

INVESTIGATING THE EFFECTS OF ADVANCEMENTS IN INFORMATION AND COMMUNICATION TECHNOLOGY AND FINANCIAL DEVELOPMENT ON TOURISM GROWTH: A CASE OF SOUTH AFRICA

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Abstract

Research background: South Africa's tourism industry has been experiencing unstable growth in the past few decades due to different factors. Studies in different countries have documented the significance of information and communications technology (ICT), and financial development towards a country's tourism growth. ICT and financial development may stimulate the growth of South Africa's tourism industry.

Purpose: To investigate the extent to which ICT advancements and financial development influence tourism growth in South Africa, given that the country has relatively strong financial and ICT sectors.

Research methodology: The study used annual time-series data for the period 1989 to 2019, and the variables are financial development, ICT, and tourism growth. The data were analysed using the Autoregressive Distributed Lag (ARDL) model.

Results: The findings indicate the existence of a long-run relationship among the variables. Results for the long-run estimates show that only ICT has a positive and statistically significant effect on tourism growth. In the short-run, financial development has a positive significant effect on tourism growth, while ICT only registers a significant effect on tourism growth in the fourth lag, albeit negative. The policy implication of these results is that the South African government ought to promote financial development to ensure that money is available and accessible for investment in tourism businesses and for tourist

spending. Furthermore, ICT upgrades are required by the government and tourism service providers to enhance tourism products and service accessibility for tourists from wider geographical locations.

Novelty: This study expanded the existing literature by assessing the effects of ICT and financial development on South Africa's tourism.

Keywords: ICT, Financial development, Tourism, ARDL, South Africa

JEL classification: C32, G00, O32, O33, O38, O47, O55

Introduction

The tourism industry has emerged as one of the largest industries in the world, generating millions of international tourist arrivals and contributing trillions of US Dollars to the global economy (United Nations World Tourism Organisation [UNWTO], 2019). Factors that promote tourism growth include information and communications technology (ICT) and financial development (Adeola, Evans, 2020; Isaeva et al., 2022; Musakwa, Odhiambo, 2021). Advancements in ICT and its application in the tourism industry have made fundamental changes in tourism activities, such as production, marketing, service delivery, management, communication, and customer relations (Sardar et al., 2021). ICT helps tourism businesses of all market sizes to sell their products and services online. Online marketing, also known as e-marketing, is not only cost-effective but also time-efficient. Information shared by tourism businesses on their websites and social media platforms, including Twitter, Facebook, and Instagram, is accessed by prospective tourists in real time, irrespective of their geographical locations (Sardar et al., 2021; Trivedi et al., 2018). The use of ICT in marketing has reduced the number of paper-based marketing projects. For example, tourism businesses and destination marketing organisations (DMO) can use online menus, brochures, and videos of tourism products instead of printed menus and brochures (Trivedi et al., 2018). This provides an opportunity for prospective tourists to view products before travelling to a destination. Some online marketing platforms allow travellers to book and purchase products online anytime from wherever they are because they are linked to Global Distribution Systems (GDS) such as Amadeus and Gailileo (Khan, Hossain, 2018). Even small local tourism businesses that incorporate ICT in their operations can sell their products and services directly to tourists anywhere in the world without involving third parties and intermediaries such as travel

agencies. The use of robotic technologies and automated machines in production has had a huge impact on labour cost and productivity, particularly because of their accuracy and speed, as they require limited human supervision. In the tourism industry, Berezina, Ciftci and Cobanoglu (2019) found that some restaurants introduced robots in food preparation and service, where they work as chefs, hosts, bartenders, and food runners. Seo and Lee (2021) established that the use of robots in restaurants reduces perceived risk and increases customer satisfaction. ICT upgrades have again proven efficient at airports, where passengers may self-check-in using a machine that issues boarding passes that show boarding time, gate number, flight number, and other journey-related information (Nikoli, Lazakidou, 2019). The use of technology-empowered security equipment such as CCTV, electric key cards and lockers, biometric access control, and luggage scanners improves the security of tourism facilities, tourists, and their belongings (Ruiz-Gómez et al., 2018).

The effect of the financial sector on tourism growth on the other hand, was documented in different studies (Khanna, Sharma, 2021; Menegaki, Tiwari, 2022; Yang, Mao, 2018). Financial development for a country is categorised by Menegaki and Tiwari (2022) to include the amount of money circulating in financial institutions, securities markets, and foreign direct investment. However, Ssekitoleko (2020) argues that the financial sector in an economy is charged with making capital more accessible, which then fuels overall business activity, which is considered financial development.

