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TOURISM AND ECONOMIC GROWTH NEXUS IN MALDIVES: ASYMMETRIC ANALYSIS AND ROLE OF ICT

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ABSTRACT

The relentless spread of the Covid-19 pandemic, which began in the first quarter of 2020, aided by the periodical emergence of new variants, is continuing to inflict unprecedented damages on the global economy. Interruptions in international travel have led to the collapse of the tourism-related service industry, which is the backbone of the economies of many small islands and developing states. This paper focuses on the Maldives, an island nation in the Indian Ocean, which is one of the top ten most tourism-dependent economies. Adopting the Solow production function, the paper examines the tourism and economic growth relationship using nonlinear autoregressive distributed lag (NARDL) methodology. The analysis shows that tourism earnings and economic growth have a significant asymmetric relationship. The result further reveals that the magnitude of the negative impact of the decline of a given size in tourism earnings on growth is of much larger magnitude than that of the positive impact of the same size rise in tourism earnings. The negative impact of tourism is found to be more pronounced in the long run. ICT spread, measured by the rise in mobile subscriptions, is positively associated with growth and has emerged as a significant contingent factor. We suggest policy measures to step up the recovery progress and growth.

Keywords: Tourism, economic growth, ICT, nonlinear ARDL, Covid-19, Maldives.

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1. INTRODUCTION

International tourism, which has been contributing to the economic growth of small island nations in the Caribbean, the South Pacific, and the Indian Ocean regions, has been hit hard by the current Covid-19 pandemic, since mid-2020. Pre-pandemic international tourism arrivals were at record levels in 2019 with 1.4 billion, having risen from 25 million in the pre-jet year of 1950, which are attributed to the use of information communication and technology (ICT)[1], hailed as the fourth industrial revolution for speeding up and making booking of travel and

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[1] The ICT has revolutionized tourism industry rendering booking for travel and accommodation and arrangement of tours much easier, more accessible, and less expensive than ever before.

accommodation by "a click of the mouse". Similarly, world tourism receipts from travel expenditure and stay in hotels and resorts rose from US$ 901 billion in 2009 to US$1,462 billion in 2018 at an annual average growth of 4.6 % (United Nations World Tourism Organization (UNWTO), 2019). Thus, tourism has raised job opportunities and improved livelihoods, notably in the informal sector. The small and medium enterprises are now meeting various interests of travelers, such as domestic tours to places of historical sites, handicrafts, and ethnic meals and products. These tourism activities are now more in the hands of part-time women entrepreneurs, which has been noted as a welcome phenomenon (UNWTO, 2019).

However, the ongoing uncontrolled spread of the Covid-19 pandemic aided by the emergence of new variants of the virus from time to time since the first quarter of 2021 and shortages of vaccines, have totally engulfed the globe, severely disrupting economic activities and trade in goods and services and tourism. The year-end review by Behusudi (2020) noted that in the first half of 2020, tourist arrivals decreased by more than 65%, compared to 8% during the global financial crisis and 17% amid the SARS epidemic of 2003. A subsequent recent review by World Tourism Organization shows that international tourist arrival has declined by 67% in 2020 due to the onslaught of Covid-19 pandemic (UNWTO, 2020).

The International Monetary Fund (IMF)'s October 2020 World Economic Outlook projected the global economy to contract by 4.4% in 2020, with the tourism-dependent economies faring much worse. The Caribbean countries were expected to experience a decline in growth by 12% while other Pacific Island countries would experience a much deeper fall in their GDP (International Monetary Fund (IMF), 2020). The United Nations Conference on Trade and Development (UNCTAD) has also cautioned that when other domestic sectors might recover, the Covid-19 would have a long-lasting effect on international tourism, because of fears of the likely continuance of the pandemic in the developed countries and the likelihood of restrictions for an extended period on international travel (UNCTAD, 2020). With a poor vaccination rate with much less than 100% coverage of the population in the developing countries, it looks that the complete global coverage would take time with a minimum of two doses followed by booster shots. Aware of these difficulties, it was estimated by UNWTO (2020) that earnings from tourism alone would fall to US$ 910 billion in 2020 from US$ 1.2 trillion recorded in 2019 and the recovery to levels of the pre-Covid-19 years is unlikely by 2023.

In the light of these developments, this paper takes up a study of the Maldives, an island nation, located in the Indian Ocean, which is one of the eight-member intergovernmental organizations, known as the South Asian Association of Regional Cooperation (SARRC). Comprising a string of atolls, coral reefs, and low-lying coral islands, Maldives heads the list of ten topmost tourism-dependent countries with 58% **o**f annual gross domestic product (GDP) coming from tourism. The forecast by UNCTAD (2020) was that the Maldives would experience a 17% decline in its GDP in 2020. The number of international tourist arrivals declined in 2020 by 67% from 1.7 million in 2019 to 0.6 million in 2020[2]. The Maldives is no stranger to shocks, whether external or domestic. External shocks stemmed from recessions in advanced countries, which are the main source of international tourists. The domestic shocks are due to periodical, political instability.

[2] As of April 2021, the available latest tourism statistics cover estimates of fall in international tourist arrivals and growth estimates. There are no official estimates of tourism arrivals and total foreign exchange earnings since then.

These setbacks, though often of short duration, do affect economic growth but the country often bounces back, once stability returns.

