Asymmetric Analysis of Tourism and Economic Growth in South Asian Countries: Lessons for Policymakers towards Mitigating the Adverse Effects of Covid-19

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Abstract:

Since the first quarter of 2020, due to the spread of the Covid-19 pandemic, which is continuing unabated with the periodical emergence of new variants, international tourism has become one of the most affected sources of external earnings for developing countries. For the South Asian countries, the crisis was predicted to result in a 42% to 60% drop in tourist arrivals in 2020 and 2021. Tourism has been providing a great impetus to the growth of the informal sector supported by information and communication technology and the participation of women, both full-time and part-time in several small and mini-enterprises. This panel study employing a nonlinear econometric methodology confirms the existence of an asymmetric association between tourism and economic growth for six South Asian countries for the period 1995 to 2018 for which data series are complete and officially available. While the positive partial-sum decomposition of tourism increased economic growth, the negative-sum decomposition of tourism had a much greater adverse effect on economic growth. There are some relevant conclusions with policy implications in the context of continuing uncertainties.

Keywords: tourism; economic growth; Covid-19; nonlinear panel ARDL; South Asia.

JEL Classification: O11; Z32.

Introduction

The rapid spread of the Covid-19 pandemic, which began in the first quarter of 2020 and engulfed the world by mid-2020, is continuing uncontrolled with the periodical emergence of newer mutations and variants. Both the developed and developing countries have been struggling to contain the onslaught of the virus which resulted in substantial loss of lives and livelihoods. After nine months of research in 2020, well-known international pharmaceutical companies came up with vaccines, which were introduced towards the end of 2020 by advanced countries in the United States of America (US) and Europe. However, the tasks of logistics involved in storage and delivery in time to the needed locations and ensuring access to all countries, especially in developing countries, in two minimum doses are still found enormous.

The International Monetary (IMF) Fund in its *World Economic Outlook* (WEO) of October 2020 (IMF 2020) cautioned that a return to normalcy would be "a long ascent back to pre-pandemic levels of activity". A review of Covid-19 impact on international tourism undertaken by the World Tourism Organization (UNWTO 2020) reported that international tourist arrivals declined by 67% in 2020. The year-end review in December 2020 by an IMF staff researcher (Behsudi 2020) pointed out the decline in international travel was much less than 8% during the global financial crisis in the first decade of the New Millennium and 17% during the SARS epidemic of 2003. The IMF's WEO (2021) reported that the Covid-19 pandemic reduced the per capita income by 6.3% in developing countries compared to 2.8% in advanced economies. It was also feared that the tourism-dependent economies would fare 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[1].

[1] The Pacific as a region contracted by 5.8% in 2020 due to Covid-19 pandemic.

The just-released IMF's WEO 2022 has grim news: although the world economic growth rate climbed out of the dismal performance with a negative rate of growth, -3.1%, in 2020 to a record 6.1% growth rate in 2021 with hopes for a recovery toward pre-Covid-19 pandemic level output, the Russian-Ukraine war which began in late February 2022 and still continuing, has introduced new uncertainties with supply-demand chain disruptions in petroleum crude and its refined products as well as food grains. These unexpected events have already caused worldwide inflationary conditions. The expected world growth rates for 2022 and 2023 are now predicted to be much lower, both at 3.6%. As for the developing countries, the corresponding growth rates for 2020, 2021, 2022, and 2023 are expected to be 1.7%, 7.3%, 5.4%, and 5.6%, respectively (IMF WEO 2022).

In South Asia, which is the focus of this article, the effects of domestic supply and demand shocks emanating from the Covid-19 pandemic have been severe. They resulted from a fall in domestic employment due to declining demand for manufactured consumer goods and agricultural products including vegetables and fruits as well as a stoppage of construction activities. Further, they contributed to a steep decline in incomes consequent to huge lay-offs and the return of the urban-based labor back to villages of origin. Besides the conventional shocks in trade in goods and services and fluctuations in foreign direct investment, there are two more external supply shocks of importance to developing countries. These relate to (i) remittances from their citizens, residing and working overseas in advanced countries; and (ii) earnings from international tourism activities. It is estimated that Covid-19 would cause remittances to decline by 14% in 2021 relative to the 2019 pre-Covid-19 level. For the South Asia region, it is estimated to decline by 22% to US$109 billion in 2020, following a 6.1% growth in 2019.

The World Bank bi-annual study with a focus on South Asia, (World Bank 2022) observes that "growth going forward will resume roughly to pre-COVID levels". The optimistic expectations were based on recent developments indicating recovery. South Asia's GDP recovered from a negative growth (-4.5%) in 2020 to record a positive growth at 7.8% in 2021 and was expected to grow by 6.6% in 2022 and 6.3% in 2023. The study, cautions about the offsetting influence on the continued recovery from the Covid-19 crisis stemming from the likely the adverse impact of the war in Ukraine, which has already clouded the overall outlook for global economic recovery. High commodity prices will weigh on import demand, while lower growth abroad will lead to softening world demand for South Asian exports and especially tourism to the region in particular to the Maldives, one of the most tourism dependent countries in South Asia, drawing tourists from Russia and Ukraine.

This paper takes up a study of six out of the eight South Asian countries, which are also members of the official inter-governmental organization, known as the South Asian Association of Regional Cooperation (SAARC) to examine the economic impact of the Covid-19 pandemic on tourism. The study does not cover two countries, which are Afghanistan and Maldives. While Afghanistan's tourism data series are incomplete, the Maldives, an island nation of atolls in the Indian Ocean is an outlier. With no significant agricultural and mineral resources, except the sun, surf, and sand, Maldives depends heavily on tourism whose share in the gross domestic product (GDP) is about 58 percent, compared to the other six member countries. The shares of tourism in the GDPs of Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka are small, unlike that of Maldives, as they range from 2% in Bangladesh to 11% in Sri Lanka.

