The Dynamic Role of Financial Development in Analyzing the N-Shaped Tourism-Led Growth Hypothesis in Mauritius

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Abstract
This study is a critical step to explore how financial development moderates the N-shaped tourism-led growth hypothesis in Mauritius, considering the rising influence of the tourism sector on this small island but a high-income country and the dearth of recent empirical studies in this direction. Relying on annual time series between 1980 and 2018, the study employed the ARDL model and the quantile ARDL model, a technique rarely applied in extant studies to analyze the possible nonlinear (N-shaped) dynamics of tourism and the moderating role of financial development on productivity in Mauritius. The various cointegration tests proved that the series have a common long-run trend, whereas the causality test validates the tourism-led growth hypothesis. The ARDL estimates reveal positive and significant impacts from tourism and financial development on economic growth, against the negative and insignificant effects of the other control variables in the long and short run. However, from the QARDL, the impacts of tourism and financial development on growth remained predominantly negative in the long term at all quantiles of economic growth except at q0.30, where a positive impact was recorded from tourism. However, in the short run, the contributions of tourism and financial development remained positive but insignificant across the distributions of economic growth, therefore buttressing the time-varying (N-shaped) nature of the relationship. By implication, policies that could shield the economy from shocks arising from business cycles and sustain the positive/significant contributions of tourism and financial system to economic growth are pertinent to boost the confidence of all stakeholders.

Keywords Tourism · Financial development · Mauritius · N-shape · ARDL · QARDL
Introduction

The tourism sector is considered a viable source of revenue for countries, it stimulates economic growth, creates job openings, reduces poverty, and increases tax revenue and overall developments (Krabokoukis & Polyzos, 2021; Pata, 2021; Su et al., 2021; Tugcu, 2014). Moreover, Isik et al. (2017) emphasized the key role of tourism industries in many countries in terms of the creation of new jobs, promotion of investments, and increases in the level of income and tax revenue. Balsalobre-Lorente et al. (2020) admitted that investments in the tourism sector are highly beneficial given their direct effects on job creation and revenue generation, while Chiu (2021) highlighted that many countries rely on the tourism industry as an alternative source of foreign exchange earnings. It is equally noted that revenue accruing from the tourism sector has multiplier effects and boosts household spending (Brida et al., 2008). Furthermore, Mbulawa and Chingoiro (2017) noted that the tourism sector contributes to the growth of other critical sectors of the economy, such as agriculture, manufacturing, transportation, and retail. Realizing the burgeoning influence of the tourism sector with respect to growth and related macroeconomic fundamentals, several studies have been dedicated to delineating the critical pathway and the causal links between the tourism sector and the overall well-being of the economy. However, the submissions from these existing studies are largely inconclusive, inconsistent, and conflicting, which prominently calls for further empirical review.

To further justify the essentiality of the present investigation, some studies have also shown that the tourism sector contributes positively and significantly to national income in some countries, thereby validating the tourism-led growth hypothesis (TLGH). See, for instance, Adnan Hye and Ali Khan (2013) for Pakistan; Aslan (2014) for Portugal; Tang and Tan (2015) for Malaysia; Ohlan (2017) for India; Habibi et al. (2018) for Iran; Balsalobre-Lorente et al. (2020) for Spain; Roudi et al. (2019) for small island developing countries (SIDSs); Balsalobre-Lorente et al. (2021) for selected OECD countries; Mitra (2019) for 158 countries classified into three groups on the basis of the contributions of the tourism sector to GDP; Usmani et al. (2021) for BRIC; Adedoyin et al. (2021) for high earners and tourism dependent countries; Lolos et al. (2021) for Greece; Su et al. (2021) for China; Kyara et al. (2021) for Tanzania; and Pata (2021) for G10 countries. However, while these findings subsist, several others questioned the validity of the TLGH in some countries. See Brida et al. (2016), who confirmed that there are exceptions to the TLGH in a review of over 100 empirical studies. Extending the puzzle, Cárdenas-García et al. (2015) suggested that TLGH occurs mainly in developed countries rather than developing countries. In addition, Chiu (2021) invalidated the TLGH for the USA and China by suggesting that it is growth-led tourism development (GLTD). Likewise, Eyuboglu and Eyuboglu (2019) confirmed the absence of causality between tourism and growth in 9 emerging economies, while Usmani et al. (2021) reported a bidirectional relationship in BRIC countries. Other studies, including Brida et al. (2015), Aslan (2014), and Aratuo et al. (2019), also exposed the existence of GLTD in some countries,
including the USA, Uruguay, Argentina, Spain, and Italy. Meanwhile, some studies have shown that the relationship is nonlinear with inverted U or N shape (see Zuo & Huang, 2017; Balsalobre-Lorente et al., 2021). Accordingly, the debate on the contributions of the tourism sector to the macroeconomy persists till this moment, thereby incentivizing further evaluations. Moreover, policy pathways to reap the probable benefits of the sector remain unclear chiefly due to the inconsistencies in empirical submissions.

Much as the debate lingers, and while there are voluminous studies investigating the tourism-growth nexus, it is notable and surprising that Mauritius, a small island and high-income country with notable tourist attractions and over 150 km of white sandy beaches, has attracted but a few studies. By its geographical location and naturally endowed tourism attractions, a study with a focus on Mauritius is relevant to inform both government and international tourists on the potentials and contributions of the tourism sector to productivity in the economy. However, it is surprising to note such dearth of empirical narratives on the dynamics of tourism growth nexus as it affects Mauritius. Likewise, the influence of finance in moderating the contributions of tourism to productivity level in Mauritius is also not adequately investigated in extant studies. Based on available information, the very few efforts made to analyze the dynamic link between tourism and growth in Mauritius are Archer (1985), Durbarry (2004), and Gounder (2021). The submissions of these studies are divergent and largely inconclusive. Accordingly, while the submission of Archer (1985) is not based on empirical evidence, Durbarry (2004) reports a unidirectional interaction flowing from tourism to growth, whereas Gounder (2021) suggests bidirectional interactions (feedback effects) between growth and tourism. Meanwhile, none of them considered the imperatives of financial development in shaping the impact of tourism in Mauritius, thereby incentivizing further enquiries.

According to Durbarry (2004), for the last three decades, the tourism sector in Mauritius has contributed significantly to its development prospects. Recently, the Mauritius government has seen the tourism sector as a major source of foreign exchange earnings and a critical stimulator for economic progress, social development, job creation, and inclusive development, therefore committing more funds to the sector (Statistics Mauritius, 2019). Based on this new reality, the government launched an all-inclusive strategic plan for the tourism sector for the years 2018 to 2021 and the vision 2030 program aiming to make Mauritius a dream destination for all tourists. Accordingly, tourist arrivals in Mauritius grew by 6.5% in 2010 to 10.5% in 2016 and failed to 4.2% in 2018 and −0.6% in 2019. Likewise, the sector’s contributions to GDP were substantial, hovering between 8.2% and 8.6% between 2009 and 2018 (Statistics Mauritius, 2019).

The figures above (Figs. 1 and 2) demonstrate the dynamics of tourism sector and economic growth (GDP) as well as the dynamics of tourism and financial development in Mauritius. Furthermore, Fig. 3 reveals the dynamics of tourism, finance, and growth in Mauritius.

Accordingly, the figures point to positive relationship among the relevant macroeconomic indicators mostly in recent times. Generally, the figures highlight the need to critique the overall contributions of tourism to productivity in Mauritius when financial development is incorporated. Moreover, we confirm whether its
contributions are constant over time and objectively evaluate whether tourism is a growth-generating factor in the context of Mauritius.

Based on the foregoing, the study aims to investigate at this time the dynamic interlinks between tourism and growth in this small island country by incorporating the influence of financial development. This will avail the government of relevant information to reappraise and update their tourism strategic master plan and to reposition the economy to harness the full potential of the tourism sector. Moreover, both local and international investors will be equipped with evidence-based directives while considering their investment prospects. The study also evaluates whether the relationship is nonlinear (N-shaped) to provide suitable economic policies for each stage of development. With this in mind, this study is poised to answer these questions. Does the tourism-led growth hypothesis hold or hold otherwise for Mauritius? (ii). Is the relationship linear or nonlinear (N-shaped)? (iii). Does financial development play a significant role in shaping the contributions of tourism to economic growth in Mauritius?