However, the recent jolt caused by the Covid 19 pandemic has substantial economic implications due to the heavy reliance of the country on tourism with lingering fears of new variants. Our objective is to empirically examine the tourism-economic growth relationship in the Maldives. In doing so, we account for any possible asymmetry to disentangle the nature of the relationship between the two key variables. In the economic literature, empirical studies are dominated by linear models, which assumed the absence of any asymmetry. To the best of knowledge of the authors, there is no quantitative study on tourism's impact on growth in the Maldives. The objective of paper is to fill the gap with an econometric study focusing on the asymmetric relationship between tourism and growth. The results of the study would provide more insights, especially into the Maldivian economy, which critically depends on tourism. We employ the nonlinear ARDL procedure (Shin et al., 2014) to examine this relationship. The asymmetric analysis a more comprehensive picture of the effect of tourism. In addition, different from previous studies, we look at the tourism-economic growth relationship in conjunction with ICT, as a contingent factor in the travel and tourism industry (Salem & Twining-Ward, 2018).

The paper is organized along the following lines. The next section looks at the tourism sector, the impact of Covid 19, and ICT trends in the Maldivian economy. The third section provides economic literature on tourism and economic growth. The fourth section outlines the theoretical framework, data, and methodology for empirical analysis. The fifth section presents the results of the empirical study and the last section provides a conclusion with policy implications.

2. TOURISM IN MALDIVES

The island nation, situated in the Indian Ocean's Arabian Sea and southwest of Sri Lanka and India has about 1,192 islands, out of which only around 188 are inhabited with a population of 492,600. Most of them are made up of atolls with no land fit for agriculture, the rest being coral reefs and low-lying coral islands. The capital city, Malé is situated on the most populous island with the same name, where nearly 40% of the country's population lives. Maldives, with about 90% of its territory covered by sea owes its growth over the last five decades to its service sector (Salem & Twining-Ward, 2018), dominated by tourism.

About 126 island resorts are located on atolls. With more territorial sea than land, the country's attractive marine and coral reefs have been playing an important part in determining the course of economic progress. The tourism industry is the main engine of the Maldivian economy, generating fiscal revenue from taxes on the tourist services sector and expenditure by tourists adding to the country's foreign reserves (World Bank, 2019). A steady inflow of tourists in the country averaged a growth rate of 7.2% per year from 2015 to 2019 and consequently, Maldives was ranked globally fourth in international tourist arrivals among the top ten tourism-dependent countries (UNWTO, 2019). In Asia and the Pacific, with tourism's share at 59% of GDP and 60% of total employment (Table 1), Maldives continues to be the most tourism-dependent country (World Bank, 2020c).

Available data series on tourism from 1995 reveal that international tourist arrivals steadily rose from 31,500 in 1995 to 61,700 in 2004. A political crisis caused instability in 2005 hurting the tourism industry, with tourist numbers decreasing to 39,500. However, there was a recovery over the next three years. In 2008, the tourist arrivals reached a new high at 656,000. With another bout of political instability in 2009, tourist numbers dipped again. Once the uncertainties disappeared in 2010, the tourism industry began to flourish. In 2018, the figure for international tourist arrivals stood at 1.5 million (UNWTO, 2019).

Table 1: International Tourism Expenditure: Contribution to GDP (%)

Country	Region	Percent of GDP	Rank
Maldives	Indian Ocean	57.9	1
Palau	Pacific	42.2	2
Vanuatu	Pacific	37.1	3
Fiji	Pacific	25.0	4
Samoa	Pacific	22.4	5
Cambodia	East Asia	19.7	6
Thailand	East Asia	12.9	7
Tonga	Pacific	10.9	8
Marshall Islands	Pacific	9.5	9
Federated States of Micronesia	Pacific	7.9	10

Source: Asian Development Bank (ADB) (2021).

The success of tourism is attributed to steadily rising foreign investment in the tourism industry, contributing to the development of hotel and resort infrastructure with the most sophisticated and modern facilities. The latter has made the Maldives one of the most attractive island countries attracting the rich, senior citizens from Europe and North America. Improvements in infrastructure, quality, and affordable public services with impressive health and education indicators (life expectancy at 77 years and a 100% literacy rate) have been pointed out as the significant factors behind the development success of Maldives (World Bank, 2019), with tourism as a major foreign exchange earner (Table 2).

Table 2: Maldives: Foreign Exchange Earnings in US$ billion (1995-2017)

	Overseas Development Assistance	Foreign Direct Investment	Remittances	Tourism Earnings
1995	0.058	7.230	0.002	0.211
	(15.324)	(1.812)	(0.592)	(52.884)
2000	0.019	22.260	0.002	0.321
	(3.222)	(3.573)	(0.351)	(51.415)
2005	0.077	73.230	0.002	0.826
	(6.761)	(4.555)	(0.194)	(71.001)
2010	0.112	216.469	0.003	1.713
	(4.904)	(8.363)	(0.122)	(66.186)
2011	0.054	423.500	0.003	1.966
	(2.189)	(15.266)	(0.108)	(70.863)
2012	0.057	228.000	0.003	2.032
	(2.170)	(7.898)	(0.109)	(70.405)
2013	0.022	360.816	0.003	2.422
	(0.740)	(10.950)	(0.100)	(73.505)

2014	0.023	333.375	0.003	2.811
	(0.674)	(9.016)	(0.093)	(76.027)
2015	0.027	297.976	0.004	2.691
	(0.710)	(7.251)	(0.088)	(65.484)
2016	0.027	456.639	0.004	2.640
	(0.664)	(10.345)	(0.086)	(59.809)
2017	0.042	492.742	0.004	2.886
	(0.938)	(10.127)	(0.082)	(59.315)

Source: World Bank (2019) and authors' calculations.
Notes: Figures in parenthesis are in percentage of GDP.

