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ICT Infrastructure, OTT Market Growth, Economic Freedom, and International Tourism: A Cross-Country Empirical Study

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Abstract: This study examined whether information and communication technology (ICT), over the top (OTT) market growth, and economic freedom affect tourism at the global level. Toward this end, the present study tested regression models of inbound tourism and outbound tourism with panel data from 50 countries covering the years 2013 to 2020. The results of the panel-data analysis suggest that high levels of OTT advertising revenue and mobile broadband penetration contribute to high levels of inbound tourism. The results also reveal that high OTT advertising revenue, labor freedom, and income are associated with high levels of outbound tourism. The obtained results underscore that ICT and media play key roles in promoting international tourism.

Keywords: ICT; OTT; economic freedom; international tourism



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1. Research Background and Questions

According to a United Nations World Tourism Organization (UNWTO) report [1], from January to March 2019, the number of international tourists (one-night visitors) increased by 4% compared to the same period last year. Although the tourism industry has shrunk during the era of the pandemic, it will certainly be revitalized after the pandemic and will constitute an important driving force for economic development. According to another UNWTO report [2], international tourism continued to recover from the COVID-19 crisis from January to March 2022. Travel destinations welcomed nearly three times more international tourists than in the same period in 2021, with Europe leading the rebound.

Tourism development has been influenced by various factors. On the global scale, previous studies have confirmed that there has been a mutually integrated relationship between economic growth and tourism development [3–8]. In recent years, researchers have also examined the relationship between international tourism and globalization indicators, including social, political, and economic globalization [9]. For example, international trade [10–13] and foreign direct investment [14,15], as economic globalization indices, could be associated with international tourism development. The rapid process of socio-cultural globalization, called cultural convergence, due to media transparency and high internet consumption, also inevitably promotes international tourism development [9,16,17]. For example, tourists' motivations and their activities can be induced by the viewing of a moving image in film, television, pre-recorded products, and current digital media including global video streaming and OTT services (e.g., YouTube, TikTok, Netflix, and Disney+). In addition, political factors could affect international tourism development. The increase in demand for international tourism comes when a country has friendly political ties with other countries, strives to resolve internal conflicts and religious incitements, actively participates in international treaties, and increases the number of foreign embassies [9].

Therefore, this study conducts a panel analysis to confirm how information and communication technology (ICT), over the top (OTT) market growth, and economic freedom

affect tourism at the global level as economic and socio-cultural factors. The rapid development of transportation technologies and the continuous innovations in the media and ICT industries have accelerated both economic and cultural globalization and enabled people to travel anytime and anywhere. Based on the so-called tourism-led growth hypothesis, tourism plays a decisive role in job creation, export income increase, and infrastructure improvement, so that many countries have opened more tourist attractions, increased their tourism investment, and explicitly considered tourism as an economic development policy [18,19].

1.1. ICT Impacts on Tourism

Recently, tourism companies have established ways to overcome obstacles, with some applying ICT as an innovative solution [20]. It is now natural for tourists to use the internet, social media, and mobile devices when planning their trips to acquire useful information. As ICT evidently affects tourism, the term “smart tourism” has been widely used in the tourism industry and academia. Smart tourism is defined in [21] (p. 181) as “tourism supported by integrated efforts at a destination to collect and aggregate/harness data derived from physical infrastructure, social connections, government/organizational sources, and human bodies/minds, combined with the use of advanced technologies to transform that data into on-site experiences and business value propositions with a clear focus on efficiency, sustainability, and experience enrichment.” Park et al. [22] identified three types of smart tourism based on the existing literature to conceptualize smart tourism. The first is an intelligent service to satisfy tourists’ needs by resolving uncertainties about unknown destinations to tourists, the second is an online marketing and promotion campaign of tourism-related companies, and the third is a combination of technology and tourism. Various empirical studies on smart tourism have been conducted in terms of the application of ICT to the tourism field, and their core agenda has been the advancement of the internet and mobile technology. For example, through ICT, tourists can make low-cost reservations with up-to-date information and share relevant information about destinations, resorts, hotels, and activities with others [23]. As ICT can promote the word-of-mouth effect online, tourists can save time from conducting lengthy information searches and reduce their uncertainties regarding expensive travel and bad experiences [23–25].

