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Tourism and economic growth in the Republic of Madagascar: An empirical investigation of causal links

Kudzai Masvingise, Amon Taruvinga *, Lindokuhle Gwala

Department of Agricultural Economics and Extension, University of Fort Hare, Alice, South Africa

Abstract

The Granger-causality between tourism and economic growth for Madagascar was empirically examined during the period 1995-2019 using data from the World Bank's World Data Bank. The study was motivated by the speculation and optimism regarding the effects of tourism on economic growth for the unique island with endemic flora and fauna not found anywhere on Earth, and the lack of recent empirical causal evidence between tourism and economic growth. The study used international tourism receipts and GDP per capita to examine the nexus. Using the Autoregressive Distributed Lag (ARDL) bounds F-test for Co-integration, the study found that there is a stable long run relationship between GDP and tourism. A unidirectional Granger-causality between GDP and tourism was also revealed lending support to the growth-led tourism (GDP → TOR) hypothesis, where economic growth propels tourism. These findings confirm the growth-led tourism hypothesis for Madagascar, contrary to the conventional hypothesis of tourism-led growth more often touted by several stakeholders. The study, therefore, recommends that, policy and investment efforts for Madagascar should be directed more at economic development leading sectors (services and agriculture) to stimulate infrastructure development necessary for attracting and connecting tourists to services and natural resources tourists may be looking for.

Keywords: Growth-Led Tourism; Autoregressive Distributed Lag (ARDL) Bounds F-Test; Granger-Causality; Natural Resources

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* Corresponding author. *E-mail address:* ataruvinga@ufh.ac.za

1. Introduction

Tourism has in recent years been flaunted as an important economic industry globally (Hwang and Lee, 2019; Wu et al., 2022) contributing to job creation, socio-economic and cultural development (Lopez and Arreola, 2019; Manzoor et al., 2019; Abbas et al., 2021). With respect to developing countries, literature claims that tourism is a critical source and foundation of a country's economic development and growth (Shahzad et al., 2017; Kyara et al., 2021). The abundance of natural resources in most African countries has attracted local, regional and international tourists significantly boosting the tourism industry of these countries. Special attention thus far has been given to the tourism industry as a potential subsector that can be leveraged to propel economic growth and employment opportunities.

The Republic of Madagascar is claimed to be the world's second-largest country after Indonesia that consists primarily of islands with endemic wildlife and a rich biodiversity (Conservation International, 2007). The Republic of Madagascar hosts several plants and animals not found anywhere on Earth (Tattersall, 2006), of which 90% of these flora and fauna species are endemic (Hobbes and Andrew, 2008). The island is therefore in some cycles referred to as the "eighth continent" (Hilstrom and Laurie, 2003). Literature highlights that more than 80% of the island's 14,883 plant species and five families are not found anywhere in the world (Callmander et al., 2011). The Republic of Madagascar has therefore a unique natural heritage with approximately 5000km of coastline capable of attracting regional and international tourists (African Development Bank Group, 2017). The tourism potential of the island is therefore huge, although largely untapped (African Development Bank Group, 2017). Poverty, unemployment, governance, fragility and poor infrastructure are some of the challenges of the Republic of Madagascar (African Development Bank Group, 2017). These challenges were worsened by the 2009 – 2013 political crisis, which further deteriorated the socio-economic situation of the country (African Development Bank Group, 2017).

The relationship between tourism and economic growth is therefore important for the Republic of Madagascar. Unfortunately, the nexus is not always direct and obvious. Several outcomes are possible ranging from; unidirectional causation (tourism-led growth hypothesis and growth-led tourism hypothesis), bidirectional causation (feedback causal relationship) to no causal relationship (Trang, et al., 2014; Pisa, 2018; Wu and Wu, 2019). The need therefore arises for country level assessment of the relationship between tourism and economic growth, to establish the prevailing causal relationships. This is against a background where over time, the nexus may change and strategic targeting to promote full realisation of the benefits associated with the nexus requires a clear understanding of the prevailing causal relationship (Rasool et al., 2021). The study therefore analysed the empirical causal relationship between tourism and economic growth for the Republic of Madagascar.

1.1. Problem statement

The causal relationship between tourism and economic growth has been widely researched globally (Lopez and Arreola, 2019). Evidence from these studies reveal that the tourism-led growth hypothesis although popular, is not always the case across countries and over time (Chatziantoniou et al., 2013). These findings have attracted a series of research on the relationship between tourism development and economic growth in different countries for purposes of understanding the prevailing causal relationships at country level to enhance strategic targeting. Unfortunately, despite a significant number of studies done globally, a few studies

are from Africa (Fayissa et al., 2008), yet there is a great deal of speculation and optimism regarding its effect on economic development.

The Republic of Madagascar typical of most African countries, leverage tourism as one of its strategic industries for economic growth (African Development Bank Group, 2017). The unique natural heritage of the island has a huge potential for the tourism industry. Newspapers, policy makers and several stakeholders have also touted the employment creation, poverty eradication and economic growth potential of the tourism industry based on the tourism-led growth hypothesis. Although tempting to believe, given the influx of tourists and the island's abundance of unique natural resources, this study questions whether such sentiments reflect the reality of the nexus of tourism and economic development in the country for the period of 1995 to 2019.