2.1. Support Factors

As Maldives is quite remote from its source markets, the role of ICT became critically important as early as the first decade of the New Millennium. The country was one of the early countries, which recognized the need for better ICT infrastructure, for connecting the atolls and promoting tourism, and sought international assistance for strengthening the ICT sector together with the development of the energy sector, which received considerable attention with large domestic investments as well as FDI inflows.

The Third Tourism Master Plan (TTMP) covering a five-year period (2007–11) recommended speeding up the adoption of electronic methods of doing business in tourism and related ancillary sectors supporting the tourism industry. Loan assistance from the ADB enabled Maldives in carrying out an ICT development project amounting to US$9.50 million[3], which was completed in late 2009 for the establishment of a network connecting the government, and its agencies in Malé and atolls, and for the installation of internet kiosks in Malé. The ICT Development Index (International Telecommunication Union, 2017) based on ten indicators comparing it across the countries over the last ten years places Maldives way ahead of the other SAARC countries (Table 3).

Acknowledging the role of ICT in tourism development as immense, as it helped to overcome the hurdles posed by distance from source markets in regard to flight booking and purchase of air tickets, and booking for accommodation, and tours, thereby reducing the traveling cost for air travelers to a substantial extent, World Bank (2021a) describes ICT as the game-changer. It is also visualized that ICT would play a significant role in other sectors in the future (World Bank, 2021a).

Table 3: ICT Indicators for SAARC Member Countries for 2017

SAARC member countries	Mobile cellular subs per 100 inhabitant	Percent of individual using internet	ICT Index
Afghanistan	66	10.6	1.95
Bangladesh	77.88	18.25	2.53
Bhutan	88.78	41.77	3.69
India	86.95	29.55	3.03
Maldives	222.99	59.09	5.25

[3] The project completed a network via fiber optic cable linking government agencies in Malé and outer islands. Following which, various applications of electronic delivery of public services have been developed including a framework for E-government services and storage hosted within the data center at the National Center for Information Technology.

Nepal	111.7	19.69	2.88
Pakistan	71.39	15.51	2.42
Sri Lanka	118.49	32.05	3.91

Source: International Telecommunication Union (2017).

2.2. Covid-19 Impact on the Economy

While the global economy contracted by 3.5% in 2020, the Maldivian economy shrunk by 33% in the first nine months of 2020. The reason behind this is the dominance of the tourism sector, whose contribution to GDP and domestic employment is 58.6% and 59.6% respectively. Only 555,494 tourists visited Maldives in 2020 –the lowest number since 2002, at 67% lower than the 2019 record high of 1.7 million tourists (World Bank, 2021b)

As domestic cases of Covid-19 infection began to rise, Maldives closed its borders. From end-March to mid-July 2020, the economy stood still (World Bank, 2020a). By late July 2020 things appeared to have eased, the country allowed tourists who were screened and cleared at both points of origin and entry. One atoll-one resort policy also helped the health authorities as the resorts served as quarantine centers for those who were suspected of infection, as the resort workers were vaccinated earlier in advance to receive the arrivals. By these measures, tourism was revived. World Bank's latest assessment is that Maldives contracted by 28% in 2020. However, the decline is much more than 13.1%, which was the recorded rate of decline in 2005 following the Indian Ocean tsunami in 2004 (World Bank, 2020b)

As tourist arrivals rose to 100,000 in January and February 2021, though still 42% below pre-pandemic levels, it was estimated by World Bank (2021a) that Maldives would grow by 17% in 2021 and 11.5% in 2022. However, the optimism was a short-lived one. New variants of the pandemic emerged in Europe and India in late March 2021, destroying hopes of any speedy recovery in source markets. Maldives had to impose travel restrictions once again, by putting an end to staying in resorts, except those stand-alone resorts on atolls with no population except the resort workers. As world shortages in vaccines developed, initial gifts of the Indian manufactured vaccine were found inadequate. Maldives had to obtain vaccines from World Health Organization under a special procedure. In the limited period of restrictions, Maldives stepped up the vaccination program[4]. As of the end of April 2021, the country (with a population of 540,000) has reached the vaccination rate of 84 per 100 people.

2.3. Macroeconomic Indicators

With the drop in tourism, not only did foreign exchange receipts fall from $752 million in December 2019 to $ 570 million in 2020, but government revenues also plummeted. Although non-priority expenditures were reduced, total expenditures in 2020 were only 4.5% lower than in 2019, because of the rise in public spending on health, social and economic relief measures. As a result, the fiscal deficit reached 20% of the estimated GDP. The large public and external financing gaps were mostly met by support from bilateral donors, with India playing a major role and international financial institutions. Claims on the central government increased due to a

[4] Total numbers infected were 47, 431 and recovered were 29,086 with deaths at 1050. Total number of doses were 451, 601 (Trading Economics, 2021).

larger quantum of issuance of T-bills and T-bonds to the State Bank of India as part of India's financial assistance of $250 million.