From the tourism viewpoint, financial development translates into much-improved access to money for purchasers of tourism products and services, or more availability of funds for investment by tourism business entities. In other words, a competent financial sector for a country should allow access to cut-rate loans, hence making businesses engaged in tourism to boost their operations, as well as making hitherto customer-expensive tourist destinations affordable. This interpretation points to the assertion by Musakwa and Odhiambo (2021) when connecting the financial sector of a country to tourism, that finance reinforces tourism activities by enabling low-priced transactions to tourists. This speaks to the degree of competence of a country's financial intermediation as an enabler of tourism growth. According to Greenbaum, Thakor and Boot (2019), financial intermediaries include a wide range of entities that provide financial services. These establishments could be commercial banks, credit unions, betting agencies, retirement funds, pawnbrokers, savings unions, insurance companies, private equity organisations, hedge funds, lotteries, and structured exchanges for investing in stocks, bonds, options trading, futures, and so on. Through these financial agents, owners of capital are linked to tourism businesses and individual tourists to help finance and enhance the country's

tourism sector, as corroborated by Menegaki and Tiwari (2022). Musakwa, Odhiambo and Nyasha (2022) conclude that a country's tourism can achieve success when its financial sector is inclusive and offers confidence for people to participate in the economic system.

This study investigates the effects of ICT advancements and financial development on tourism in South Africa. The rationale for South Africa as the choice of analysis emerges from the Statistics South Africa (Stats SA, 2022) report on tourism and migration that documents a sluggish recovery picture of tourism as a sector, coming off the hard lockdown period of COVID-19 in the year 2020, as well as generally low levels of travel in 2021. In addition, this research is thought-provoked by South Africa's strategy to be a continental leader in the fourth industrial revolution technology upgrades, as set out in the presidential commission's report on the 4th industrial revolution (Department of Communications and Digital Technologies in South Africa DCDTSA, 2020). The report shows that South Africa aims to capitalise on advancements in the latest technologies to boost various sectors, including tourism and ICT, as part of the long-term economic recovery trajectory.

South Africa has relatively large, developed, and sophisticated financial systems compared with other African countries (Financial Sector Conduct Authority [FSCA], 2022; Odhiambo, 2004). The South African financial sector was commended by the International Monetary Fund (IMF) for being resilient. The sector has made progress in ensuring that financial services are easily accessible to a large population and businesses. However, the accessibility of financial services is still limited to individual people and businesses, particularly small, micro, and medium-sized enterprises (SMMEs) (FSCA, 2022; IMF, 2022). On the other hand, reports indicate that South Africa's ICT is more advanced compared with other African countries. Most of the country's population has access to ICT services. However, the progress in the use of ICT is hampered by the high cost of the internet, data, and other communication products (Gillwald, Mothobi, Rademan, 2018; Mtotywa et al., 2022; Ssekitoleko, Dhlwayo, 2023).

In contributing to the existing body of knowledge, this study differs from that of Musakwa and Odhiambo (2022), who test causality between financial development and tourism in South Africa for the period 1995–2017. The current research used data for the period 1989–2019 and includes a third variable, ICT (a composition of the sum of the two proxies: mobile cellular subscriptions and fixed telephone subscriptions) to determine the influence of upgrades in ICT and financial development on tourism growth in South Africa, applying the Autoregressive Distributed Lag (ARDL) bounds test for cointegration. Additionally, testing an empirical relationship between ICT and tourism has been largely ignored, particularly for African countries, as the majority of research probes tourism demand in the developed world (Adeola,

Evans, 2020). Similarly, numerous studies, including Menegaki and Tiwari (2022), Musakwa et al. (2022), and Tang et al. (2020), contend that there is a dearth of empirical studies on financial development-tourism research. Therefore, this study strives to fill this void, particularly in South Africa, by examining the influence of both ICT and financial development on tourism, which is an important industry to the country's economy. Prior to the COVID-19 pandemic, the total contribution of the tourism industry to South Africa's gross domestic product (GDP) was commendable. In 2019 for example, the industry generated 6.4% (US\$27.4 billion) of the country's GDP (World Tourism and Travel Council, 2022).

The rest of this paper is organised as follows. Section 2 summarizes the theoretical and empirical literature regarding the effects of advances in ICT and financial development on tourism. Section 3 presents the research methodological framework and Section 4 presents and discusses the findings. The final section concludes the paper.

1. Literature review

This research is underpinned by Jafari's interdisciplinary model of tourism studies, which highlights tourism scholarship at universities. According to this theory, Jafari and Richie (1981) argued that it is the responsibility of various disciplines or departments at universities to conduct research on tourism. These disciplines or fields of specialisation are seen to bring out an assortment of analyses and interpretations, all of which build up a body of work in tourism research. For instance, researching tourism through the eyes of economics is best suited to emanating from a university department of economics, from which theory is built to understand tourism through its economic facets. It should be noted that this interdisciplinary view of tourism studies is considered the best approach by its originators, and it initially entailed 16 disciplines, including political science, sociology, education, psychology, marketing, agriculture, and others. In this way, this research views the interdisciplinary theory of tourism scholarships as fitting in this context and is extended to include the fields of Information and Communication Technology and finance as variables that also influence tourism growth.