1.2. Objectives

To examine the co-integration of tourism and economic growth for the Republic of Madagascar.

To examine the causal relationship between tourism and economic growth for the Republic of Madagascar.

1.3. Hypotheses

Hypothesis 1 (H1). There is a co-integration of tourism and economic growth in the Republic of Madagascar.

Hypothesis 2 (H2). Tourism growth granger-cause GDP growth in the Republic of Madagascar.

2. Literature review

The tourism industry in the Republic of Madagascar is believed to play a major role towards employment creation and economic growth (African Development Bank Group, 2017). The island of Madagascar offers tourists with a wide range of activities: scenic hikes, game parks, beach tourism, wildlife viewing, cultural encounters, adventure sports, scuba diving, scenic landscapes (highlands, rainforests, canyons) and deserts (the Avenue of the Baobabs). Figure 1 presents the Republic of Madagascar's tourism trends as measured by the international tourism receipts (current US$) and economic growth (GDP per capita, $). The international tourism receipts reveal a general upward trend since 1995. This upward trend was interrupted in several years (2001; 2002; 2003; 2009; 2015 and 2017) among other factors by economic and political crisis (African Development Bank Group, 2017).

The economic growth front of the Republic of Madagascar has generally been flat across the period under consideration (1995 – 2019) with sharp declines in 2001, 2002 and 2009. Literature highlights that, the island experienced little structural transformation since 2000 and the economy is based on services with a poorly developed industry (African Development Bank Group, 2017). Other sectors of economic importance for the country include, the extractive industries, the beverage and food industries, agriculture, and tourism (African Development Bank Group, 2017). What is interesting to note in Figure 1 although not that conclusive, are elements of potential co-integration of tourism and economic growth. As GDP drops, tourism also drops (2001 – 2002; 2008 – 2009) and as GDP increases, tourism increases (1995 – 2000; 2003 – 2008; 2014 – 20019).

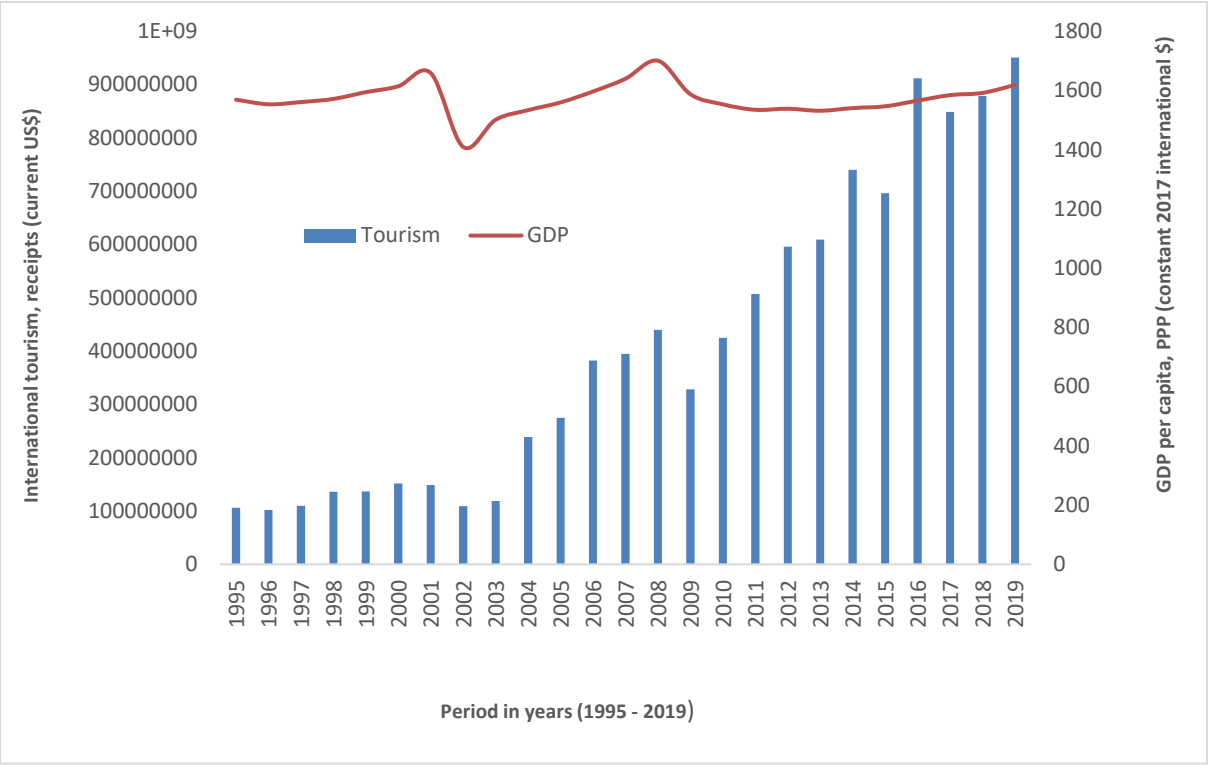

Figure 1. The international tourism receipts (current US$) and economic growth (GDP per capita, $) trends for the Republic of Madagascar (1995 – 2019) (Source: World Bank, 2022).