Lee et al. [26] found that reliable mobile subscriptions, secure internet servers, and fixed broadband subscriptions had effects on inbound tourism, tourism receipts, and sector returns. Anse et al. [27] also analyzed whether ICT indicators including internet users, fixed broadband, mobile phones, and secured internet servers impacted tourism using the panel data from 44 Asian countries. They revealed that ICT contributes to tourism development in the East Asia Pacific and South Asian regions, except for fixed broadband in the South Asian region.

Similarly, various studies have been conducted on the effects of ICT on tourism. However, the topics of most previous studies involved the impacts of ICT on inbound tourism or the development of the local tourism industry. In addition, the scope of research has been limited to specific areas. Therefore, employing a cross-country panel data set, this study attempts to analyze how the necessary conditions of ICT, such as mobile and fixed broadband infrastructure, affect international inbound and outbound tourism [26]. Since the integrated digital network formed through the use of broadband networks can serve as a platform for sharing tourism information essential for smart tourism development, this study poses the following research question:

Research Question (RQ) 1: Do mobile and fixed broadband infrastructure affect inbound or outbound tourism in a country?

1.2. OTT Market Growth Impacts on Tourism

According to Garrison and Wallace [16], media, including movies, television, video games, and books, have become increasingly important factors in terms of recent tourism development. For example, Teng [17] found that film-tourism experiences increase tourist

engagement, which further strengthens behavioral intentions, including recommending a film tour to others, participating in other film tours in the future, or revisiting film-tourism sites. Kim [28] also demonstrated that audiences' emotional and behavioral involvements at film locations positively affect their on-site film-tourism experiences. Kim and Long [29] argued that watching television (TV) dramas in the context of film tourism can promote identification, empathy, emotional connection, and parasitic interaction, which could motivate some audiences to visit drama locations. Kantarci, Başaran, and Özyurt [30] suggested that the tourism industry should establish strategic cooperation with the film and TV industry with the aim of marketing the destinations embedded in video contents.

OTT is defined as "video content offered on the internet" by the United States Federal Communications Commission [31]. The OTT service started with a TV set-top box distributed by internet protocol (IP) over a network and is intended for online video providers (OVDs) to provide video content [32]. OTT services are used with professional players such as Netflix and YouTube for watching video content, along with traditional TV providers. Thus, OTT video services can be defined as online content providers that use internet infrastructure with non-affiliated broadbands [33]. The OTT market is constantly growing. For example, revenue from internet video subscriptions increased from \$12.5 billion in 2014 to \$45.26 billion in 2019, including subscription and transactional video-on-demand services [34]. According to Statista [35], Netflix, as a leading global OTT platform, has about 221.64 million paid subscribers worldwide as of the first quarter of 2022. Most Netflix subscribers are based in the US and Canada, which account for more than 75 million of Netflix's total global subscriber base. Notably, the OTT platform competition has become fiercer than ever with the launch of Disney+, Apple TV+, HBO Max, and Peacock streaming services.

Furthermore, advertising video-on-demand (AVOD) services, such as YouTube and Facebook, are also growing. It is estimated that over 2.6 billion users worldwide use YouTube once a month [36]. In 2024, video internet advertising markets, including mobile video internet advertising, will reach 76,249 million USD.

OTT services have not only changed consumers' video-content consumption behavior, but also formed a video-content value chain at a global level. Due to OTT's international achievements, broadcasters have moved online by building their own platforms or signing business contracts with other OTT services or broadcasters in the local market, as well as changing their position as program providers for international OTT services [37]. OTT services have expanded internationally through the globalization of platforms, occupying a dominant position in national players, from broadcasting networks to local carriers, content producers, and governments [38]. These changes in the TV-content value-chain system can increase the number of global OTT subscribers and provide viewers with the opportunity to watch more diverse content. As OTT subscribers increase and the competition between platforms continues, global OTT operators are trying to expand the number of subscribers by providing various genres of video content, such as TV series, movies, and documentaries. OTT services now enable viewers to watch various kinds of videos in a comfortable environment at a convenient time, especially foreign videos with subtitles and dubbing. For example, OTT users can watch movies and TV series around the world through diverse OTTs. Furthermore, travel-related documentaries have developed in various forms, for example, by introducing restaurants or regions that are not well known, thus attracting viewers' attention. It is assumed that watching videos using OTT services, such as YouTube and Facebook, can affect intentions to visit tourist destinations. Therefore, this study poses the following research question:

RQ 2: Does the market growth of advertizing-based OTT affect inbound or outbound tourism in a country?