1.1. Effects of ICT on tourism growth

ICT functions as a lubricant in the tourism industry. It connects different tourism service providers, potential consumers, and other service providers such as financial institutions. The effect of ICT on tourism has made management, marketing, production, communication, and service delivery in tourism businesses relatively cheap, fast, and effective

(Sardar et al., 2021; Trivedi et al., 2018). A conceptual study of Bangladesh stresses the importance of ICT advancement in the tourism industry, arguing that it is the tourism sector that was at the forefront of adopting ICT purely for business purposes (Rahman et al., 2022). In that study, due to the ubiquity of advancements in ICT, the tourism sector has raked a wave of increased tourism figures in recent years. This has mainly been due to the incorporation of ICT, which allows tailor-made tourist products and services to match demand. This study surveyed recent empirical literature on the effect of ICT on tourism and the findings showed a positive relationship, the nature of study (country-specific/multi-country), or techniques used notwithstanding. This may then be interpreted as ICT application growing tourism in an economy, as endorsed by Gössling (2021).

Studies such as Law, Chan and Wang (2018) and Wang, de Almeida Correia, van Arem and Timmermans (2018) observed that upgrades in ICT devices and applications such as cell phone and Internet usage, positively affect the tourism sector, as they make better communication, aid in online payments, and easily offer key information to make decisions on where to visit. Kumar and Kumar (2020) studied the link between ICT and international tourism demand in nine main destinations using the Pooled Mean Group (PMG) regression approach, and the results showed that foreign tourist arrivals increased by 0.04% when mobile subscriptions increased by 1%, while a 1% increase in broadband subscriptions increased inbound tourists by 0.11%. This is evidence that upgrades in several facets of ICT and its application are associated with growth in tourism.

Moreover, Adeola and Evans (2020) examined the linkage between ICT, infrastructure, and tourism growth on the African continent during the period 1996–2016 from the dynamic gravity model technique. Their results indicate that ICT and infrastructure have a positive and statistically significant impact on tourist arrivals. This means that improvements in both ICT and infrastructure are associated with an increase in the number of tourist arrivals. Sharma, Mohapatra and Giri (2022) examined the role of ICT, governance, and infrastructure on incoming tourists in India and found that ICT has a positive and significant effect on in-bound international tourists, both in the short and long run. They also established cointegration among all variables. In analysing China, using quarterly data and the ARDL, Shehzad et al. (2019) investigated the role of ICT and silk road infrastructure on tourism growth and found that the introduction of ICT positively affects tourism in that country. Seetanah's (2019) study in Mauritius used annual data for the period 1992–2017 with the ARDL model analysis and established that telecommunications contribute positively to tourism development in both the short and long run.

In a panel data study of 95 economies for the period 2012–2017, Lorente-Bayona, Gil and Enguix (2022) used Ordinary Least Squares (OLS) and Fixed Effects (FE) estimations to check the effect of Internet penetration on international tourism expenditure. Their investigation found that improvements in Internet penetration increased tourism expenditures. This suggests that increased Internet usage is associated with increased purchases of tourism products and services by tourists at a destination, which points to tourism growth. Similarly, Gholipour et al., (2021) investigated the link between telecommunication infrastructure financing and the number of tourist arrivals in 46 growing economies for the period 2005–2019, and the results showed a strong and positive relationship between the two variables. Their research utilised Generalised Methods of Moments (GMM) and dynamic FE.

This research also provided evidence of the existence of a nonlinear relationship between ICT and tourism in Adeola and Evans (2019), a study of countries in Africa for the period 1996–2017 with GMM, which accommodates cross-section dependence while analysing the effects of cell phones and Internet usage on tourism. Specifically, their results indicate a U-shaped relationship, where both cell phone penetration and Internet usage have significant negative effects on tourism up to a particular point, after which both constructs register significant positive effects on tourism. Such results may point to the existence of threshold levels that are required upon which advancements in ICT positively affect tourism growth for countries. Based on the above discussed literature, the following hypothesis was developed:

H1: ICT advancement has an effect on tourism growth.

1.2. Effects of financial development on tourism growth

A country's financial sector is a crucial factor that enhances tourism activities, a combination of which contributes immensely to economic growth. As supported by Isaeva et al. (2022) and Yenişehirlioğlu and Bayat (2019), tourism receipts are consolidated in the country's financial sector, which is a vital stimulant of economic growth. The empirical literature on the effect of financial development on tourism is of a mixed bag nature, which could be ascribed to a number of factors, including the level of financial sector development, the degree of attractiveness of a country as a tourism destination, safety levels, or the nature of the economic characteristics of a country; the specific methods used to analyse the variables; and the components used to gauge the variables or the time period under consideration.