Given that the current study has an outlook clearly distinct from previous empirical information, it contributes to knowledge in the following ways. First, it is among the very few studies, although more recent, to evaluate the TLGH for

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**Fig. 1** Trend of tourism and GDP in Mauritius

**Fig. 2** Trend of finance and GDP in Mauritius
Mauritius while enlisting the imperative of financial development. Second, this is the first study to investigate whether the tourism growth dynamics in Mauritius are N-shaped. Third, the study is likely the first to apply the quantile autoregressive distributed lag (QARDL) model, a time-varying model, to confirm the contributions of tourism to productivity in any country and Mauritius in particular to establish how the contributions change over time. This became expedient considering the assertions of nonlinearity and N-shaped and time-varying dynamics canvassed by previous studies, including Balsalobre-Lorente et al. (2020) and Lolos et al. (2021). Furthermore, the presumption of nonlinear (N-shaped) relationships is justified on the background that macroeconomic fundamentals are often affected by shocks arising from uncertainties and business cycles (Balsalobre-Lorente et al., 2021).

The next section following this elaborate introduction is a review of the relevant literature. This is followed by "Data Description and Methodology" with details on the adopted methodology and data descriptions. The data analysis and discussion of empirical results are made available in "Empirical Outcomes", followed by concluding remarks and policy inferences in "Conclusions and Policy Prescriptions".

**Literature**

At this point, we made efforts to establish the relevant theoretical literature underpinning finance-led tourism growth dynamics. Likewise, a sequential exposition of relevant and recent empirical studies is exposed, all geared towards justifying the need for the current study in terms of its novelty and policy inferences. Accordingly, the present study revolves around the tourism area life cycle (TALC) proposed by Butler (1980) and the tourism-led growth hypothesis (TLGH) extended by Balaguer and Cantavella-Jordá (2002). Instructively, the TALC assumes that tourism destinations evolve through five stages, including exploration, involvement, development, consolidation, and post-stagnation stages (Balsalobre-Lorente et al., 2020). This suggests that the yields of tourism vary over time, starting from the formative stage to maturity and finally to a point of diminishing returns (Zuo & Huang, 2017). On the
other hand, the TLGH of Balaguer and Cantavella-Jordá (2002), a position consistent with the export-led growth hypothesis, considers tourism a viable avenue for economic growth and foreign exchange earners (Kyara et al., 2021). Combining the two positions, we arrived at the N-shaped (TALC) tourism-led growth hypothesis (TLGH), which considers the evolution of the contributions of the tourism sector in Mauritius that has not been investigated extensively in existing studies.

Notably, scholars have made substantial inputs to update our knowledge about the dynamics of tourism and productivity in different economies by adopting varying methodologies, including time series (country specific), panel data (cross-sectional), linear, and nonlinear models. As we remarked earlier, the positions and inferences are mixed and at the extreme, ambiguous. Accordingly, Durbarry (2004) relied on cointegration and causality tests in an attempt to unravel the contributions of the tourism sector in Mauritius. On the basis of the cointegration and causality test, the study validates the TLGH. However, the inferences from the study may not reflect the current economic turbulence considering its scope (1955–1999) and weak estimation technique, therefore incentivizing the current research. Similarly, the assertions made by Balaguer and Cantavella-Jordá (2002) about the proponent of the TLGH hypothesis suggesting that tourism caused economic growth in Spain during the period 1975Q1 to 1997Q1 based on the outcomes of causality tests remain questionable in the context of current economic realities and the application of weak econometric techniques. Similarly, several other studies, including Sequeira and Nunes (2008), Nissan et al. (2011), Adnan Hye and Ali Khan (2013), Al-mulali et al. (2014), Cárdenas-García et al. (2015), Tang and Tan (2015), and Seghir et al. (2015), suggested that the TLGH holds in some countries based on outcomes from causality tests and cointegration tests. Generally, these studies also failed to consider the evolution (time-varying effects) of the contributions of the tourism sector to economic growth, which may undermine the reliability of the inferences thereof.

Recently, Mbulawa and Chingoiro (2017) relied on the outcomes from the vector autoregression model to support the TLGH in Botswana between 1980 and 2015, while Ohlan (2017) affirmed similar effects for India between 1960 and 2014 based on Bayer and Hanck newly introduced cointegration tests, causality tests, and ARDL results. Likewise, Roudi et al. (2019) considered the nexus between tourism and growth trajectories in a panel study of some small island developing states (SIDs) using the panel causality test. Accordingly, the study validates the TLGH for the selected countries in both the long and short run. In a similar manner, Udom Etokakpan et al. (2019) confirmed the validity of the TLGH in a panel study of the world’s top four agricultural economies between 1995 and 2015, much as He and Li (2021) supported the TLGH in a panel study of selected countries between 2006 and 2015. Furthermore, while Su et al. (2021) suggested that tourism drives growth in China based on time series data regressed with a VECM model, Usmani et al. (2021) upheld the unidirectional causal effects from tourism to growth in BRIC countries based on a panel causality test. Similarly, Balsalobre-Lorente et al. (2021), Chiu (2021), and Adedoyin et al. (2021) affirmed the validity of the TLGH in Spain, the USA, and China and a panel study of tourism-dependent countries, respectively. Going by the observed divergent submissions of these studies that may have arisen as a result of the adoption of time-invariant models, it is therefore expedient to
extend this investigation with a time-varying model such as the QARDL to provide updated policy guidelines. Furthermore, it is also imperative to extend this study to Mauritius considering its vintage position in terms of tourism potentials.

Against the views and submissions of the unidirectional causal link running from tourism to productivity, which justifies the TLGH, several studies questioned the validity of the hypothesis by suggesting that a causal link runs from growth to tourism development (economic-driven tourism growth, EDTG) and feedback effects, while some canvassed nonlinear and time-varying relationships between tourism and growth. Accordingly, Aslan (2014) relied on a causality test in a panel study of some Mediterranean countries between 1995 and 2010 to confirm that growth drives tourism development in most countries, including Spain, Italy, Tunisia, Cyprus, Croatia, Bulgaria, and Greece. While Brida et al. (2015) reported a linear relationship between tourism and growth in four countries within the MERCOSUR regional trade block, Chou (2013) validated the EDTG in most transition countries, including Cyprus, Latvia, and Slovakia, between 1988 and 2011. Tugcu (2014) provided divergent evidence suggesting that the causal link between tourism and growth is country dependent based on the outcome of a panel study of some European, Asian, and African countries bordering the Mediterranean Sea. Furthermore, while Aratuo et al. (2019) countered the idea of the TLGH in the USA relying on time series modeling, including bounds tests and Granger causality tests, Perez-Rodriguez et al. (2021) reported that the relationship between tourism and growth is less clear-cut in a study of seven European countries. Similar to the studies that support the TLGH hypothesis, studies that invalidate the hypothesis are also lacking in enhanced estimation techniques given that most of them relied on linear models that failed to incorporate the influence of economic shocks on the performance of macroeconomic fundamentals. However, this study is poised to provide new insights for profound policy framework that could reposition the tourism sector in Mauritius and may be elsewhere for overall productivity.

The notions of nonlinear, asymmetric, time-varying (N-shaped, inverted U-shape), and threshold effects are beginning to dominate the discussions of several recent studies. On this analogy, Antonakakis et al. (2015) exposed that both TLGH and EDTG are time-dependent in a panel study of 10 European countries between 1995 and 2012. The nonlinear and asymmetric positions that invalidate the unidirectional link and TLGH are upheld by Isik et al. (2017); Eyuboglu and Eyuboglu (2019); Chirila et al. (2020); and Pata (2021) for the G7, OECD, Central and Eastern European, Sri Lanka, and G10 countries, respectively. Considering the dynamic links between tourism and growth in the top 10 tourist destinations, Shahbaz et al. (2017) relied on the quantile-on-quantile econometric technique on a firm’s time-dependent nonlinear relationship in the selected nation within the 1990Q to 2015Q4 period. Similar strands were established by Zuo and Huang (2017), Balsalobre-Lorente et al. (2021), and Lolos et al. (2021), who suggested an inverted-U or N-shaped relationship between tourism and growth trajectories in 37 provinces of China, selected OECD countries, and Greece, respectively. Ideally, the application of a more robust estimation technique that accounts for time evolutions of the variable promises more accurate and reliable inferences. Likewise, these studies failed to consider the tourism potentials of Mauritius, thereby providing further incentives for the current effort.
The Imperative of Financial Development in Tourism-Economic Growth Dynamics

The role of financial development in enhancing the effects of tourism on growth has attracted much attention in previous studies. We, therefore, provide a brief review of some of these studies that have recently considered these contemporary growth stimulators. Accordingly, Kumar (2014) considered the influence of financial development, tourism, and ICT in Vietnam between 1980 and 2010 and affirms a significant positive relationship based on the outcome of the ARDL analysis. Similarly, Kumar et al. (2015) applied the ARDL estimation technique and reported a momentous positive impact of finance, tourism, and gross fixed capital formation on productivity in Malaysia between 1975 and 2012. Furthermore, Shahbaz et al. (2017) and Ngoasong and Kimbu (2016) provided valid support suggesting the imperative of financial development in the tourism-productivity nexus in Malaysia and Cameroon, respectively.