1.3. Economic Freedom Impacts on Tourism

Economic, political, press, or personal freedom can determine inbound and outbound tourism [39–41]. Political stability, civil rights, and political freedom, which indicate

advances in a country's level of democracy, can make an important contribution to its development of tourism. [42]. For example, Saha, Su, and Campbell [39] used the panel data of 110 countries from 1995 to 2102 to test the impact of three types of political freedom on inbound tourism: civil liberties, democratic responsibility, and political rights. They found that civil liberties had a significant and positive impact on inbound tourism. Meanwhile, Bulnut, Kocak, and Suess [42] showed that the level of freedom in terms of the effects of political rights and civil liberties could play a role in explaining the volume of inbound tourism using panel-data analysis with the annual data of France, the US, Spain, China, Italy, the United Kingdom, Germany, and Mexico from 1998 to 2016. Enright and Newton [43] found using importance performance analysis (IPA) that some factors, including political stability, government policy, access to information, and transparency in policymaking, are important business-related factors affecting the tourism competitiveness of Hong Kong. In addition, Das and DiRienzo [44] argued that freedom of information plays an important role in tourism competitiveness because it leads tourists to have high levels of access to unrestricted information.

In particular, the level of economic freedom can affect tourism competitiveness in a country. According to The Heritage Foundation [45], economic freedom is "the fundamental right of every human to control his or her own labor and property. In an economically free society, individuals are free to work, produce, consume, and invest in any way they please. In economically free societies, governments allow labor, capital, and goods to move freely and refrain from coercion or constraint of liberty beyond the extent necessary to protect and maintain liberty itself."

Both economic freedom and globalization are mutually interconnected, and they have an impact on the international economic growth. Using panel data from 106 countries from 1981 to 2004, Dreher et al. [46] analyzed whether globalization and economic liberalization affected the government's respect for human rights. Their results showed that physical integrity rights had increased with globalization and economic freedom. For exploring the impact of economic freedom on economic growth, Tran [47] found that higher economic and labor freedom led to higher economic growth using data from ASEAN countries from 2000 to 2017. With regard to the impact of economic freedom on tourism, Enright and Newton [43] found that investment incentives in the banking and financial system and overall economic conditions are associated with Hong Kong's relative tourism competitiveness. Dwyer and Kim suggested that the economic level of freedom, which comes from the domestic business environment in a destination, the management capabilities of tourism firms, and the level of cooperation between firms in the destination's tourism industry, could be important situational conditions for destination competitiveness. The tourists may not be willing to visit countries with low levels of economic freedom because of concerns that the itinerary may be canceled or problems may arise during their trip [48]. According to Akar and Özcan [49], low levels of economic freedom can also give tourists negative experiences and impressions when visiting such countries.

Notably, although many studies have investigated the impacts of the level of freedom on tourism competitiveness in destinations, there is still a dearth of research about the association between tourism and the level of freedom. Gholipour et al. [41] assumed that the lower the level of personal freedom in a country, the greater the outbound tourism from that country. On the other hand, local business managers with optimistic confidence about their business performance travel more frequently to other countries to find more business opportunities in the international market [50].

As such, research on the relationship between the degree of economic freedom and tourism development in a country has been continuously conducted, but few studies have confirmed the simultaneous impacts on inbound and outbound tourism. Therefore, this study attempts to confirm the degree to which economic freedom affects the number of inbound tourists and the number of outbound tourists with the following research question:

RQ 3: Does the level of economic freedom (e.g., investment freedom, labor freedom, financial freedom, trade freedom) affect inbound or outbound tourism in a country?

2. Research Method

Panel-data analysis was employed to examine inbound and outbound tourism at the national level. Panel-data analysis has some advantages over pooled Ordinary Least Square (OLS) regression analysis. First, since each country is observed repeatedly, panel-data analysis can estimate a dynamic relationship. Second, panel-data analysis can control for unobserved country characteristics which may be related to international tourism, while the pooled OLS regression analysis is likely to suffer from heterogeneity bias of coefficient estimates [26,51,52]. Third, as the panel-data analysis provides more information and variability of variables, more efficient estimators can be obtained compared to cross-sectional data. The data for this study covered the years 2013 to 2020. A total of 400 observations from 50 countries were employed for the panel-data analysis.

2.1. Inbound Tourism Model

Employing an inbound tourism model, the factors affecting inbound tourism were analyzed. Model (1) provides the inbound tourism model. In the inbound tourism model, the dependent variable $In_Tourism_{it}$ is the number of inbound tourists in country i by time t . For the independent variables, income, OTT advertising revenue, mobile broadband penetration, fixed broadband penetration, investment freedom, labor freedom, financial freedom, and trade freedom were included. Population density was also included as a control variable.