2.1. The nexus between tourism and economic growth

There are four hypotheses that are suggested by literature with reference to the nexus between tourism and economic growth: tourism led-growth hypothesis, growth led-tourism hypothesis, feedback hypothesis and neutral hypothesis. The tourism-led growth hypothesis attests that tourism development causes economic growth (Kyara et al., 2021). It confirms a unidirectional causal relationship running from tourism to economic growth. Several studies confirm this hypothesis (Tugcu, 2014; Payne and Mervar, 2010; Katircioglu, 2010; Mishra et al., 2011; Ribeiro and Wang, 2019) arguing that greater economic growth can be experienced if the government encourages economic policies that promote the development of tourism (Sokhanvar et al., 2018). Most of these studies were however conducted outside Africa with a few from southern Africa [Phiri, 2016 (South Africa); Midoun and Nardjess, 2019 (North African Countries); Kyara et al., 2021 (Tanzania)]. The tourism-led growth hypothesis therefore suggests that a country's tourism industry can propel economic growth through increased expenditure in the tourism related industries (hotel and catering, transport), foreign exchange reserves and investments in local infrastructure and human capital (Fuinhas et al., 2020).

The growth led-tourism hypothesis (reverse hypothesis) asserts that economic growth is the cause of tourism development (Kyara et al., 2021). This means that the growth of a country's economy, infrastructure and political stability promote tourism growth (Odhimbo and Nyasha, 2020). Several studies confirm this hypothesis (Alhowaish, 2016; Nene and Taivan, 2017; Wu and Wu, 2019). Just a few African studies confirms this relationship [Ahiawodzi, 2013 (Ghana); Bouzahzah and Menyari, 2013 (Morocco and Tunisia); Phiri, 2016; Nene and Taivan, 2017 (Sub Saharan Africa), Muzekenyi et al., 2018 (South Africa)]. The growth led-tourism

hypothesis therefore suggests that a country's economic growth can propel tourism through improvement in supporting infrastructure (accommodation facilities, road networks, communication networks, banking systems, and political stability) which attracts and connects tourists to a country's services and natural resources. In addition, the political stability of a country provides a conducive environment for tourists worth promoting for safety assurance.

The feedback hypothesis suggests a two-way causal relationship between tourism and economic growth (Kyara et al., 2021). This hypothesis is also referred to as a reciprocal (bi-directional) hypothesis, where both tourism development and economic growth are expected to drive each other (Sokhanvar et al., 2018; Odhimbo and Nyasha, 2020). This could be probably the relationship between tourism and economic growth countries should aim to achieve. This relationship has been confirmed in various countries (Tugcu, 2014; Tang, 2011; Perles-Ribes et al., 2017; Bilen et al., 2017; Wu and Wu, 2018). For southern Africa, this relationship has been confirmed in South Africa by Phiri (2016) and Odhimbo and Nyasha, (2020). The feedback hypothesis thus far suggests that a country may have a feedback relationship where good infrastructure and political stability attracts and connects tourists to a country's services and natural resources. As tourists are attracted, the expenditure on the tourism related industries (hotel and catering, transport) increases including foreign exchange reserves and investments in local infrastructure and human capital (Fuinhas et al., 2020).

The neutral hypothesis suggests that there is no causal relationship between economic growth and tourism development (Oh, 2005; Sokhanvar et al., 2018). This means that economic growth cannot be achieved by promoting the growth of tourism, nor is tourism affected by changes in economic growth (Oh, 2005; Sokhanvar et al., 2018). Given that tourists travel for a wide range of things (leisure / holiday, business, visits to friends and relatives, medical and religious purposes) the neutral hypothesis, seem to suggest that, as tourists visit countries, the influence may not have a significant influence on economic growth. The studies that confirm this relationship include Katircioglu, (2009), Ozturk and Acaravci, (2009), Jackman and Lorde, (2010) and Ekanayake and Long, (2012). It is also interesting to note that this narrative is supported by just a few studies.

Literature thus far suggests various possibilities (unidirectional, bidirectional and neutral) when it comes to the nexus between tourism and economic growth, although the neutral narrative is not widely supported especially in recent years. A clear understanding of the prevailing nexus is therefore critical at the country level, to enhance strategic targeting through investments and supporting policies. Literature further reveals limited tourism and economic development nexus studies among a majority of African countries, more specifically in southern Africa, yet tourism is touted as a strategic industry that can promote economic growth. Given that tourism is closely related to culture, politics and economics of a country, country level empirical studies that seek to understand the nexus between tourism and economic growth are therefore required than trying to speculate based on conclusions from other countries. Southern African countries have different cultures and politics compared to other parts of the continent (North, East and West Africa) and other regions outside Africa, a scenario that may present a unique nexus between tourism and economic growth worth understanding.