The objective of the paper is to undertake a panel study of the South Asian countries, covering a period of 23 years (1995 to 2017), for which data series on relevant variables including capital stock are complete and available. We examine the existence of an asymmetric relationship between tourism and economic growth, which is now supported by information communications and technology (ICT). The latter has revolutionized the tourism industry by facilitating faster and smoother booking with a click of the mouse, not only for conventional travel and accommodation for luxury hotels and resorts, which are for the rich and retired seniors but also for medical tourism, besides new products such as cheaper home-stays, ecotourism by the young and adventurous individuals, tours of historical and religious nature, which are more in the hands of small and medium enterprises, increasingly handled by part-time women entrepreneurs (World Bank 2018a).

The study employs the neoclassical growth model of Solow (1956) to examine the growth in per capita real GDP with real capital stock per capita as a fundamental variable, tourism as a conditional variable, and ICT as a contingent factor. Unlike the conventional studies on tourism and growth nexus, which assume a symmetric relationship, our study distinguishes positive shocks from negative shocks and seeks to examine the outcomes of the conditional variable along the lines of Shin *et. al* (2014) and Yilanci and Aydin (2017).

The paper is organized along the following lines: the next section presents a brief review of the literature review; the third section looks at trends in tourism and increasing support from the spread of ICT; the fourth section outlines the theoretical framework, data, and methodology employed in the study. The fifth section reports results and discussion, and the sixth section presents conclusions and policy recommendations.

1. Literature Review

There has been a notable increase in the number of studies, both descriptive and empirical, since the late 1990s, as the world began to witness sustained economic growth facilitated by globalization, resulting in the rising number of international travelers. Earlier studies before the New Millennium dealt with tourism in developed countries. They were followed by studies later on in the developing countries, including island countries in the Caribbean and the South Pacific regions.

These studies were of two categories: (i) country-specific and (ii) panel and cross-country. While the country-specific studies are straightforward, where only variables included change over time, the panel studies have, however, some restrictive assumptions. They assume economic backgrounds and other characteristics of the countries included are homogeneous, at least to start with. Some examples of country-specific studies on tourism and growth are Durbarry (2004) for Mauritius, Nowak *et al.* (2007) for Spain, Kumar (2014b) for Kenya, Ishikawa and Fukushige (2007) for Japan, Katircioglu (2009), for Turkish, Dritsakis (2004) for Greece and Shareef and McAleer (2007) for Maldives. 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).

Notable empirical studies test the relationship between tourism and growth including Balaguer and Cantavella-Jorda (2002), Cortez-Jimenez and Paulina (2006), Lee and Chang (2008), Narayan *et al.* (2010), Tang and Tan (2015), Stauvermann *et al.* (2018). They conclude that international tourism promotes long-term economic growth. Some studies such as Aslan (2013) and Payne and Mervar (2010) among others examine conservation propositions. They show evidence that tourism development occurs as a result of economic development. Some empirical studies show a bidirectional causality between tourism and economic growth. They include Durbarry (2004), Seetanah (2011) and Kim *et. al* (2006). Most of the studies on South Asia's tourism relationship and growth are descriptive, which include Rasul and Manandhar (2009) and Nawaz and Hassan (2016). This is because most of the data series on international tourism in the Indian subcontinent are of recent origin since tourism emerges as a source of external support for economic growth only in the late 1990s.

2. The Role of Information and Communication Technologies

Studies on ICT and growth began in the 1990s focusing on developed countries, such as the US and European countries. The vast majority of the studies showed a positive association between ICT and economic growth. Leading studies are Jorgenson et al. (2000), Inklaar *et al.* (2005), who compared the role of ICT in Europe and the US between 1979-2000 and showed the contribution of ICT to economic growth was greater in the US than in Europe; and Roller and Waverman (2001) in their study on OECD-21 countries concluded improvement in the telecommunication sector has been crucial for economic growth.

Specific country case studies emphasizing the beneficial effect of ICT in boosting long-term growth and development are Jalava and Pohjola (2008) for Finland, Kumar (2011) for Nepal, Jorgenson and Motohashi (2005) for Japan and Kasahar and Rodrique (2008) for Indonesia, Kumar *et al.* (2016) for China. All of them established that developing countries can leapfrog and achieve higher growth rates. Table 1 provides a summary of notable studies on tourism and economic growth.

Table 1. Tourism- growth literature review 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 Annual	Tourist earnings	VECM	T↔GDP	+
Lee and Chang (2008)	1990-2002	Panel OECD	Annual	Tourist earnings	Panel	T→GDP	+
Narayan *et al.* (2010)	1988-2004	Panel: PICs	Annual	Tourist earnings	Panel FMOLS	T→GDP	+

Author	Period	Country	Frequency	Variables	Methodology	Causality	Effect
Seetanah (2011)	1990-2007	Panel Caribbean and Islands	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: not applicable. T→GDP - causality relationship from tourism to GDP. T↔GDP - the bidirectional relationship between tourism and GDP. PICs - Pacific Island Countries. + is a positive effect of tourism on GDP.

3. Trends in Tourism Growth in South Asian Countries

Reforms by the South Asian nations which were introduced in mid-1990 for opening up their economies resulted in a gradual shift away from fixed exchange rate regimes towards eventual adoption of flexible rates and relaxation of exchange controls together with mobility of capital and labor. They contributed to the liberalization of the economies which encouraged FDI inflows as well as manufacturing and services, including hotels and resorts and airline services. International tourism began to make a mark. Increasingly liberalized air transport market, the emergence of low-cost carriers offering inexpensive flights, and relaxation of visa requirements eased travel to South Asia. (Asian Development Bank 2020).

Available statistics indicate tourists from overseas to South Asia rose from around 23.6 million. Table 2 presents data on international tourist arrivals in numbers and tourism earnings as a percent of GDP for each of the six SAARC countries.