Maldives monetized the deficit, obtaining $ 262 million through short-term advances from the Maldives Monetary Authority (MMA) in July 2020. Total public and publicly guaranteed debt rose from $4.4 billion or 78.4% of GDP in 2019 to USD 5.6 billion or 139.3% of estimated GDP in 2020. With the sharp decline in travel receipts, shortages of US dollars led the parallel market rate to widen. The MMA activated a $ 400 million swap agreement with the Reserve Bank of India to reduce pressures on the exchange rate (World Bank, 2021a). Table 4 with key macroeconomic indicators including foreign exchange reserves illustrates the grave situation faced by Maldives.

Table 4: Maldives Key Macroeconomic Indicators

Indicator	2019	2020 (estimate)	2021 (forecast)
Growth rate (%)	7	-28	17.1
Inflation (%)	0.2	-1.4	2.5
Fiscal Balance (% of GDP)	-6.6	-20.1	-1.85
Current Account Balance (% of GDP)	26.8	-26.3	-27.1
Debt (**%** of GDP)	78.4	139.3	135.2
Foreign Res($ mill)	762.4	569.6	NA

Source: World Bank (2021a) and ADB (2021).

3. LITERATURE REVIEW[5]

The tourism activities and economic growth literature date back to 1997, largely to the pioneering study by Sheldon (1997). Since then, substantial research literature on tourism activities and growth nexus has emerged. The subject was examined mostly using two settings. One is a country-specific setting, and the other is a panel and cross-country setting. Some of the examples of country-specific studies on tourism and growth are Durbarry (2004) for Mauritius; Nowak et al. (2007) for Spain; Kumar (2014) for Kenya; Ishikawa and Fukushige (2007) for Japan; Katircioglu (2009) for the Turkish; Dritsakis (2004) for Greece. Examples of panel studies include Wu et al. (2018); Holzner (2010); Kumar and Kumar (2013); Lee and Chang (2008); Narayan et al. (2010); Roque and Raposo (2016) and Seetanah (2011).

Empirical investigations have confirmed the positive impact of tourism activities on economic growth. However, the outcomes of the causality direction test varied among these studies. This could be due to different proxies of variables, datasets, and analysis techniques. Further, other factors such as differences in cultural traditions, political situation, and economic policies could be the reason for such results (Ozturk, 2010). Table 5 presents a summary of well-known studies on tourism and economic growth.

[5] This section heavily draws upon Jayaraman and Makun (2020, 2022).

Table 5: Tourism - Growth Literature Review: A Summary

Author	Period	Country	Frequency	Variables	Methodology	Causality	Effect
Balaguer and Cantavella-Jorda (2002)	1975-1998	Spain	Quarterly	Tourist earnings, exchange rate	VECM	T→GDP	+
Durbarry (2004)	1952-1999	Mauritius	Annual	Tourism earnings, capital stock, human capital, labor	VECM	T↔GDP	+
Cortez-Jimenez and Paulina (2006)	1954-2000	Italy	Annual	Tourist earnings, capital stock, human capital	VECM	T↔GDP	+
Kim et al. (2006)	1971-2003	Taiwan	Quarterly and Annual	Tourist earnings	VECM	T↔GDP	+
Lee and Chang (2008)	1990-2002	OECD	Annual	Tourist earnings	Panel	T→GDP	+
Narayan et al. (2010)	1988-2004	PICs	Annual	Tourist earnings	Panel FMOLS	T→GDP	+
Seetanah (2011)	1990-2007	Panel of Islands (19)	Annual	Tourist earnings	GMM	T↔GDP	+
Tang and Tan (2015)	1975-2011	Malaysia	Annual	Tourist earnings, political stability	VECM	T→GDP	+
Stauvermann et al. (2018)	1980-2014	Sri-Lanka	Annual	Tourist earnings, capital stock, exchange rate, labor	ARDL	T→GDP	+

Notes: GDP - Gross Domestic Product. ARDL - Autoregressive Distributed Lag approach. na refers to not applicable. T→GDP - causality relationship from tourism to GDP. T↔GDP - the bidirectional relationship amid tourism and GDP. PICs - Pacific Island Countries. + is a positive effect of tourism on GDP.

4. THEORETICAL FRAMEWORK

We adopt the neoclassical growth model of Solow (1956) augmented by tourism and ICT and apply the dynamic ARDL bounds test technique designed by Pesaran et al. (2001). The bounds test within the ARDL framework has been widely employed in recent years to investigate long-run relations amongst time series factors with reliable econometric tests. This methodology is also robust and efficient with minor sample observations (Ishida, 2015). Further, an extended tourism-growth model that accounts for the asymmetric effect of tourism by a nonlinear ARDL (NARDL) is also introduced.