2.2. Conceptual framework

Figure 2 presents the conceptual framework summarising the four possible causal links between tourism and GDP (Chatziantoniou et al., 2013). Horizontally, the conceptual frameworks present potential unidirectional causal linkages, while vertically, bidirectional and no causal linkages are presented. Empirical studies have

revealed that tourism (TOR) in some countries is capable of propelling GDP (economic growth), through the spill over and multiplier effects (Schubert et al., 2011). This is possible through stimulation of investments in new infrastructure (Andriotis, 2002; Blake et al., 2006), augmentation of foreign exchange reserves (McKinnon, 1964) and job creation (Lee and Chang, 2008; Brida and Pulina, 2010). For such countries, it is important to allocate more resources, investment and supporting policies to the tourism industry and tourism related industries to trigger economic growth (Rasool et al., 2021). The causal relationship therefore runs from tourism to GDP as indicated by arrows from tourism to GDP (TOR → GDP). To the contrary in other countries, it is economic growth that propels the development of the tourism industry (Mahmoudinia et al., 2011; Odhiambo and Nyasha, 2020). For such countries, more resources, investment, and policy support should be allocated to economic development leading industries to boost infrastructure that attract and connect tourists to resources and serves of a country thus promoting tourism (Rasool et al., 2021). The causal relationship therefore runs from GDP to tourism as indicated by arrows from GDP to tourism (GDP → TOR).

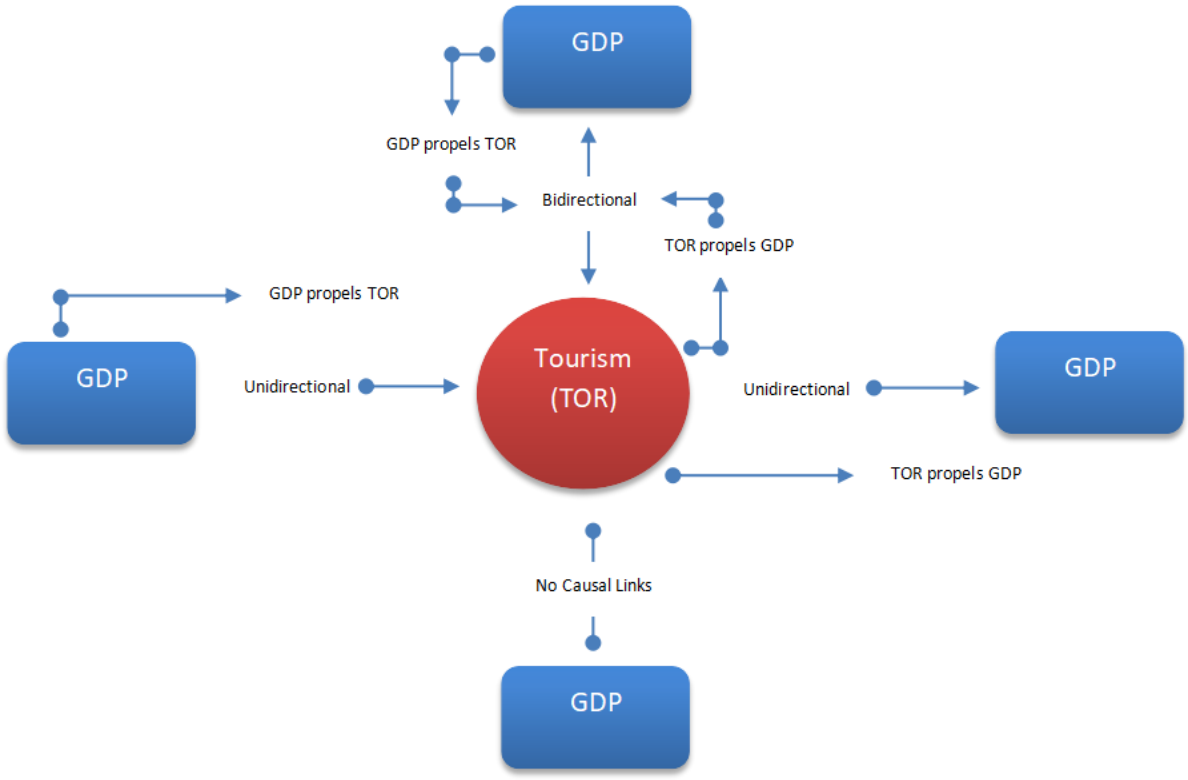

Figure 2. Tourism – GDP causal linkages framework (Source: Authors' own illustration).

Bidirectional causal linkages are also possible in other countries, where tourism and GDP (economic growth) propels each other as illustrated in Figure 2. In such cases, balanced allocation of resources, investment and policy support for the tourism and economic development leading industries becomes necessary to boost both GDP and tourism (Rasool et al., 2021). The causal relationship therefore runs from both directions (GDP to tourism and tourism to GDP) as indicated by the bidirectional arrows (TOR ↔ GDP). A good infrastructure and political stability attract and connects tourists to a country's services and natural

resources. As tourists are attracted, the expenditure on the tourism related industries (hotel and catering, transport) increases including foreign exchange reserves and investments in local infrastructure and human capital. Lastly, the conceptual framework presents a no causal linkage possibility in some countries (Po and Huang, 2008; Katircioglu, 2009; Tang, 2013) implying that, not much attention may be given to the tourism industry in as far as trying to promote economic growth is concerned and vice versa. No causal relationship is therefore indicated by a non-pointed line between GDP and tourism (GDP ― TOR). Limited availability of these services may discourage the willingness of tourists to visit a country. In addition, the existence or non-existence of these services and natural resources may also fail to attract tourists especially when the political and economic environment is not stable (for safety and cost reasons). Understanding of the prevailing causal relationships between tourism and GDP thus far, provide necessary insights to governments for purposes of adjusting their economic investment priorities and economic policies to boost their economic growth using their scarce resources (Rasool et al., 2021).