For the empirical model, both fixed effects and random effects models were considered. In the inbound tourism model, β_0 is constant, ν_i denotes the error term that indicates country characteristics, and ε_{it} is the pure error term. Since the distribution of the inbound tourism and some independent variables such as income and population density in the empirical model are skewed, data transformation with a logarithm was employed. Logarithmically transforming variables in a regression model is a common and effective way to handle situations where a non-linear relationship exists between the independent and dependent variables. Using the logarithm of variables in the model makes the effective relationship non-linear, while still preserving the linear regression model.

$$In_Tourism_{it} = \beta_0 + \beta_1 * LnINC_{it} + \beta_2 * LnPOD_{it} + \beta_3 * OTT_ADV_{it} + \beta_4 * MobileB_{it} + \beta_5 * FixedB_{it} + \beta_6 * Investment_F_{it} + \beta_7 * Labor_F_{it} + \beta_8 * Financial_F_{it} + \beta_9 * Trade_F_{it} + \nu_i + \varepsilon_{it} \quad (1)$$

2.2. Outbound Tourism Model

Employing an outbound tourism model, the factors affecting outbound tourism were examined. Model (2) provides the outbound tourism model. In Model (2), the dependent variable $In_Out_Tourism_{it}$ is the number of outbound tourists in country i by time t . Income, OTT advertising revenue, mobile broadband penetration, fixed broadband penetration, investment freedom, labor freedom, financial freedom, and trade freedom were included as independent variables in Model (2). As a control variable, population density was included. For the empirical model, both fixed-effects and random-effects models were considered. In the inbound tourism model, β_0 is constant, ν_i denotes the error term that indicates country characteristics, and ε_{it} is the pure error term. Since the distribution of the outbound tourism and some independent variables such as income and population density in the empirical model are skewed, data transformation with a logarithm was employed.

$$In_Out_Tourism_{it} = \beta_0 + \beta_1 * LnINC_{it} + \beta_2 * LnPOD_{it} + \beta_3 * OTT_ADV_{it} + \beta_4 * MobileB_{it} + \beta_5 * FixedB_{it} + \beta_6 * Investment_F_{it} + \beta_7 * Labor_F_{it} + \beta_8 * Financial_F_{it} + \beta_9 * Trade_F_{it} + \nu_i + \varepsilon_{it} \quad (2)$$

2.3. Measurement and Data Sources

Table 1 presents the variables, their measurements, and the data sources for this study. Inbound tourism was measured by the number of inbound tourists, while outbound tourism was measured by the number of outbound tourists. Based upon the previous

studies, some explanatory variables may influence inbound tourism and outbound tourism. The OTT advertising revenue in the media industry was measured by the OTT advertising revenue per 1,000,000 inhabitants. Mobile broadband penetration was measured by the number of mobile broadband subscribers per 100 inhabitants. Fixed broadband penetration was measured by the number of fixed broadband subscribers per 100 inhabitants. Income was measured by the gross domestic product (GDP) per capita. For the measurement of population density, population per square kilometer (km²) was used.

Table 1. Description of variables.

Variables	Measurement	Data Sources
Inbound tourism	Number of inbound tourists	UNTWO
Outbound tourism	Number of outbound tourists	UNTWO
OTT advertising revenue	OTT advertising revenue per 1,000,000 inhabitants	PwC
Mobile broadband penetration	Total number of mobile broadband subscribers per 100 inhabitants	ITU
Fixed broadband penetration	Total number of fixed broadband subscribers per 100 inhabitants	ITU
Income	GDP per capita	World Bank
Population density	Population per km ²	World Bank
Investment freedom	Investment freedom index	World Bank
Labor freedom	Labor freedom index	World Bank
Financial freedom	Financial freedom index	World Bank
Trade freedom	Trade freedom index	World Bank

The effects of some components of the Economic Freedom Index (labor freedom, investment freedom, trade freedom, and financial freedom) on international tourism were also examined. Economic freedom index data were collected from World Bank Group. Other data employed were collected from different sources (UNWTO, PwC, ITU, and World Bank groups). Table 2 provides 50 countries represented in the data set used.

Table 2. Countries represented in panel data set.