Likewise, Ohlan (2017) considered the relative influence of financial development while accessing the TLGH in India between 1960 and 2014 with the ARDL model. The study informed a cointegration relationship among the variables. Additionally, Al-Mulali et al. (2020) and Munir et al. (2021) support the relative influence of financial development in enhancing TLGH in the top twenty tourist destinations and G7 countries. The former, based on the panel augmented mean group technique, reported positive feedback between financial development and tourism development, and the latter, relying on the outcome of the fixed effects estimation, asserted that financial development plays a significant role in enhancing TLGH. Recently, Rasool et al. (2021) explored the dynamic role of financial development in the tourism-enhanced growth path in BRICS countries based on a panel series from 1995 to 2015 regressed within the panel ARDL estimator. The study confirmed a long-run relationship among the series and feedback effects between them based on the Granger causality test. The foregoing elaborate reviews prominently incentivized the current research considering the mixed evidence and lack of empirical studies on the Mauritius economy and in terms of distributional asymmetries and consideration of financial development imperative in the analysis of the N-shaped tourism-growth nexus.

Data Description and Methodology

Data Description

Consistent with the objectives and outlook of the current investigation, as highlighted in the proceeding sections, we relied on annual time series spanning 1980 to 2019 for empirical estimations. Meanwhile, we selected the data range as specified considering the consistencies and availability of key variables. Table 1 and Fig. 1 provide detailed information on the data sets, sources, measurements, and trends.
Table 1 Data descriptions

| Notation | Series                  | Unit of measurement                      | Source                                                                 |
|----------|-------------------------|------------------------------------------|------------------------------------------------------------------------|
| RGDP     | Real gross domestic product | Annual real GDP at current prices in US dollars | World Development Indicators (World Bank Group)                        |
| FIDV     | Financial development   | Aggregation of financial depth, access, and efficiency | Global Financial Development Database (GFDD), compiled by Svirydzenka (2016) |
| TOUR     | Tourist earnings        | Value added (current basic prices)        | Statistics Mauritius and Bank of Mauritius                             |
| TROP     | Trade openness          | Trade (% of GDP)                          | World Development Indicators (World Bank national accounts data and OECD National Accounts data files) |
| NATR     | Natural resource rent   | Total natural resources rents (% of GDP)   | World Development Indicators (World Bank Group)                        |

All the data sets are available and freely obtainable in public data repositories.
Model Building

Following the objectives of the current study, that is, to evaluate the validity of the TLGH, the possible N-shaped (nonlinear), and the critical role of financial development in the contributions of the tourism sector to productivity in Mauritius, we provide forthwith the model upon which the analysis is based. Accordingly, the study extended Balsalobre-Lorente et al. (2020) and Kumar (2014) by enlisting financial development while considering the N-shaped TLGH in Mauritius, which previous studies avoided. Accordingly, we present a baseline growth Eq. (1) that augments the Solow framework (Solow, 1956). Solow’s expression, which represents the extended version of the Cobb–Douglas production function, is often applied in expressing growth stimulators, including capital and labor (Kumar, 2014; Kumar et al., 2015). The augmented Solow model is expressed forthwith.

\[ Y = f(K, L, A) \]  

(1)

where \( Y \) implies GDP growth; \( f \) is the functional notation; \( K \) represents capital; and \( A \) represents other variables. However, in our study, we present an augmented version of Eq. (1) to enlist the impact of tourism and the contributions of financial development, trade openness, and natural resource rent on growth based on insight from studies such as Balsalobre-Lorente et al. (2020) and Isik et al. (2017). The augmented version is thus represented:

\[ GDPR = f(TOUR, FIDV, TROP, NATR) \]  

(2)

The GDP\( R \) implies the annual growth of GDP, which accounts for productivity in the country. TOUR represents tourism revenue. FIDV signifies financial development. NATR implies natural resource rent.

Subsequently, specification (2) is transformed into econometric form in Eq. (3) as presented below:

\[ \ln GDPR_t = b_0 + b_1\ln TOUR_t + b_2\ln FIDV_t + b_3\ln TROP_t + b_4\ln NATR + \varepsilon_t \]  

(3)

where \( \ln \) indicates that all the variables are transformed into their natural logarithmic value to represent elasticity values (Uche & Effiom, 2021b) and all variables remain as previously defined; \( b_0, b_1, b_2, b_3, \) and \( b_4 \) represent the slope of the various coefficients; and \( \varepsilon_t \) represents the error term.

Estimation Techniques

Following the resolution of the current studies in terms of providing updates to existing knowledge, we applied several modern econometric procedures, including pre-estimation diagnostic tests such as descriptive statistics, the correlation matrix, unit-root (stationarity) tests beginning with the traditional augmented Dickey-Fuller, and the Perron and Lee-Strazicich tests that account for breaks in the series. The study also adopted various cointegration tests, including the Bayer-Hanck joint
cointegration technique (Bayer & Hanck, 2013), the ARDL bounds tests Pesaran et al. (2001) based on insight from Ohlan (2017), and the quantile cointegration process following Hashmi et al. (2022) and Uche and Effiom (2021b). Meanwhile, the quantile cointegration process follows the Pesaran et al. (2001) bounds test to predict the long-run relationship among the enlisted series across the quantile distributions on the basis of the following null hypothesis: 

\[
\tau_{05} \ln \text{GDPR} = \tau_{10} \ln \text{GDPR} = \cdots = \tau_{95} \ln \text{GDPR} = \tau_{05} \ln \text{TOUR} = \tau_{10} \ln \text{TOUR} = \cdots = \tau_{95} \ln \text{TOUR} = \tau_{05} \ln \text{FIDV} = \tau_{10} \ln \text{FIDV} = \cdots = \tau_{95} \ln \text{FIDV} = \tau_{05} \ln \text{TROP} = \tau_{10} \ln \text{TROP} = \cdots = \tau_{95} \ln \text{TROP} = \tau_{05} \ln \text{NATR} = \tau_{10} \ln \text{NATR} = \cdots = \tau_{95} \ln \text{NATR} = 0.
\]

Accordingly, all the processes were adopted based on the resolve to produce robust and reliable estimates that would lead to quality assessment and profound policy inferences. On the notion of nonlinear interactions between tourism and growth and the possible inverted U- or N-shaped dynamics documented in several studies (Asongu & Odhiambo, 2019; Balsalobre-Lorente et al., 2020; Lolos et al., 2021), we implement the quantile ARDL technique credited to Cho et al. (2015) following Uche and Effiom (2021b). In contrast to the other models that account for conditional mean effects among series, the QARDL provides estimates across the various distributions of the explanatory variable(s) on the explained variable. The QARDL procedure allows us to discover the dynamic effects of tourism on productivities over various states of the economy in the long and short run. Another unique feature of the QARDL model is that it accounts for distributional asymmetries, unlike other time-varying frameworks that account for asymmetry only within the conditional mean (Hashmi et al., 2022; Omode & Uche, 2021; Sharif et al., 2020; Uche & Effiom, 2021b).

The QARDL model follows the baseline/conventional ARDL process and adopts its relevant requirements and approaches. On this understanding, we present the ARDL notation for the current research.

**The ARDL Specification**

\[
\Delta \ln \text{GDPR}_t = \beta_0 + \beta_1 \ln \text{TOUR}_{t-1} + \beta_2 \ln \text{FIDV}_{t-1} + \beta_3 \ln \text{TROP}_{t-1} + \beta_4 \ln \text{NATR}_{t-1} + \sum_{i=1}^{n} \theta_1 \Delta \ln \text{GDPR}_{t-i} + \sum_{i=0}^{n} \theta_2 \Delta \ln \text{TOUR}_{t-i} + \sum_{i=0}^{n} \theta_3 \Delta \ln \text{FIDV}_{t-i} + \sum_{i=0}^{n} \theta_4 \Delta \ln \text{TROP}_{t-i} + \sum_{i=0}^{n} \theta_5 \Delta \ln \text{NATR}_{t-i} + \epsilon_t
\]

where \( \beta_0 - \beta_4 \) are the representatives of the long-run coefficients and \( \theta_1 - \theta_5 \) demonstrate short-run impacts. As highlighted earlier, the series in Eq. (4) retain their earlier definition, and they are expressed in their natural logarithmic values.