3. Methodology

Stationary time series has statistical properties (autocorrelation, mean and variance) that remain the same over time (Enders, 1995). Order of integration summarises the minimum number of differences to obtain a covariance-stationary series (Shrestha and Bhatta, 2018). Stationary data and order of integration are therefore important for time series estimations to avoid spurious regression results (Kyara et al., 2021). The Augmented Dikey-Fuller (ADF) and Phillips-Perron (PP) tests were therefore used to test unit root and order of integration of the variables at 1% and 5% significance level (tourism, gross domestic product, foreign direct investment and exports).

3.1. Co-integration

The Autoregressive Distributed Lag (ARDL) bounds test was used to estimate the long-run relationship between tourism and economic growth. The ARDL bounds test accommodate smaller sample sizes (Pesaran et al., 2001), provides reliable estimates when some of the regressors are endogenous (Odhiambo, 2008) and accommodates variables that are integrated at different orders (Odhiambo and Nyasha, 2020). For the purpose of addressing the omission-of-variable bias common with bivariate Granger-causality model, two control variables were used [foreign direct investment (FDI) and exports of goods and services – annual % growth (EXP)]. The two control variables were selected based on their strong direct and indirect ability to explain economic growth and tourism growth. This created a multivariate Granger-causality model as illustrated in equation 1 following Odhiambo and Nyasha (2020).

$$GDP = f(TOR, FDI, EXP) \quad (1)$$

Where:

- GDP = Gross Domestic Product;
- TOR = Tourism;
- FDI = Foreign Direct Investment;
- EXP = Export of goods and services;

The general co-integration model was therefore expressed as a set of four co-integration equations 2 – 5 following Odhiambo and Nyasha (2020).

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta TOR_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta FDI_{t-i} + \sum_{i=0}^{n} \alpha_{4i} \Delta EXP_{t-i} + \alpha_5 GDP_{t-1} + \alpha_6 TOR_{t-1} + \alpha_7 FDI_{t-1} + \alpha_8 EXP_{t-1} + u_{1t} \quad (2)$$

$$\Delta TOR_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \Delta TOR_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta FDI_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta EXP_{t-i} + \beta_5 TOR_{t-1} + \beta_6 GDP_{t-1} + \beta_7 FDI_{t-1} + \beta_8 EXP_{t-1} + u_{2t} \quad (3)$$

$$\Delta FDI_t = \pi_0 + \sum_{i=1}^{n} \pi_{1i} \Delta FDI_{t-i} + \sum_{i=0}^{n} \pi_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \pi_{3i} \Delta TOR_{t-i} + \sum_{i=0}^{n} \pi_{4i} \Delta EXP_{t-i} + \pi_5 FDI_{t-1} + \pi_6 GDP_{t-1} + \pi_7 TOR_{t-1} + \pi_8 EXP_{t-1} + u_{3t} \quad (4)$$

$$\Delta EXP_t = \rho_0 + \sum_{i=1}^{n} \rho_{1i} \Delta EXP_{t-i} + \sum_{i=0}^{n} \rho_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \rho_{3i} \Delta TOR_{t-i} + \sum_{i=0}^{n} \rho_{4i} \Delta FDI_{t-i} + \rho_5 EXP_{t-1} + \rho_6 GDP_{t-1} + \rho_7 TOR_{t-1} + \rho_8 FDI_{t-1} + u_{4t} \quad (5)$$

where:

- GDP = Gross Domestic Product;
- TOR = Tourism;
- FDI = Foreign Direct Investment;
- EXP = Export of goods and services;
- $\alpha_0, \beta_0, \pi_0, \rho_0$ = respective constants;
- $\alpha_1 - \alpha_4, \beta_1 - \beta_4, \pi_1 - \pi_4, \rho_1 - \rho_4$ = respective short-run coefficients.
- $\alpha_5 - \alpha_8, \beta_5 - \beta_8, \pi_5 - \pi_8, \rho_5 - \rho_8$ = respective long-run coefficients;
- Δ = difference operator;
- n = lag length;
- t = time period and
- μ_{it} = white-noise error terms.

The respective ECM-based Granger-causality models were therefore specified as illustrated in equations 6 to 9 following Odhiambo and Nyasha (2020).

$$\Delta GDP_t = \alpha_0 + \sum_{i=0}^{n} \alpha_{1i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \alpha_{2i} \Delta TOR_{t-i} + \sum_{i=0}^{n} \alpha_{3i} \Delta FDI_{t-i} + \sum_{i=0}^{n} \alpha_{4i} EXP_{t-i} + \delta_1 ECM_{t-1} + u_{1t} \quad (6)$$

$$\Delta TOR_t = \beta_0 + \sum_{i=0}^{n} \beta_{1i} \Delta TOR_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta FDI_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta EXP_{t-i} + \delta_2 ECM_{t-1} + u_{2t} \quad (7)$$

$$\Delta FDI_t = \pi_0 + \sum_{i=0}^{n} \pi_{1i} \Delta FDI_{t-i} + \sum_{i=0}^{n} \pi_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \pi_{3i} \Delta TOR_{t-i} + \sum_{i=0}^{n} \pi_{4i} \Delta EXP_{t-i} + \delta_3 ECM_{t-1} + u_{3t} \quad (8)$$

$$\Delta EXP_t = \rho_0 + \sum_{i=0}^{n} \rho_{1i} \Delta EXP_{t-i} + \sum_{i=0}^{n} \rho_{2i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \rho_{3i} \Delta TOR_{t-i} + \sum_{i=0}^{n} \rho_{4i} \Delta FDI_{t-i} + \delta_4 ECM_{t-1} + u_{4t} \quad (9)$$

where:

- ECM = error-correction term.
- $\delta_1 - \delta_4$ = respective coefficients for the error-correction terms.
- μ_{it} = mutually uncorrelated white-noise residuals.

