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Tourism and Economic Growth in Kenya: A Time Series Analysis

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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Original Research Article

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Abstract

Aims: To investigate the dynamic relationship between international tourism inflows and economic growth in Kenya over the period 2012-2023 using time series analysis.
Methodology: Annual data on real Gross Domestic Product (GDP) and international tourist arrivals were analyzed using unit root tests, Johansen cointegration analysis, vector error correction models (VECM), Granger causality tests, and forecast error variance decomposition techniques. The optimal lag order was chosen based on the Akaike Information Criterion.
Results: The Johansen cointegration test revealed one cointegrating equation (trace statistic = 35.52, $p < 0.05$), indicating a long-run equilibrium relationship between GDP and tourism arrivals. The VECM showed a significant error correction term for GDP (-3.1857, $p < 0.01$), confirming long-run causality. However, the Granger causality test failed to reject the null hypothesis that tourism arrivals do not Granger-cause GDP (F-statistic = 0.1626, $p = 0.8543$). Forecast error variance decomposition showed that by the 10th period, 99.9% of tourism arrivals variance was attributed to its shocks, while GDP shocks contributed only 0.1%.
Conclusion: While a long-run equilibrium relationship exists between tourism and economic growth in Kenya, there is no evidence of short-run causality from tourism arrivals to GDP. The results suggest that factors specific to the tourism sector, rather than broader economic conditions, have a more substantial

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influence on tourism arrivals in the long run. Policymakers should focus on developing targeted strategies to enhance the tourism sector's linkages with other economic sectors to maximize its potential for driving sustainable economic growth. Practical recommendations include diversifying tourism products, improving tourism infrastructure, and implementing marketing strategies to attract high-value tourists.

Keywords: Vector error correction models; gross domestic product; forecast error variance; time series analysis; economic growth, Kenyan tourism influx.

1 Introduction

Tourism is one of the largest and fastest-growing industries globally, providing tremendous economic benefits to countries worldwide. In 2017, travel and tourism directly contributed 8.8 trillion USD and 319 million jobs to the global economy [1]. As an invisible export, tourism brings in foreign exchange, encourages infrastructure development, and creates extensive employment and entrepreneurial opportunities, stimulating wider economic growth [2]. With its colorful culture, abundant wildlife, scenic landscapes, and beaches, Kenya has firmly established itself as a leading tourist destination in Sub-Saharan Africa. Tourism is a vital sector of Kenya's economy, contributing about 10% to the national Gross Domestic Product (GDP) and 9% of total employment in 2016 [3-7].

However, the economic potential of tourism in Kenya remains underdeveloped and vulnerable to external shocks. Like many African countries, Kenya's tourism industry suffered immense losses due to the negative travel advisories during the post-election violence 2008 [8]. More recently, tourist arrivals fell by 25% in the first half of 2017 as security concerns caused mass cancellations by European tourists after a prolonged electioneering period [9]. Terrorist threats by groups linked to Al-Shabaab have also devastated Kenya's tourism industry in the past decade [10]. These disruptions demonstrate that political stability and security are essential prerequisites for tourism to thrive.

On the other hand, technological improvements such as digital marketing and diversification into new source markets have expanded Kenya’s tourism despite an uncertain political climate [11]. This complex interplay of political, economic, and social factors on tourism requires further empirical investigation: particularly on the linkage between tourism expansion and broader economic growth at the national level over time [12]. Most existing research has focused on the unidirectional impacts of tourism on economic growth, even though there may be a reverse effect where income growth spurs higher tourist arrivals [2]. As such, this study will analyze the dynamic two-way causal relationship between international tourism earnings and economic growth in Kenya using modern time series techniques.

2 Literature Review

A considerable body of empirical research has analyzed tourism-led growth from a time series perspective, yielding mixed evidence on the existence, direction, and significance of causality [13]. Early studies by Balaguer and Cantavella-Jorda [14] and Durbarry [15] applied the Granger causality test and found bidirectional causality between tourism receipts and economic growth in Spain and Mauritius respectively. However, most studies have detected unidirectional causality. Eugenio-Martin et al. [16] established tourism-led growth in Latin American economies, while Oh [17] and Lee and Chang [2] confirmed economic-driven tourism growth in Korea and OECD countries. More recent studies have questioned the robustness of Granger causality tests [18].

