j.ssaho.2026.102498>

Received 9 June 2025; Received in revised form 19 January 2026; Accepted 20 January 2026

Available online 23 January 2026

2590-2911/© 2026 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

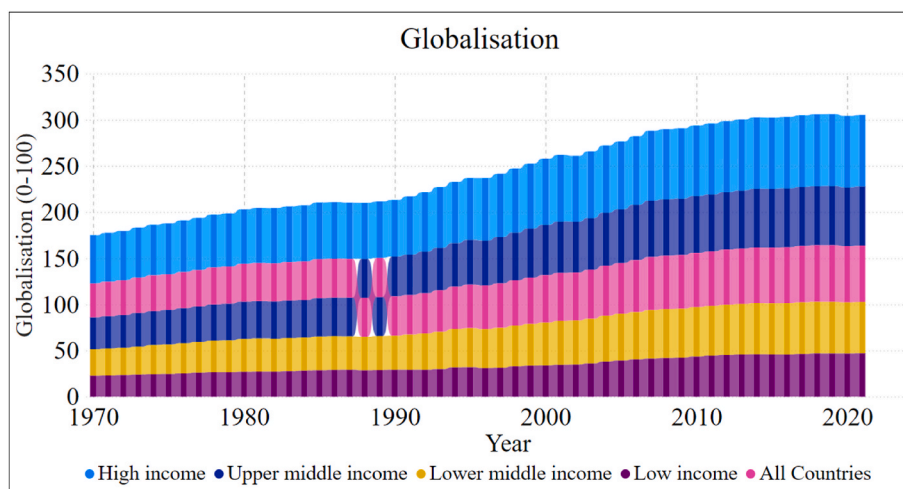


Fig. 1. Globalisation trend by the income classifications using ribbon charts.

Source: Authors' illustration based on the KOF Globalisation Index (Globalisation Index 0–100) (Eidgenössische Technische Hochschule Zürich, 2024).

context of globalisation. As per the annual classification performed by the World Bank in the year 2024 basing the Gross National Income (GNI) of nations, economies that had recorded a GNI per capita of \$1135 or less in 2022 constitute the low-income group (World Bank Group, 2025). Several structural and cyclical factors, such as restricted access to global markets, heavy reliance on foreign financial assistance, weaker infrastructural capabilities, reduced focus on human capital investments, conflicts between these nations and their related casualties during this period, can be identified as plausible reasons for this observation.

While research has explored globalisation's role in middle- and high-income economies, studies focusing low-income countries are comparatively limited in this discourse. This gap points to a significant research problem stemming from the absence of sufficient and robust empirical evidence on the means and extents through which globalisation impacts the performance of these ecosystems, and vice versa. Greater attention to these low-income counterparts could yield nuanced insights that may fundamentally transform their relationship with globalisation.

Backed by this rationale and based on the data availability, the study focuses a period of 52 years from 1970 to 2021 and considers 14 low-income nations in assessing the globalisation-growth interplay in them. Furthermore, building on this broad objective, the specific objectives explored in this context are as follows,

1. Identifying the direction of causality between economic growth and economic globalisation.
2. Identifying the direction of causality between economic growth and social globalisation
3. Identifying the direction of causality between economic growth and political globalisation.

Accordingly, this study attempts to make a significant contribution to the existing body of literature as outlined. First, in addition to the low-income sector being largely overlooked in related literature, many prior studies have just focused on the overall and economic dimensions of global integration in this regard. Hence, the novelty of this study lies in its holistic framework combining all facets of globalisation -economic, social, and political-to investigate the globalisation-growth connection in the low-income group and 14 of its nations. Thus, the nations in this pursuit are Burkina Faso, Burundi, Central African Republic, Chad, Gambia, Madagascar, Mali, Niger, Rwanda, Sierra Leone, Sudan, Syrian Arab Republic, Togo, and Uganda.

Secondly, this study makes a methodological contribution by adopting a dual-method approach. The cross-country causal analysis is conducted using the Granger Causality test, a technique capable of

analysing extensive cross-sectional time series data, capturing directional causal progressions (unidirectional and bidirectional) at the aggregate level, and widely utilised in multiple disciplines but less utilised in related research. In order to underpin the cross-country analysis, the causal dynamics of the overall low-income group were also studied using the Wavelet Coherence Methodology. This has enabled the identification of causal relationships in a nuanced manner with relevance to specific dimensions of time (short, medium, and long-term), nature of the correlation (positive, negative, and mixed) and the type of frequency (low, medium, and high).

Lastly, based on the resulting causal dynamics, the study also recommends specific policy recommendations to the nations in consideration in line with the Sustainable Development Goals established by the United Nations (UN SDGs). In this effort, SDGs 2: Zero Hunger, 3: Good Health and Wellbeing, 4: Quality Education, 5: Gender Equality, 8: Decent Work and Economic Growth, 9: Industry, Innovation, Infrastructure, 10: Reduced Inequalities, 16: Peace, Justice and Strong Institutions, and 17: Partnership for the Goals are particularly focused. These recommendations may provide timely insights for policymakers and related stakeholders in forming well-grounded and focused policy interventions to optimise the globalisation-growth dynamics while aiding the economic progression low-income sector.

The following sections of the study are structured to constitute a critical literature review, an elaborate description of the data and methodologies utilised, a presentation of the findings thus obtained, a detailed discussion thereof and specific policy suggestions.

2. Literature review

2.1. Critical literature review

2.1.1. Globalisation and economic growth

The nexus between globalisation and economic growth has been a trending topic of discussion among researchers recently. Overall, globalisation positively impacts economic growth in low-income nations across the world (Aslan & Altinoz, 2021; Chang et al., 2013; Ehigiamusoe, 2023; Rao & Vadlamannati, 2011; Uddin & Azam Khan, 2023). Globalisation was found to positively influence human development in low income nations which elevates economic growth (Behera & Sahoo, 2023). Regarding the Sub-Saharan African (SSA) region, globalisation tends to have a non-linear impact on economic growth where there is a positive impact up to a certain point and declines (Zahonogo, 2018), while global integration presents a strong positive correlation with economic progression in the SSA (Glennice Fosah et al., 2023). In the

same regional bloc, globalisation tends to have a positive effect on the participation of women in economic activities, hence elevating economic participation and expansion (Asongu et al., 2020). Globalisation tends to promote growth rates to higher levels in the presence of trade liberalisation in Sub-Saharan Africa (Abubakar, 2024). In the West African group, globalisation tends to promote economic growth (Shittu et al., 2020), and exerts a positive impact on the economic growth of Sudan in the long run (Elfaki & Ahmed, 2024). However, in Southern Africa, globalisation has a marginal impact on economic growth and an adverse impact on occupational health of the population (Loewenson, 2001). Furthermore, globalisation contributes to reducing poverty in low income African nations (Bolarinwa et al., 2025) and developing nations (Naz, 2023). Globalisation was discovered to elevate income inequality in low income nations (Heimberger, 2020). Globalisation was found to have a two-way causal direction between growth and globalisation in the overall low-income faction (Sandanyaka et al., 2025). Overall, the existing literature indicates that globalisation tends to have a positive effect on economic growth in low-income economies, thereby fostering opportunities for economic expansion.

2.1.2. Economic globalisation and economic growth

Economic globalisation is deemed to endow avenues for development for global low-income nations in terms of widened opportunities for trade and investments, while also giving rise to challenges of economic inequality and exposure to external shocks, thereby impeding growth. These contrasting effects have been empirically investigated in numerous studies. Economic integration, with its trade and financial facets, was discerned as a stimulator of economic advancement in low-income nations housed in the African region and other regional counterparts (Burhan et al., 2015; Gomes Neto & Veiga, 2013; Ngueta et al., 2022; Ngueta et al., 2024). Economic globalisation was identified as encouraging labour force participation and women's employment rates in Sub-Saharan Africa (Asongu et al., 2020), eventually resulting in their economic development. However, a negative impact of economic globalisation on overall employment was discovered in low income nations (Pal & Villanthenkodath, 2024). Project finance, linked to economic globalisation, drives growth (Kleimeier & Versteeg, 2010). In contrast, economic regulatory bodies are critical mediums for economic advancement in Africa (Agu et al., 2024). Trade globalisation is identified as enhancing agricultural productivity in the Gambia and Sierra Leone (Iwegbu & de Mattos, 2022), leading to broadened production potentials, and stimulating the growth of low-income nations in the East African Community (EAC) and the West African Economic and Monetary Union (WAEMU) (Ibrahim & Abdulmalik, 2023). Both trade and financial globalisation elevate income inequality in small and large amounts, respectively (Heimberger, 2020). A two-way causal progression was discovered between foreign direct investments of financial integration and economic growth (Iamsiraroj, 2016) about global low-income economies.

In contrast, banking and debt globalisation under financial integration were discovered to exert contradictory effects on global low-income nations (Gaies et al., 2020). Overall economic integration was found to demote growth rates with reference to the African region (Rao & Vadlamannati, 2011) and global low-income nations (Ehigiamusoe, 2023). A reverse causal flow where growth was inducing economic integration was discovered in a study basing the overall low-income sector (Sandanyaka et al., 2025). Accordingly, despite of the positive and detrimental influences, economic integration with its trade and financial aspects of integration can be largely determined as drivers for the economic proliferation of low-income nations in the world at large.

2.1.3. Social globalisation and economic growth

The significance of social globalisation to global low-income nations and its multidimensional outcomes have been examined in a several pieces of literature. It is identified to impact the economic growth of global low-income nations positively (Burhan et al., 2015; Ehigiamusoe,

2023; Ngueta et al., 2022). Social globalisation, specifically informational globalisation, was observed boosting female economic engagement in low-income nations in Sub-Saharan Africa (Asongu et al., 2020), ultimately leading to development of human capital and economic advancement. The technological aspect of social integration was discerned as having a significant favourable correlation with economic growth in African low-income nations (Adeleye & Eboagu, 2019). Deviating from this observation, the technological factor was documented as exerting both positive and negative influences on the economic progress in the Sub-Saharan African region (Akinlo & Dada, 2022). The overall dimension of social integration was also observed to hinder growth rates and negatively influence economic expansion in African low-income nations (Rao & Vadlamannati, 2011). Furthermore, a two-way causal progression was identified between social globalisation and the low-income growth (Sandanyaka et al., 2025). Accordingly, social globalisation can be evaluated as a phenomenon with paradoxical outcomes of both favourable and unfavourable for worldwide nations with low income.