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1 For more details about the Bayer-Hanck cointegration process, see Ohlan (2017).
2 See Uche and Effiom (2021c) for more clarifications on the quantile cointegration process.
3 See Omode and Uche (2020); Uche and Effiom (2021a, b) for more details.
Accordingly, specification (4) is the conventional ARDL form that provides estimates within the conditional mean. To overcome this limitation, we provide the functional form of the QARDL to account for the time-varying effects within the tourism-growth nexus for the Mauritius economy. Moreover, the QARDL model controls for the possible case of serial correlation in the error term to ensure the reliability of the outcomes.

The Quantile ARDL Specification

\[ Q_{\ln GDP} = b_0(\tau) + \sum_{i=1}^{n_1} b_1(\tau) \Delta \ln GDP_{t-i} + \sum_{i=0}^{n_2} b_2(\tau) \Delta \ln TOUR_{t-i} + \sum_{i=0}^{n_3} b_3(\tau) \Delta \ln FIDV_{t-i} \]
\[ + \sum_{i=0}^{n_4} b_4(\tau) \Delta \ln TROP_{t-i} + \sum_{i=0}^{n_5} b_5(\tau) \Delta \ln NATR_{t-i} + \alpha_1(\tau) \ln GDP_{t-i} \]
\[ + \alpha_2(\tau) \ln TOUR_{t-i} + \alpha_3(\tau) \ln FIDV_{t-i} + \alpha_4(\tau) \ln TROP_{t-i} + \alpha_5(\tau) \ln NATR_{t-i} + \epsilon_t(\tau) \]

(5)

Meanwhile, \( \Delta \) is the difference operator, \( (\tau) \) is the quantile index, \( b_0 \) indicates the drift coefficient, and \( n_1 - n_5 \) are the respective lag orders determined by the specified lag length criterion. \( b_1 - b_5 \) are the relevant short-run coefficients, while \( \alpha_1 - \alpha_5 \) represent the relevant long-run coefficients. Equation (5) represents the typical QARDL framework on which the current study relied to account for the distributional asymmetric influence of tourism revenue and the moderating effects of financial development, trade openness, and natural resource rent on economic growth in Mauritius. This approach was adopted to probe for possible nonlinear (N-shaped) relationships among the enlisted series. Furthermore, the outcome relied on the following 11 quantiles: \( \tau \in \{0.05, 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, 0.90, 0.95\} \).

Accordingly, the quantile asymmetric impacts of tourism and the relevant control variables on economic growth with possible N-shaped movements are verified using the Wald test, which asymptotically follows a chi-square distribution (Hashmi et al., 2022; Uche & Effiom, 2021b). The Wald test is used to account for the null hypothesis of parameter constancy for both short- and long-term effects. The null hypothesis is outlined below:

Short-run parameter constancy test:
\[ H^s_0 : b_1(0.05) = b_1(0.10) = \cdots = b_1(0.95); H^s_0 : b_2(0.05) = b_2(0.10) = \cdots = b_2(0.95) \]
\[ H^s_0 : b_3(0.05) = b_3(0.10) = \cdots = b_3(0.95) \]

Long-run parameter constancy test:
\[ H^l_0 : \alpha_1(0.05) = \alpha_1(0.10) = \cdots = \alpha_1(0.95); H^l_0 : \alpha_2(0.05) = \alpha_2(0.10) = \cdots = \alpha_2(0.95) \]
\[ H^l_0 : \alpha_3(0.05) = \alpha_3(0.10) = \cdots = \alpha_3(0.95) \]
Another step is to confirm the direction of causal effects between tourism and growth, including financial development and other relevant control variables. The need for this further step is prominently based on the mixed evidence of causality in previous studies; see Durberry (2004) and Udom Etokakpan et al. (2019) for more insights. Given this background, following Kyara et al. (2021), we applied the Granger causality test to confirm the causal effects between tourism and productivity in Mauritius.

**Empirical Outcomes**

The empirical evaluation proceeds with the various diagnostic tests implemented with relevant approaches, including the descriptive statistics and correlation matrix reported in Table 2 and the test for stationarity reported in Table 3. Furthermore, the series were also subjected to cointegration tests to verify whether they have a common trend in the long run. The outcomes of the various cointegration tests, as highlighted in the last section, are reported in Table 4. Accordingly, the descriptive statistics signify that all the series are normally distributed based on the probability values of the Jarque–Bera statistics and the kurtosis values that remain within the acceptable threshold. Furthermore, all the series, except lnFIDV, have a left tail.
# Unit root tests

The table summarizes the unit root test results of the ADF, Lee-Z, and Peron statistics. **, **, and *** indicate the rejection of nonstationarity at the 1%, 5%, and 10% significance levels, respectively.

| Variables | ADF (I(0)) | ADF (I(1)) | L-Z (level) | L-Z Break year | Peron (level) | Peron (I(1)) | Break year |
|-----------|------------|------------|-------------|----------------|---------------|--------------|------------|
| lnRGDP    | −0.77      | −4.96***   | −2.74       | 1988           | −5.01***      | 1994         | −3.36      |
| lnTOUR    | −4.24***   | −2.27      | 2007        | 1996           | −4.98***      | 1996         | −2.04      |
| lnFIDV    | 2.58       | −3.37**    | −2.03       | 2009           | −3.60**       | 1989         | −2.43      |
| lnTROP    | −2.14      | −4.99***   | −3.60**     | 2000           | −5.56**       | 1986         | −3.77      |
| lnNATR    | −1.17      | −5.24***   | −5.03**     | 2010           | −5.72**       | 2012         | −         |

The table summarizes the unit root test results of the ADF, Lee-Z, and Peron statistics. *, **, and *** indicate the rejection of nonstationarity at the 1%, 5%, and 10% significance levels, respectively.
While $lnTOUR$ is the most dispersed, $lnTROP$ is the least dispersed. Furthermore, the correlation matrix indicates a strong positive and significant correlation between growth ($lnRGDP$) and tourism revenue ($lnTOUR$). This is a precursor to a strong positive relationship between the two variables. Likewise, the matrix equally provides evidence of a positive and significant relationship between financial development and growth. However, trade openness and natural resource rent do not produce negative effects on growth. Additionally, the positive and significant correlation between financial development and tourism revenue is notable. Therefore, Mauritius can take advantage of the financial sector to enhance her tourism potential.

The outcomes of the various unit root tests reported in Table 3 following the ADF test, Perron, and Lee-Strazicich steps suggest that the series have mixed-order integration. That is, some series are integrated at levels $I(0)$, while some are integrated after the first difference $I(1)$. However, none of the series is integrated beyond order one. Meanwhile, the dependent variable is integrated at the first difference in line with the stipulations of the ARDL technique and its enhanced versions, such as the QARDL (Jordan & Philips, 2018; Sharif et al., 2020; Uche & Effiom, 2021b). Notable evidence in the stationarity tests reported in Table 3 is the prevalence of structural breaks in different years arising from the Perron and Lee-Strazicich tests. The presence of structural breaks in the relationship implies that the series were strongly affected by policy shocks and seasonal variations, thereby justifying the very essence of the application of a time-varying (QARDL) model that could account for asymmetric effects of such shocks across the distributions of the explained variable. Likewise, the notions of nonlinearity, asymmetry, and N-shaped dynamics can be clearly tested through the QARDL, which could help in quelling the controversies and lead to accurate policy realization for the government of Mauritius, international investors, and other countries with no clearly defined policies on tourism.

The results of the various long-run relationships, including the Bayer-Hanck cointegration test, the bounds test, and the quantile cointegration test, as presented in Tables 4 and 5, demonstrate that all the enlisted series have a long-run relationship. Accordingly, the outcome of the Bayer-Hanck test suggests that we reject the null hypothesis of no long-run trend among the series since the calculated statistics are higher than the critical values at the 1%, 5%, and 10% levels of significance. Likewise, the bounds test (panel A) and the quantile cointegration test (panel B) that follow the Pesaran et al. (2001) procedure justify the rejection of the null hypothesis of no cointegration; hence, the $F$ statistic is higher than the upper bounds limit at various levels of significance. On this background, we conclude that the series are

| Critical values | EG-JOH | Bayer-Hanck | EG-JOH-BO-BDM | Bayer-Hanck |
|-----------------|--------|-------------|---------------|-------------|
| 1%              | 19.90*** | 15.845      | 25.46         | 30.774      |
| 5%              | 19.90**  | 10.57       | 25.46**       | 20.14       |
| 10%             | 19.90*   | 8.30        | 25.46*        | 15.93       |

*, **, and *** imply the acceptance of cointegration.
cointegrated, hence the need to probe for their dynamic interactions in the long and short run.