The Solow (1956) framework, which is along the lines of the Cobb-Douglas function, takes into consideration of Hicks-neutral technological development, the real GDP per-capita (y_t) equation is expressed as:

$$y_t = A_t k_t^{\alpha}, \qquad 0 < \alpha < 1 \tag{1}$$

Where y_t is real GDP per capita; A_t is technology stock; k_t is capita stock per capita; α is the capital share. Accordingly, technological progress is represented by:

$$A_t = A_0 e^{gt} \tag{2}$$

where A_t is the cumulative technology in period *t*, A_0 is the initial stock of technology, *t* is time and *g* is the exogenous progress of technology. The pace of technical progress determines the output growth, which is exogenous in the model. Thus, it is possible to include other growth-enhancing variables. Besides capital stock, we introduce the variables representing tourism and mobile cellular subscription - a proxy for ICT into the aggregate technology function. Consequently, it is possible to adopt the following:

$$A_t = f(TE_t, MOB_t) \tag{3}$$

Here, *TE* is tourism earnings as a share of GDP and *MOB* is mobile subscription per 100 inhabitants. The aforesaid variables are shift factors, with capital stock as the fundamental factor determining per-capita output. Hence, the initial Cobb-Douglas function is amended as:

$$y_t = A_0 e^{\alpha_1 TE_t + \alpha_2 MOB_t} k_t^{\alpha_3} \tag{4}$$

For econometric estimation purposes, we employ the model in the natural log (*l*) form. The logarithmic model has two advantages. First, the process of utilizing the variables in log form reduces various errors including those arising from high standard error. Secondly, the magnitudes of the coefficients indicate the elasticity of the variables. The stochastic model in its logarithmic form for estimation purposes is expressed as:

$$ly_t = \alpha_0 + \alpha_1 lk_t + \alpha_2 lTE_t + \alpha_3 lMOB_t + \varepsilon_t \quad (5)$$

Based on this specification, we test the following hypotheses: (i) the fundamental variable, namely, real capital per capita stock (*lk*) is positively associated with real output per capita (*ly*); and (ii) the other explanatory variables, tourism earnings (*lTE*) and mobile subscription (*lMOB*) are directly related with *ly*.

4.1. Data

The data series for the Maldives, covering a period of 1995 to 2019 employed in the study, are drawn from various sources. Data series of real GDP per capita in constant US$ (2010), tourism earnings expressed as a percent of GDP, and mobile subscriptions represented by a number per 100 inhabitants are sourced from *World Development Indicators* (WDI). The data series on capital stock per capita in constant US$ (2010), which are available only up to 2019, is obtained from Penn World Tables. We use quarterly observations (96) obtained by resorting to the cubic spline procedure.[6]

The summary statistics and correlation analysis in levels are shown in Panel A and B of Table 6, respectively. Panel A shows the maximum values, mean, and variance of the variables. Regarding correlation, it is seen the capital stock per capita *(k)* is directly correlated at 0.97 and remarkably has a greater correlation with GDP per capita *(y)*. Tourism earnings (*TE*) and ICT indicator (*MOB*) are also seen positively associated with per capita GDP (*y*) at 0.52 and 0.95 respectively.

Table 6: Summary Statistics of the Variables

Panel A: Descriptive measures				
	y	*k*	*TE*	*MOB*
Mean	6633.38	22926.88	60.32	81.69
Median	6736.81	21036.26	61.23	82.8
Maximum	8971.13	41946.7	81.09	206.29
Minimum	4600.67	8727.15	37.57	0.01
Std. Dev.	1159.8	10695.57	12.74	70.7
Skewness	0.14	0.25	-0.42	0.14
Kurtosis	1.92	1.59	2.18	1.46
Jarque-Bera	4.61	8.31	5.11	9.13
Probability	0.1	0.09	0.08	0.11
Panel B: Correlation matrix				
	y	*k*	*TE*	*MOB*
y	1			
k	0.972	1		
TE	0.525	0.59	1	
MOB	0.959	0.994	0.64	1

Source: Authors' calculations. Note: *y* is per capita RGDP. *k* is per capita real capital stock. *TE* is tourism earnings, as a percent of GDP. *MOB* is a mobile cellular subscription per 100 persons, a proxy for ICT. *TE*MOB* is the interaction of ICT and tourism.

[6] The cubic spline interpolation procedure, which was noted to be a robust technique of transforming annual data to quarterly series (Ajao et al., 2012), has been extensively used in the quantitative analysis.

4.2. Methodology and Estimation Procedure

We employ the bounds test procedure of Pesaran et al. (2001), within Autoregressive Distributed Lag (ARDL) context, which has some technical advantages. It allows for conducting cointegration tests even when variables are of mixed order of integration, that is, I(0) or I(1) (Pesaran et al., 1999). It is also considered more suitable than other multivariate approaches if the sample observation is small (Narayan, 2005). The ARDL estimates are also found to be consistent (Pesaran & Shin, 1999). The following unrestricted model based on the ARDL framework is used to examine the existence of cointegration:

$$\Delta ly_t = \alpha_0 + \alpha_1 ly_{t-1} + \alpha_2 lk_{t-1} + \alpha_3 lTE_{t-1} + \alpha_4 lMOB_{t-1} + \sum_{i=1}^{n} \beta_1 \Delta ly_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta lk_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta lTE_{t-i} + \sum_{i=0}^{n} \beta_4 \Delta lMOB_{t-i} + \varepsilon_t \quad (6)$$

Here, Δ is the difference factor and denotes the short-run impacts. Specifically, two steps are required in this method. First, Equation (6) is regressed using the OLS method. Second, the confirmation of cointegration is determined by imposing constraints on the coefficients of the lagged level variables. The null hypothesis is that there is no cointegration ($H_0 : \beta_{i1} = \beta_{i2} = \beta_{i3} = \beta_{i4} = \beta_{i5} = 0$) and the alternative hypothesis is that there is cointegration between the variables ($H_1 : \beta_{i1} \neq \beta_{i2} \neq \beta_{i3} \neq \beta_{i4} \neq \beta_{i5} \neq 0$). To test the null hypothesis, the estimated F-statistics from coefficient restrictions are compared with critical values. According to Narayan (2005), the critical values of Pesaran et al. (2001) are for larger sample studies and cannot be applied to small samples. Consequently, he tabulated critical values based on a small sample study. Therefore, we employ Narayan's (2005) critical values. The null hypothesis is dismissed when F-statistic is greater than the critical value at a given level of significance and if it is less than, the null hypothesis is not rejected.