Recent studies have reported the existence of a positive relationship between financial development and tourism, which means that improvements in a country's financial sector are related to tourism developments. This positive connection between financial development and tourism has been interpreted as financial development inducing tourism growth, as evidenced by Al-Mulali et al. (2020) and Khanna and Sharma (2021). Tsaurai (2022) assessed the role of financial development on tourism advancement in some developing economies for the period 2001–2019 using panel data techniques of Fully Modified Ordinary Least Squares (FMOLS), Fixed Effects (FE), pooled Ordinary Least Squares (OLS), and Random Effects (RE). The study found that variables including financial development, economic growth, Foreign Direct Investment (FDI), human capital development, trade openness, and the accompanying variable all had a significant positive effect on tourism. In addition, using annual data for the period 1995–2018 for a selection of 207 countries, Khanna and Sharma (2021) established that bank and stock market development as proxies for financial development positively influence the three tourism demand measures (expenditure per arrival, tourist arrivals, and the ratio of tourism expenditure per gross domestic product), with improvements in tourism arrivals being more significant vis-a-vis tourism expenditure.

In addition, this research encountered literature on a neutral relationship between financial development and tourism, as demonstrated by Khan et al. (2019) among high-income countries in both Europe and Asia. In this scenario, it may be interpreted that improvements in these countries' financial sectors have no bearing on tourism activity, and that such results for countries imply that efforts are needed to boost the financial sector to realise positive effects on their tourism. However, evidence of the cointegration between financial development and tourism has also been found. This is proven in Khanal et al. (2022), wherein the effects of financial development, market investment, and trade are measured on tourism service employment in Australia. Both the ARDL and NARDL bound tests for cointegration evinced a long-run connection among all variables. Using the Pedroni and Kao tests for 12 post-communist states, for 1995–2014, Isaeva et al. (2022) revealed a cointegration relationship among the variables of financial development, tourism, energy consumption, and carbon emissions. The above discussion leads to forming the following hypothesis:

H2: Financial development has an effect on tourism growth.

2. Research methodology

2.1. Description and sources of data

Annual time-series data from 1989 to 2019 were used in this study. This sample period was dictated by the availability of data on the variables used. The data consist of three variables (financial development, ICT, and tourist arrivals). Financial development and ICT are the independent variables, whereas tourism arrivals is the dependent variable. To come up with a single indicator of ICT, this research used the total indicators of both mobile cellular and fixed telephone subscriptions and these were accessed from the World Bank Development indicators. Financial development is measured using the Financial Development Index from the International Monetary Fund's (IMF, 2022) database. This index is an upgrade from the orthodox way that many studies gauge financial development by using a single or two indicators, instead, this is a wide-ranging indicator of an array of proxies of a financial sector. The index, developed by Syirydzhenka (2016), is a composition of the sub-indices of a country's financial institutions and markets with regards depth, access, and efficiency that distils several sub-indices through principal component analysis to come up with an overall indicator of financial development. Tourist arrivals, obtained from the Statistics South Africa website, are used as a proxy for tourism growth. The data were analysed using Eviews version 12.

Table 1 reports on the descriptive statistics and correlation matrix for the study variables, with all their values presented in natural logarithmic format. It can be observed that the mean of financial development (lnFD) is -0.744 , peaking at -0.442 . For the ICT (lnICT) and tourist arrivals (lnTA) variables, the mean values are 16.874 and 15.711 , which peaked at 18.410 and 16.164 correspondingly. Also, the research variables are negatively skewed, with both lnFD and lnICT being platykurtic whereas lnTA is leptokurtic. It was observed that there is a positive correlation between tourist arrivals and each of the two independent variables (financial development and information communication technology), as supported by significant p-values. However, it was still necessary to estimate the relationships between the dependent and independent variables to arrive at definite conclusions.

Table 1. Descriptive statistics and correlation matrix

Descriptive statistics

	lnFD	lnICT	lnTA
Mean	-0.743914	16.874310	15.711430
Median	-0.712089	17.063630	15.762420
Maximum	-0.442157	18.410600	16.164230
Minimum	-1.143336	14.941840	14.351740
Std. Dev.	0.235713	1.271785	0.417170
Skewness	-0.497617	-0.284196	-1.422249
Kurtosis	1.880078	1.514595	5.072844
Jarque-Bera	2.899425	3.267266	16.000970
Probability	0.234638	0.195219	0.000335
Sum	-23.061340	523.103700	487.054200
Sum Sq. Dev.	1.666812	48.523090	5.220934
Observations	31	31	31

Correlation

lnFD	1.000000		

lnICT	0.935804	1.000000	
	0.000000	-----	
lnTA	0.833193	0.781474	1.000000
	0.000000	0.000000	-----

Source: authors' computations.