Table 2. South Asian countries. International tourist arrivals and international tourism earnings: 2000-2018

Bangladesh	2000	2005	2010	2015	2016	2017	2018
Intl Tourism Arrivals (number mill)	199	208	303	643	830	1,026	NA
Intl Tourism Earnings (US $ mill)	50	82	103	150.3	214.3	348	357
Intl Tourism Earnings (% of GDP)	0.07	0.10	0.09	0.10	0.13	0.19	0.18
Bhutan							
Intl Tourist Arrivals (number mill)	7.6	13.6	41	155	210	255	274
Intl Tourism Earnings (US $ mill)	10	19	64	120	139	153	121
Intl Tourism Earnings (% of GDP)	1.51	1.95	4.13	5.99	6.44	6.24	5.13
India							
Intl Tourist Arrivals (number mill)	2,649	3,919	5,776	13,284	14,570	15,543	17,423
Intl Tourism Earnings (US $ Mill)	3,598	7,659	14,490	21,472	23,111	27,878	29,143
Intl Tourism Earnings (% of GDP)	0.77	0.93	1.01	1.09	1.09	1.21	1.17
Nepal							
Intl Tourist Arrivals (number mill)	464	375	603	539	753	940	1,173
Intl Tourism Earnings (US $ mill)	219	160	378	509	498	712	7,444
Intl Tourism Earnings (% of GDP)	3.99	1.97	2.36	2.38	2.35	2.83	3.24
Pakistan							
Intl Tourist Arrivals (number mill)	557	798	907	NA	NA	NA	NA
Intl Tourism Earnings (US $ mill)	551	828	998	915	791	866	818
Intl Tourism Earnings (% of GDP)	0.47	0.55	0.56	0.42	0.35	0.36	0.32
Sri Lanka							
Intl Tourist Arrivals (number mill)	400	549	654	1,798	2,051	2,116.4	2,334
Intl Tourism Earnings (US $ mill)	388	729	1,044	3,978	4,591	5,083	5,608
Intl Tourism Earnings (% of GDP)	1.13	1.75	1.84	5.20	5.74	6.14	6.55

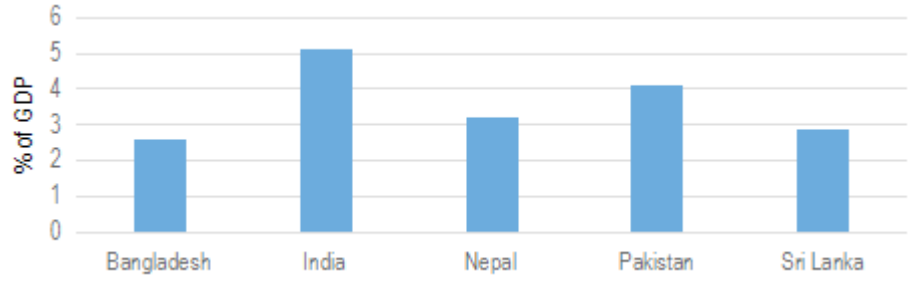
Source: WDI (2020) and author's calculations

Annual international tourism earnings are also added to the foreign exchange reserves of each country, thus providing a sizeable cushion to reduce pressures on current accounts in the balance of payments. Since exports of SARRC countries were growing slowly or remaining stagnant, the rise in tourism earnings has been a major support, especially when South Asian countries found themselves unable to withstand competition from China regarding manufactured consumer goods. Further, the rise in foreign exchange reserves enabled SAARC countries to raise their creditworthiness to borrow more from international as well as private lending agencies.

3.2. Regional Tourism and Domestic Tourism

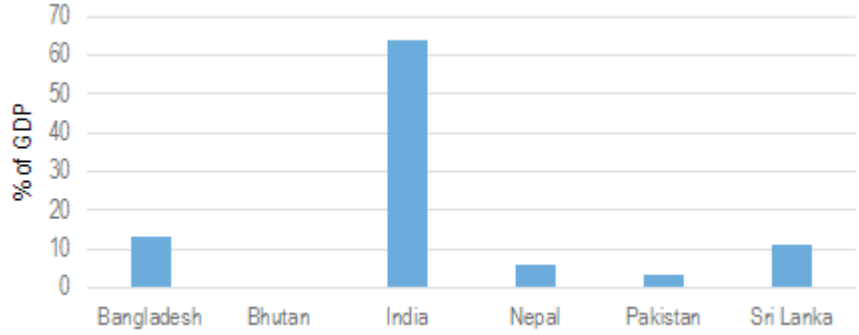
Intra-regional tourism by destination is dominated by India. Out of 24.5 million international tourists to SAARC countries, 20% are from within the region and about 63.94% of them were received by India followed by Bangladesh and Sri Lanka (World Bank, 2020). Domestic tourism figures are best reported by expenditures as a % of GDP. Indians spend 5.03% of GDP on travel within the country, which is mostly for visiting relatives and friends and religious tours, educational tours, and travel during the hot summer to hill stations and cooler places. In domestic travel, next to India were Pakistan and Nepal (Figure 1).

Figure 1. SAARC: Expenditure of domestic tourism as a %of GDP in 2019



Source: World Travel and Tourism Council.

Figure 2. Intra-regional trips in 2018 (% of total international arrivals arrival into destination countries)



Source: World Travel and Tourism Council (2019 and 2021*)*.

3.3. Tourism and Jobs

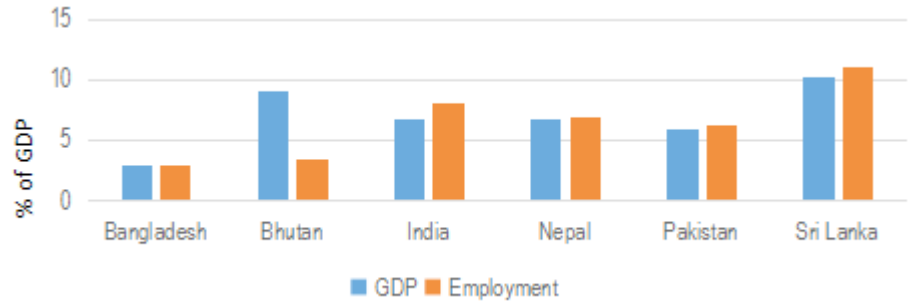
The WTC report (2020) reviewing the impact of Covid-19 reflects how growth in the tourism industry has been creating jobs over the last two decades. It is estimated one out of every 10 jobs in the economy is in the tourism sector as a whole and there were about 296 million jobs in 2019 (WITC 2020).