In Kenya's tourism industry, empirical evidence remains relatively sparse with conflicting conclusions on causal relationships with economic expansion [19]. Sindiga [11] found that tourism stimulus drove wider economic growth in Kenya between 1964-1996. However, the analysis was descriptive with limited econometric rigor. After the 2008 political crisis, Njoya and Seetaram [20] established that tourism led to economic growth but not vice versa from 1999–2016, contrasting an earlier study by Muchapondwa and Pimhidzai [21] that found no causality between tourism earnings and economic growth in Kenya from 1985-2009. The discrepancies indicate that the choice of study period and econometric methodology significantly impact detected causalities [22] highlighting the need for an updated investigation. Moreover, existing analyses have not distinguished between

different categories of tourist arrivals or domestic tourism, which can exhibit differential impacts on the local economy [23].

In filling these research gaps, this study will undertake a time series analysis to examine the dynamic relationship between international tourism inflow and economic growth in Kenya over an extensive 10-year period from 2012–2023. Cointegration, unit roots, and Granger causality tests were conducted on an annual data series that had structural breaks identified and corrected. The impulse response functions and the variance decomposition measures that were employed also determined the magnitude and duration of the shock effects between the variables [24].

3 Materials and Methods

3.1 Data source

Our analysis depended on the annual data that includes the value of real GDP and the inflow of International tourists for the years 2012-2023. The data (GDP and tourist numbers) was downloaded from the Central Bank of Kenya and the Ministry of Tourism. The retrieved data is stored in Comma Separated Values (CSV) format in the Excel spreadsheet for further cleaning and transformation and then imported into R software for analysis.

3.2 Vector Error Correction Model (VECM)

A vector error correction model (VECM) is created to examine the dynamic processes that link economic growth to the tourist inflow in Kenya. A VECM technique considers both the short-term dynamics and equilibrium relationships in the long run between the variables. The model is represented as:

$$\Delta y_t = \Pi y_{t-1} + \sum \Gamma i \Delta y_{t-i} + \varepsilon_t \quad (1)$$

Where $\Pi = \alpha\beta'$, α represents the speed of adjustment to equilibrium, β contains the cointegrating vectors, Γi is short-run coefficient matrices, and εt is the error correction term. The VECM is estimated using the 'ca.jo()' function in the 'urca' package in R. The optimal lag order is chosen based on the Akaike Information Criterion (AIC).

3.3 Diagnostic tests

The estimated VECM model is evaluated for stability, serial correlation, heteroscedasticity, and normality of residuals. Stability is checked using inverse roots of AR characteristics polynomials. Breusch-Godfrey LM tests are utilized to test for autocorrelation. ARCH-LM tests are performed for heteroscedasticity detection. Residual normality is examined through the Jarque-Bera test.

3.4 Data analysis

Unit root tests (Augmented Dickey-Fuller and Phillips-Perron) are first conducted to examine stationarity properties. Johansen cointegration analysis is applied to determine the presence of long-run relationships. Granger causality tests based on the VECM model indicate the direction of causality between tourist inflows and economic growth. Impulse response functions and variance decompositions evaluate the dynamic interactions and shock transmission mechanisms between the two variables. Descriptive statistics and correlation analysis are also performed as preliminary examinations.

4 Results

4.1 Time series plot

The tourism plot in Fig. 1 displays the annual international tourist arrivals in Kenya from 2012 to 2023. The time series exhibits significant volatility, with sharp fluctuations from year to year, indicating the tourism industry's vulnerability to various internal and external factors. Notable observations include a strong tourism

sector in the initial years (2012-2013), followed by a decline in 2014-2016, a severe disruption in 2017, a recovery period from 2018-2020, another decline in 2021 (potentially attributed to the COVID-19 pandemic), and a rebound in 2023 to pre-pandemic levels [25,26]. The overall trend appears to be fluctuating, with no clear upward or downward pattern, suggesting that tourism inflow in Kenya is highly sensitive to economic conditions, political instability, security concerns, and global events impacting travel and tourism.