2.1.4. Political globalisation and economic growth

The political dimension of globalisation optimistically influences the growth rates by promoting them to higher levels in low-income African nations (Rao & Vadlamannati, 2011). Furthermore, political globalisation impacts economic growth positively in low-income countries worldwide (Burhan et al., 2015; Chang et al., 2013; Ehigiamusoe, 2023; Ngueta et al., 2022; Sandanyaka et al., 2025). Good governance free from corruption enhanced political stability of the nations and lowered crime and violence rates, which can be listed as proxies for political integration, tend to exert positive impacts on economic proliferation, hence promoting growth rates to higher levels (Uddin & Azam Khan, 2023). Political integration, adopting favourable and healthy governance across regional factions for the nations in the East African Community (EAC) and the West African Economic and Monetary Union (WAEMU), would lead to the promotion of economic expansion. In contrast, poor political integration across the blocs would hinder economic growth (Ibrahim & Abdulmalik, 2023). The national economies in the African region benefit from the efficient and favourable governance institutions capable of attracting ample investments and trade advancements driving economic growth (Agu et al., 2024). In Sub-Saharan Africa, political globalisation tends to weaken and hinder the participation of women in the economic processes, which acts as a proxy for economic growth (Asongu et al., 2020).

Furthermore, in the Sub-Saharan African region, the political dimension of institutions mediates the pessimistic impact exerted by foreign direct investments on the process of industrialisation, leading to economic growth (Oduola et al., 2022). In the West African regional bloc, political governance fosters economic development by promoting investments (Shittu et al., 2020). Political integration and good governance foster economic progression by elevating the growth rates to higher levels in low-income nations.

2.2. Observed literature gap

Upon evaluating the literature review, the following voids pertaining in the related literature are identified. Although findings for the low-income components have been generated in previous studies, it was identified that most of them had come from studies basing global, regional, sub-regional, and other categorisations based on economic, social, and political alliances. This may lead to certain dynamics and circumstances specific to the low-income sector being overlooked, thus limiting the targeted nature of policy insights.

Another such void is the understudied aspect of the growth-globalisation nexus specific to the low-income group in a comprehensive manner, due to the large focus extended on the overall and economic aspects of the phenomenon.

Hence, as mentioned in the rationale of the study, these gaps have

Table 1
Variables' data sources.

Variable	Parameter	Source
Economic Growth (GDP)	GDP Per Capita (Current US\$)	World Bank (2022) https://data.worldbank.org/indicator/NY.GDP.PCAP.CD
Globalisation (GLO)	KOF Globalisation Index (Scaling from 1 to 100)	KOF Swiss Economic Institute (2022) https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html
Economic Globalisation (EGLO)	KOF Economic Globalisation Index (Scaling from 1 to 100)	KOF Swiss Economic Institute (2022) https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html
Social Globalisation (SGLO)	KOF Social Globalisation Index (Scaling from 1 to 100)	KOF Swiss Economic Institute (2022) https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html
Political Globalisation (PGLO)	KOF Political Globalisation Index (Scaling from 1 to 100)	KOF Swiss Economic Institute (2022) https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html

Source: Authors' compilation.

thus moulded the general and specific aims pursued in this literature to explore the growth-globalisation association specific to the low-income faction in a holistic manner.

3. Data and methodology

This section elaborates on the variables along with the respective methodologies utilised in the study.

3.1. Data

As illustrated in Table 1, the databases of the World Bank and the KOF Swiss Economic Institute were used to procure the data on economic growth and globalisation, respectively. The KOF Globalisation Indices capture not only the overall status of globalisation but also its constituents: economic globalisation, with its trade and financial components; social globalisation, with its interpersonal, informational, and cultural aspects; and the political facet of integration. Through this multidimensional approach, this index enables the nuanced and rigorous assessment of the phenomenon. On the other hand, the GDP Per Capita (Current US\$), which is a core macroeconomic indicator of economic performance, is utilised as the measurement for economic growth. These variables have been justified for usage in research (Abid & Alotaibi, 2020; Guan et al., 2020).

The study focuses on a 52-year period from 1970 to 2021 and is based on 14 low-income countries. This analysis period and the country sample are derived based on the common data accessibility for all the considered variables. In this regard, countries and years with missing values for any of the variables considered were omitted from the analysis. The datafile used in this context is attached in S1 Appendix.

3.2. Methodology

The study analyses the dynamics under two separate sections: panel and cross-country analyses. The methodologies (Granger Causality and Wavelet Coherence) used in this regard are justified in existing literature (Akadiri et al., 2020; Athalage et al., 2025; Baidoo et al., 2023; Sandanayaka et al., 2025; Wijesuriya et al., 2025). Although both the Granger Causality test and Wavelet Coherence are sophisticated methodologies used by researchers, the two methodologies both consist of pros and cons that complement each other. The Granger Causality test cannot be

Table 2
Strengths of the dual method approach.

Feature	Granger Causality	Wavelet Coherence	Strengths of the dual-method approach
Time dimension	Does not capture the dynamics at specific time intervals.	Captures dynamics in short, medium- and long-term time intervals.	Usage of both the methodologies evaluates both overall and time varying effects of the causal relationships.
Frequency effects	Does not evaluate the dataset at varying frequencies.	Evaluates the dataset at varying frequencies (high, medium and low).	Captures both static and dynamic natures of causal relationships.
Strength of the relationship	Does not evaluate the strength of the relationship, only provides the direction of the causality.	Evaluates both the strength (correlation) and the direction of causality.	Evaluations and interpretations are more robust and reliable.
Applicability to the cross-country suitability	Highly applicable for cross country analyses.	Cannot be deployed to study cross-country dynamics.	Analyses both income panel (Wavelet) and cross country (Granger) dynamics which is makes the study more reliable in policy making.

Source: Authors' illustration.

deployed at instances where the strength of the relationship, along with the time frequency of the occurrence, is measured. In this regard, Wavelet Coherence provides both the strength and the time frequency (long, short and medium term) of the relationships. However, Wavelet Coherence is not recommended to be used for cross-sectional analyses since it mostly deals with panel or time series data. Hence, Granger Causality is utilised for both panel and cross-sectional data but requires the data to be stationary and stable. Furthermore, although the existing literature frequently explored the unidirectional causal impacts of globalisation on economic growth by deploying models like Autoregressive models and Generalised Methods of Moments (Abubakar, 2024; Rao & Vadlamannati, 2011; Shittu et al., 2020) The studies that explored the bi-directional causalities between the variables utilising the Granger Causality test and Wavelet Coherence are comparatively less prominent in the existing literature. Table 2 depicts the summary of pros and cons of the two methodologies which complement each other and the strengths of the dual approach.

3.2.1. Panel analysis

The low-income panel of 14 nations is analysed for causal progressions, deploying Morlet Wavelet Coherence as a background study for the cross-country analysis. A slope homogeneity test was conducted in this regard to evaluate the homogeneity of cross-sections across the panel.

3.2.2. Slope homogeneity test

Slope Homogeneity test (Hashem Pesaran & Yamagata, 2008) was conducted to determine the heterogeneity across the nations due to the deviations of the weights in the countries of the panel dataset (Athalage et al., 2025). The statistical expressions in of the slope and adjusted slope are shown in Equation (1) and Equation (2), respectively. The null and alternative hypotheses utilised for this study were,

H0. Homogeneous slope coefficients

H1. Heterogeneous slope coefficients

$$\Delta = \sqrt{N \left(\frac{N^{-1}S\% - K}{\sqrt{2K}} \right)} \tag{1}$$

$$\Delta_{adj} = \sqrt{N \left(\frac{N^{-1}S\% - K}{\sqrt{\frac{2K(t-k-1)}{T+1}}} \right)} \tag{2}$$

3.2.3. Wavelet Coherence

The nexus between globalisation, its subdimensions and economic growth have been analysed by utilising the entirety of the low-income category using the Wavelet Coherence methodology (Goupillaud et al., 1984). This methodology can evaluate the relationships with the time–frequency, co-movement and phase-lead. Researchers have strongly preferred this methodology and has been deployed in a multitude of studies discussing similar topics under the economics discipline (Adebayo et al., 2024; Asafo-Adjei et al., 2020; Orhan et al., 2019; Yang et al., 2016).

Equation (3) delineates the basic equation of computing the Wavelet Coherence. The Morlet Wavelet function is denoted by $\psi^{a,b}$ while a signifies the contractions and b denotes the translations.

$$\psi^{a,b}(x) = |a|^{-\frac{1}{2}} \psi\left(\frac{x-b}{a}\right) \tag{3}$$

This methodology is considered a robust and sophisticated methodology in identifying relationships among variables under short-, medium-, and long-term time frames. The correlation between the variables and their dynamics across different time periods can also be assessed using Wavelet Coherence. Furthermore, this method provides the readers' convenience and clarity compared to other generic methodologies by means of a comprehensive chart. This model employs a padding method in which data points are synthesised and extended over time. However, to improve reliability and accuracy, only the region within the Cone of Influence is considered for causal interpretations. The Wavelet Coherence graphs presented in this study have been generated utilising R language.

3.2.4. Cross-country analysis

This study presents a cross-country analysis in evaluating the causal progressions between globalisation, its sub-dimensions and economic growth. The study utilised the Granger causality test (Granger, 1969) to obtain the cross-country dynamics. This methodology has been used by many researchers globally in similar discussions (Akadiri et al., 2019; Shahbaz et al., 2018). Granger Causality is highly recommended when bidirectional causalities are evaluated in both panel and cross-sectional data. Furthermore, this methodology delineates the direction of causality while producing a reliable analysis for predictions. Before conducting the Granger causality test, stationarity and stability should be determined as a pre-requisite for the causality test. Hence, this study the Dickey -Fuller Unit Root test (Dickey & Fuller, 1979) to ascertain the stationarity and Vector Auto Regressor (VAR) to determine the stability while discerning the optimal lag length of variables in the dataset at a cross-country level. To affirm the reliability and validity of results obtained, robustness checks on alternative lag lengths and slope homogeneity tests have been done.

3.2.5. Dickey Fuller Unit Root test

The Dickey-Fuller unit root test (Dickey & Fuller, 1979) was utilised in this study to determine the stationarity of the time series used in this study. Equation (4) expresses the formula that was used in the computations. The regression coefficient and the constant's vector are symbolised by λ and R_t , respectively (Wijesuriya et al., 2025).