South Asia is highly dependent on travel and tourism, especially as a generator of jobs, which is estimated to be about 47.7 million in 2019 (World Bank 2020). Since exports of some SARRC countries were growing slowly or nearly stagnant in some years, tourism earnings proved major support, especially when South Asian countries found themselves unable to withstand competition from China with consumer goods. The subsectors of the tourism industry include hotels and resorts, airlines and cruise lines, domestic transport sector including railways and surface transport to assist tourists in their travels to various points of interest within the host countries such as national parks and historical sites and eating places of ethnic interest aside from conventional restaurants and tour operators and online travel agencies. Almost all of them use ICT sector services. It is of interest that most of the enterprises catering to the various needs of tourists happen to be mini and micro-enterprises, which are in the informal tourism sector dominating the tourism sector to the extent of 85% and some are in the hands of a growing number of women entrepreneurs as well part-time housewives. The supply chain

extends to link livelihoods in agriculture, fisheries, handicrafts, and creative industries, which include the preparation of ethnic meals for tourists, music, dance, and other entertainment services.

Most of the jobs in the tourism industry, as the Global Report on Women and Tourism (2020) notes, are handled by women. It is estimated that about 53% of the frontline staff positions and housekeeping jobs are held by female workers. In the informal sector, selling handicrafts and clothing and serving ethnic food are nearly 80 percent women sellers most of them being part-time employees (WITC, 2020). Amongst the six SAARC member countries, the shares of tourism in GDP and total employment are in the range of 2% (Bangladesh) to 11% (Sri Lanka).

Figure 3. Share of tourism in GDP and total employment (%) in 2019



Source: World travel and tourism council and UN World Travel Organization

3.4. Tourism and ICT

The spread of ICT in developed countries since the 1980s and the subsequent adoption of ICT and usage of mobile phones in a big way by the urban and rural population and those in remote and far-flung areas in developing countries have brought about an unprecedented economic transformation, now called "the Fourth Industrial Revolution" (Schwab 2015). As the *2016 World Development Report* (World Bank 2016) notes the Fourth Industrial Revolution is still ongoing, "where all economic agents, either as producer, retailer, and consumer, or units, institutions and individuals move between digital domains and offline reality with the use of connected technology to enable and manage their lives".

Aside from enhancing labor productivity through upgrading skills, ICT now plays a critical role in all sectors of the economy such as manufacturing, trading, distribution, transportation, education, and new sectors like e-commerce by reducing transaction costs (Xing 2018). Further, technology has also become a cornerstone for the banking and financial systems, as it has enabled greater financial inclusion through reaching unbanked segments of the population through mobile banking and new financial products (Jayaraman and Makun 2020). More than 40% of the world's population has been improving access to the internet with new users coming online every day; among the poorest 20% of households, nearly 7 out of 10 have a mobile phone; and "the poorest households are more likely to have access to mobile phones than to toilets or clean water!" (World Bank 2016). The Geneva based International Telecommunication Union has evolved an ICT index based on 11 indicators and has been monitoring the progress of ICT adoption in developed and developing countries[2]. Table 3 presents a comparative picture of ICT based on the ICT index for SAARC countries.

Table 3. ICT indicators for SAARC: 2019

Countries	ICT Index
Bangladesh	2.53
Bhutan	3.69
India	3.03
Nepal	2.88
Pakistan	2.42
Sri Lanka	3.91

Source: International Telecommunication Union website.

[2] A composite index that combines 11 indicators into one benchmark measure. The main objectives are: (i) the level and evolution over time of ICT developments within countries and the experience of those countries relative to others; (ii) progress in ICT development in both developed and developing countries; (iii) the digital divide; and (iv) the development potential of ICTs and the extent to which countries can make use.

All economic activities are now touched by internet and mobile phone connectivity. Tourism is no exception. Increasing usage of the internet by international travelers for online booking of travel by air or cruise ships and accommodation of all kinds, ranging from luxury resorts and hotels to homestays and guest houses providing cheaper accommodation for the youth and backpackers seeking adventure through ecotourism and travel in the interior and rural parts of host countries, has been made easier and faster. The Table 4 from Appendix presents trends in the usage of ICT in the six countries under study. During the 18 years, the growth in the use of cellular phones, popularly known as mobile phones has been phenomenal. The usage of the internet is, however, mainly confined to urban towns, which have greater access to an uninterrupted supply of electricity compared to rural areas and remote parts of the country.

4. Methodology

To explore the tourism-economic growth nexus, we employ the neoclassical economic growth model of Solow (1956). The output per capita is formulated as:

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

where: y = GDP per capita in constant US dollars; A = stock of technology; k = stock of capital per capita in constant US dollars; α = share of capital; t = time

The model is postulated as follows:

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

where, A_o = initial stock of technical technology; g = technology growth over time trend t.

Given the objective, the present study includes tourism and ICT in the growth equation, which takes the production function approach. We also test their interaction term to determine whether tourism and ICT are complementary to each other or behave as substitutes. The effects of tourism and ICT on A_t (also called total factor productivity) are realized as shift variables. Hence, we formulate the functional relationship as below:

$$A_t = f(TOUR_t, ICT_t, TOIC) \tag{3}$$

where: *TOUR* = tourism earnings as a percent of GDP; *ICT* = number of mobile subscriptions per 100 inhabitants; and *TOIC* = interaction term, which is the product of tourism and ICT.

Hence, the Cobb-Douglas production function is further modified as:

$$y_t = (A_o e^{gt} TOUR_t^{\beta_1}, ICT_t^{\beta_2}, TOIC^{\beta_3}) k_t^{\alpha_1} \tag{4}$$

Taking logs (*l*) and reorganizing Equation (4) leads us to tourism-growth Equation (5):

$$ly_t = \alpha_0 + \alpha_1 lk_t + \beta_1 lTOUR_t + \beta_2 lICT_t + \beta_3 lTOIC_t + \varepsilon_t \tag{5}$$

The rationale for taking logs is to statistically adjust the variables and to see the magnitude change of the variables. It also enables us to interpret the coefficients of the variables in terms of elasticity. Theoretically, it is hypothesized that capital stock, tourism, and ICT are directly associated with economic growth. The sign of the interaction term, TOIC is however ambiguous. A statistically significant and positive coefficient of the interaction term would imply a complementary relationship while a negative sign of the coefficient would mean tourism and ICT are substitutes.