2.2. Model specification

The effects of ICT and financial development on tourism growth were determined using the Autoregressive Distributed Lag (ARDL) model (Pesaran, Shin, 1999; Pesaran, Shin and Smith, 2001). The strength of this model is that it generates robust results for small samples, and the variables may be integrated with different orders, I(0), I(1), or a combination of I(0) and I(1). The model is not applied in a study if any of the variables are integrated in order I(2) (Pesaran et al., 2001). The data analysis followed several steps: the first step was to conduct a unit root test for stationarity; secondly, a bounds test for cointegration was done; thirdly, estimation of the ARDL test for long and short run relationships followed, and the last step was to carry out diagnostic and stability tests of the ARDL model.

A unit root test for stationarity was conducted to determine whether there was any variable that was integrated of order I(2). Thus, two Unit root tests, the Augmented Dickey Fuller (ADF) and Phillips Perron (PP) tests, were conducted, and the results confirmed that there was no variable with stationarity at I(2). All variables were first transformed into natural logarithms to ensure the reliability of measurements and balanced data (Nathaniel et al., 2020).

Based on contemporary empirical literature (Adeola, Evans, 2020; Khanna, Sharma, 2021; Kumar, Kumar, 2020; Sharma et al., 2022; Tsaurai, 2022), tourism growth is a function of information and communication technology and financial development, as expressed in the following equation:

$$TA = f(ICT, FD) \quad (1)$$

where TA implies tourist arrivals as a proxy for tourism growth; f denotes a functional notation; ICT represents information and communication technology; and FD symbolises financial development. The above model was transformed into natural logarithm format and it became as follows:

$$\ln TA = f(\ln ICT, \ln FD) \quad (2)$$

Thus, the ARDL model specification for testing the effects of information and communication technology and financial development on tourism growth was expressed as:

$$\ln TA_t = \alpha_0 + \varphi_1 \ln TA_{t-1} + \varphi_2 \ln ICT_{t-1} + \varphi_3 \ln FD_{t-1} + e_t \quad (3)$$

where α_0 denotes a constant; φ_1 , φ_2 and φ_3 represent the coefficients of the long-run relationship; and e_t symbolises the error correction term. The regression equation applied for the ARDL analysis is represented as follows:

$$\begin{aligned} \Delta \ln TA_t = & \alpha_0 + \varphi_1 \ln TA_{t-1} + \varphi_2 \ln ICT_{t-1} + \varphi_3 \ln FD_{t-1} + \\ & + \sum_{i=1}^n \omega_1 \Delta \ln TA_{t-i} + \sum_{i=1}^n \omega_2 \Delta \ln ICT_{t-i} + \sum_{i=1}^n \omega_3 \Delta \ln FD_{t-i} + e_t \end{aligned} \quad (4)$$

where $\Delta \ln TA_t$ indicates the change in the logarithm value of tourist arrivals in South Africa at time t and α_0 is a constant. The variation in the logarithm value of ICT is represented by $\Delta \ln ICT_{t-i}$, whereas $\Delta \ln FD_{t-i}$ symbolises the fluctuation in the natural logarithm value of financial development; whereas ω_1 , ω_2 and ω_3 represent the coefficients of the short-run relationship in the model. To this end, the error correction term is represented as e_t .

After the ADF and PP unit root tests for stationarity, the long-run relationship in the model is examined. Thus, a bound cointegration test is conducted based on the following hypotheses:

H0: $\varphi_1 = \varphi_2 = \varphi_3 = 0$ (there is no relationship among variables).

H1: $\varphi_1 \neq \varphi_2 \neq \varphi_3 \neq 0$ (there is a relationship among variables).

The results of the bound co-integration test confirmed that the calculated F-statistic value was above the upper critical values. Consequently, the null hypothesis that the study variables have no cointegration was rejected. This rejection implies that a long-run relationship exists among the study variables. Judging from the cointegration test results, this research then proceeded to express the error correction model (ECM) and to determine the equilibrium adjustment as follows:

$$\Delta \ln TA_t = a_0 + \sum_{i=1}^n \omega_1 \Delta \ln TA_{t-i} + \sum_{i=1}^n \omega_2 \Delta \ln ICT_{t-i} + \sum_{i=1}^n \omega_3 \Delta \ln FD_{t-i} + \theta ECT_{t-i} + e_t \quad (5)$$

where ECT_{t-i} denotes the Error Correction term (ECT) and θ denotes the coefficient of the ECT.

3. Empirical results

This section contains the results of unit root tests, long-and short-run empirical results that analyse the effect of ICT advancements and financial development on tourism growth for South Africa. Firstly, this research checked whether the data adheres to the stationarity assumption that is required to determine the order of integration so that ARDL estimation can be applied. The stationarity results are presented in Table 2.