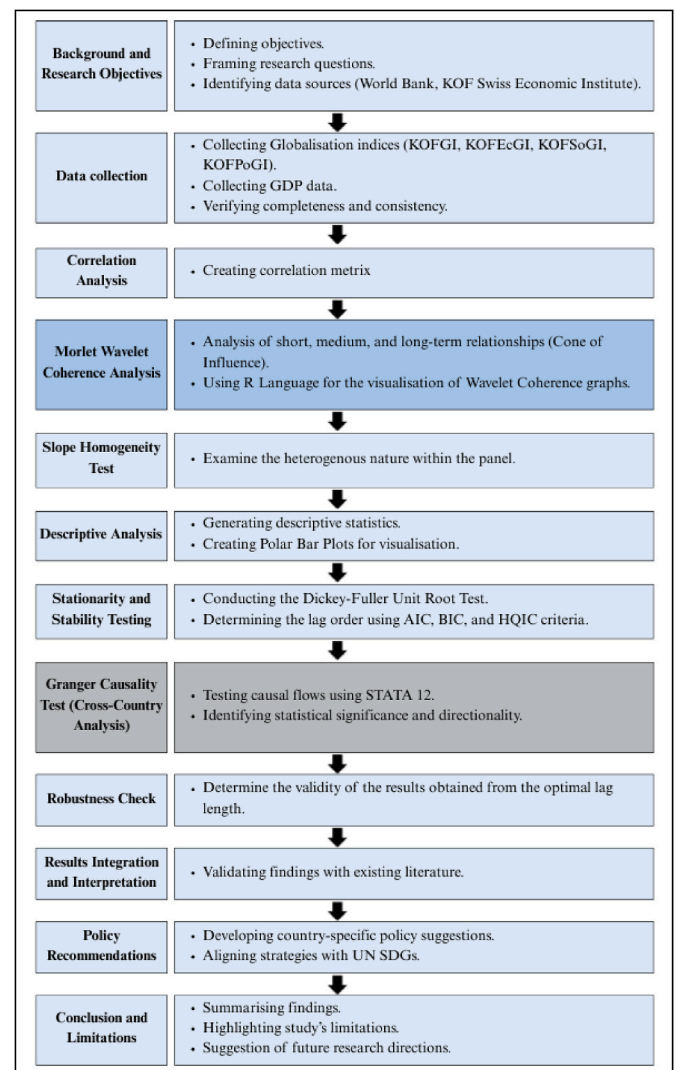


Fig. 2. Research methodology flow diagram. Source: Authors' illustration.

$$Y_t = \hat{\beta}R_t + \lambda Y_{t-1} + \sum_{j=1}^p \theta_j \Delta Y_{t-j} + \epsilon_t \tag{4}$$

The stationarity of the variables is tested against the null and alternative hypotheses,

H0. Unit roots prevail in the dataset

H1. Unit roots are absent in the dataset

When unit roots were present in the dataset at 1 % significance level, the time series was non-stationary, hence the null hypothesis was accepted. The non-stationary variables were differenced and it is depicted by Δ in front of the variable acronym. The differenced variables were once again tested for stationarity, and this process was conducted until the null hypothesis was rejected at 1 % significance level.

3.2.6. Vector Autoregression

Vector Autoregression was deployed in this study to ascertain the optimal lag length for the Granger Causality test and to determine the stability of the variables. This model handles variables as endogenous and permits heterogeneity which is not observed (Love & Zicchino, 2006). The criteria utilised in determining the optimal lag lengths were Akaike's Information Criterion (AIC) (Akaike, 1998). Schwarz's Bayesian

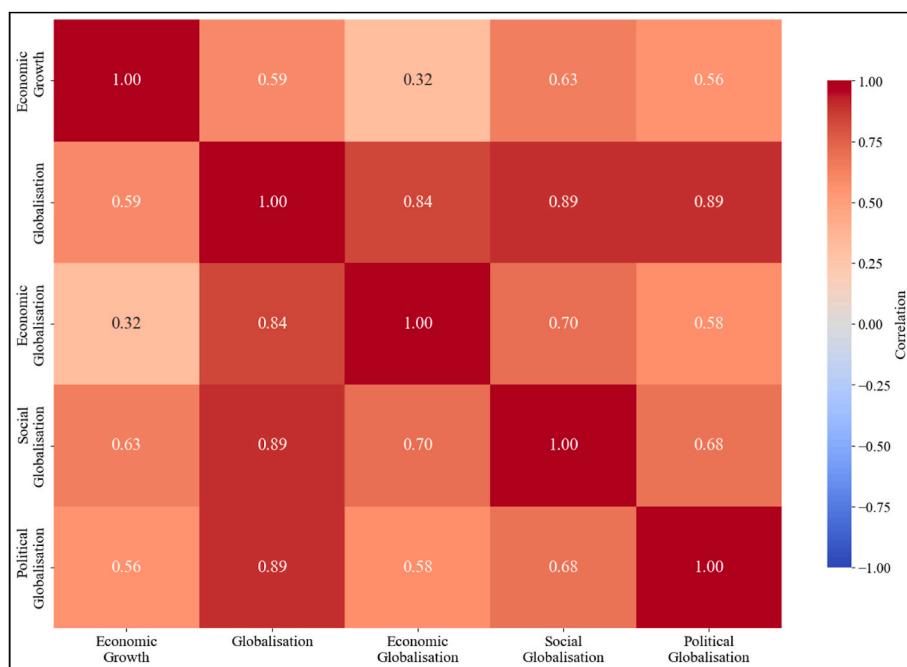


Fig. 3. Correlations between economic growth and the dimensions of globalisation. Source: Authors' illustration.

Criterion (SBIC) (Schwarz, 1978) and Hannan and Quinn Information Criterion (HQIC) (Hannan & Quinn, 1979). The stability of the variables was determined from the Roots of the Companion Matrix graphs generated from the VAR model and it was affirmed from the placement of the eigenvalues inside the unit circle (Sandanyaka et al., 2025).

3.2.7. Granger Causality test

The Granger causality test (Granger, 1969) was deployed after determining the stationarity, stability and optimal lag lengths and the statistical expression is presented in Equation (5). GLO and GDP acts as the independent and dependent variables, respectively and vice versa to test the bi-directional causal flows. In this regard, globalisation, its subdimensions (economic, social and political) along with economic growth variables were substituted accordingly, across the 14 selected nations to obtain the causal progressions. β delineates regression coefficient while θ denotes the regression constant values. k symbolises the lag frequency and it could take any value between 1 to N (total number of observations). Number of lags is delineated by ρ while the error term is denoted by u .

$$GLO_{i,t} = \sum_{k=1}^{\rho} \beta_i GLO_{i,t-k} + \sum_{k=0}^{\rho} \theta_k GDP_{i,t-k} + u_{i,t} \tag{5}$$

Fig. 2 outlines the sequential procedure followed in conducting the data analysis of the study.

4. Results and discussion

An initial analysis of the pairwise association between growth and the types of globalisations followed by the detailed display and discussion of findings from both Granger Causality and Wavelet Coherence analyses are presented in this section.

4.1. Correlation analysis

The patterns of association between economic growth and the dimensions of globalisation across the considered low-income panel are visualised by the correlation matrix in Fig. 3. This analysis is performed

Table 3 Interpretation of Wavelet Coherence.

Indicator	Description
\rightarrow	In-phase relationship
\leftarrow	Anti-phase relationship
\swarrow, \searrow	GDP (first variable) leading GLO, EGLO, SGLO, PGLO (second variable).
\nearrow, \nwarrow	GLO, EGLO, SGLO, PGLO (second variable) causing GDP (the first variable).
\swarrow and \nwarrow and \searrow and \nearrow	Two-way movement between GDP (first variable) and GLO, EGLO, SGLO, PGLO (second variable).
Areas in Red	Presence of correlation
Areas in Blue	No correlation
0-8	Short term
8-32	Medium term
32-128	Long term

Source: Authors' compilation.

with the sole purpose of providing an initial overview of the relationships.

While all pairwise correlations have turned out being positive, social globalisation appears to have the strongest association with the low-income growth, followed by overall and political globalisations respectively. The correlation between growth and economic globalisation is observed to be comparatively weaker.

4.2. Wavelet Coherence analysis

The Wavelet Coherence analysis in this study was performed for the low-income category, with GDP accounted as the first variable and GLO, EGLO, SGLO, and PGLO as the second variables. Accordingly, Wavelet Coherence graphs were obtained for each growth-globalisation nexus.

Presented in Table 3 is the key for the interpretation of the generated Wavelet Coherence diagrams. The 'area of influence' bound by the conical shape is the region subjected to analysis.

Fig. 4 demonstrates the globalisation-growth nexus of the low-income panel considered. A strong, high-frequency nexus is observable during 1970–2000 in the short run owing to the arrows pointing both in

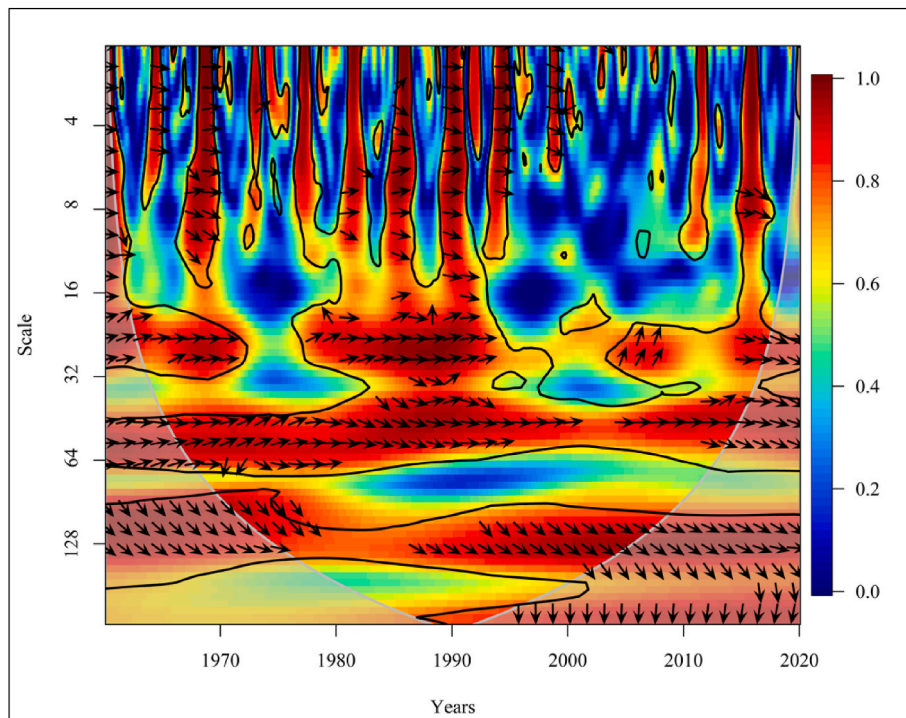


Fig. 4. Wavelet coherence diagram: GLO
Source: Authors' illustration.