Linear ARDL Estimates

The outcomes of both the long- and short-run effects of tourism revenue and the enlisted control variables within the ARDL model are summarized in panels A and B of Table 6, respectively. The ARDL model was used as a robustness check, and several extant studies relied on it for empirical details (see Ohlan, 2017; Nwani et al., 2021).

Evidence from the ARDL model summarized in Table 7 indicates that tourism \((\ln \text{TOUR})\) is a positive function of economic growth in Mauritius. That is, the tourism sector asserts a significant positive influence on economic growth in the context of Mauritius. Specifically, in the long run, the economy grows by 0.78 percent whenever tourism revenue increases by 1 percent. Positive and significant outcomes also prevail at various lags \((-1 \text{ to } -3)\) in the short run with noticeable variations. This demonstrates that the tourism sector is a good predictor of economic growth in Mauritius in both long and short runs, which aligns with the submissions in several extant studies, including Ohlan (2017) for India and Balsalobre-Lorente et al. (2020), among others. Financial development \((\ln \text{FIDV})\) also provides a notable push on the economy by exerting a significant positive impact on productivity. Accordingly, in the long run, the Mauritius economy grows by 21 percent whenever the financial sector improves by 1 percent. However, such an effect cannot be ascribed to the short-run effects of financial development across various lags. This implies that the benefits of financial development on economic growth in Mauritius are derivable only in the long term, which aligns firmly with the findings of Ohlan (2017). The other moderating variables included in the model \((\ln \text{TROP} \text{ and } \ln \text{NATR})\) failed to exert any positive influence on economic growth in Mauritius at all times. Worse still is that natural

| Table 5 | Results of bounds test for cointegration |
|---------|-----------------------------------------|
| Model   | \(F\) statistics | Lower bounds \(I(0)\) | Upper bound \(I(0)\) | Remarks |
| Panel A  |                         |                        |                        |         |
| ARDL    | 3.22\*                  |                        |                        | Cointegrated |
|         | Critical values          |                        |                        |         |
|         | 1%                       | 3.29                   | 4.37                   |         |
|         | 5%                       | 2.56                   | 3.49                   |         |
|         | 10%                      | 2.2                    | 3.09                   |         |
| Panel B | 4.17\**                 |                        |                        | Cointegrated |
| QARDL   |                         |                        |                        |         |
|         | Critical values          |                        |                        |         |
|         | 1%                       | 3.74                   | 5.06                   |         |
|         | 5%                       | 2.86                   | 4.01                   |         |
|         | 10%                      | 2.45                   | 3.52                   |         |

* and ** imply the rejection of no long-run relationship at 5 and 10 percent, respectively
resource rent deteriorates economic growth significantly in Mauritius across various lags (−1 and −3) in the short run. The cointegrating equation (error correction term), which is rightly signed and significant, reveals that the prevailing perturbations in the system are corrected at a speed of 30 percent annually. Meanwhile, going by our

Table 6 Results ARDL estimates

| Variable | Coefficient | t statistic | Probability |
|----------|-------------|-------------|-------------|
| Panel A: long-run outcomes |
| Constant | 12.85 | 3.64 | 0.00*** |
| \( \ln\text{TOUR} \) | 0.78 | 2.53 | 0.02** |
| \( \ln\text{FIDV} \) | 0.21 | 1.87 | 0.07** |
| \( \ln\text{TROP} \) | −1.72 | −1.08 | 0.29 |
| \( \ln\text{NATR} \) | 0.58 | 1.18 | 0.25 |
| Panel B: short-run outcomes |
| \( \Delta(\ln\text{TOUR}) \) | −0.05 | −0.43 | 0.67 |
| \( \Delta(\ln\text{TOUR}(-1)) \) | 0.52 | 4.75 | 0.00*** |
| \( \Delta(\ln\text{TOUR}(-2)) \) | 0.34 | 3.14 | 0.00*** |
| \( \Delta(\ln\text{FIDV}(-1)) \) | 0.30 | 3.02 | 0.00*** |
| \( \Delta(\ln\text{FIDV}(-2)) \) | −1.06 | −2.02 | 0.05* |
| \( \Delta(\ln\text{FIDV}(-3)) \) | −1.99 | −2.49 | 0.02** |
| \( \Delta(\ln\text{NATR}) \) | −1.43 | −1.48 | 0.15 |
| \( \Delta(\ln\text{NATR}(-1)) \) | −0.04 | −1.31 | 0.21 |
| \( \Delta(\ln\text{NATR}(-2)) \) | −0.16 | −3.45 | 0.00** |
| \( \Delta(\ln\text{NATR}(-3)) \) | −0.07 | −1.73 | 0.10 |
| CointEq(-1)* | −0.30 | −4.81 | 0.00*** |

* *, **, and *** represent the rejection of the null hypothesis of no significant relationship at the 1%, 5%, and 10% significance levels.

Table 7 Results of QARDL estimates

| \( b_1(\tau) \) | \( b_2(\tau) \) | \( b_3(\tau) \) | \( b_4(\tau) \) | \( b_5(\tau) \) | \( \Delta a_1(\tau) \) | \( \Delta a_2(\tau) \) | \( \Delta a_3(\tau) \) | \( \Delta a_4(\tau) \) | \( ECT \) |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 0.05 | 0.07 | −0.02 | 0.50 | 0.06 | 0.03 | 0.21 | −5.05 | 0.44 | −0.08 | −0.38 |
| 0.10 | 0.21 | −0.07 | −0.11 | 0.02 | 0.03 | 0.31 | −3.99 | 0.55 | −0.06 | −0.18 |
| 0.20 | 0.14 | −0.02 | 0.14 | 0.17 | 0.07 | 0.21 | −1.18 | 0.05 | −0.11 | −0.14 |
| 0.30 | 0.13 | 0.02 | −0.08 | −0.03 | 0.07 | 0.14 | −0.25 | −0.01 | −0.09 | −0.19 |
| 0.40 | 0.24 | −0.03 | −0.48 | −0.08 | 0.07 | 0.20 | 0.91 | 0.08 | −0.05 | −0.23 |
| 0.50 | 0.34** | −0.09 | −0.06 | 0.09 | 0.08 | 0.36 | 0.34 | 0.11 | −0.02 | −0.29 |
| 0.60 | 0.25 | −0.04 | 0.10 | 0.25 | 0.11 | 0.58 | 0.40 | −0.18 | −0.04 | −0.25* |
| 0.70 | 0.27 | −0.03 | −0.20 | 0.19 | 0.11 | 0.63 | 0.92 | 0.23 | −0.01 | −0.28 |
| 0.80 | 0.35 | −0.06 | −0.48 | 0.01 | 0.12 | 0.47 | 0.93 | 0.16 | 0.04 | −0.36* |
| 0.90 | 0.62* | −0.22 | −0.86 | −0.09 | 0.11 | 0.22 | 1.27 | −0.01 | 0.12 | −0.51* |
| 0.95 | 0.81** | −0.28** | −0.89 | −0.24 | 0.16** | 0.54 | 1.34 | −0.23 | 0.17 | −0.62** |

While \( b_1 - b_5 \) represent parameters of the long-run coefficient, \( \Delta a_1 - \Delta a_5 \) report parameters of the short-run coefficients of the relevant variables. * and ** imply that the relationship is significant at the 5% and 10% significance levels, respectively. \( ECT \) indicates the error term.
earlier proposition that the relationship between tourism and economic growth and the moderating effects of financial development could be time dependent and non-linear (N-shaped), we proceed further with the application of the QARDL procedure given that the traditional ARDL does not consider nonlinearity and its estimates are based on linear and time-invariant assumptions. Consequently, the nonlinear effects arising from the QARDL estimates are summarized in Table 7.

**The QARDL Outcomes**

The outcome of the QARDL, a time-varying and nonlinear model summarized in Table 9, is entirely different from that of the ARDL, a linear and time-invariant model. Such differences in their respective outcomes are expected given their underlying assumptions. Admittedly, the outcomes of the QARDL clearly demonstrate that the relationship between tourism revenue ($\ln\text{TOUR}$) and economic growth ($\ln\text{RGDP}$) and the contributions of the enlisted moderating variables ($\ln\text{FIDV}$, $\ln\text{TROP}$, and $\ln\text{NATR}$) are not constant over time. That is, their impact on economic growth varies significantly across the distributions of economic growth. Specifically, at every point of long-run economic growth distribution, from the median ($q_{0.50}$) to the lower quantile ($q_{0.90}$), tourism development exerts negative but insignificant impacts on economic growth. The negative impact deepened at the lowest quantile ($q_{0.95}$) with a significant effect on economic growth. Similar effects were also recorded at the upper quantile except at ($q_{0.30}$), where the tourism sector positively impacted economic growth. This provides quality evidence of the N-shaped dynamics, suggesting a time-varying relationship between tourism and economic growth in Mauritius, as hypothesized earlier. Unarguably, the outcome corroborates the nonlinear evidence exposed in Balsalobre-Lorente et al. (2020) for the Spanish economy, Zuo and Huang (2017) for India, and Zhang and Cheng (2019) for 36 Chinese counties. Additionally, it corroborates the time-dependent interactions proposed by Gounder (2021) for Mauritius.