4.1. Data

The study covers the period from 1995 to 2017. The term *y* stands for GDP per capita in constant US$, as a dependent variable, which represents economic growth. Tourism earnings as percent GDP is used as a proxy for tourism, while mobile subscriptions per 100 inhabitants is used to represent the ICT variable. The data sets for these variables are obtained from *World Development Indicators* (WDI) published by World Bank. The capital stock per capita (in constant US$) is obtained from *Penn World Tables.* Table 5 reports the basic descriptive summary of these variables. The mean statistics show the average tourism earnings in six subcontinent countries is about 2 %. The mobile subscription on average is 37 per hundred inhabitants. Tourism earnings are positively

linked to GDP per capita at about 0.52 while ICT and capital stock are at 0.58 and 0.93 with GDP per capita, respectively.

Table 5. Descriptive summary

	Y	*k*	*TOUR*	*ICT*	*TOIC*
Mean	1,307.640	14,916.620	1.800	37.436	0.654
Median	990.362	8,547.303	1.005	21.757	0.623
Maximum	3,860.150	53,342.590	6.605	133.468	3.095
Minimum	436.560	3,262.186	0.066	0.002	-1.334
Std. Dev.	837.524	11,819.990	1.682	38.682	1.014
Observations	126	126	126	126	126
	Y	*k*	*TOUR*	*ICT*	*TOIC*
y	1.000				
k	0.927	1.000			
TOUR	0.518	0.662	1.000		
ICT	0.583	0.521	0.162	1.000	
TOIC	0.183	0.010	-0.145	0.697	1.000

4.2. Model

We employ the NARDL model developed by Shin *et al.* (2014) to explore the asymmetric effects of tourism on the real per capita GDP of six Indian sub-continent countries. The NARDL model represents an asymmetric extension of Pesaran *et al.*'s (2001) linear ARDL model. We begin by presenting the linear panel ARDL model first. According to Pesaran *et al.* (2001), the following unrestricted error correction model is written:

$$\Delta ly_{it} = \alpha_0 + \alpha_1 ly_{it-1} + \alpha_{2i} lk_{t-1} + \alpha_{3i} lTOUR_{t-1} + \alpha_{4i} lICT_{t-1} + \alpha_{5i} lTOIC + \sum_{i=1}^{n} \beta_{1i} \Delta ly_{it-i}$$
$$+ \sum_{i=0}^{n} \beta_{2i} \Delta lk_{it-i} + \sum_{i=0}^{n} \beta_{3i} \Delta lTOUR_{it-i} + \sum_{i=0}^{n} \beta_{4i} \Delta lICT_{it-i} + \sum_{i=0}^{n} \beta_{5i} \Delta lTOIC_{it-i} + \mu_i + \varepsilon_{it} \quad (6)$$

Here α_0 is the constant, μ_i is the group-specific effect, ε_t is the error term, $\alpha_{1,2..5}$ represents long-run parameters, and $\beta_{1...5}$ is short-run parameters. n indicates optimal lags of variables in difference form which is selected by SIC. Equation (6) can be further re-specified as error correction model as:

$$\Delta ly_{it} = \delta \tau_{it-1} + \sum_{i=1}^{n} \beta_{1i} \Delta ly_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta lk_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta lTOUR_{it-i} \sum_{i=0}^{n} \beta_{4i} \Delta lICT_{it-i}$$
$$+ \sum_{i=0}^{n} \beta_{5i} \Delta lTOIC_{it-i} + \mu_i + \varepsilon_t \quad (7)$$

where: $\delta \tau_{it-1}$ is the error correction term and δ is the adjustment parameter. Δ is the difference form indicating short-run dynamics.

To analyze the nonlinear panel ARDL, which allows for the asymmetric effect of tourism on real per capita GDP, we consider Equation (6) following Shin et al. (2014). Employing this methodology, positive and negative shocks of tourism are examined. The positive and negative shocks are expected to have a differential effect on GDP. The asymmetric version of Equation (6) is presented below:

$$\Delta ly_t = \alpha_{0i} + \alpha_{1i} ly_{t-1} + \alpha_{2i} lk_{t-1} + \alpha_{3i} lICT_{t-1} + \alpha_{4i}^{+} lTOUR_t^{+} + \alpha_{4i}^{-} lTOUR_t^{-} + \alpha_{5i} lTOIC_{t-1} + \sum_{i=1}^{n} \beta_{1i} \Delta ly_{t-i}$$
$$+ \sum_{i=0}^{n} \beta_{2i} \Delta lk_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta lICT_{t-i} + \sum_{i=0}^{n} \beta_{4i}^{+} \Delta lTOUR_{t-i}^{+} + \sum_{i=0}^{n} \beta_{4i}^{-} \Delta lTOUR_{t-i}^{-} + \sum_{i=0}^{n} \beta_{5i} \Delta lTOIC_{t-i} + \mu_i + \varepsilon_t \quad (8)$$

where: $lTOUR_t^+$ and $lTOUR_t^-$ are the positive and negative partial sum derivation computed as:

$$lTOUR_t^+ = \sum_{t=1}^{n} \Delta lTOUR_t^+ = \sum_{t=1}^{n} \max(\Delta lTOUR_{t,} 0)$$

$$lTOUR_t^- = \sum_{t=1}^{n} \Delta lTOUR_t^- = \sum_{t=1}^{n} \min(\Delta lTOUR_{t,} 0).$$

where: $lTOUR_t = lTOUR_0 + lTOUR_t^+ + lTOUR_t^-$. The elasticity coefficient of $lTOUR_t^+$ and $lTOUR_t^-$ is computed as: $\eta^+ = -\frac{\alpha_{4i}^+}{\alpha_{1i}}$ and $\eta^- = -\frac{\alpha_{4i}^-}{\alpha_{1i}}$.