Next, the long-run elasticity estimates of *y* with respect to each of the included variables are estimated using the ARDL model. The presence of cointegration requires an error correction model (ECM) to account for the short-run effect of ICT and tourism and to test the strength of the long-run estimates in Equation (6). The ECM is stated in Equation (7) as:

$$\Delta ly_t = \alpha_0 + \sum_{i=1}^{n} \beta_1 \Delta ly_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta lk_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta lTE_{t-i} + \sum_{i=0}^{n} \beta_4 \Delta lMOB_{t-i} + \lambda ECM_{t-1} + \varepsilon_t \quad (7)$$

In Equation (7), λ is a coefficient of the ECM_{t-1} and is expected to have a negative sign, reflecting the convergence process in the model.

4.2.1. Asymmetric model

The asymmetric estimation is the nonlinear extension of Pesaran et al.'s (2001) ARDL linear model, which is a single long-run cointegration and short-run dynamic process. In the nonlinear

ARDL, we resort to Equation (6) following Shin et al. (2014). Under this scenario, positive and negative shocks of tourism are examined and their impacts on GDP are not expected to be the same. The asymmetric version of Equation (6) is presented as below:

$$\Delta ly_t = \alpha_0 + \alpha_1 ly_{t-1} + \alpha_2 lk_{t-1} + \alpha_3 lMOB_{t-1} + \alpha_4^+ lTE_t^+ + \alpha_4^- lTE_t^- + \sum_{i=1}^{n} \beta_1 \Delta ly_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta lk_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta lMOB_{t-i} + \sum_{i=0}^{n} \beta_4^+ \Delta lTE_{t-i}^+ + \sum_{i=0}^{n} \beta_4^- \Delta lTE_{t-i}^- + \varepsilon_t \quad (8)$$

Where lTE_t^+ and lTE_t^- are the tourism's partial sum decomposition in a positive and negative effect, respectively, and computed as $lTE_t^+ = \sum_{t=1}^{n} \Delta lTE_t^+ = \sum_{t=1}^{n} \max(\Delta lTE_{t,} 0)$ and $lTE_t^- = \sum_{t=1}^{n} \Delta lTE_t^- = \sum_{t=1}^{n} \min(\Delta lTE_{t,} 0)$. Where $lTE_t = lTE_0 + lTE_t^+ + lTE_t^-$. The elasticity coefficient of lTE_t^+ and lTE_t^- is computed as: $\eta^+ = -\frac{\alpha_4^+}{\alpha_1}$ and $\eta^- = -\frac{\alpha_4^-}{\alpha_1}$.

The error correction representation of Equation (8) yields the following:

$$\Delta ly_t = \alpha_0 + \sum_{i=1}^{n} \beta_1 \Delta ly_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta lk_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta lMOB_{t-i} + \sum_{i=0}^{n} \beta_4^+ \Delta lTE_{t-i}^+ + \sum_{i=0}^{n} \beta_4^- \Delta lTE_{t-i}^- + \sum_{i=0}^{n} \beta_5 \Delta lTE * MOB_{t-i} + \gamma ECM_{t-1} + \varepsilon_t \quad (9)$$

The error correction term (γECM_{t-1}) estimates the equilibrium asymmetric relationship in the specified model and the associated parameter (γ) captures the adjustment speed after shock. The short-run positive and negative changes in tourism are captured by β_4^+ and β_4^- respectively. To test for the asymmetry, the Wald test is applied. The null hypothesis ($H_{null} : \eta^+ = \eta^-$) for long-run symmetry is tested against the alternative hypothesis ($H_{alt} : \eta^+ \neq \eta^-$). Similarly, the short-run symmetry of remittances is tested by evaluating the null hypothesis ($\sum_{i=0}^{n} \beta_4^+ = \sum_{i=0}^{n} \beta_4^-$).

5. RESULTS AND DISCUSSION

Before undertaking the econometric exercise, we conducted unit toot tests to determine the order of integration. Results show all variables are stationary in differences, except MOB which was already stationary in level. Thus the maximum order of integration is one, which confirms the appropriateness of the NARDL cointegration procedure.

Table 7: Unit root test result

Variables	ADF T_{stat}	
	In Level	In the first Diff.
ly	-0.642 (0.854)	-5.766 (0.000)*
lk	-1.261 (0.644)	-5.312 (0.000)*
lTE	-2.318 (0.168)	-3.369 (0.014)**
lMOB	-5.898 (0.000)	-2.951 (0.043)**

Notes: Critical values for the ADF test are based on Mackinnon (1996). The length lag is based on Akaike Information Criterion (AIC). The null hypothesis is that a series has a unit root (non-stationary). *, ** and *** indicate 1%, 5%, and 10% level of significance.