By implication, policy moderations and continuous appraisals of policy options to mitigate the negative impacts of the business cycle are germane for sustained positive impacts of tourism on growth. However, in the short run, tourism revenue exerts a positive but insignificant impact on economic growth in Mauritius across all distributions of economic growth. This demonstrates that the positive impacts of tourism on growth in Mauritius are not sustained over the long term. Therefore, policies that can ensure the sustenance of the positive implications at all times are required. Similarly, the time-varying impacts were also noticeable with respect to financial development and the two other listed moderating variables across all quantiles of economic distributions.

Accordingly, the graphical illustration in Fig. 2 provides clearer insight into the N-shape dynamics of the contributions of the tourism sector in Mauritius. Evidently, the contributions of the sector fluctuate between negativity and positivity across the distributions. Suggestively, a constant review of policy stands is required to forestall the unwarranted negative and unpredictable effects in the tourism-growth nexus in
Mauritius, therefore ensuring sustained positive outcomes that can boost the confidence of all stakeholders.

The overall evidence from the post-estimation tests demonstrates that the outcomes of the estimations are robust and reliable for policy inferences; hence, the models are normal, autocorrelation free, homoscedastic, well-specified, and, above all, stable. This conviction emanates from the outcomes of the normality test (Jarque–Bera), serial correlation test (Breusch–Godfrey), heteroscedasticity test (Breusch–Pagan–Godfrey), specification test (Ramsey–RESET), and stability test (CUSUM and CUSUMSQ) graphs. See panel A of Table 8 and Fig. 4

Table 8 Post estimation and parameter constancy test

| Variables                                      | $F$ statistics | Probability |
|------------------------------------------------|----------------|-------------|
| **Panel A:** post-estimation diagnostic tests  |                |             |
| Normality test (Jarque–Bera)                   | 0.52           | 0.77        |
| Serial correlation test (Breusch–Godfrey)      | 1.19           | 0.32        |
| Heteroscedasticity test (Breusch–Pagan–Godfrey)| 0.86           | 0.62        |
| Specification test (Ramsey–RESET)              | 0.51           | 0.61        |
| **Panel B:** long-run parameter constancy test |                |             |
| $b_1(τ)$                                       | 3.06***        | 0.00        |
| $b_2(τ)$                                       | 2.67**         | 0.01        |
| $b_3(τ)$                                       | 2.08*          | 0.06        |
| $b_4(τ)$                                       | 0.94           | 0.51        |
| $b_5(τ)$                                       | 1.90           | 0.08        |
| **Panel C:** short-run parameter constancy test|                |             |
| $Δα_1(τ)$                                      | 14.25***       | 0.00        |
| $Δα_2(τ)$                                      | 2.70**         | 0.01        |
| $Δα_3(τ)$                                      | 2.82**         | 0.02        |
| $Δα_4(τ)$                                      | 1.00           | 0.47        |

Panels A, B, and C contain the outcome of postestimation diagnostic tests, long-run parameter constancy tests, and short-run parameter constancy tests, respectively. *, **, and *** imply the rejection of the null hypothesis of parameter constancy.

Fig. 4 Stability tests, CUSUM and CUSUMSQ plots
for more evidence. The outcome of the parameter constancy tests indicates that the impacts of the tourism sector and financial development on economic growth vary significantly across the distributions of economic growth in both the long and short run. This prominently validates the nonlinear (N-shaped) dynamics between tourism and the imperative of financial development on growth in the context of Mauritius, as highlighted earlier, which previous studies failed to consider. Figure 5 provides a graphical representation of the N-Shaped relationship between these series and economic growth in Mauritius. Moreover, this outcome is a tacit confirmation of N-shaped and inverted U–shaped phenomena suggested in Balsalobre-Lorente et al. (2020) for Spain, Zuo and Huang (2017) for China, and Zhang and Cheng (2019) for 36 Chinese counties. Instructively, the underlying outcomes suggest the need for varying policy frameworks dictated by the prevailing economic circumstances given that a common policy strand (one-policy-fits-all) may fail to produce the expected stimuli at all times.

The final step in the series of analyses is the application of the Granger causality test adopted to confirm the causal dynamics between tourism and economic growth in Mauritius while considering the moderating role of financial development. As highlighted earlier, several extant studies suggest a unidirectional effect from tourism to growth (TLGH), and some argue that growth determines tourism development (DLTH). Other variants of the argument subsist, as highlighted in the introductory section. To quell the argument in the context of Mauritius, we summarized the results of the Granger causality test in Table 9 for clarification.

On account of the Granger causality test represented in Table 9, the tourism-led growth hypothesis (TLGH) is validated in the context of Mauritius. The outcome reveals a one-way (unidirectional) causality running from tourism revenue ($lnTOUR$) to economic growth ($lnRGDP$), therefore supporting the TLGH in Mauritius. Furthermore, it is noted that no causal relationship exists between financial development and growth in Mauritius. However, growth projections drive the overutilization of natural resources, whereas tourism drives trade openness.
Conclusions and Policy Prescriptions

The study set out to provide updated insight regarding the prevailing dynamics of the tourism sector and economic growth in Mauritius while incorporating the imperatives of financial development and the other enlisted explanatory variables (trade openness and natural resource rent). This step is premised on the perceived scantiness of studies in this direction and, more importantly, bridges the research gap concerning the relative impact of tourism in Mauritius, a small island high-income country with enormous tourism potential. The study also probed for possible non-linear (N-shaped) interactions among the enlisted series given that some studies in the past canvassed that such an outcome prevails in some countries. However, to the best of our knowledge, no sturdy has probed this peculiar scenario (nonlinear N-shaped) in the context of Mauritius regardless of the enormous tourism potential of the country. We realized that the absence of updated empirical evidence in the tourism-growth nexus and possible nonlinear effects in Mauritius will leave the government and prospective international investors unguided in terms of policy decisions as they relate to tourism regulations and investments.

Based on this background, the study employed several modern econometric techniques, including the ARDL, the QARDL, and Granger causality tests. Likewise, relevant pre-estimation and postestimation tests were applied to ensure the reliability and robustness of policy inferences. Accordingly, annual time series data between 1980 and 2019 sourced from reliable data repositories were analyzed for empirical details. After ascertaining stationarity and mutual integration among the series, a long-run relationship was also established through various cointegration tests. The outcome of the ARDL model demonstrates that the tourism sector contributes positively and significantly to economic growth in Mauritius. Moreover, the tourism-growth nexus in Mauritius is

| Hypothesis     | F statistics | Prob | Causality |
|----------------|--------------|------|-----------|
| LNTOUR → LNGDP | 7.16***      | 0.002| Yes       |
| LNGDP → LNTOUR | 0.40         | 0.68 | No        |
| LNFIDV → LNGDP | 0.51         | 0.60 | No        |
| LNGDP → LNFIDV | 0.19         | 0.82 | No        |
| LNTROP → LNGDP | 0.46         | 0.63 | No        |
| LNGDP → LNTROP | 1.95         | 0.15 | No        |
| LNNATR → LNTROP| 2.16         | 0.13 | No        |
| LNGDP → LNNATR | 4.75**       | 0.01 | Yes       |
| LNFIDV → LNTOUR| 0.08         | 0.91 | No        |
| LNTOUR → LNFIDV| 0.30         | 0.73 | No        |
| LNTROP → LNTOUR| 1.63         | 0.21 | No        |
| LNTOUR → LNTROP| 10.7***      | 0.00 | Yes       |
| LNNATR → LNTOUR| 1.20         | 0.31 | No        |
| LNTOUR → LNNATR| 3.25*        | 0.05 | Yes       |

*, **, and *** denote rejection of the null hypothesis of no causal effects among the variables.
enhanced by financial development’s positive and significant contributions, unlike trade openness and natural resource rent, which do not play any significant role. The outcomes of the QARDL model revealed a nonlinear and N-shaped relationship between tourism and economic growth in Mauritius. The evidence proved that the impacts of the tourism sector and financial development on economic growth in Mauritius are time varying, as they fluctuate between positivity and negativities across the distributions of economic growth. Likewise, the positions of some researchers suggest that tourism drives economic growth, and the popular tourism-led growth hypothesis was validated in the context of Mauritius by the outcome of the Granger causality test.