Table 2. Unit root test results

Variable	Integration orders		lnFD	lnICT	lnTA
PP (t-values)	I(0)	Intercept	-0.897	-1.067	-1.768
		Trend & intercept	-1.755	-0.618	-4.611*
	I(1)	Intercept	-4.502*	-2.945**	-7.196*
		Trend & intercept	-4.538*	-3.139	-6.867*
ADF (t-values)	I(0)	Intercept	-4.747*	-1.312	-1.860
		Trend & intercept	-2.234	0.165	-4.611*
	I(1)	Intercept	-3.305*	-3.024*	-6.659*
		Trend & intercept	-5.296*	-3.219	-6.627*
Order of integration			I(1)	I(1)	I(1)

Note: * and ** Rejection of the null hypothesis was at the 5% and 10% level of significance respectively.

Source: authors' computations.

3.1. Results of the Unit Root Tests

The results of the ADF and PP tests show that the variables are a mixture of orders zero and one (Table 2), leading to the rejection of the null hypothesis that the variables have a unit root. It was concluded that the ARDL model could be employed to analyse the long-run relationship among ICT, financial development, and tourism growth. Then, the bounds test for cointegration was conducted.

3.2. F-bounds cointegration and long-run estimations

The results of the Bounds test for cointegration in Table 3 indicate that there is a long-run relationship among the variables because the value of the F-statistic (11.280) is greater than the upper critical values at the 10%, 5%, and 1% level of significance. The null hypothesis that there is no long-run relationship among the study variables, therefore, was rejected, suggesting that there is a long-run relationship between the study variables. The rule of thumb is that variables have a long-run relationship when the calculated F-statistic is greater than the critical values of the upper bounds (Pesaran et al., 2001). The model selection criterion employed was the Akaike Information Criterion (AIC), and the selected model was ARDL (1, 1, 5).

Table 3. Results of the bounds test

Test Statistic						Value
F-statistic						11.279986
	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
30	2.915	3.695	3.538	4.428	5.155	6.265
Asymptotic	2.630	3.350	3.100	3.870	4.130	5.000

Note: * Rejection of the null hypothesis at the 5% significance level.

Source: authors' computations.

The long-run findings in Table 4 indicate that financial development does not have an important effect on tourism growth in South Africa. The coefficient (1.44061) of financial development is positive, but is not significant at the 5% level, suggesting that any improvement in the financial sector in South Africa has no effects on tourist arrivals in the country. This result does not substantiate the hypothesis H2, which stipulates that financial development has an effect on tourism growth. On the other hand, the coefficient of ICT is positive and significant at the 5% level. This leads to a conclusion that any changes in ICT as measured by mobile cellular subscriptions and fixed telephone subscriptions have effects on tourism growth.

Thus, the hypothesis H1 that advancement in ICT influences tourism growth was supported. Precisely, the number of tourist arrivals to South Africa grew by 0.23% in the long-run if the number of fixed telephone subscribers and mobile cellular subscribers increases by 1%.

Table 4. Estimated coefficients of the long-run relationship

Variable	Coefficient	Std. error	t-Statistic	Prob.
lnFD	0.144061	0.255687	0.563426	0.5786
lnICT	0.233269	0.043952	5.307342	0.0000
C	11.925740	0.923077	12.919550	0.0000

Source: authors' computations.

3.3. Short-run results and ECT estimation

The short-run estimates presented in Table 5 confirm that financial development influences tourism growth in South Africa. A 1% increment in financial development ultimately causes an increase in tourist arrivals of about 0.48% in the short-run, denoting that South Africa's tourism industry grows when financial development improves. Information and communication technology on the other hand, has an inconsequential effect on tourist arrivals in the short-run. The coefficient (0.050120) of ICT is positive but is insignificant at the 5% level, denoting that any changes in ICT as measured by fixed telephone subscribers and mobile cellular subscribers do not influence tourist arrivals in the short-run. This result does not validate the hypothesis H1.

Table 5. Estimated short-run and ECT

Variable	Coefficient	Std. error	t-Statistic	Prob.
COINTEQ	-0.793458	0.108398	-7.319831	0.0000
D(lnFD)	0.484836	0.205315	2.361430	0.0290
D(lnICT)	0.050120	0.106212	0.471885	0.6424
D(lnICT(-1))	0.089052	0.118764	0.749824	0.4625
D(lnICT(-2))	0.243750	0.117901	2.067420	0.0526
D(lnICT(-3))	0.241327	0.118015	2.044885	0.0550
D(lnICT(-4))	-0.609064	0.106347	-5.727133	0.0000

Source: authors' computations.

However, it was detected that ICT has a negative lagged effect on South Africa's tourism growth. The coefficient (0.609064) of ICT in lag four indicates that the number of tourist arrivals to South Africa contracts by 0.61% in the current year due to a 1% increase in ICT that happened in the fourth lag (implying four years back). This result suggests changes in ICT causes a significant effect on tourist arrivals after four years.