Other variables and characters are as described in equations 2 – 5.

3.2. Data sources

The study used annual time-series data for the period of 1995 and 2019 from the World Bank's World Data Bank (World Bank, 2022). The analysis of data was done using statistical tests in the EView 11 statistical package.

4. Results and discussion

This section presents study results starting with stationarity test results, followed by co-integration results and lastly by the ECM-Granger-causality results. The interest was on confirming existence of a stable long run relationship between GDP and TOR and any causal linkages. Stationarity tests were done to confirm that the statistical properties (autocorrelation, mean and variance) of all the variables considered (GDP, TOR, FDI, EXP) were constant over the period of investigation (1995 – 2019) to avoid spurious regression results (Kyra et al., 2021). Co-integration tests were done to confirm existence of possible long run relationships between the variables. ECM-based Granger-causality tests were also done to firstly confirm the existence of stable long run relationships (ECT) and secondly the direction of causality (Granger-causality) between variables focusing only on vectors with long run relationships. The error correction terms (ECT) were specifically introduced to confirm the long run equilibrium relationships and the speed of adjustment towards long run equilibrium if shocks are introduced in the short term.

4.1. Unit root tests

This section presents stationarity tests of all the variables. For the purpose of ruling out the possibility of non-stationarity of the data, a unit root test was conducted to check if all the variables are integrated of order one [I (1)] and/or below to avoid spurious regression results (Manzoor et al., 2019; Odhiambo and Nyasha 2020). Augmented Dickey-Fuller test (ADF) and the Phillips-Perron (PP) unit root tests were employed as detailed in Table 1. Unit root test results evinces that TOR and FDI are non-stationary at level but stationary at first difference, while GDP and EXP are stationary at level.

Table 1. Stationarity tests for GDP, TOR, FDI and EXP

Variable	Test for unit root in level		Test for unit root in first difference	
	Intercept	Trend and intercept	Intercept	Trend and intercept
Augmented Dickey-Fuller (ADF)				
GDP	-3.201502**	-3.156634	-5.936333***	-5.805653***
TOR	1.039037	-2.461931	-6.885052***	-7.351049***
FDI	-1.983245	-1.943827	-3.036754**	-3.033098
EXP	-5.958856***	-5.462630***	-5.679079***	-5.503875***
Phillips-Perron (PP)				
GDP	-3.201502**	-3.156634	-6.193246***	-6.046719***
TOR	0.959340	-2.366874	-6.833296***	-7.319229***
FDI	-1.620667	-1.573735	-3.036754**	-3.033098
EXP	-7.075279***	-14.77123***	-20.17892***	-19.49343***

Source: Author's calculation by using E-view 11.

*Notes: *** and ** denote stationarity at 1% and 5% significance levels.*

GDP – Gross Domestic Product, TOR – Tourism, FDI – Foreign Direct Investment and EXP – Exports.

These findings imply that the variables are integrated at different levels [I(0) and I(1)] which therefore justifies the use of the Autoregressive Distributed Lag (ARDL) bounds F-test for co-integration as detailed in the next section.

4.2. Selection of optimum lag length

For the purposes of preventing loss of degrees of freedom common with too much lagging, the optimum lag length was estimated using the unrestricted VAR Lag Order Selection Criteria as summarised in Table 2. Results reveal that the Akaike information criterion (AIC) has the lowest (least) significant value (98.99371). This therefore indicates that lag 1 is the optimum lag to select.

Table 2. VAR Lag Order Selection Criteria Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1236.267	NA	9.06e+39	103.3556	103.5519	103.4077
1	-1167.206	109.3469*	1.11e+38*	98.93382*	99.91554*	99.19427*

* Indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error; AIC: Akaike information criterion, SC: Schwarz information criterion & HQ: Hannan-Quinn information criterion.

4.3. Co-integration tests

Table 3 presents the Autoregressive Distributed Lag (ARDL) bounds F-test for the estimation of the long run relationship between tourism and economic growth. Co-integration confirms the existence of possible relationships between variables, which is a necessary precondition for querying causal linkages. Two co-integration vectors were confirmed suggesting the presence of stable long run relationships among the variables in models 1 and 4. Based on model 1 and 4, the study accept the null hypothesis that, there is a co-integration of economic growth and tourism during the period of investigation for the Republic of Madagascar. The long-run causality was therefore, estimated for functions that confirmed the presence of a stable long run relationship (co-integration) with an error-correction term following several previous studies (Odhiambo, 2010; Odhiambo, 2014; Odhiambo and Nyasha, 2019; Odhiambo and Nyasha 2020).