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

$$\Delta ly_t = \rho\varsigma_{it-1} + \sum_{i=1}^{n} \beta_{1i}\Delta ly_{t-i} + \sum_{i=0}^{n} \beta_{2i}\Delta lk_{t-i} + \sum_{i=0}^{n} \beta_{3i}\Delta lICT_{t-i} + \sum_{i=0}^{n} \beta_{4i}{}^{+}\Delta lTOUR_{t-i}^{+}$$
$$+ \sum_{i=0}^{n} \beta_{4i}{}^{-}\Delta lTOUR_{t-i}^{-} + \sum_{i=0}^{n} \beta_{5i}\Delta lTOIC_{t-i} + \mu_i + \varepsilon_t \quad (9)$$

The error correction term ($\rho\varsigma_{it-1}$) estimates the equilibrium asymmetric relationship in the specified model and the associated parameter (ρ) captures the adjustment rate. The short-run positive and negative changes in tourism earnings are captured by β_{4i}^+ and β_{4i}^- respectively. To test for the long run and short run symmetry, the standard 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 tourism is tested by evaluating the null hypothesis ($\sum_{i=0}^{n} \beta_{4i}{}^{+} = \sum_{i=0}^{n} \beta_{4i}{}^{-}$).

5. Results and Discussion

A pre-condition of the ARDL procedure is that variables should not be integrated order of more than one. Ouattara (2004) advises the result could be invalid if the series are of I(2). Thus, it is important to determine the integration of the variables. To do this we applied panel unit root tests. The heterogeneous panel data model is commonly used where non-stationary is an issue.

We used two different types of panel unit root tests. The first type of panel unit root test involves the null hypothesis of unit root with a common process (Levin, Lin and Chu 2002). The second type assumes unit root with individual unit root process (Im, Pesaran and Shin 2003, Maddala and Wu 1999, Fisher-ADF, Fisher-PP). All the series have unit root in level form, except for the ICT variable, which is I(0), and the interaction term (*ITOIC*), which is I(0) under the LLC test. However, in the first difference form, all the variables are integrated of order one [I(I)]. Given the mixed integration order of the variables, our estimation framework that takes into consideration heterogeneity and unit root concerns in the panel data setting is valid. Essentially, the unit root test further confirms the appropriate choice of panel ARDL model in this paper.

Table 6. Panel unit root test results

Variables	Test statistics (probability values)				
Panel A: in Level	LLC	IPS	MW(ADF)	MW(PP)	Conclusion
Ly	3.784 (0.999)	6.381 (0.100)	0.2755 (0.100)	2.101 (0.999)	-
Lk	0.270 (0.606)	3.247 (0.999)	2.392 (0.998)	7.522 (0.821)	-
ITOUR	-0.208 (0.417)	-0.125 (0.449)	-15.360 (0.222)	12.121 (0.436)	-
IICT	-5.503 (0.000)*	-5.823 (0.000)*	50.989 (0.000)*	64.027 (0.000)*	I (0)
ITOIC	-3.845 (0.000)*	-0.175 (0.430)	14.025 (0.299)	15.627 (0.208)	

Variables	Test statistics (probability values)				
Panel B: In First Difference					
Ly	1.467 (0.071)***	3.405 (0.000)*	33.545 (0.000)*	63.047 (0.000)*	I (1)
Lk	2.110 (0.017)**	1.874 (0.030)**	20.514 (0.058)***	24.992 (0.014) **	I (1)
ITOUR	-7.329 (0.000)*	-6.811 (0.000)*	64.904 (0.000)*	85.399 (0.000)*	I(1)
IICT	-2.213 (0.081)***	-1.553 (0.060)**	19.555 (0.076)***	33.586 (0.000)*	I (1)
ITOIC	6.968 (0.000)*	-3.658 (0.000)*	73.859 (0.000)*	38.922 (0.000)*	I(1)

Note: LLC and IPS indicate Levin *et al.* (2002) and Im *et al.* (2003) panel unit root tests. MW (ADF) and MW (PP) represent Maddala and Wu's (1999) Fisher-ADF and Fisher-PP panel unit root tests, respectively. The LLC, IPS, MW (ADF), and MW (PP) all inspect the null hypothesis of a unit root. The values in brackets are the probabilities; *, **, and *** indicate significance levels at 1%, 5%, and 10% levels respectively.

5.1. Estimation of the Two Models

We now proceed to estimate linear and nonlinear models for tourism and economic growth relationship[3]. We use both, the Pooled Mean Group (PMG) estimator and the Mean Group (MG) estimator (Pesaran *et al.* 1999). PMG and MG estimators are subjected to the Hausman test to determine the better estimator of the two (Salisu and Isah 2017)[4]. The result of the Hausman test is reported in the respective tables.

Our results indicate the null hypothesis cannot be rejected and that the PMG estimator is the efficient estimator for modeling the tourism-growth nexus. Therefore, the result of only the PMG estimator is reported and discussed in this paper. According to Bahmani-Oskooee and Bohl (2000), the long-run relationship between variables depends on lag order. On the other hand, taking too many or too few lags can vitiate the model in capturing essential information (Stock and Watson 2012). Considering this essential feature, we used one lag following SBC criteria as the optimal lag order.

5.2. Nonlinear ARDL Model

Table 8 provides the results of the nonlinear ARDL estimation. Prior to the application of the asymmetric model, we test the presence of long-run and short-run asymmetries. Table 7 shows the results of the Wald test for symmetry. The estimated probability values of F-statistics are significant at one percent, which rejects the null hypothesis of long and short-run symmetry. Thus, it is confirmed from the panel study of six SAARC countries there is an asymmetric relation between tourism and economic growth.

Table 7. Asymmetric effect Wald test

Null hypothesis	Long run	Short-run
Tourism has a symmetric effect on real per capita GDP	$X^2(1)$=7.030 (0.000)*	$X^2(1)$=2.651 (0.009)*

*Note: * represent statistical significance at a 1% level.*

In estimation (Table 8), the long-run asymmetric parameters ($lTOUR_t^+$ and $lTOUR_t^-$) capture the asymmetric effect of tourism earnings on economic growth. The coefficients 0.055 and 0.096 are associated with positive ($lTOUR_t^+$) and negative ($lTOUR_t^-$) partial sum decompositions, respectively. The positive shock of tourism, say a 1% increase in tourism leads to a 0.055% increase in economic growth while a negative shock indicates a 1% decrease in tourism results in a 0.096% decline in economic growth. The impact of negative ($lTOUR_t^-$) partial sum decomposition on economic growth is much greater in magnitude than that of positive ($lTOUR_t^+$) partial sum decomposition of tourism in these economies. The decline in tourism is likely to have more detrimental than a similar-sized increase in tourism.