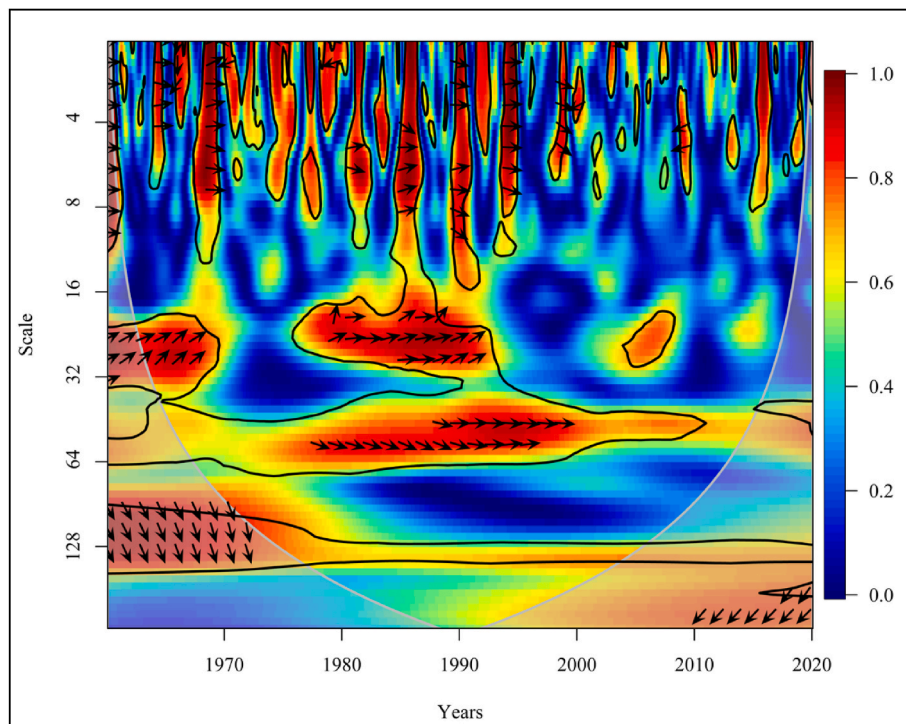


Fig. 5. Wavelet coherence diagram: EGLO
Source: Authors' illustration.

left and right directions. This dynamic then transforms into a high-frequency one-way causal progression where economic growth causes globalisation from 2000 to 2020. Similarly, between 1970 and 2000, in the medium term, the darker shade of red depicts a high-frequency correlation with two-way causal connections with mixed and positive

correlation effects observable. This causal connection then shifts to a positive one-way coherence with high frequency, where globalisation leads economic growth during 2000–2010 and vice versa between 2010 and 2020. Only two-way causal effects are visible during the long run with a lighter shade of red, between 1970 and 1980. These dynamics in

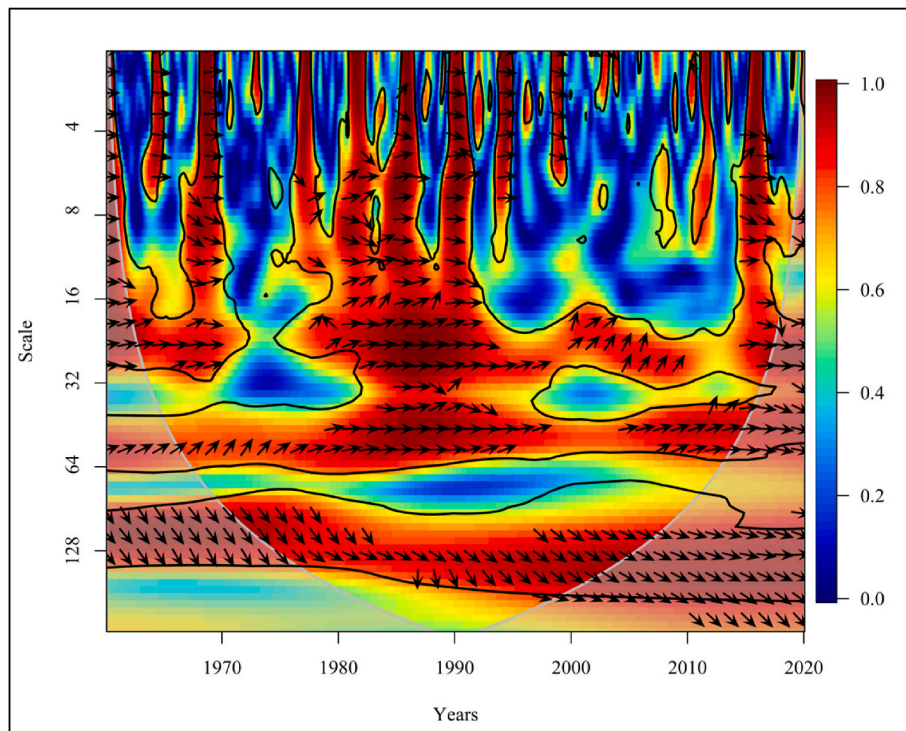


Fig. 6. Wavelet coherence diagram: SGLO
Source: Authors' illustration.

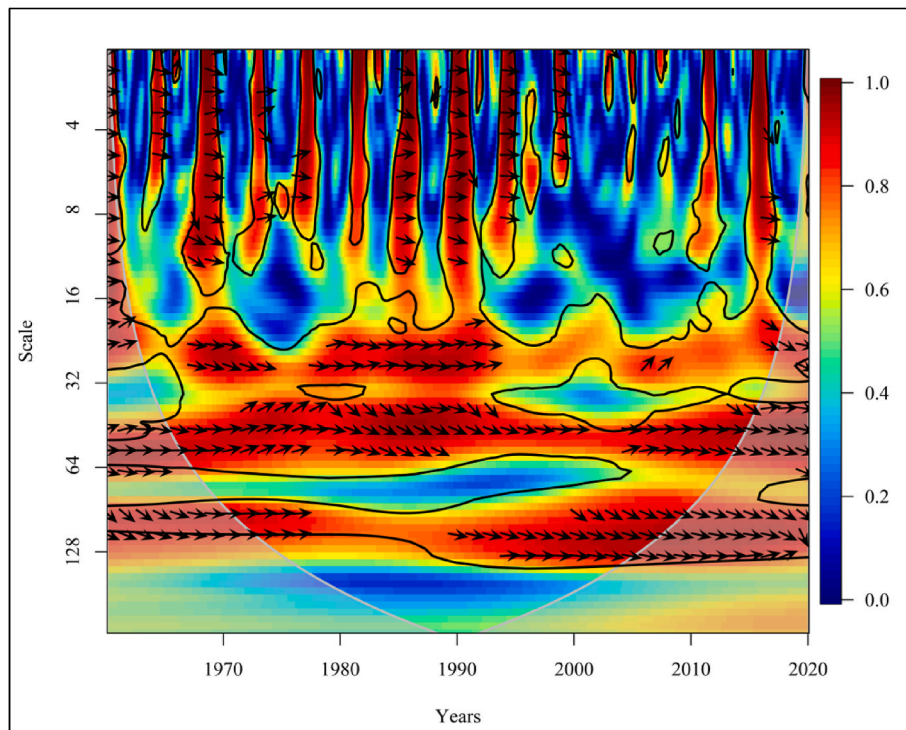


Fig. 7. Wavelet coherence diagram: PGLO
Source: Authors' illustration.

the low-income nations present how economic growth promotes globalisation in the short to medium term and tends to have a mutual influence over each other in the long term during the recent decade.

As per Fig. 5, a coherence of economic globalisation being driven by growth is revealed in both short (1970–1980 and 2000–2010) and long

(1970–1980 and 1980–1990) terms. The reverse of this dynamic at a high-frequency cycle is suggested by the upward-pointing rightward arrows located in the middle part of the plot, during the years 1970–1990 in the medium run. Growth-economic globalisation alignments indicating mutual reinforcement between the phenomena are also

Time range	Short term				Medium term				Long term				
	GDP GLO	GDP EGLO	GDP SGLO	GDP PGLO	GDP GLO	GDP EGLO	GDP SGLO	GDP PGLO	GDP GLO	GDP EGLO	GDP SGLO	GDP PGLO	
1970 – 1980													
1980 – 1990													
1990 – 2000													
2000 – 2010													
2010 - 2020													

Fig. 8. Wavelet coherence analysis summary. Source: Authors' illustration.

identified across all time spans in brief periods, but with positive correlation. Furthermore, no coherences are revealed between the variables towards the latter phases in neither time span. Hence, it is implied that towards the concluding years of the analysis period, the responsiveness of the two phenomena had reduced, possibly due to macroeconomic frictions.

The coherence between social globalisation and growth depicted in Fig. 6 indicates a reciprocal association concentrated in high-frequency bands during most of the short term. Moving from the middle area of the plot, the right facing arrows in these sections imply positive correlation. In the medium run, apart from bidirectional interrelations (1970–1980 and 1990–2000), trajectories of growth led social integration are evident during 2010–2020, and the vice versa in during 1980–1990 and 2000–2010. The coherence structures of the medium term are mirrored by the long run, albeit with variations in terms of frequency and time periods. These sustained dynamics during the mid to long phases suggest the possibility of social globalisation and growth being functionally interdependent phenomena for the low-income faction.

The nexus between political globalisation and economic growth of the low-income nations is illustrated in Fig. 7. A positive correlation is observed during all time frequencies. The dark red region depicts high frequency, and arrows pointing in both directions symbolise bidirectional causal processes during the periods 1970–1980 and 1980–1990. Economic growth causes political integration during the periods 1990–2000 and 2010–2020 in the short run. However, no causal flows were discovered in 2000–2010 in the short term. Political globalisation mutually affects each other during 1970–1980, 1980–1990 and 1990–2000 in the medium term. Towards the most recent decade, economic growth has impacted political globalisation in the medium term. In the long run, bidirectional dynamics were discovered over multiple decades in the low-income nations.

The above findings from the Wavelet Coherence analysis are summarised and presented in Fig. 8.

Following the Wavelet analysis, slope homogeneity test was performed to comprehend the nature of the globalisation-growth nexuses across the 14 nations within the panel. The test results provided in the S2 Appendix indicated heterogeneity at the 5 % significance level, leading to a cross-country causal analysis.

4.3. Cross-country analysis

After the Wavelet Coherence analysis, a cross-country analysis was conducted to elucidate summary statistics and the globalisation-growth dynamics for each of the 14 low-income nations considered.

4.3.1. Descriptive analysis

Fig. 9 showcases the average GDP, GLO, EGLO, SGLO, and PGLO levels demonstrated by the 14 low-income nations under consideration.

Accordingly, the Syrian Arab Republic has the highest mean GDP value, with Burundi having the lowest. Togo has the highest averaged GLO and EGLO levels, with the SGLO and PGLO levels peaking in Gambia and Uganda, respectively. Burundi has the minimum mean GLO, EGLO, and PGLO levels, while Chad has the lowest SGLO level. The extended summary statistics are presented in S3 Appendix.

4.3.2. Granger Causality analysis

Based on the Dickey-Fuller unit root test conducted prior to the Granger Causality test, all variables except for PGLO became stationary for all nations after first differencing. The extended details comprising of all test statistics and significance levels pertaining to this process are demonstrated in S4 Appendix. The model stability was then verified by choosing the ideal lag interval optimising all lag selection metrics – AIC, BIC and the HQIC. This process is documented in S5 Appendix. The companion matrices corresponding to the chosen optimal lag lengths are comprised in the S6 Appendix, thus establishing the model's stability.

Ultimately, Granger Causality Analysis was conducted of which the results are provided in detail in Table 4.