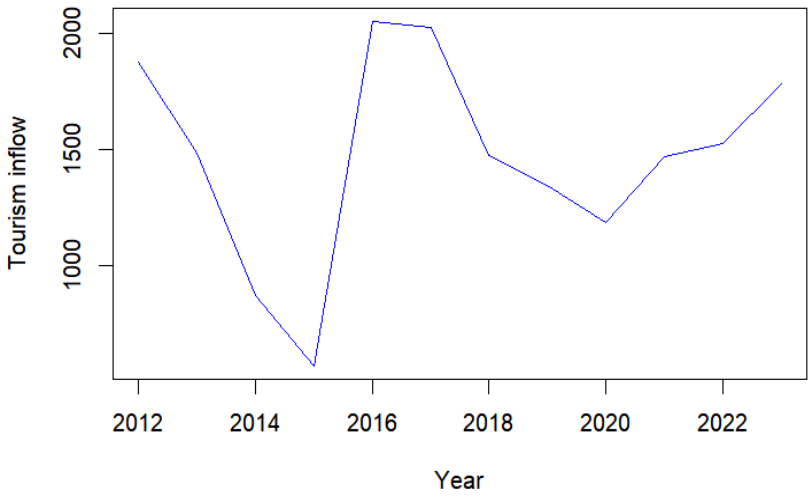

Fig. 1. Time series plot for tourism plot in-flow into Kenya

4.2 Summary statistics

The summary statistics in Table 1 provide insights into the distribution of the two-time series variables, GDP and Tourist Influx. The GDP variable has a mean of 5.225 and a median of 5.550, indicating a slight positive skew in the distribution. The minimum value of 1.500 and the maximum value of 8.400 suggest a wide range of GDP growth rates during the period under consideration. On the other hand, the Tourism_ts variable has a mean of 1471 and a median of 1480, indicating a more symmetric distribution. The minimum value of 568 and the maximum value of 2049 represent the lowest and highest levels of international tourist arrivals, respectively.

Table 1. Summary statistics

Statistic	GDP	Tourist Influx
Minimum	1.500	568
1st Quartile	4.750	1303
Median	5.550	1480
Mean	5.225	1471
3rd Quartile	5.950	1804
Maximum	8.400	2049

Table 2. Correlation matrix

	GDP	Tourist Influx
GDP	1.000	-0.160
Tourist Influx	-0.160	1.000

The correlation matrix in Table 2 shows a weak negative correlation of -0.160 between GDP (Annual GDP growth) and Tourist Influx. This negative correlation suggests that as GDP growth increases, international tourist arrivals tend to decrease slightly, and vice versa. However, it is important to note that correlation does not imply causation, and this relationship may be influenced by other factors not accounted for in the analysis.

The negative correlation between GDP growth and international tourist arrivals may seem counterintuitive, as one might expect higher economic growth to attract more tourists. However, several factors could contribute to this observed relationship: Economic growth may lead to an appreciation of the local currency, making travel to the country more expensive for international tourists. Periods of rapid economic growth may be associated with increased business activity, construction, and infrastructure development, which could temporarily disrupt or discourage tourism. The time lag between economic growth and its impact on the tourism industry may differ, leading to a negative correlation in the short term.

4.3 Unit root test

The unit root tests were applied to both the GDP and tourism series to know if they were stationary. Similarly, there are few ADF and PP tests were carried out for the GDP time series. The result of the ADF test is that the test statistic is equal to -3.2692 with a p-value equal to 0.09594, while the result of the PP test is that the test statistic is equal to -7.7496 with a p-value equal to 0.626. Both the null hypothesis of unit root was not rejected at the significance level of 5% level, thus might be a sign that the GDP time series may have a unit root and it may not be stationary.

Also for the tourism time series, ADF and PP tests were carried out. The obtained statistic from the ADF test was -2.6893 with a p-value of 0.3098 whereas the statistic obtained from the PP test was -7.8269 with a p-value of 0.6208. In accordance, the null hypothesis of a unit root was not rejected at the 5% significance level. Such facts suggest the possibility that the tourism time series is probably non-stationary and is not stationary.

4.4 Cointegration

The Johansen cointegration test in Table 3 exhibits a trace statistic of one cointegrating equation, which implies that there is a long-term equilibrium association between GDP and tourism arrivals in Kenya. The cointegrating vector holds the long-term relation, which showcases that GDP is positively connected to itself and negatively related to tourism arrivals.