[3] See linear model estimate in Appendix.

[4] The extensively used methodologies in panel ARDL estimation procedure are the MG estimator-relies on estimating *N* time-series regression and takes the average coefficient (Blackburne and Frank 2007), whereas the PMG estimator takes the combination of pooling and averaging of coefficients. Nevertheless, to obtain the preferred estimator between the two, the Hausman test is applied. The null hypothesis is that the PGM is an efficient estimator while the alternative hypothesis is that the MG is an efficient estimator. In addition to panel regression analysis, the PMG and MG estimators also estimate the short-run coefficient of individual units.

The effect of other conditioning variables, such as capital stock, ICT, and interaction term have expected positive signs and are also statistically significant in the long run. The effect of the interaction term (*TOIC*) is positive and statistically significant in the long run. These findings imply that tourism and ICT are complementary in boosting economic growth in South Asian countries. Such effects of tourism and ICT were not explored earlier in South Asian nations. The advent of ICT, particularly mobile phone usage has a substantial effect on how communication and business are carried out in the economy including in the tourism industry (Bethapudi 2013). The usage of mobile phones has substantially increased in Indian sub-continent countries, enhancing access to information and services, consequently contributing to economic growth. The additional gains in productivity enhanced by ICT lower the cost and boost the process of economic activities.

Table 8. Non-linear panel ARDL estimation

Variables	Coefficient	Standard error	P-value
lk	0.689	0.120	0.000*
$lTOUR_t^+$	0.055	0.026	0.042**
$lTOUR_t^-$	0.096	0.029	0.001*
lICT	0.075	0.004	0.000*
lTOIC	0.008	0.004	0.058***
Δlk	0.549	0.022	0.000*
$\Delta lTOUR_t^+$	0.036	0.082	0.662
$\Delta lTOUR_t^-$	0.101	0.015	0.000*
ΔlICT	0.024	0.008	0.005*
ΔTOIC	0.004	0.012	0.720
Constant	0.182	0.127	0.158
$\hat{\tau}_{t-1}$	-0.352	0.011	0.000*
Hausman test	1.213 (0.274)		
Log-likelihood	270.970		
No. of observations	139		
Error correction terms for each country			
Bangladesh	-0.085	0.001	0.000*
Bhutan	-0.212	0.011	0.000*
India	-0.245	0.002	0.000*
Nepal	-0.132	0.002	0.000*
Pakistan	-0.391	0.018	0.000*
Sri Lanka	-0.702	0.114	0.008**

Note: *, ** and *** indicate statistical significance at 1%, 5% and 10% respectively. "+" and "-" denote positive and negative partial sums respectively. The probability value for the Hausman test is in the brackets.

In the short run, the results show that a positive shock ($lTOUR_t^+$) in tourism earnings has a positive effect on growth, however, it is not statistically significant. The negative shock ($lTOUR_t^-$) in tourism earnings is positive and significant at a one percent level. Nonetheless, like in the long run, the negative shock in tourism has a greater impact on growth in the short run. The error correction term (ECT) coefficients for the nonlinear panel is negative and statistically significant ($\hat{\tau}_{t-1}$ =-0.352). Any shock to the nonlinear tourism-growth relationship will be adjusted by about 35%, and the system converging in the long run in about 3 years. Besides this PMG estimator also gives the individual country groups error correction model. In Table XX, the error correction coefficient of each country is shown. From these ordered error correction estimates, all the countries have a negative and statistically significant error correction coefficient, confirming that there is a long-run cointegration relationship.

Conclusions

This paper investigated the role of tourism supported by ICT in the economic growth of the six South Asian countries, namely Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. Results from the Nonlinear ARDL modeling procedure confirm the presence of an asymmetric relationship between tourism earnings and economic growth. Although a positive shock in tourism earnings has a beneficial effect on long-run growth, the negative shock in tourism earnings leads to a substantial reduction in growth both in the long and short run. The results of the study are relevant in the context of the current Covid -19 pandemic which has drastically reduced the number of tourist arrivals in the region.

Although the progress of vaccination of the populations against the pandemic with two minimum doses after the required intervals between the first and second doses has picked up fast, it looks full coverage with an addition of a booster shot to meet the new variants, including the recent Omicron, is not certain until the mid-2022. Full consumer trust of the same level as in pre-Covid days cannot be restored and assured, as the fear of international tourists especially from advanced countries is likely to persist for some more time and well into 2023. Steps towards the encouragement of intraregional tourism within SAARC would lead to greater travel in the short-run since international travel from outside the region would take some more time to materialize. First and foremost is the need for returning to a confidence level matching that of pre-Covid-19 pandemic years. However, the success of intraregional travel promotion would depend on efforts that would include air travel bubble agreements between countries within the SARRC region, which can be bilaterally and multilaterally negotiated.

In the recovery phase, SAARC countries may consider special efforts such as waiving visa requirements, attractive discounts on travel fares, and accommodation charges to attract travelers from within the SAARC region. Restoration of confidence to travel can be fostered by improved sanitary and hygienic conditions and strict enforcement of Covid-19 protocols, with due publicity. No doubt, the downsides of the pandemic include loss of lives and livelihoods but there are positive and encouraging 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, 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 higher degree of broadband and mobile internet penetration in each country in the region, 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 promoting more balanced development within each member country of the SAARC region. More importantly, other sectors such as fisheries and marine products development which have export potential and similar efforts towards land-intensive exportable in landlocked countries such as Bhutan and Nepal can now be taken up more seriously in collaboration with regional and international commercial interests.