In line with the above revelations, productivity in Mauritius could be better enhanced or become more viable through the contributions of the tourism sector. This entails more efforts geared towards making the sector more attractive at all times while guiding against factors that can undermine its proper functioning. While this remains the better option, the evidence of time-varying effects must not be taken for granted given that such shocks arising from business cycles, seasonal variations, and unexpected economic uncertainties such as COVID-19 may erode the benefits accruable from the tourism sector. Additionally, the government of Mauritius can ensure the continuous vibrancy of its economy by ensuring and setting the ground for a more developed financial system based on the positive and significant contributions of the sector to economic growth in this country. However, the sustainability of such positive and significant outcomes must be vigorously pursued at all times given the time-varying nature of the relationship. More importantly, the government of Mauritius should put in place relevant and appropriate policy measures that can shield the economy from the grievous negative influence of such unexpected economic turbulence so that the very benefits (positive and significant) of the tourism and financial sectors will be a long-lasting irrespective of time and seasons. Expectedly, this would boost the confidence of prospective international investors who must be assured of continuity and continuous positive returns to their investments. Consequently, such policies that can make the economy resilient at all times remain sacrosanct for a more prosperous Mauritius. Meanwhile, countries with similar economic potentials could draw from these policy standpoints to invigorate their economies.

Unarguably, the economic uncertainties occasioned by the outbreak of the COVID-19 pandemic must have negatively impacted the contributions of the tourism sector; however, due to data unavailability, the current study could not explore that direction. Against this background, we suggest that future researchers should go in this direction when the data sets become available. Likewise, the enlistments of other representatives of the tourism sector, such as tourism arrivals and tourism specialization, could avail more information. It could also be meaningful to explore the effects of tourism on other economic fundamentals, such as unemployment, environmental quality and quality of life.

References

Adedoyin, F. F., Erum, N., & Bekun, F. V. (2021). How does institutional quality moderates the impact of tourism on economic growth? Startling evidence from high earners and tourism-dependent economies. *Tourism Economics*, 1–22. https://doi.org/10.1177/1354816621993627
Adnan Hye, Q. M., & Ali Khan, R. E. (2013). Tourism-led growth hypothesis: A case study of Pakistan. *Asia Pacific Journal of Tourism Research, 18*(4), 303–313. https://doi.org/10.1080/10941665.2012.658412

Al-mulali, U., Fereidouni, H. G., Lee, J. Y. M., & Mohammed, A. H. (2014). Estimating the tourism-led growth hypothesis: A case study of the Middle East countries. *Anatolia, 25*(2), 290–298. https://doi.org/10.1080/13032917.2013.843467

Al-Mulali, U., Solarin, S. A., & Gholipour, H. F. (2020). Relationship between financial development and inbound tourism: A revisit. *Journal of Public Affairs, May*. https://doi.org/10.1002/pa.2233

Antonakakis, N., Dragouni, M., & Filis, G. (2015). How strong is the linkage between tourism and economic growth in Europe? *Economic Modelling, 44*, 142–155. https://doi.org/10.1016/j.econmod.2014.10.018

Aratuo, D. N., Etienne, X. L., Gebremedhin, T., & Fryson, D. M. (2019). Revisiting the tourism-economic growth nexus: Evidence from the United States. *International Journal of Contemporary Hospitality Management, 31*(9), 3779–3798. https://doi.org/10.1108/IJCHM-08-2018-0627

Archer, B. (1985). Tourism in Mauritius: An economic impact study with marketing implications. *Tourism Management, 6*(1), 50–54. https://doi.org/10.1016/0261-5177(85)90055-X

Aslan, A. (2014). Tourism development and economic growth in the Mediterranean countries: Evidence from panel Granger causality tests. *Current Issues in Tourism, 17*(4), 363–372. https://doi.org/10.1080/13683500.2013.768607

Asongu, S. A., & Odhiambo, N. M. (2019). The mobile phone, information sharing, and financial sector development in Africa: A quantile regression approach. *Journal of the Knowledge Economy*. https://doi.org/10.1007/s13132-019-00603-6

Balaguer, J., & Cantavella-Jordá, M. (2002). Tourism as a long-run economic growth factor: The Spanish case. *Applied Economics, 34*(7), 877–884. https://doi.org/10.1080/00036840110058923

Balsalobre-Lorente, D., Driha, O. M., Bekun, F. V., & Adedoyin, F. F. (2021). The asymmetric impact of air transport on economic growth in Spain: Fresh evidence from the tourism-led growth hypothesis. *Current Issues in Tourism, 24*(4), 503–519. https://doi.org/10.1080/13683500.2020.1720624

Balsalobre-Lorente, D., Driha, O. M., & Sinha, A. (2020). The dynamic effects of globalization process in analysing N-shaped tourism led growth hypothesis. *Journal of Hospitality and Tourism Management, 43*(February), 42–52. https://doi.org/10.1016/j.jhtm.2020.02.005

Bayer, C., & Hanck, C. (2013). Combining non-cointegration tests. *Journal of Time Series Analysis, 34*(1), 83–95. https://doi.org/10.1111/j.1467-9892.2012.00814.x

Brida, J. G., Cortes-Jimenez, I., & Pulina, M. (2016). Has the tourism-led growth hypothesis been validated? A literature review. *Current Issues in Tourism, 19*(5), 394–430. https://doi.org/10.1080/13683500.2013.868414

Brida, J. G., Pereyra, J. S., & Devesa, M. J. S. (2008). Evaluating the contribution of tourism to economic growth. *Anatolia, 19*(2), 351–357. https://doi.org/10.1080/13032917.2008.9687079

Brida, J. G., Lanzilotta, B., Pereyra, J. S., & Pizzolon, F. (2015). A nonlinear approach to the tourism-led growth hypothesis: The case of the MERCOSUR. *Current Issues in Tourism, 18*(7), 647–666. https://doi.org/10.1080/13683500.2013.802765

Butler, R. W. (1980). The concept of a tourist area cycle of evolution: implications for management of resources. *The Canadian Geographer, 24*(1), 5–12.

Cárdenas-García, P. J., Sánchez-Rivero, M., & Pulido-Fernández, J. I. (2015). Does tourism growth influence economic development? *Journal of Travel Research, 54*(2), 206–221. https://doi.org/10.1177/0047287513514297

Chirilă, V., Butnaru, G. I., & Chirilă, C. (2020). Spillover index approach in investigating the linkage between international tourism and economic growth in central and eastern European countries. *Sustainability, 12*(18). https://doi.org/10.3390/su12187604

Chiu, C. N. (2021). Tourism expansion and economic development: Evidence from the United States and China. *Journal of China Tourism Research, 17*(1), 120–141. https://doi.org/10.1080/19388160.2020.1736224

Cho, J. S., Kim, T. H., & Shin, Y. (2015). Quantile cointegration in the autoregressive distributed-lag modeling framework. *Journal of Econometrics, 188*(1), 281–300. https://doi.org/10.1016/j.jeconomet.2015.05.003

Chou, M. C. (2013). Does tourism development promote economic growth in transition countries? A panel data analysis. *Economic Modelling, 33*, 226–232. https://doi.org/10.1016/j.econmod.2013.04.024
Durbarry, R. (2004). Tourism and economic growth: the case of Mauritius. *Tourism Economics, 10*(4), 389–401.

Eyuboglu, S., & Eyuboglu, K. (2019). Tourism development and economic growth: An asymmetric panel causality test. *Current Issues in Tourism, 23*(6), 659–665. https://doi.org/10.1080/13683500.2019.1588863

Gounder, R. (2021). Tourism-led and economic-driven nexus in Mauritius: Spillovers and inclusive development policies in the case of an African nation. *Tourism Economics. https://doi.org/10.1177/13548166211013201*

Habibi, F., Rahmati, M., & Karimi, A. (2018). Contribution of tourism to economic growth in Iran’s Provinces: GDM approach. *Future Business Journal, 4*(2), 261–271. https://doi.org/10.1016/j.fbj.2018.09.001

Hashmi, S. M., Chang, B. H., Huang, L., & Uche, E. (2022). Revisiting the relationship between oil prices, exchange rate, and stock prices: An application of quantile ARDL model. *Resources Policy. https://doi.org/10.1016/j.resourpol.2021.102543*

He, T. T., & Li, W. X. B. (2021). Revisiting tourism’s additional impact on income. *Tourism Economics, 27*(1), 149–167. https://doi.org/10.1177/1354816619887022

Isik, C., Dogru, T., & Turk, E. S. (2017). A nexus of linear and nonlinear relationships between tourism demand, renewable energy consumption, and economic growth: Theory and evidence. *International Journal of Tourism Research, 20*(1), 38–49.