Results of the bounds test for the nonlinear model are provided in Table 8. The estimated F-statistics is 6.24 for Equation (7). It is more than the critical value at one percent, confirming that there is a long-run nonlinear association. Similar specifications are tested with different dependent variables however, none of the equations emerged with significant F-statistics. Thus, it is confirmed that there is only one nonlinear cointegration equation, with ly as the dependent variable.

Table 8: Bound F-test Results for Cointegration

Dependent series	Estimated F-statistics	
ly	6.24	
lk	1.04	
lTE(+)	3.16	
lTE(-)	2.76	
lMOB	1.98	
	Critical Value [a]	
Significance level	Lower limit	Upper limit
1%	4.483	6.320
5 %	3.120	4.560

Notes: [a] Narayan (2005) critical bounds values from Case D: restricted intercept, and no trend.

In the nonlinear analysis, which seeks to investigate the existence of the asymmetric relationship, the impact of tourism on economic growth is disaggregated by positive and negative partial sum decomposition. The results reported in Table 9 confirm the existence of the asymmetric effect of tourism earnings on economic growth.

Table 9: Asymmetric Test

Null hypothesis	Long run	Short-run
Symmetric effect of tourism earnings on real per capita GDP	= 4.26 (0.000)*	$X^2(1)$ = 5.83 (0.001)*

Note: * is statistical significance at 1% level.

Following the asymmetric test, we estimate the long-run and short-run nonlinear model and trace out the impact of tourism on economic growth. Table 10 reports the findings of this analysis. In the long run, the capital stock and output per capita are positively related. On average, the share of capital stock is 0.33, which is in line with stylized values for developing countries (Rao et al., 2010). This finding is supplemented by our initial result in Table 6 where the capital stock has a significant positive correlation with output. Maldives as an emerging economy has also experienced an increase in capital stock over time.

Tourism earnings (both negative and positive decomposition) emerged with a positive sign and is statistically significant in the long run and short run. The estimates reveal that an increase in tourism earnings (positive partial sum decomposition) by one percent, in the long run, causes about 0.46% growth in per capita real GDP. A decrease in tourism earnings (negative partial sum decomposition) by one percent leads to a decline in the per capita real GDP by about 0.54%. The findings indicate that a decrease in tourism earnings by one percent has a larger negative impact on economic growth when compared to a positive outcome of an increase by the same size in tourism earnings. Similarly, in the short run, a one percent increase in tourism earnings increases per capita GDP by 0.11%, and a one percent decline in tourism earnings will reduce income by a much larger extent, about 0.33%. The negative impact of tourism is much more pronounced both in the long run and in the short run.

The impact effect of ICT measured by mobile subscription (*MOB*) is positive and statistically significant both in the short run and long run. The estimated coefficient of 0.01 in long run and 0.02 in the short run implies that a one percent increase in ICT leads to less than one percent increase in economic growth, respectively. The significant positive effect confirms the vital role of ICT in the tourism and economic growth process. This finding is consistent with the World Bank's (2021b) observation that ICT is a game-changer for tourism and travel. Finally, the cointegrating equation (ECM_{t-1}) which shows the speed of adjustment to stability after shock is quite slow. It is estimated that there is about 43% convergence in the first period implying recovery to long-run equilibrium would take about two years.

Table 10: Asymmetric Long Run and Short-Run Estimates

Long Run Estimates		**Short Run Estimates**		**Model Diagnostics**	
Variables	**Coefficient**	**Variables**	**Coefficient**	**Test**	**Statistics**
lk	0.335*** (0.059)	Δ*lk*	0.069** (0.032)	*DW*	2.08
lTE(+)	0.457** (0.011)	Δ*lTE(+)*	0.111* (0.002)	*R-square*	0.69
lTE(-)	0.536* (0.004)	Δ*lTE(-)*	0.329* (0.000)	*R-bar-sq*	0.654
lMOB	0.012* (0.000)	Δ*lMOB*	0.002** (0.004)	*SC*	0.420 (0.518)
Constant	4.096* (0.000)	*Constant*	3.535* (0.000)	*NORM*	0.800 (0.374)
Trend	0.004* (0.000)	*Trend*	0.002* (0.005)	*FF*	0.479 (0.489)
		ECM_{t-1}	-0.431* (0.000)	*HET*	0.811 (0.368)

Notes: Values in brackets are probability values. The lag length based on Schwartz Information Criterion is set to one. * and ** designates 1% and 5% levels of statistical significance. DW is Durbin Watson statistics to account for autocorrelation. SC is a test for serial correlation, NORM is a normality test, FF is to test the functional form and HET is a test for heteroscedasticity.

The model diagnostic tests show that the results of the cointegration and error-correcting model are reliable. We take into consideration the following: (i) Lagrange multiplier test of serial correlation (X^2sc); (ii) Ramsey's RESET test for correct functional form (X^2ff) using square of the fitted values; (iii) Jarque-Bera's normality (X^2NORM) test; and (iv) test for heteroscedasticity (X^2HET) using the regression of squared residuals on squared fitted values. The findings of the aforementioned tests are reported in Table 8. It indicates that the specified model does not suffer from any classical econometric issue for the reasons that the null hypotheses that (i) there is no serial correlation, (ii) sample is normally distributed, (iii) the functional form is correct and (iv) the presence of homoscedasticity cannot be rejected. Further, the parameter stability is confirmed by the cumulative sum of recursive squares (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMQ) in Figure 1 and 2. Therefore, results of the NARDL bounds test, long-run elasticity estimates and ECM are reasonably reliable.