Table 3. Johansen cointegration test results

Test	Value
Trace Test Statistic ($r \leq 1$)	8.36
Trace Test Statistic ($r = 0$)	35.52*
Cointegrating Vector (GDP)	1.000
Cointegrating Vector (Tourism)	-0.0006
Cointegrating Vector (Constant)	6.519
Loading Coefficient (GDP)	-3.185
Loading Coefficient (Tourism)	-469.175

The adjustment coefficients are the measure of how fast the equilibrium is approached after the changes in the long run. The negative coefficient for GDP indicates convergence to the equilibrium, while the negative coefficient for tourism arrivals also suggests convergence, but at a slower rate.

Table 4. Vector Error Correction Model (VECM) Coefficients for GDP Equation

Variable	Coefficient Estimate	Standard Error	t-value	p-value
ECT	-3.1857	0.7440	-4.282	0.00365**
ΔGDPt-1	-1.5335	0.3689	-4.157	0.00426**
ΔTourismt-1	-0.0009	0.0007	-1.170	0.28017

The VECM estimation results in Table 4 provide insights into the short-run dynamics and causality between the variables. In the GDP equation, the error correction term (ECT) is statistically significant, confirming the long-run relationship. The lagged GDP growth rate has a significant negative effect on current GDP growth, suggesting potential cyclical behavior. However, lagged tourism arrivals do not significantly impact current GDP growth in the short run.

In the tourism equation, the ECT is not statistically significant, indicating a lack of long-run causality from GDP to tourism arrivals. Additionally, neither lagged GDP growth nor lagged tourism arrivals significantly impact current tourism arrivals in the short run.

4.5 Granger Causality

Table 5 presents the Granger causality test results for the null hypothesis that tourism arrivals do not Granger-cause GDP in Kenya. The F-statistic value of 0.1626 and the corresponding p-value of 0.8543 indicate that the null hypothesis cannot be rejected at the 5% significance level.

Table 5. Granger causality test results

Null Hypothesis	F-statistic	p-value	Conclusion
Tourism arrivals do not Granger-cause GDP	0.1626	0.8543	Fail to reject the null hypothesis

The failure to reject the null hypothesis suggests that past values of tourism arrivals do not have predictive power for future values of GDP in Kenya. In other words, the results do not provide evidence of a causal relationship running from tourism arrivals to economic growth (GDP) in the Granger sense.

4.6 Diagnostic tests

The Breusch-Godfrey test for autocorrelation yielded a test statistic value of 3.8298 with 1 degree of freedom and a p-value of 0.05035. The ARCH LM test for heteroscedasticity resulted in a test statistic value of 8.0000 with 12 degrees of freedom and a p-value of 0.7851.

Table 6. Diagnostic Test Results for VECM Residuals

Test	Test Statistic	Degrees of Freedom	p-value
Breusch-Godfrey (Autocorrelation)	3.8298	1	0.05035
ARCH LM (Heteroscedasticity)	8.0000	12	0.7851

On the other hand, the Breusch-Godfrey test for autocorrelation and the ARCH LM test for heteroscedasticity both fail to reject their null hypothesis at the 5% level of significance. Such as the VECM residuals do not show up with substantial autocorrelation or heteroscedasticity, and the model does not violate any assumptions about no serial correlation and constant variance.

4.7 Forecast error variance decomposition

The forecast error variance decomposition in Fig. 2 reveals the relative contributions of the GDP (gdp_ts) and tourism arrivals shocks in explaining the variations of these variables across times. The outcomes of the GDP variable illustrate that the causative forces of its shocks or innovations are the principal drivers of its variability, with about 99.9% percent of the forecast error variance attributed to these forces across the 10-period outlook interval. The contribution of shocks to tourism figures to the forecast error variance of GDP is negligible, coming at a maximum of 0.1% after the first 10 periods. This implies that the GDP fluctuations are mostly the result of the inherent weaknesses in the GDP series itself or various shocks to the series, not caused by tourism-related shocks.

Contrary to that, the arrivals of tourists' variables are more complicated, because the decomposition shows a more complex dynamic. Initially, volatility in GDP contributes to almost three-quarters (70.6%) of the tourism arrival forecast error variance, while the remaining volatility (29.4%) is explained by tourism arrival shocks only. Yet, the further horizon we gaze, there is no surprise that shocks are not as relevant for GDP when compared to tourism arrivals' own shocks' significance. By the 10th period, approximately 99.9% of the forecast error variance in tourism arrivals (tourism_ts) is attributed to its shocks, while the contribution of GDP shocks becomes negligible (around 0.1%).