Table 3. Autoregressive Distributed Lag (ARDL) bounds F-test for co-integration

Dependent variable	Function	F-statistic	Decision
1) GDP	F(GDP|TOR, FDI, EXP)	8.520704***	Co-integrated
2) TOR	F(TOR|GDP, FDI, EXP)	1.723299	Not co-integrated
3) FDI	F(FDI|GDP, TOR, EXP)	2.782249	Inconclusive
4) EXP	F(EXP|GDP, TOR, FDI)	14.96124***	Co-integrated

	1%		5%		10%	
F-statistic	I(0)	I(1)	1(0)	I(1)	I(0)	I(1)
	4.614	5.966	3.272	4.306	2.676	3.586

*Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively.*

4.4. ECM-based Granger-causality test

The ECM-based Granger-causality results are presented in Table 4. Co-integration was confirmed for model 1 and 4 in the previous section implying a stable long run relationship between variables. This section therefore queried the stability of the long run relationship and the direction of any causal linkages among variables in model 1 and 4. The error correction term (ECT) results show evidence of moving towards a long run equilibrium among variables in model 1 (Coefficient = -0.420439: t-Statistics = -7.216022) and model 4 (-1.223952: t-Statistics = -9.561894) if shocks are introduced in the short term. For model 1, if there is any short-run deviation (shock), a 42% speed of adjustment towards long-run equilibrium is expected while 122% is expected for model 4. These results therefore confirm existence of long run stable relationships among variables in model 1 and 4 capable of leading to possible causal relationships.

Table 3. ECM-based multivariate Granger-causality test results

Dependent variable	F – statistics [probability]				ECT $_{t-1}$
	ΔGDP_t	ΔTOR_t	ΔFDI_t	ΔEXP_t	[t-statistics]
Model 1:					
ΔGDP_t	-	3.80319* [0.0646]	3.60543* [0.0714]	5.89488** [0.0243]	-0.420439*** [-7.216022]
Model 2:					
ΔTOR_t	0.52336 [0.4774]	-	0.02216 [0.8831]	1.72783 [0.2029]	-
Model 3:					
ΔFDI_t	0.03053 [0.8630]	0.00693 [0.9344]	-	0.17456 [0.6803]	-
Model 4:					
ΔEXP_t	0.82898 [0.3729]	0.17565 [0.6794]	3.16308* [0.0898]	-	-1.225914*** [-9.561894]
Long run Decisions	**Model 1**: Unidirectional Causation GDP → TOR (GDP Granger-cause TOR) GDP → FDI (GDP Granger-cause FDI) GDP → EXP (GDP Granger-cause EXP) **Model 4**: Unidirectional Causation EXP → FDI (EXP Granger-cause FDI)				Significance level 10% 10% 5% 10%

*Note: *, ** and *** denote statistical significance at 10%, 5% and 1% levels, respectively*

4.4.1. GDP → TOR (GDP Granger-cause TOR)

Causal linkages results show Granger-causality between GDP and tourism (3.80319: p-value = 0.0646) for model 1. The confirmed causal linkage runs from GDP to tourism (GDP → TOR). Thus far, a long run unidirectional Granger-causality was confirmed between GDP and TOR lending support to the growth-led tourism hypothesis. These findings show that, in the Republic of Madagascar, the conventional hypothesis of tourism-led growth did not hold for the period under investigation (1995 – 2019), but rather, the growth-led tourism hypothesis holds. This therefore means, the Republic of Madagascar should channel more of its resources and investment on economic development (economic development leading sectors – services and agriculture subsectors) than the travel and tourism sector.

Previous studies argue that a country's economic growth (physical infrastructure, governance structures, human capital, political stability and economic policies) creates a supportive environment that attracts and connects tourists to the services and natural resources of a country which then propels tourism growth (Oh, 2005; Payne and Mervar, 2010). These results are consistent with conclusions inferred by Ahiawodzi, (2013) from Ghana, Bouzahzah and Menyari, (2013) from Morocco and Tunisia, Phiri, (2016) and Muzekenyi et al. (2018) from South Africa. These studies argued that economic growth improves a country's physical infrastructure necessary for connecting tourists to services and natural resources tourists may be looking for in a country.

For the Republic of Madagascar, the services and agriculture sectors can be prioritized to trigger infrastructure development given their high historical contributions to the GDP. Such infrastructure developments supported by good governance, political and economic stability attracts and connects tourists to the unique natural resources of the country and various services (business, religion etc) thereby propelling the tourism sector. The following unidirectional causal relationships were also confirmed; GDP → FDI (GDP Granger-cause FDI), GDP → EXP (GDP Granger-cause EXP) and EXP → FDI (EXP Granger-cause FDI). These findings show that improvement in economic growth (GDP) propels exports, and foreign direct investment in the Republic of Madagascar, while growth in exports also promotes foreign direct investments.

4.5. Residual diagnostics

With respect to model 1, no serial correlations were detected using the Breusch-Godfrey Serial Correlation LM Test (F-statistic: 1.165960: p-value: 0.2953). These results confirm that, there were no problems of omitted variables in the first model (Alaali, 2020). No heteroscedasticity was also detected in model 1 (F-statistic: 2.093533: p-value: 0.1135) using the Heteroskedasticity Test: Breusch-Pagan-Godfrey. The results confirm the ability of the first model to predict the dependent variable consistently across all values of the explanatory variables (Khaled et al., 2019).