Figure 1: CUSUM

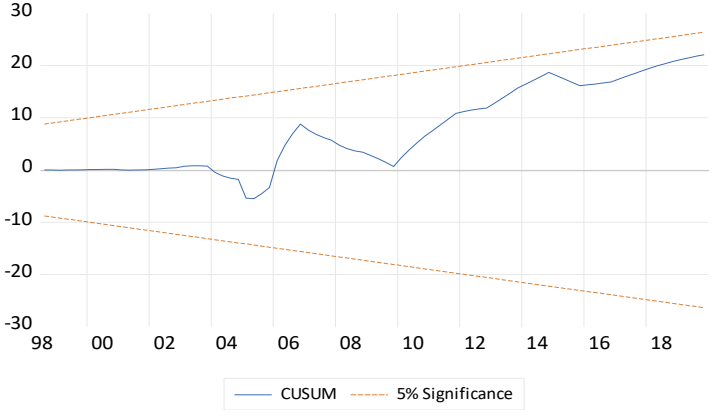
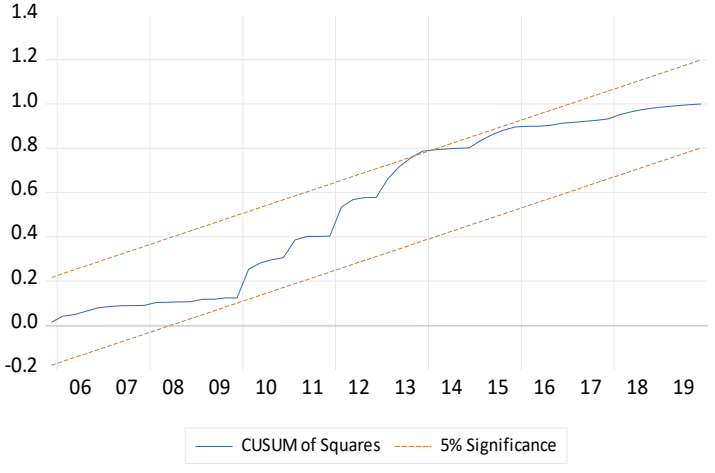


Figure 2: CUSUMQ



6. CONCLUSION

In this paper, we investigated Maldives' tourism and economic growth nexus in an augmented Solow production functional model. Employing a non-linear ARDL model, we find the existence of an asymmetric relationship between tourism earnings and economic growth. The results reveal that while the positive partial sum decomposition of tourism earnings increases economic growth, negative partial sum decomposition of the same size in tourism earnings reduces economic growth to a larger extent, both in the long run and short. Further, it is found that ICT has a significant, positive effect on economic growth.

From a policy perspective, the adverse asymmetric impact of tourism needs to be minimized with the appropriate response. Given the severe extent of the decline in international tourism from the overseas source markets, expansion of domestic and intra-regional tourism can be encouraged. The domestic tourism of Maldives, as a percentage of spending on total travel, is presently small. On the other hand, the number of intra-regional trips by destination to the Maldives as a percent of total trips within the SAARC region is much higher, most of which are from India and Sri Lanka. Promotion of intra-regional tourism within SAARC offers greater scope in the short-run, as the resumption of international travel from outside the region to Maldives would take a long time as travelers' confidence level has to be restored. The intra-regional travel mobilization efforts could include air travel bubble agreements between countries within the SARRC region, and they can be bilaterally and multilaterally be negotiated.

In the recovery phase, Maldives may consider special efforts such as waiving visa requirements and offering attractive discounts on travel fares and accommodation charges to attract Indian and other regional Sri Lankan tourists. Middle-class families from India have been reported to be spending more on international travel. Also, Indian movie producers, who prefer exotic, scenic beauty and sandy beaches for shooting their movies, can now be targeted by Maldives. Confidence of tourists can be built further by improved sanitary and hygienic conditions and strict enforcement of Covid-19 protocols. The recent fast track package of US$7.3 million to Maldives by the World Bank is specifically directed toward strengthening its public health preparedness.

Just as there are downsides of Covid-19 impact in terms of loss of lives and livelihoods, there are upsides, which would give confidence to policymakers towards strengthening efforts for economic diversification and reducing dependency on tourism alone. As the World Bank (2021b) has characterized ICT's role in tourism in Maldives as "A Digital Dawn", the pandemic has brought to light the hidden potential during the lockdowns in several spheres, including payment systems, telehealth, online hygiene education, and many other digital applications. Given the high degree of broadband and mobile internet penetration in the country compared to other countries in South Asia, there is great scope for improvements in many areas of economic development, especially in small and medium enterprises, manufacturing consumer goods and their supplies for domestic consumption, delivering health and education services across the small, dispersed islands for more balanced development. More importantly, other sectors such as fisheries and marine products development which have export potential can now be taken up more seriously in collaboration with foreign commercial interests, who are specialized in these spheres.

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