Accordingly, significant unidirectional causal flows from globalisation to economic growth are revealed in Burundi at 10 % significance level (P Val = 0.051 < 0.1), Sudan at 5 % significance level (P Val = 0.016 < 0.05), Sierra Leone (P Val = 0.001 < 0.01) and Uganda (P Val = 0.005 < 0.01) at 1 % significance level. This result stays consistent with the findings of previous literature presenting a statistically significant impact of globalisation on the economic growth factors (Ehigiamusoe, 2023; Rao & Vadlamannati, 2011; Uddin & Azam Khan, 2023). All these nations belong to the Sub-Saharan African regional bloc hence, the economic openness towards the rest of the world could be identified as a primary cause of this causal impact within the SSA nations (Zahonogo, 2018). Improvements in the labour market with increasing levels of women employment and suspension of contradictory social norms and perceptions towards equality and inclusion has resulted in the expansion of the human capital participation in the SSA regional bloc propagating global integration while promoting the economic expansion (Asongu et al., 2020). Furthermore, in the context of Sudan, globalisation influencing economic growth stays consistent with previous literature findings. However, Sudan can benefit more from globalisation towards achieving higher rates of economic development by investing in the financial sector to outcast the disintegrational loss generated from losing oil exports with the geographical separation of South Sudan (Elfaki & Ahmed, 2024).

A significant bidirectional nexus between globalisation and

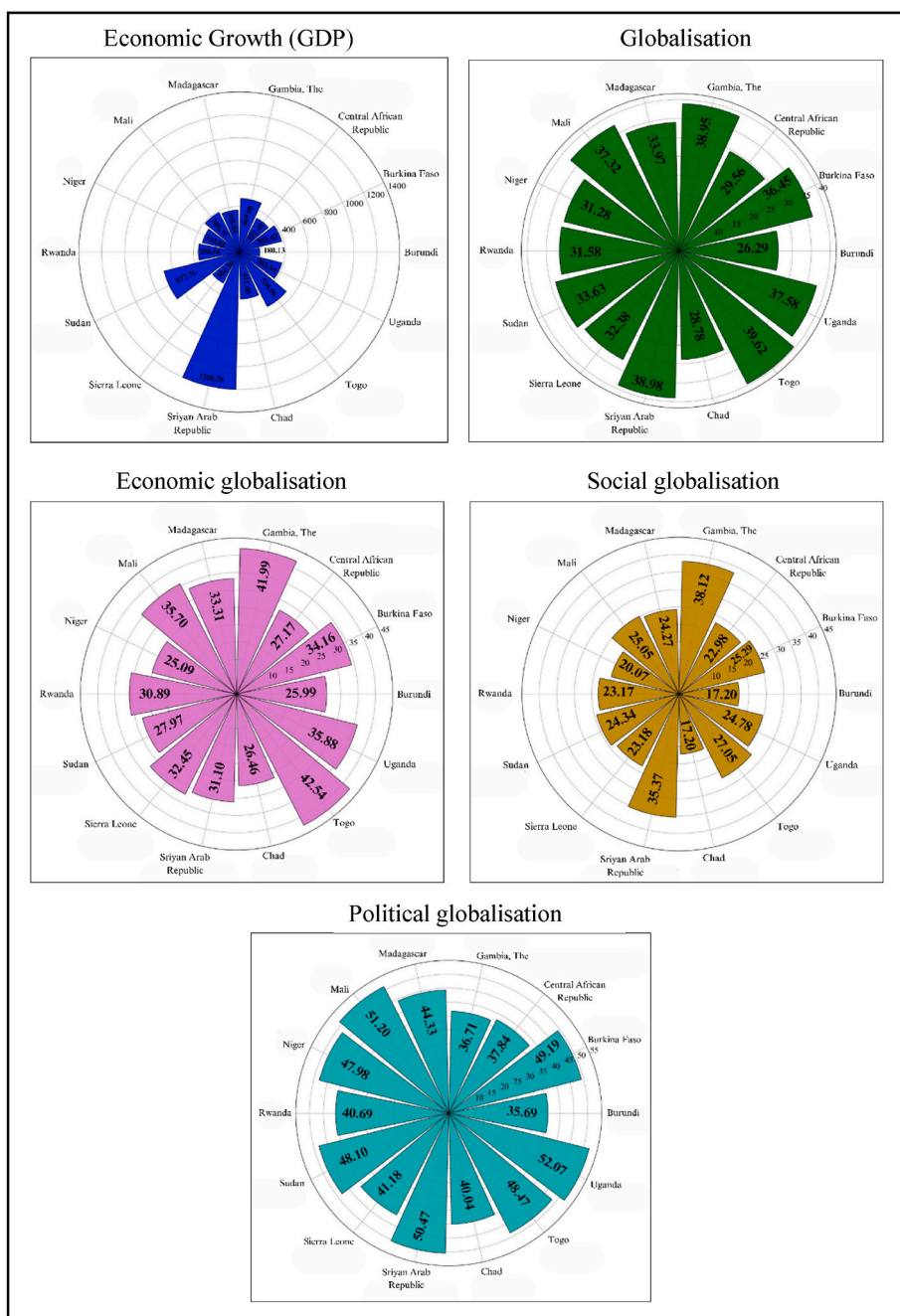


Fig. 9. Polar bar plot representations for cross-country average globalisation levels. Source: Authors' illustration.

economic growth is also identified in Rwanda where economic growth impacts globalisation at 1 % significance level and globalisation causes economic growth at 5 % significance level ($P\text{ Val} = 0.004 < 0.01$; $P\text{ Val} = 0.050 < 0.05$). Rwanda is considered a rapidly developing nation in the SSA although it was severely affected by a civil war during the 1990s. The improving institutional quality and the ability of attracting foreign direct investments towards the economy (Kadozi, 2019) has created opportunities in global integration towards economic growth and vice versa.

With respect to the Objective 01, the analysis uncovers a two-way causal dynamic between economic integration and growth in Burkina Faso under the 1 % significance level ($P\text{ Val} = 0.001 < 0.01$; $P\text{ Val} = 0.002 < 0.01$). The balanced trade frameworks implemented in the nation facilitating both inflows and outflows in terms of trade and

investment guided by regional agreements such as the Economic Community of West African States (ECOWAS) can be cited as possible regional dynamics explaining the observed two-way nexus. Mono-directional causal flows from growth to economic globalisation are disclosed in the Central Arab Republic under the 1 % significance level ($P\text{ Val} = 0.004 < 0.01$), under the 5 % significance level in both Mali ($P\text{ Val} = 0.014 < 0.05$) and Rwanda ($P\text{ Val} = 0.03 < 0.05$). Economic globalisation is observed influencing growth in Madagascar and Sierra Leone at 5 % ($P\text{ Val} = 0.039 < 0.05$) and 1 % significance levels ($P\text{ Val} = 0.004 < 0.01$), respectively. While the causal dynamics discovered in Madagascar and Sierra Leone are confirmed by existing empirical evidence (Acheampong et al., 2021), this equation can be owed to the economic liberalism fuelled industrial development and the external capital flow led growth observed in these nations (Asongu et al., 2020).

Table 4
Granger causality Results.

Country	Δ GDP ↓ ΔGLO	P Val	Δ GLO ↓ ΔGDP	P Val	Δ GDP ↓ ΔEGLO	P Val	Δ EGLO ↓ ΔGDP	P Val
Burundi	1.6541	0.198	3.8044	0.051	0.1855	0.911	0.7074	0.702
Burkina Faso	2.7019	0.259	0.5355	0.765	11.539	0.001	9.170	0.002
Central African Republic	0.4410	0.802	0.9287	0.629	8.106	0.004	0.9271	0.336
Gambia, The	0.4698	0.791	1.6152	0.446	0.4612	0.794	1.959	0.376
Madagascar	1.1897	0.552	3.0754	0.215	0.52913	0.768	6.4879	0.039
Mali	3.0493	0.218	0.26564	0.876	6.0846	0.014	0.1038	0.747
Niger	1.7969	0.407	1.0312	0.597	1.0887	0.580	2.2358	0.327
Rwanda	8.407	0.004	3.846	0.050	4.685	0.030	0.4910	0.483
Sudan	0.8277	0.661	8.331	0.016	1.9195	0.383	0.3499	0.839
Sierra Leone	0.7069	0.400	10.74	0.001	0.00043	0.983	8.221	0.004
Syrian Arab Republic	0.7990	0.371	0.8818	0.348	0.496	0.780	0.3388	0.844
Chad	0.1833	0.669	0.2816	0.596	3.4179	0.181	0.9400	0.625
Togo	0.0432	0.979	1.4791	0.477	2.1696	0.338	3.4124	0.182
Uganda	0.0792	0.778	7.916	0.005	0.8697	0.647	2.0317	0.362
	Δ GDP ↓ ΔSGLO	P Val	Δ SGLO ↓ ΔGDP	P Val	Δ GDP ↓ ΔPGLO	P Val	Δ PGLO ↓ ΔGDP	P Val
Burundi	1.8674	0.393	8.1797	0.017	1.6373	0.441	2.1672	0.338
Burkina Faso	0.4796	0.787	4.8374	0.089	0.1093	0.947	1.1298	0.568
Central African Republic	1.495	0.474	0.0689	0.966	1.7601	0.415	0.8818	0.643
Gambia, The	0.5833	0.747	3.7349	0.155	2.0355	0.361	1.224	0.542
Madagascar	0.6686	0.716	0.0148	0.993	1.328	0.515	1.0824	0.582
Mali	0.6686	0.414	0.2652	0.607	4.1238	0.127	3.0726	0.215
Niger	9.828	0.002	0.0542	0.816	3.3509	0.187	1.3817	0.501
Rwanda	7.677	0.006	2.1056	0.147	2.48	0.289	4.9275	0.085
Sudan	2.1984	0.138	7.071	0.008	0.6883	0.407	39.86	0.000
Sierra Leone	3.1726	0.075	0.01294	0.909	0.55553	0.758	3.0215	0.221
Chad	0.9757	0.323	0.0578	0.810	1.0934	0.269	0.0662	0.797
Togo	2.3212	0.313	1.0157	0.602	0.1467	0.702	0.1306	0.718
Uganda	0.2740	0.601	7.789	0.005	0.8339	0.659	3.2689	0.195
					Δ GDP ↓ ΔGLO		Δ GLO ↓ ΔGDP	
Syrian Arab Republic	0.1933	0.660	2.3007	0.129	1.4008	0.237	3.9561	0.047

Source: Authors' compilation.

Note:

■ - *** Significance at 1%, ■ - **Significant at 5%, ■ - * Significant 10%.

Source: Authors' compilation.

However, the same survey identifies the exact reversal of the casual progressions obtained in this study about the Central Arab Republic, Mali, and Rwanda (Acheampong et al., 2021). The differences between the two studies, where one considers economic integration instigated by actual flows (de facto) and the current study considering both de facto and de jure aspects of economic globalisation, can be a possible cause for this inconsistency.