The fact that there is cointegration in the study variables, the Error Correction Model was evaluated to estimate the period required to correct disequilibrium caused by short-run shocks. The error correction term (ECT) shows the speed of adjustment from short-run shocks to long-run equilibrium, and the ECT must be statistically significant and a negative sign (Brooks, 2019). As expected, the coefficient (-0.793458) of ECT is negative, and its p-value (0.0) is significant at the 5% level (Table 5). This implies that almost 79% of the short-run shocks are adjusted each year. Thus, the period required to reach the long-run equilibrium is 1,2603 ($1/0.793458$) years, which means almost one year and three months.

3.4. Results of the residual diagnostic and stability tests

To determine whether the ARDL model is suitable for this study, residual diagnostic tests (serial correlation, homoscedasticity, and parameter stability) were carried out, and the results are presented in Table 6. The results of the tests confirm that the ARDL model meets the requirements of residual diagnostic tests at the 5% level of significance, indicating that the model does not have autocorrelation and is homoscedastic.

Table 6. Residual diagnostic test results

Test	Null hypothesis	Prob.
Breusch-Godfrey Serial Correlation LM Test	No serial correlation	0.9529
Breusch-Pagan-Godfrey	Homoscedasticity	0.4600
Jarque-Bera Normality test	No normality	0.6000

Source: authors' computations.

The series was normally distributed. Therefore, the results of this study were valid, accurate, and reliable. The CUSUM stability test also showed that CUSUM and CUSUM of squares fluctuated within the critical boundaries at the 5% significance level for the entire sample period (Figures 1 and 2), confirming that the model was stable. This stability implies that the effects of ICT and financial development on tourism growth are moderate.

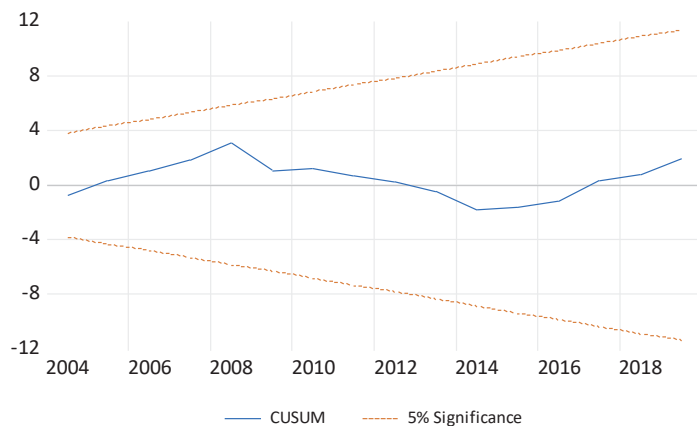


Figure 1. Results of CUSUM

Source: authors' computations.

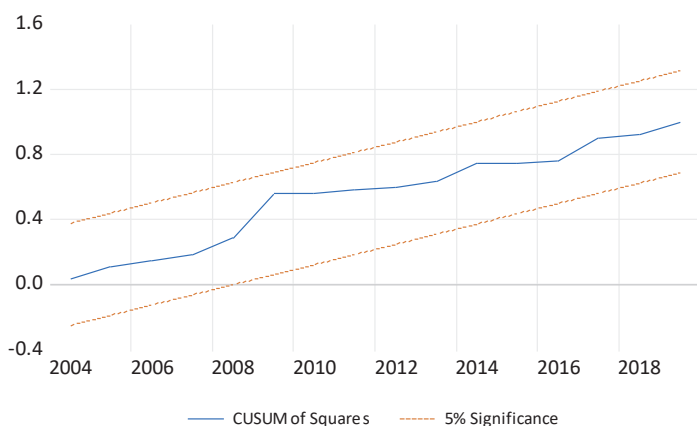


Figure 2. Results of CUSUM of squares

Source: authors' computations.

4. Discussion

The underlying aim of this study was to investigate the effects of financial development and ICT advancements on tourism growth in South Africa. The bounds cointegration test indicates that the study variables have a long-run relationship, but the effect of financial development on tourism growth is not statistically significant at the 5% level despite the effect

being positive. This suggests that any changes in financial development do not trigger the inflow of foreign tourists to South Africa in the long-run. These results oppose those of previous studies which indicated that improving financial development has a positive effect on tourism growth (Al-Mulali et al., 2020; Khanna, Sharma, 2021). On the contrary, it was found that ICT is a determinant of tourism growth in South Africa. The number of foreign tourist arrivals in the country increases when the use of ICT intensifies. This result is not surprising since the use of ICT enables tourism destinations and tourism establishments to market and sell their products and services to potential tourists anytime and anywhere in the world irrespective of their geographical locations. The current results are consistent with the findings of Adeola and Evans (2020), who analysed African countries in which ICT was found to have a positive and statistically significant influence on tourist arrivals. A study conducted in India shows that a one percent increase in ICT leads to a 1.40% increase in tourist arrivals in the long run (Sharma et al., 2022).