This pattern suggests that in the short run, fluctuations in tourism arrivals are influenced by both shocks to GDP and shocks specific to the tourism sector itself. However, in the long run, the variability in tourism arrivals is

primarily driven by its shocks or innovations, potentially related to factors such as changes in tourism policies, marketing strategies, or external events that directly impact the tourism industry. The diminishing impact of GDP shocks on tourism arrivals over time indicates that the influence of broader economic conditions on the tourism sector may be more temporary or transitory.

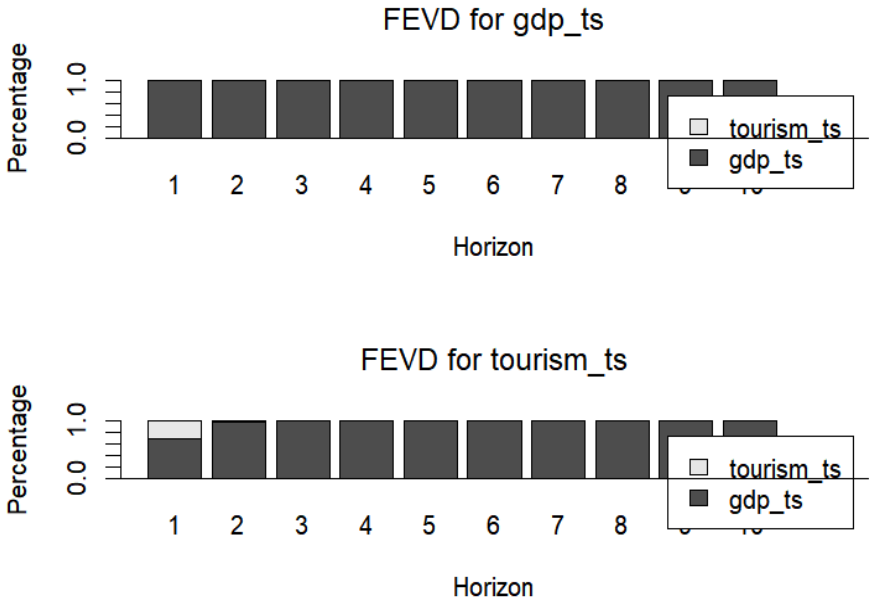

Fig. 2. Forecast error variance decomposition

5 Discussion

The time series analysis conducted in this study aimed to investigate the dynamic relationship between international tourism inflows and economic growth in Kenya over the period 2012-2023. These empirical results give a way of establishing the extent and the pattern of causality between these two variables.

The results of the unit root tests indicated that both the GDP and tourism arrivals were integrated and that therefore cointegration techniques were applicable to investigate long-run relations. The Johansen cointegration test further affirmed the same showing that there existed one cointegrating equation suggested by the fact that at 0.05 level, the GDP and tourism arrivals in Kenya were in a long-run equilibrium relationship. There is a concurrence with other similar findings stating that co-integration exists between tourism, and economic growth in different countries [13,16,15].

The above-estimated results of the VECM helped to understand the short-run properties and causality between the variables. The variables integrated and the results suggested that there is a long-run relationship between GDP and tourism arrivals in Jamaica by achieving ECT of 0.316 for GDP which shows a significant error correction term expressing that any deviations from long-run equilibrium are corrected over time. Nonetheless, the Granger causality test results provided no evidence to reject the null hypothesis that tourism arrivals do not Granger cause GDP to indicate that there is no short-run causality from tourism arrivals to economic growth.

These results are contrary to the previous research done by Sindiga [11] and Njoya and Seetaram [20] who established a positive impact of tourism on the economic growth of Kenya. Nevertheless, the latter results could be explained by variations in the study periods and the methods applied. The findings of the current study are somehow contrary to the findings of an earlier study by Muchapondwa and Pimhidzai [21] and in this regard closer to the limits of causality and the existence of a long-run relationship between tourism earnings, investment, and economic growth in Kenya, from 1985 to 2009.