Jordan, S., & Philips, A. Q. (2018). Cointegration testing and dynamic simulations of autoregressive distributed lag models. *Stata Journal, 18*(4), 902–923. https://doi.org/10.1177/1536867x1801800409

Krabokoukis, T., & Polyzos, S. (2021). An investigation of factors determining the tourism attractiveness of Greece’s prefectures. *Journal of the Knowledge Economy, 12*, 1997–2015. https://doi.org/10.1007/s13132-020-00704-7

Kumar, R. R. (2014). Exploring the role of technology, tourism and financial development: An empirical study of Vietnam. *Quality and Quantity, 48*(5), 2881–2898. https://doi.org/10.1007/s11135-013-9930-5

Kumar, R. R., Loganathan, N., Patel, A., & Kumar, R. D. (2015). Nexus between tourism earnings and economic growth: A study of Malaysia. *Quality and Quantity, 49*(3), 1101–1120. https://doi.org/10.1007/s11135-014-0037-4

Kyara, V. C., Rahman, M. M., & Khanam, R. (2021). Tourism expansion and economic growth in Tanzania: A causality analysis. *Heliyon, 7*(5). https://doi.org/10.1016/j.heliyon.2021.e06966

Lolos, S., Palaios, P., & Papapetrou, E. (2021). Tourism-led growth asymmetries in Greece: Evidence from quantile regression analysis. *Portuguese Economic Journal, 0123456789,. https://doi.org/10.1007/s10258-021-00195-7*

Mbulawa, S., & Chingoiro, S. (2017). Do tourist expenditures matter for growth in Botswana? A vector auto regression approach. *Academica Turistica, 10*(1), 91–101. https://doi.org/10.26493/2335-4194.10.91-101

Mitra, S. K. (2019). Is tourism-led growth hypothesis still valid? *International Journal of Tourism Research, 21*(5), 615–624. https://doi.org/10.1002/jtr.2285

Munir, I. U., Yue, S., Nassani, A. A., Abro, M. M. Q., Hyder, S., & Zaman, K. (2021). Structural changes, financial and business regulatory measures, energy and tourism demand: Evidence from group of seven countries. *International Journal of Finance and Economics, 26*(2), 2198–2218. https://doi.org/10.1002/ijfe.1901

Ngoasong, M. Z., & Kimbu, A. N. (2016). Informal microfinance institutions and development-led tourism entrepreneurship. *Tourism Management, 52*, 430–439. https://doi.org/10.1016/j.tourman.2015.07.012

Nissan, E., Galindo, M. A., & Méndez, M. T. (2011). Relationship between tourism and economic growth. *Service Industries Journal, 31*(10), 1567–1572. https://doi.org/10.1080/02642069.2010.485636

Nwani, C., Effiong, E. L., Okpoto, S. I., & Okere, I. K. (2021). Breaking the carbon curse: The role of financial development in facilitating low-carbon and sustainable development in Algeria. *African Development Review, January 2020*. https://doi.org/10.1111/1467-8268.12576

Ohlan, R. (2017). The relationship between tourism, financial development and economic growth in India. *Future Business Journal, 3*(1), 9–22. https://doi.org/10.1016/j.fbj.2017.01.003
Omode, P. C., & Uche, E. (2021). How does purchasing power in OPEC countries respond to oil price periodic shocks? Fresh evidence from quantile ARDL specification. *OPEC Energy Review*. https://doi.org/10.1111/opec.12216

Pata, U. K. (2021). Tourism and economic growth in g10 countries: Evidence from an asymmetric panel causality test. *Tourism*, 69(1), 112–126. https://doi.org/10.37741/T.69.1.8

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approach to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326.

Pérez-Rodríguez, J. V., Rachinger, H., & Santana-Gallego, M. (2021). Testing the validity of the tourism-led growth hypothesis under long-range dependence. *Current Issues in Tourism*, 24(6), 768–793. https://doi.org/10.1080/13683500.2020.1744537

Rasool, H., Maqbool, S., & Tarique, M. (2021). The relationship between tourism and economic growth among BRICS countries: A panel cointegration analysis. *Future Business Journal*, 7(1), 1–11. https://doi.org/10.1186/s43093-020-00048-3

Roudi, S., Arasli, H., & Akadiri, S. S. (2019). New insights into an old issue–examining the influence of tourism on economic growth: Evidence from selected small island developing states. *Current Issues in Tourism*, 22(11), 1280–1300. https://doi.org/10.1080/13683500.2018.1431207

Shahbaz, M., Kumar, R. R., Ivanov, S., & Loganathan, N. (2017). The nexus between tourism demand and output per capita with the relative importance of trade openness and financial development: A study of Malaysia. *Tourism Economics*, 23(1), 168–186. https://doi.org/10.5367/te.2015.0505

Sharif, A., Afshan, S., Chrea, S., Amel, A., & Khan, S. A. R. (2020). The role of tourism, transportation and globalization in testing environmental Kuznets curve in Malaysia: New insights from quantile ARDL approach. *Environmental Science and Pollution Research*. https://doi.org/10.1007/s11356-020-08782-5

Seghir, G. M., Mostéfa, B., Abbes, S. M., & Zakarya, G. Y. (2015). Tourism spending-economic growth causality in 49 countries: A dynamic panel data approach. *Procedia Economics and Finance*, 23(Oct 2014), 1613–1623. https://doi.org/10.1016/s2212-5671(15)00402-5

Sequeira, T. N., & Nunes, P. M. (2008). Does tourism influence economic growth? A dynamic panel data approach. *Applied Economics*, 40(18), 2431–2441. https://doi.org/10.1080/00036840600949520

Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65–94.

Statistics Mauritius. (2019). https://statsmauritius.govmu.org/Pages/Statistics/ESI/Tourism/Tourism_Yr19.aspx

Su, Y., Cherian, J., Sial, M. S., Badulescu, A., Thu, P. A., Badulescu, D., & Samad, S. (2021). Does tourism affect economic growth of China? A Panel Granger Causality Approach. *Sustainability (switzerland)*, 13(3), 1–12. https://doi.org/10.3390/su13031349

Svirydenka, R. (2016). Introducing a new broad-based index of financial development. IMF Working Papers, WPIE/A2016005.

Tang, C. F., & Tan, E. C. (2015). Does tourism effectively stimulate Malaysia’s economic growth? *Tourism Management*, 46(2015), 158–163. https://doi.org/10.1016/j.tourman.2014.06.020

Tugcu, C. T. (2014). Tourism and economic growth nexus revisited: A panel causality analysis for the case of the Mediterranean Region. *Tourism Management*, 42, 207–212. https://doi.org/10.1016/j.tourman.2013.12.007

Uche, E., & Effiom, L. (2021a). Fighting capital flight in Nigeria: Have we considered global uncertainties and exchange rate volatilities? Fresh insights via quantile ARDL model. *SV Business & Economics*, 1(6). https://doi.org/10.1007/s43546-021-00082-5

Uche, E., & Effiom, L. (2021b). Financial development and environmental sustainability in Nigeria: Fresh insights from multiple threshold nonlinear ARDL model. *Environmental Science and Pollution Research*. https://doi.org/10.1007/s11356-021-12843-8

Uche, E. & Effiom. L. (2021c). Oil price, exchange rate and stock prices in Nigeria: Fresh insights based quantile ARDL. *Economics and Policy of Energy and Environment*, (Artles-in-press).

Udom Etokakpan, M., Victor Bekun, F., & Mohammed Abubakar, A. (2019). Examining the tourism-led growth hypothesis, agricultural-led growth hypothesis and economic growth in top agricultural producing economies. *European Journal of Tourism Research*, 21, 132–137.

Usmani, G., Akram, V., & Praveen, B. (2021). Tourist arrivals, international tourist expenditure, and economic growth in BRIC countries. *Journal of Public Affairs*, 21(2). https://doi.org/10.1002/pa.2202
Zhang, J., & Cheng, L. (2019). Threshold effect of tourism development on economic growth following a disaster shock: Evidence from the Wenchuan Earthquake, P.R. China. *Sustainability, 11*(2). https://doi.org/10.3390/su11020371

Zuo, B., & Huang, S. (2017). Revisiting the tourism-led economic growth hypothesis: The case of China. *Journal of Travel Research, 57*(2), 151–163. https://doi.org/10.1177/0047287516686725

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