With regards to Objective 02 pertaining to social globalisation, one-way causal connections from social globalisation to economic growth are evident in Burundi at the 5 % significance level (P Val = 0.017 <

0.05), Burkina Faso at the 10 % significance level (P Val = 0.089 < 0.1), and at the 1 % significance level in both Sudan (P Val = 0.008 < 0.01) and Uganda (P Val = 0.005 < 0.01). The reverse of this dynamic is observable in Niger (P Val = 0.002 < 0.01) and Rwanda (P Val = 0.006 < 0.01) under the 1 % significance level, and at the 10 % significance level in Sierra Leone (P Val = 0.075 < 0.1). The study's findings about Burundi, Sudan, and Uganda are substantiated by a survey which explained how the transformation of societal norms brought about by globalisation leads to increased capital market involvement, resulting in economic development in these socioeconomic systems (Asongu et al., 2020). The causal connection between social integration and economic progress in Burkina Faso is also substantiated in a study which explains how digital technology, falling within the social dimension of globalisation, is a stimulant for industrial growth, private and public sector development, expansion of trade and human capital development in the nation (Adeleye & Eboagu, 2019). In contrast to the observed causal progression in Niger, social integration is identified to impact economic growth positively in existing literature (Ehigiamusoe, 2023). Context-specific factors such as the differences in the statistical methodologies utilised in both studies and the periods considered can be plausible reasons for this contrast. Furthermore, fuelled by the variation of the study's span, consideration of economic phenomena such as recessions resulting from recent global crises such as the COVID-19 pandemic might have favoured this growth-led perspective.

A unidirectional nexus from political integration to growth is noted only in Rwanda at 10 % significance level (P Val = 0.085 < 0.1), Sudan at 1 % significance level (P Val = 0.000 < 0.01) and the Syrian Arab Republic at 5 % significance level (P Val = 0.047 < 0.05). The findings of this study tend to be in line with the findings of the existing literature presenting a significant impact of political integration on economic growth (Ehigiamusoe, 2023). Rwanda is a pioneering nation in the African Union and highly integrated within the region (Diop et al., 2024) and is a part of the African Continental Free Trade Area, allowing access to global markets and cultural and technological transfers while politically integrating across the region (Adams et al., 2024). The Syrian Republic is one of the nations which has suffered immensely due to the continuous humanitarian violence and crises that have existed for over a decade, resulting in a large number of refugees and displacements (Younes, 2024). Hence, the nation's political spectrum tends to have a significant impact on the economy in the journey towards searching for avenues for peacekeeping with the help of regional and inter-governmental organisations. Thus are the findings derived for Objective 03.

Additionally, Gambia, Chad, and Togo did not unveil any statistically significant causal dynamics between economic growth and any of the aspects of globalisation at neither 1 %, 5 % or 10 % significance levels. The findings about Togo contradicts a previous study where globalisation with its economic, social and political factions were identified to exert statistical significance on its economic growth (Ehigiamusoe, 2023). The said analysis incorporating an additional variable of energy consumption to its investigation of the globalisation-growth dynamic, as opposed to the current study which directly examines the said dynamic can be cited as a possible reason for this observed deviation.

These findings are then encapsulated in Fig. 10.

The identified causal nexuses were then checked for robustness considering alternative lag lengths. Outcomes of this robustness tests provided in S7 Appendix were observed to differ considerably from the main findings, thus suggesting sensitivity to model specifications.

5. Conclusion

This study investigated the causal progressions between globalisation along with economic, social and political dimensions and economic growth in the low-income category. With the GDP data extracted from the World Bank and globalisation indices (GLO, EGLO, SGLO and PGLO) extracted from KOF Swiss Economic Institute, the data was analysed for

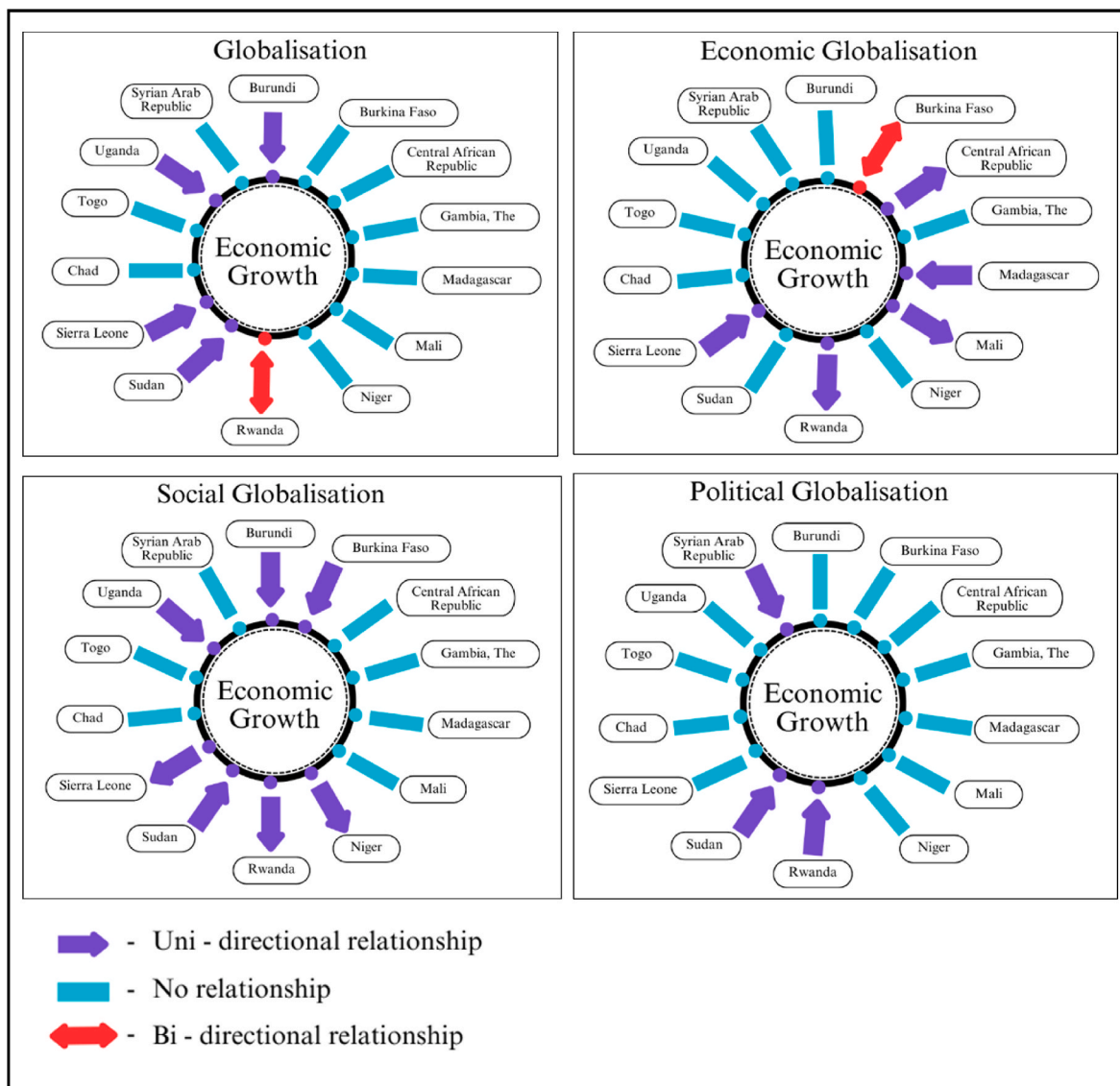


Fig. 10. Summary of cross-country Granger results. Source: Authors' illustration.

52 years from 1970 to 2021. This study evaluated 14 nations across the globe that belong to the low-income category at a cross-country level by contributing to existing literature to bridge the gap of underexplored dimensions (social and political) and low-income classification. The findings of this study are derived through the statistical evaluations done utilising the main methodologies, the Granger causality test for cross-country analysis and Wavelet Coherence for the low-income data panel.

The panel analysis conducted by deploying Wavelet Coherence resulted in bidirectional causal flows between economic growth and globalisation, including the dimensions, which were discovered in the short term towards the beginning of the period studied. However, diverse dynamics were observed in the recent 20 years in all short, medium and long terms while many relationships were also discovered to be insignificant during the same period. Granger Causality findings extracted from the cross-country analysis, present how a bidirectional causal flow between globalisation and economic growth is found in Rwanda. Findings of objective one depict a bidirectional relationship between economic globalisation and economic growth in Burkina Faso. Results related to objectives two and three, which evaluated the causalities of social and political globalisation, respectively, did not present

any bidirectional causalities with economic growth. Eleven nations out of fourteen in consideration have generated some causal relationship between any of the variables utilised. However, Gambia, Chad and Togo do show any statistically significant causal flow between economic growth and any of the dimensions of globalisation.

6. Policy implication

The study recommends policies that align with the United Nations Sustainability Development Goals (SDGs) in developing low-income nations, to lift their economy above their current position, as presented in Table 5. The policies have been drafted based on the globalisation-growth dynamics. However, policies for nations presenting less to no dynamics in the globalisation-growth nexus have been drafted utilising their overall performance in terms of their overall descriptive statistics.

With reference to the overall dynamics of the panel of low-income groups, the economic restrictions and unwanted sanctions, limit the global market access of low-income nations hindering their opportunities in globalisation. Hence, lifting unwanted trade barricades would elevate opportunities in global integration and sustainable development

Table 5
Country-specific policy recommendations in conformance with the UN SDGs.