Forecast error variance decomposition analysis indicated that the effect of shocks to GDP on tourism arrivals' volatility pales off in the long run. Alternatively, the impact of shocks to the tourism arrivals is shown to have a

low pass-through and contributes only to the movements in GDP in the short forecast period. This implies that other factors close to the travel and tourism industry like marketing techniques, tourism plans, and events within the travel and tourism industry have a relatively bigger impact on travel and tourism arrivals in the long run than the overall economic factors. On the other hand, the changes in GDP are mostly explained by changes within the GDP or some other factors which could be shocks of tourists' arrival.

Therefore, these results are in line with studies found in the tourism-led growth literature where the empirical evidence is inconclusive. In this regard, a few scholars have come up with evidence that revealed a one-way causality from tourism to economic development [16,27]other scholars determined that evidence of economic-led tourism development [17,2] and a few researchers did not find causality relationship between tourism and economic development [21,28]. The mixed findings raise the unsteadiness and contingency that surrounds the tourism-economic development relationship that considers other factors such as a nation's level of development, the tourism industry's development, and the used analytical methodological tools [13,29].

It may also be necessary to mention that the lack of causality between tourism arrival and economic growth in the case of Kenya does not mean that the subject of tourism in the given country is unessential. The fact that the industry contributes significantly to the nation's GDP and employment as highlighted at the beginning of this paper further emphasizes its importance in the Kenyan economy.. However, the findings suggest that the benefits of tourism expansion may not automatically translate into broader economic growth, at least in the short run. Effective strategies and policies may be required to enhance the tourism industry's linkages with other sectors of the economy and maximize its potential for driving sustainable economic development [30,31].

Future research could further explore the factors influencing the tourism-growth nexus in Kenya, such as the specific types of tourism activities (e.g., eco-tourism, cultural tourism), the origin of tourists, and the level of tourism-related infrastructure and investments. Additionally, investigating the potential reverse causality from economic growth to tourism arrivals could provide insights into policy interventions that can enhance the competitiveness and attractiveness of Kenya's tourism industry [32].

6 Conclusion

This study aimed to investigate the dynamic relationship between international tourism inflows and economic growth in Kenya over the period 2012-2023 using time series analysis techniques. The empirical result is a common tool that may enable us to see the direction and kind of causality between two variables. The Johansen cointegration test revealed that a long-run equilibrium existed between reform in the economy of Kenya and tourism arrivals in which there was a positive relation between reform and tourism and a negative relation between growth and tourism. In contrast to this stand, the Granger causality test results do not reject the null hypothesis that tourism arrivals do not, however, under a short-run horizon, Granger-cause GDP. Thus, there is no short-run causality from tourism arrivals to economic growth.

The prediction variance dyestuff decomposition analysis revealed that shocks to GDP tend not to fund the fluctuation of tourism arrivals during the long run, while shocks to tourism arrivals have less influence on the volatility of GDP at different horizon points of this forecast. This reveals that rather than overall economic conditions that direct the demand in the entire economy, a particular set of factors such as marketing strategies, tourism policies, and events to be supplemented by the tourism industry in the long run, has a stronger impact.

The data disproves certain findings of the earlier studies done in Kenya that indicated a relationship between tourism and economic growth but agrees with the findings of other studies that found no causal effects. This confusion just indicates the non-homogeneous, unique nature of this bond between tourism and economic growth, which may be influenced by many variables like the standard of the country's economic development, the aging of their tourism industry, and methods of analysis.

However, notwithstanding the lack of a direct relationship between tourism arrivals and economic growth, the study reveals that the merits of the tourism industry to the Kenyan economy cannot be denied since continuous increase of tourist arrivals could be the reflection of growth, for financial measures, in the tourism sector without necessarily, at least in the short run, reflecting wider economic output. From strategies to policies, some might need to be set for the tourism sector to be more interlinked to other aspects of the economy and thus increase its capacity to drive sustainable economic growth.

Future research could further explore the factors influencing the tourism-growth nexus in Kenya, such as the specific types of tourism activities, the origin of tourists, and the level of tourism-related infrastructure and investments. Additionally, investigating the potential reverse causality from economic growth to tourism arrivals could provide insights into policy interventions that can enhance the competitiveness and attractiveness of Kenya's tourism industry.

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Competing Interests

Authors have declared that no competing interests exist.

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