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APPENDIX

Linear model

The results show that tourism (*ITOUR*) has a positive effect on economic growth, consistent with the findings of Lee and Chang (2008). Specifically, the long-run estimate of tourism with respect to the growth of six Indian sub-continent countries is 0.21. In other words, the result indicates that a one percent increase in tourism earnings will increase economic growth by 0.21%. It is found that the size of tourism earning's effect on growth is higher in long run than that in the short run, suggesting the importance of tourism in long run for enhancing economic growth through enhanced investment in the tourism industry as well as helping countries by accumulating much need foreign reserves.

There are several studies that suggest the positive effect of tourism on growth. Tourism helps the economy through various conduits; it creates jobs, revenues for governments, and income, which consequently contributes to the economy (Lim 1997, Oh 2005). The contribution of ICT is found to be positively associated with economic growth, both in the long run and short run. The elasticity coefficient of ICT with respect to growth is 0.041%, consistent with studies such as Kumar *et al.* (2015) and Niebel (2018). Moreover, the interaction term (*ITOIC*) is found to be positive and statistically significant – implying that tourism and ICT act as complementary to promote economic growth.

Table 1. Linear panel ARDL estimation

Variables	Coefficient	Standard error	P-value
lk	0.469	0.099	0.000*
lTOUR	0.210	0.034	0.000*
lICT	0.041	0.004	0.000*
lTOIC	0.017	0.005	0.004*
Δlk	0.377	0.372	0.313
ΔlTOUR	0.028	0.017	0.098***
ΔlICT	0.0378	0.012	0.003*
ΔTOIC	0.099	0.022	0.000*
Constant	1.269	0.157	0.000*
$\hat{\tau}_{t-1}$	-0.449	0.250	0.077***
Hausman test	0.109 (0.741)		
Log-likelihood	281.827		
No. of Observations	139		
Error correction terms for each country			
Bangladesh	-0.041	0.002	0.000*
Bhutan	-0.296	0.030	0.002*
India	-0.608	0.045	0.000*
Nepal	-0.054	0.005	0.002*
Pakistan	-0.443	0.022	0.000*
Sri Lanka	-0.902	0.001	0.000*

Note: *, ** and *** indicate statistical significance at 1%, 5% and 10% respectively. The probability value for the Hausman test is in the brackets.

Table 4. Usage of Internet and mobile phones: 2015- 2018 *Source*: WDI (2020)

Bangladesh	2010	2011	2012	2013	2014	2015	2016	2017	2018
Individuals using Internet (% of population)	3.70	4.50	5.00	6.63	13.90	14.40	18.02	15.00	15.00
Secure internet servers	30.00	73.00	111.00	146.00	202.00	314.00	3,731.00	10,413.00	18,712.00
Secure internet servers (per million)	0.20	0.49	0.74	0.96	1.31	2.01	23.62	65.22	115.97
Mobile cellular subscription (per 100)	46.03	56.52	64.36	76.30	82.10	84.08	86.08	94.53	97.28
Mobile cellular subscriptions (in millions)	67.92	84.37	97.18	116.55	126.87	131.38	135.98	150.95	156.99
Bhutan									
Individuals using Internet (% of population)	13.60	14.40	15.60	22.40	30.30	39.80	41.77	48.11	48.11
Secure internet servers	1.00	2.00	8.00	7.00	13.00	14.00	27.00	88.00	134.00
Secure internet servers (per million)	1.46	2.88	11.40	9.86	18.08	19.23	36.65	118.03	177.63
Mobile cellular subscription (per 100)	57.52	69.84	79.95	76.64	86.86	92.84	94.80	98.00	93.26
Mobile cellular subscriptions (in millions)	0.39	0.48	0.56	0.54	0.62	0.68	0.70	0.73	0.70
India									
Individuals using Internet (% of population)	7.50	10.07	12.58	15.10	21.00	17.00	22.00	34.45	34.45
Secure Internet servers	2061.00	2,842.00	5,704.00	7,880.00	10,941.00	15,313.00	50,723.00	164,791.00	254,032.00
Secure Internet servers (per million)	1.67	2.27	4.51	6.15	8.44	11.69	38.30	123.10	187.81
Mobile cellular subscription (per 100)	60.94	71.49	68.32	69.20	72.86	76.41	85.15	87.32	86.94
Mobile cellular subscriptions (in millions)	752.19	893.86	864.72	886.30	944.01	1001.06	1,127.81	1,168.90	1,176.02
Nepal									
Individuals using Internet (% of population)	7.93	9.00	11.15	13.30	15.44	17.58	19.69	34.00	34.00
Secure Internet servers	24.00	35.00	63.00	79.00	99.00	147.00	508.00	4,372.00	5,126.00
Secure Internet servers (per million)	0.89	1.29	2.33	2.93	3.68	5.44	18.63	158.25	182.50
Mobile cellular subscription (per 100)	34.04	49.39	61.54	79.36	85.56	101.86	117.82	130.63	139.45
Mobile cellular subscriptions (in millions)	9.20	13.35	16.61	21.36	23.02	27.52	32.12	36.10	39.18
Pakistan									
Individuals using Internet (% of population)	8.00	9.00	9.96	10.90	12.00	14.00	12.39	15.51	15.51
Secure Internet servers	106.00	146.00	240.00	328.00	479.00	680.00	6,448.00	23,923.00	23,161.00
Secure Internet servers (per million)	0.59	0.80	1.28	1.71	2.45	3.41	31.67	115.07	109.14
Mobile cellular subscription (per 100)	55.28	59.39	64.16	66.79	69.51	63.13	67.03	69.51	72.56
Mobile cellular subscriptions (in millions)	99.19	108.90	120.15	127.74	135.76	125.90	136.49	144.53	153.99
Sri Lanka									
Individuals using Internet (% of population)	12.00	15.00	18.29	21.90	25.80	12.10	16.40	34.11	34.11
Secure Internet servers	72.00	106.00	189.00	238.00	331.00	439.00	1,507.00	6,545.00	8,937.00
Secure Internet servers (per million)	3.55	5.20	9.25	11.56	15.93	20.93	71.07	305.21	412.41
Mobile cellular subscription (per 100)	85.68	89.81	94.16	98.32	106.42	114.31	122.72	133.47	115.06
Mobile cellular subscriptions (in millions)	17.36	18.32	19.33	20.32	22.12	23.90	25.80	28.20	24.43