Country	Key Dimension	Identified Issue/Challenge	Policy Recommendation	Alignment with UN SDGs
Rwanda	Economic Globalisation	Low levels of FDI inflows.	Introduce incentives for foreign investors, including tax relief and streamlined regulatory process.	SDG 9: Industry, Innovation, Infrastructure. SDG 9: Industry, Innovation and Infrastructure. SDG 17: Partnership for the Goals.
	Social Globalisation	Digital divide, especially in the rural areas in Rwanda.	Establish affordable internet facilities, accessible by citizens nationwide.	
	Political Globalisation	Weak regional connections	Initiation of sustainable peacekeeping endeavours with neighbouring regions aiming at the reinforcement of regional cooperation.	
Burundi	Social Globalisation	Limited access to information and communication technologies.	Expand digital infrastructure and ensure affordable access to internet service.	SDG 8: Decent Work and Economic Growth.
Burkina Faso	Economic Globalisation	Limited access to global markets in the context of exports.	Diversifying and liberalising trade by gaining more accessibility to the global markets.	SDG 17: Partnerships for the Goals SDG 4: Quality Education.
	Social Globalisation	Limited cultural integration	Encouraging endeavours for cultural exchange and cooperation in a global context.	
Syrian Arab Republic	Political Globalisation	Existence of a humanitarian crisis resulting in high number of refugees and the displaced people.	Substantial efforts should be made in ending violence and determining peace by combatting terrorism and crime collectively with the help of developed nations.	SDG 16: Peace, Justice and Strong Institutions.
Madagascar	Economic Globalisation	Increased exposure to global market susceptibilities fuelled by the dependence on the trade of primary goods such as vanilla and cloves.	Diversification of exports to manufacturing sectors to minimise the dependence on the export of basic commodities.	SDG 8: Decent Work and Economic Growth.
Central African Republic	Economic Globalisation	Heavy reliance on the export of natural resources like diamond and timber, often leading to unlawful market activities.	Establishment of sound and transparent regulation mechanisms for the sound management of natural resources and restriction of unlawful commerce.	SDG 16: Peace, Justice and Strong Institutions.
Uganda	Social Globalisation	Constraints to international educational opportunities.	Strengthening of global partnerships and exchange initiatives to ensure increased access to global education opportunities.	SDG 10: Reduced Inequalities.
Gambia	Economic Globalisation	High volatility and inability to resist during external shocks to the economy.	Strengthening the economy to external shocks, enhancing resilience by diversifying the industries within the nation.	SDG 9: Industry, Innovation, Infrastructure. SDG 2: Zero Hunger
Mali	Economic Globalisation	Limited industrialisation and global economic competitiveness due to increased dependence on agriculture.	Enriching value to the agriculture sector by investing in agro-industrial sectors to facilitate industrial development and a competitive edge in global markets.	SDG 5: Gender Equality.
Niger	Social Globalisation	Persistent gender disparities.	Addressing of gender-based inequities through laws and policies aimed at creating equal opportunities for women in terms of education, decision making and employment.	
Sudan	Social Globalisation	Restricted press freedom owing to the conflicts in the country (observed by the country's ranking in the Press Freedom Index)	Encouraging the freedom of journalists to amplify informational and interpersonal globalisation through informed citizenship in the country.	SDG 16: Peace, Justice and Strong Institutions.
	Political Globalisation	Existence civil and military conflicts leading to political instability.	Strengthening the security and rule of law providing justice and equitable treatment to the entirety of the population by collaborating with the institutional factions of the nation and ensuring inclusiveness.	SDG 16: Peace, Justice and Strong Institutions.
Sierra Leone	Economic Globalisation	Inefficient economic infrastructures	Reinforcing the existing commercial infrastructures such as ports and road networks to enhance trade and financial integration.	SDG 9: Industry, Innovation, Infrastructure. SDG 3: Good Health and Wellbeing
	Social Globalisation	Limitedness in health and medical infrastructure.	Adequate resource allocation for healthcare infrastructure to eventually facilitate resilience of social systems.	
Chad	Political Globalisation	Weak diplomatic ties	Augment diplomatic competence of Chad's representatives while actively engaging in global forums to amplify its representation and strengthen their political networks.	SDG 17: Partnerships for the Goals.
Togo	Political Globalisation	Governance inefficiencies leading to constraints in being incorporated into international diplomatic networks.	Enforcement of regulatory mechanisms advocating for good governance and political transparency in compliance with international political practices and endorsing for the country's global persona through active engagement in global and regional movements.	SDG 17: Partnerships for the Goals.

Source: Authors' compilation.

through SDG 17: Partnerships for Goals. Furthermore, adopting to sustainable production methods incorporating sustainable technology transfer within low-income nations would inflate the opening towards achieving the targets of SDG 9: Industry, Innovation and Infrastructure. This will directly influence the enterprises, business organisations and industries in terms of development and expansion. Apart from that, least developed nations in the low-income panel often experience political conflicts, corruption and humanitarian issues and such phenomenon hinders political integration. Peacekeeping and obtaining international assistance to maintain peace and justice in such nations would promote their chances in reaching the targets listed down under SDG 16: Peace, Justice and Strong Institution by 2030. Academicians and policymakers will benefit in this endeavour for future avenues in research and for national policy making activities.

The findings of this study provide comprehensive insights into the causal progressions between globalisation, its sub-dimensions, and economic growth in the low-income countries considered. The following section notes certain limitations of the study and suggests avenues for value addition for potential researchers.

7. Limitations of the study and directions for future studies

Findings of this study are subjected to several limitations. Firstly, owing to constraints in data availability the analysis considers only 14 low-income nations over a period of 52 years. Though this extensive timeframe enables the analysis of long-term causal dynamics, structural breaks during this period caused by exogenous events are likely to affect the stability of the observed relationships. Hence, future studies can

address this issue by accounting for structural breaks through break tests and sub-period checks.

Secondly, though the Granger Causality and Wavelet Coherence approaches followed in the study can capture directional flows and temporal frequencies of causal patterns, they might not capture more complex dynamics. Potential research therefore can develop the present results by utilising more advanced econometric techniques.

Thirdly, findings of the study are sensitive to model setup decisions such as scale determination during Wavelet Coherence, variable transformations to ensure stationarity, and choice of the optimal lag length in ascertaining stability. Though robustness checks were performed using alternate lag structures, variations in other model assumptions could still lead to differing outcomes. Future research could therefore build on alternate Wavelet scales and variable transformations and consider alternate measures of globalisation -such as de facto vs de jure indices and trade-to-GDP ratios-to further evaluate the validity of observed trends.

Lastly, omitted variable bias is likely due to the non-consideration of control variables -such as conflict, education, inflation, and investment- thus affecting the resulting causal dynamics. Potential researchers can expand on these findings through the inclusion of a wider array of control variables and by also considering individual blocks of the sub-dimensions of globalisation.

While acknowledging these constraints, the study provides a comprehensive analysis of the globalisation-growth dynamics of the low-income sector to facilitate insights valuable for policy discussion and inform future research.

CRediT authorship contribution statement

Danushi Rathnayake: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Irushi Sandanayaka:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Piyara Wijesuriya:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Dinithi Athalage:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Ruwan Jayathilaka:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization.

Ethics approval

Review and/or approval by an ethics committee was not required for this study, as the research utilised publicly available secondary data only. The analysis did not involve direct interaction with human participants or animals, nor did it use any confidential or personally identifiable information. Consequently, institutional ethics approval was not applicable.

Declaration of AI use

No AI tools were used in the writing, editing, data analysis, or preparation of this manuscript. All content is the original work of the authors.

Funding statement

The authors declare that no funds, grants, or other support were received during the preparation of this manuscript.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssaho.2026.102498>.

Data availability

All data generated or analysed during this study are included in this published article and its supplementary information files.

References

- Abid, M., & Alotaibi, M. N. (2020). Crude oil price and private sector of Saudi Arabia: Do globalization and financial development matter? New evidence from combined cointegration test. *Resources Policy*, 69, 1–15. <https://doi.org/10.1016/j.resourpol.2020.101774>
- Abubakar, M. (2024). Globalisation and output growth nexus in Sub-Saharan Africa: The critical role of trade liberalisation. *Journal of the Knowledge Economy*, 15(1), 2218–2240. <https://doi.org/10.1016/j.eneco.2021.105472>
- Acheampong, A. O., Boateng, E., Amponsah, M., & Dzator, J. (2021). Revisiting the economic growth–energy consumption nexus: Does globalization matter? *Energy Economics*, 102, 1–18. <https://doi.org/10.1016/j.eneco.2021.105472>
- Adams, K., Attah-Boakye, R., Yu, H., Chu, I., & Mali, D. (2024). African continental free trade area and regional trade in ICT and digital technologies. *Journal of International Management*, 30(4), 1–22. <https://doi.org/10.1016/j.intman.2024.101156>
- Adebayo, T. S., Alola, A. A., & Ullah, S. (2024). Probing the carbon neutrality drive of environmental-related technologies and energy transition in France and Germany: A novel time–frequency technique. *Clean Technologies and Environmental Policy*, 26(12), 4325–4343. <https://doi.org/10.1007/s10098-024-02816-z>
- Adeleye, N., & Eboagu, C. (2019). Evaluation of ICT development and economic growth in Africa. *Nemomics: Economic Research and Electronic Networking*, 20(1), 31–53. <https://doi.org/10.1007/s11066-019-09131-6>
- Agu, C., Ogbuabor, J. E., & Onah, B. U. (2024). How are economic governance institutions moderating the effect of economic complexity on trade, FDI Inflow, environmental degradation, and economic growth in Africa? *Journal of the Knowledge Economy*, 1–32. <https://doi.org/10.1007/s13132-024-02284-2>
- Akadiri, S. S., Alola, A. A., & Akadiri, A. C. (2019). The role of globalization, real income, tourism in environmental sustainability target. Evidence from Turkey. *Science of the Total Environment*, 687, 423–432. <https://doi.org/10.1016/j.scitotenv.2019.06.139>
- Akadiri, S. S., Lasisi, T. T., Uzuner, G., & Akadiri, A. C. (2020). Examining the causal impacts of tourism, globalization, economic growth and carbon emissions in tourism island territories: Bootstrap panel Granger causality analysis. *Current Issues in Tourism*, 23, 470–484. <https://doi.org/10.1080/13683500.2018.1539067>
- Akaike, H. (1998). Information theory and an extension of the maximum likelihood principle. In E. Parzen, K. Tanabe, & G. Kitagawa (Eds.), *Selected papers of hirotugu akaike* (pp. 199–213). New York, NY: Springer New York.
- Akinlo, T., & Dada, J. T. (2022). Information technology, real sector and economic growth in Sub-Saharan Africa: A cross-sectional dependence approach. *Quality and Quantity*, 56(6), 4241–4267. <https://doi.org/10.1007/s11135-021-01308-2>
- Akusta, E. (2024). The impacts of different types of globalization on energy security risk: Can globalization be a remedy for the energy security risk of OECD countries? *Energy*, 313, 1–12. <https://doi.org/10.1016/j.energy.2024.133787>
- Asafo-Adjei, E., Agyapong, D., Agyei, S. K., Frimpong, S., Djimatey, R., & Adam, A. M. (2020). In *Economic policy uncertainty and stock returns of Africa: A wavelet coherence analysis* (Vol. 2020, pp. 1–8). <https://doi.org/10.1155/2020/8846507>, 1.
- Aslan, A., & Altinoz, B. (2021). The impact of natural resources and gross capital formation on economic growth in the context of globalization: Evidence from developing countries on the continent of Europe, Asia, Africa, and America. *Environmental Science and Pollution Research*, 28(26), 33794–33805. <https://doi.org/10.1007/s11356-021-12979-7>
- Asongu, S. A., Efobi, U. R., Tanankem, B. V., & Osabuohien, E. S. (2020). Globalisation and female economic participation in Sub-Saharan Africa. *Gender Issues*, 37(1), 61–89. <https://doi.org/10.1007/s12147-019-09233-3>
- Athalage, D., Wijesuriya, P., Sandanayaka, I., Rathnayake, D., & Jayathilaka, R. (2025). The interplay between globalisation and economic growth: A multi-regional analysis. *Discover Sustainability*, 6(1), 1–14. <https://doi.org/10.1007/s43621-025-01403-6>
- Baidoo, S. T., Tetteh, B., Boateng, E., & Ayibor, R. E. (2023). Estimating the impact of economic globalization on economic growth of Ghana: Wavelet coherence and ARDL analysis. *Research in Globalization*, 7, 1–14. <https://doi.org/10.1016/j.resglo.2023.100183>
- Behera, J., & Sahoo, D. (2023). Does globalization spur human development at income-group and regional levels? Evidence from cross-country data. *Asia-Pacific Journal of Regional Science*, 7(4), 1395–1436. <https://doi.org/10.1007/s41685-023-00298-3>