4.6. Stability diagnostics

For the purposes of testing the stability of parameters estimated and structural breaks in the first model, CUSUM and CUSUMSQ tests were employed as summarized in Figure 3 and 4 for model 1. Strong evidence of model fit was confirmed (the blue lines do not transcend the red lines).

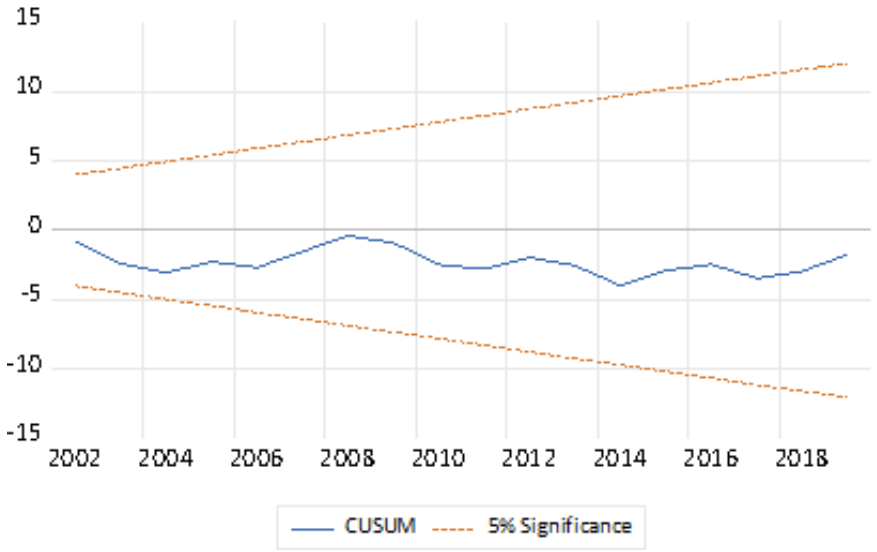

Figure 3. Plot of CUSUM, model 1.

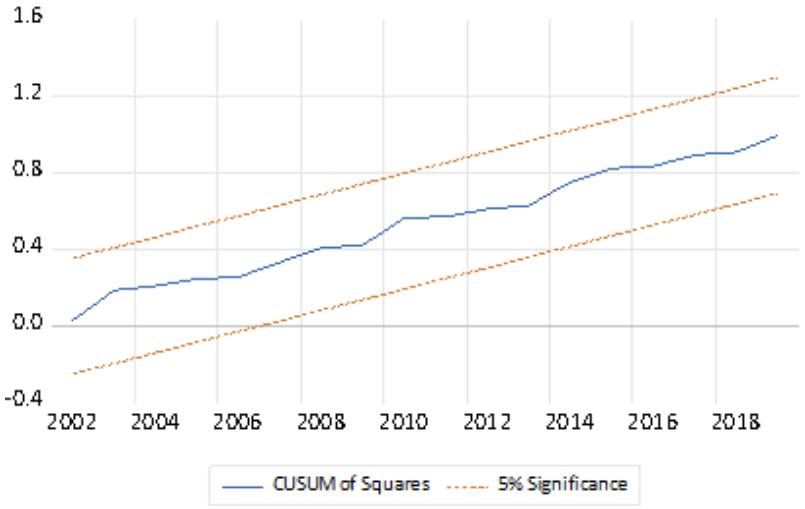

Figure 4. Plot of CUSUMQ, model 1.

These results provide strong evidence that the estimated first model is stable and valid to infer long run decisions (Kunwar, 2019). As a result, policy implications may be based on the results. Overall, residual and stability diagnostics results indicate that model 1 is stable and valid for the inference of results for long run decisions.

5. Conclusion and policy insights

The study investigated the causality between tourism and economic development in the Republic of Madagascar for the period of 1995 – 2019. Causality between tourism and economic development in the Republic of Madagascar for the period of 1995 to 2019. The study was motivated by the huge tourism potential of the "eighth continent" of the world – the Republic of Madagascar. This was against a background where the country has unique endemic wildlife (flora and fauna) and a rich biodiversity not found anywhere on this Earth. The island has therefore attracted international tourists, prompting several stakeholders to label its tourism industry as a strategic sector that propels economic development. Given that the relationship between tourism and economic growth is not obvious as suggested by literature, the study analyzed the causal linkages between the two variables to enhance evidence based strategic interventions. The Autoregressive Distributed Lag (ARDL) bound F-test for co-integration confirmed the presence of a significant stable long run relationship between tourism and economic growth for the period under consideration. The ECM-based Granger causality test result for tourism and economic growth revealed a unidirectional causation running from economic growth to tourism. These findings confirm the growth-led tourism hypothesis for the Republic of Madagascar, contrary to the conventional hypothesis of tourism-led growth more often touted by several stakeholders. The study concluded that more resources, investment and support should be allocated to economic growth leading sectors in the country (services and agriculture) to trigger growth in the tourism industry. The study therefore argues that the tourism sector of the Republic of Madagascar although unique and highly promising, it requires a supportive economic environment (good physical infrastructure, good governance structures, political stability and good economic policies) for the country to fully benefit from the sector. These findings are

however, limited to the period under investigation and specific to the Republic of Madagascar and largely based on the data from the World Bank's World Data Bank.

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No potential conflict of interest was reported by the authors.

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