Another result worth mentioning is that improving financial development in South Africa has a positive effect on tourism growth in the country in the short-run. This result is not surprising given that augmentation in financial development implies that financial services are easily accessible by tourists, service providers and potential tourism investors. Ultimately, increasing tourism investment stimulates the demand for tourism. The effect of financial development on tourism growth has been underscored by Isaeva et al. (2022) and Yenişehirlioğlu and Bayat (2019). Unlike in the long-run, advancements in ICT have no effect on tourism growth in South Africa in the short-run, but ICT has a lagged effect in lag four (meaning four years ago). Probably, ICT fails to cause an effect in the short-run because South Africa's ICT sector is relatively advanced (International Trade Administration [ITA], 2021), and most tourism products and services are already visible and accessible online. Thus, a small increase in ICT fails to influence tourist arrivals in the country. It is argued that some potential tourists may see no need of visiting South Africa physically after reading online information or watching online videos about the country's tourism destinations. Alternatively, potential tourists may opt for visiting other destinations. This phenomenon is in line with the information validation model by Silaban et al. (2023) that aids in the forecasting of prospective tourists' ambitions as well as the preliminary information checking by potential tourists (Ho et al., 2016) or the tourist destination identity that emanates from online information checks (Mansur et al., 2021). The current results also support Kumar's (2014) study in Vietnam, which showed that the short-run effects of ICT on tourism are not statistically significant. In contrast, the current results are

antithetical to that of Sharma et al. (2022), which shows that ICT has a positive and significant short-run effect on inbound tourism in India.

Conclusions

Information and communication technology and financial development have significantly influenced the growth of tourism in many countries. Advancements in ICT have transformed the tourism industry in all aspects, including marketing, management, production, and customer relations. For instance, online marketing and sales enable tourism destinations and businesses, irrespective of their size, to reach a wider market. Similarly, potential tourists view and buy products online anytime and anywhere without physical contact with service providers. On the other hand, financial development instigates tourism growth by ensuring that money is available and accessed by tourism investors to develop new or expand existing tourism infrastructure, leading to an increased demand for tourism. Additionally, financial development also implies that tourists can easily access money to purchase tourism products and services.

This study aimed to investigate the effects of advancements in ICT and financial development on tourism growth in South Africa. This study used the ARDL model and annual time series data for the period 1989–2019. In the short-run though, the effect of advancement in ICT on tourist arrivals in South Africa is insignificant, however, it has a negative and significant effect with a lag of four. Implying that a 0.61% reduction in tourist arrivals is experienced in the current year with 1% in the upgrades in ICT that took place four years ago. The findings show that in the long-run, the coefficient of ICT is positive and significant, denoting that any changes in ICT in South Africa affect foreign tourist arrivals. Because South Africa's ICT sector is advanced as per ITA (2021), tourism products are visible and accessed more by potential visitors in the long-run, with the help of ICT advancements. An improvement in ICT via the availability and accessibility of online information about tourism products is expected to buoy tourist arrivals because potential tourists eventually arrive at a destination after reading online information about the tourism facilities or destination, especially because of compelling reviews of previous visitors or when compared with other tourist destinations outside South Africa.

With regards to the country's financial sector, this study has found that in the short-run, financial development has a 0.48% positive and significant effect on tourist arrivals. However, in the long-run, financial development's effect is not noteworthy on tourism growth. Financial

development has a positive but insignificant effect on tourist arrivals in South Africa for the period 1989–2019. This infers that improvement in South Africa's financial sector are not felt by participants in its tourist industry, which intimates to a need for more financial inclusion to help register a long-term effect of the financial sector on tourism in the country. For improvements in the financial sector to reflect fully on South Africa's tourism requires more economic players being included in terms of businesses further spending on tourism development as well as more tourists who would pay to visit local tourist destinations, leading to the growth of tourism in the country. Therefore, the South African government must continue strengthening its financial sector to ensure that it is healthy and sound to attract more investors and facilitate tourist spending. In light of the empirical findings, this study suggests that South Africa's tourism sector should continue to invest in ICT to ensure that tourism products and services are visible and accessible to foreign tourists, which increases the value of the country's tourism.

This study investigated the effects of ICT advancements and financial development on South Africa's tourism growth, which was only measured by international tourist arrivals. The results would be different if tourism growth was measured by both international tourist arrivals and domestic tourists. Therefore, further studies should investigate the impacts of ICT advancements and financial development on South Africa's outbound tourism. Furthermore, future studies may examine the effects of ICT and financial development on South Africa's outbound tourists.

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