- Bolarinwa, S. T., Adekunle, I. A., & Al-Faryan, M. A. S. (2025). Is globalisation all good? Asymmetric analysis of the roles of globalisation on poverty in Africa. <https://doi.org/10.1002/ijfe.3156>.
- Burhan, N. A. S., Sidek, A. H., Kurniawan, Y., & Mohamad, M. R. (2015). Has globalization triggered collective impact of national intelligence on economic growth? *Intelligence*, 48, 152–161. <https://doi.org/10.1016/j.intell.2014.11.003>
- Chang, C.-P., Berdiev, A. N., & Lee, C.-C. (2013). Energy exports, globalization and economic growth: The case of South Caucasus. *Economic Modelling*, 33, 333–346. <https://doi.org/10.1016/j.econmod.2013.04.027>
- Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366a), 427–431. <https://doi.org/10.1080/01621459.1979.10482531>
- Diop, S., Asongu, S. A., & Ndiaye, C. T. (2024). Supporting African union: Do macroeconomic fluctuations matter? *Economic Systems*, 48(3), 1–10. <https://doi.org/10.1016/j.ecosys.2024.101186>
- Dreher, A. (2006). Does globalization affect growth? Evidence from a new index of globalization. *Applied Economics*, 38, 1091–1110. <https://doi.org/10.1080/00036840500392078>
- Ehigiamusoe, K. U. (2023). In *A disaggregated approach to analysing the effects of globalization and energy consumption on economic growth: New insights from low-income countries* (Vol. 28, pp. 3976–3996). <https://doi.org/10.1002/ijfe.2631>, 4.
- Eidgenössische Technische Hochschule Zürich. (2024). KOF globalisation index. Retrieved from <https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html>.
- Eltayeb Elfaki, K., & Musa Ahmed, E. (2024). Globalization and financial development contributions toward economic growth in Sudan. *Research in Globalization*, 9, 1–11. <https://doi.org/10.1016/j.resglo.2024.100246>
- Gaies, B., Goutte, S., & Guesmi, K. (2020). Does financial globalization still spur growth in emerging and developing countries? Considering exchange rates. *Research in International Business and Finance*, 52, 1–19. <https://doi.org/10.1016/j.ribaf.2019.101113>
- Glennice Fosah, M.-S., Mama, N., Dohba Dinga, G., & Nchofoung, T. N. (2023). The effect of globalisation on sub-Saharan Africa's development thrives. *Research in Globalization*, 7, 1–8. <https://doi.org/10.1016/j.resglo.2023.100149>
- Gomes Neto, D., & Veiga, F. J. (2013). Financial globalization, convergence and growth: The role of foreign direct investment. *Journal of International Money and Finance*, 37, 161–186. <https://doi.org/10.1016/j.jimonfin.2013.04.005>
- Goupillaud, P., Grossmann, A., & Morlet, J. (1984). Cycle-octave and related transforms in seismic signal analysis. *Geoexploration*, 23(1), 85–102. [https://doi.org/10.1016/0016-7142\(84\)90025-5](https://doi.org/10.1016/0016-7142(84)90025-5)
- Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica*, 37, 424–438. <https://doi.org/10.2307/1912791>
- Guan, J., Kirikkaleli, D., Bibi, A., & Zhang, W. (2020). Natural resources rents nexus with financial development in the presence of globalization: Is the “resource curse” exist or myth? *Resources Policy*, 66, 1–9. <https://doi.org/10.1016/j.resourpol.2020.101641>
- Hannan, E. J., & Quinn, B. G. (1979). In *The determination of the order of an autoregression* (Vol. 41, pp. 190–195). <https://doi.org/10.1111/j.2517-6161.1979.tb01072.x>, 2.
- Hashem Pesaran, M., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, 142(1), 50–93. <https://doi.org/10.1016/j.jeconom.2007.05.010>
- Heimberger, P. (2020). Does economic globalisation affect income inequality? *A meta-analysis*, 43(11), 2960–2982. <https://doi.org/10.1111/twec.13007>
- Iamsiraroj, S. (2016). The foreign direct investment–economic growth nexus. *International Review of Economics & Finance*, 42, 116–133. <https://doi.org/10.1016/j.iref.2015.10.044>
- Ibrahim, A., & Abdulmalik, M. R. (2023). Do trade openness and governance matter for economic growth in Africa? A case of EAC and WAEMU countries. *International Economics and Economic Policy*, 20(3), 389–412. <https://doi.org/10.1007/s10368-023-00565-w>
- Iwegbu, O., & de Mattos, L. B. (2022). Financial development, trade globalisation and agricultural output performance among BRICS and WAMZ member countries. *SN Business & Economics*, 2(8), 1–27. <https://doi.org/10.1007/s43546-022-00271-w>
- Kadozi, E. (2019). Remittance inflows and economic growth in Rwanda. *Research in Globalization*, 1, 1–15. <https://doi.org/10.1016/j.resglo.2019.100005>
- Kleimeier, S., & Versteeg, R. (2010). In *Project finance as a driver of economic growth in low-income countries* (Vol. 19, pp. 49–59). <https://doi.org/10.1016/j.rfe.2010.01.002>, 2.
- Loewenson, R. (2001). Globalization and occupational health: A perspective from southern Africa. *Bulletin of the World Health Organization*, 79(9), 863–868. <https://doi.org/10.1590/S0042-96862001000900012>
- Love, I., & Zicchino, L. (2006). Financial development and dynamic investment behavior: Evidence from panel VAR. *The Quarterly Review of Economics and Finance*, 46(2), 190–210. <https://doi.org/10.1016/j.qref.2005.11.007>
- Mominur Rahman, M., Golam Faruque, M., & Emran Hossain, M. (2024). Does good governance intensify the impact of energy finance on globalization? Evidence from BRICS nations. *Research in Globalization*, 9, 1–12. <https://doi.org/10.1016/j.resglo.2024.100264>
- Naz, A. (2023). Linkages between different types of globalization and socio-economic variables: Panel data analysis for 129 countries. *Journal of Economic Structures*, 12(1), 7. <https://doi.org/10.1186/s40008-023-00301-2>
- Nguea, S. M., Fotio, H. K., & Baida, L. A. (2022). In *Investigating the effects of globalization on economic sophistication in selected African countries* (Vol. 34, pp. 324–338). <https://doi.org/10.1111/1467-8268.12666>, 3.
- Nguea, S. M., Noula, A. G., & Nomba, I. (2024). Financial globalization and democracy: Implications for economic growth in African countries. *Journal of the Knowledge Economy*, 15(1), 3355–3379. <https://doi.org/10.1007/s13132-023-01311-y>
- Oduola, M., Bello, M. O., & Popoola, R. (2022). Foreign direct investment, institution and industrialisation in Sub-Saharan Africa. *Economic Change and Restructuring*, 55(2), 577–606. <https://doi.org/10.1007/s10644-021-09322-y>
- Orhan, A., Kirikkaleli, D., & Ayhan, F. (2019). Analysis of wavelet coherence: Service sector index and economic growth in an emerging market. *Sustainability*, 11, 1–12. <https://doi.org/10.3390/su11236684>
- Pal, S., & Villanthenkodath, M. A. (2024). In *Economic globalization and unemployment: Evidence from high-, middle- and low-income countries* (Vol. 74, pp. 1087–1112). <https://doi.org/10.1111/issj.12499>, 253.
- Rao, B. B., & Vadlamannati, K. C. (2011). Globalization and growth in the low income African countries with the extreme bounds analysis. *Economic Modelling*, 28, 795–805. <https://doi.org/10.1016/j.econmod.2010.10.009>
- Sandanayaka, I., Rathnayake, D., Athalage, D., Wijesuriya, P., & Jayathilaka, R. (2025). Interweaving globalisation and growth: A causal exploration across income levels. *Social Sciences & Humanities Open*, 11, 1–18. <https://doi.org/10.1016/j.ssaho.2025.101399>
- Schwarz, G. (1978). Estimating the dimension of a model. *Annals of Statistics*, 6(2), 461–464. <https://doi.org/10.1214/aos/1176344136>
- Shahbaz, M., Mallik, H., Mahalik, M. K., & Hammoudeh, S. (2018). Is globalization detrimental to financial development? Further evidence from a very large emerging economy with significant orientation towards policies. *Applied Economics*, 50, 574–595. <https://doi.org/10.1080/00036846.2017.1324615>
- Shittu, W. O., Yusuf, H. A., El Moctar El Houssein, A., & Hassan, S. (2020). The impacts of foreign direct investment and globalisation on economic growth in West Africa: Examining the role of political governance. *Journal of Economic Studies*, 47(7), 1733–1755. <https://doi.org/10.1108/JES-09-2019-0446>
- Traore, S. (2023). In *The impact of globalization on leadership and governance in Mali* (Vol. 3, pp. 13–23). <https://doi.org/10.47604/ijlg.1925>, 1.
- Uddin, I., & Azam Khan, M. (2023). Global evidence on the impact of globalization, governance, and financial development on economic growth. *Journal of the Knowledge Economy*, 1–32. <https://doi.org/10.1007/s13132-023-01656-4>
- Wijesuriya, P., Athalage, D., Rathnayake, D., Sandanayaka, I., & Jayathilaka, R. (2025). Globalisation and growth nexus: Evidence from Africa through granger causality and wavelet coherence. *Sustainable Futures*, 9, 1–19. <https://doi.org/10.1016/j.sfr.2025.100833>
- World Bank Group. (2025). World bank group country classifications by income level for FY24 (July 1, 2023– June 30, 2024). Retrieved from <https://blogs.worldbank.org/en/opendata/new-world-bank-group-country-classifications-income-level-fy24>.
- Yang, L., Cai, X. J., Zhang, H., & Hamori, S. (2016). Interdependence of foreign exchange markets: A wavelet coherence analysis. *Economic Modelling*, 55, 6–14. <https://doi.org/10.1016/j.econmod.2016.01.022>
- Younes, R. (2024). The road to sustainable peace: Galtung's concept of positive peace as a framework to examine post-war reconstruction initiatives in Syria. *International Journal of Educational Development*, 111, 1–9. <https://doi.org/10.1016/j.ijedudev.2024.103164>
- Zahonog, P. (2018). Globalization and economic growth in developing countries: Evidence from Sub-Saharan Africa. *International Trade Journal*, 32, 189–208. <https://doi.org/10.1080/08853908.2017.1333933>