Country
Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, China, Colombia, Czech Republic, Denmark, Egypt, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Kenya, Korea (R.O.K.), Malaysia, Mexico, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Arab Emirates, United Kingdom, United States

3. Results

Table 3 provides the summary statistics of key variables employed. For the research models, the data of 50 countries between 2012 and 2019 were analyzed. The mean of inbound tourism was 21,044.76, with a standard deviation of 28,686.62. The mean of outbound tourism was 21,810.76, with a standard deviation of 36,363.30. Table 4 presents a correlation matrix. To detect multicollinearity, the variance inflation factors (VIFs) were checked and presented in Table 5. A VIF value over 10 is a signal of multicollinearity. For the inbound tourism model, the values of VIFs are within the range 1.03 to 2.04, with a mean of 1.44. For the outbound tourism model, the values of VIFs are within the range 1.05 to 2.38, with a mean of 1.54, which indicates no multicollinearity issue. Thus, all of the variables were included in the final model.

Table 3. Summary statistics of key variables.

	N	Mean	Min	Max	S.D.
Income	400	10.216	7.836	11.538	0.774
Population density	400	4.565	1.084	8.992	1.498
OTT advertising revenue	274	7.275	0.004	129.342	13.512
Mobile broadband penetration	400	78.062	0.310	250.040	40.341
Fixed broadband penetration	395	23.144	0.010	46.820	13.528
Investment freedom	400	67.875	20.00	90.00	18.851
Labor freedom	400	64.558	31.00	98.50	14.825
Financial freedom	400	63.300	20.00	90.00	15.579
Trade freedom	400	81.900	60.40	95.00	7.486
Inbound tourism	396	21,044.76	282.00	196,464.0	28,686.62
Outbound tourism	397	21,810.76	145.00	277,265.0	36,363.30

Table 4. Correlation matrix.

	Income	Population Density	OTT Advertising Revenue	Mobile Broad Band Penetration	Fixed Broad Band Penetration	Investment Freedom	Labor Freedom	Financial Freedom	Trade Freedom	In Bound Tourism	Out Bound Tourism
Income	1.000										
Population density	0.005	1.000									
OTT advertising revenue	0.105	0.041	1.000								
Mobile broadband penetration	0.662	0.079	0.109	1.000							
Fixed broadband penetration	0.844	0.034	0.158	0.481	1.000						
Investment freedom	0.612	0.145	0.095	0.265	0.621	1.000					
Labor freedom	0.421	0.107	0.061	0.403	0.268	0.343	1.000				
Financial freedom	0.643	0.080	0.147	0.420	0.616	0.823	0.491	1.000			
Trade freedom	0.809	0.066	0.085	0.476	0.693	0.762	0.410	0.729	1.000		
Inbound tourism	0.266	−0.023	0.398	0.237	0.240	0.111	0.287	0.156	0.206	1.000	
Outbound tourism	0.109	0.020	0.238	0.105	0.236	−0.176	0.127	−0.149	−0.010	0.530	1.000

Table 5. Variance inflation factors.

Variables	Inbound Tourism Model	Outbound Tourism Model
	VIF	VIF
Income	1.87	1.67
Population density	1.03	1.58
OTT advertising revenue	1.11	1.13
Mobile broadband penetration	2.04	2.38
Fixed broadband penetration	2.02	2.23
Investment freedom	1.47	1.44
Labor freedom	1.11	1.14
Financial freedom	1.31	1.31
Trade freedom	1.05	1.05
Mean VIF	1.44	1.54

Table 6 provides the results of panel regressions of the inbound tourism model. Initially, four independent variables from the economic freedom index were included for the model with two control variables (income and population density). The initial result (Model 1) indicates that investment freedom and income variables were statistically significant. When three other ICT infrastructure variables, OTT advertising revenue, mobile broadband penetration, and fixed broadband penetration, were included for the second model (Model 2) with two control variables, OTT advertising revenue and mobile broadband penetration variables were statistically significant. In the final model, all independent variables were included for the model. The results of the final model (Model 3) indicate that OTT advertising revenue and mobile broadband penetration variables were statistically significant. This result reveals that, in spite of importance of income and investment

freedom variables in the inbound tourism, the main explanatory variables are OTT advertising revenue and mobile broadband penetration variables. A Hausman test was used to differentiate between the fixed effects and random effects model, as shown in Table 6. Based upon Table 6, inbound tourism models' p -value is over 0.1, demonstrating that the random effects model is preferred.

Table 6. Panel regressions of inbound tourism.

Variables	Inbound Tourism					
	Model 1		Model 2		Model 3	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Income	9997.716	4.778 **	7153.011	1.930	5870.171	1.535
Population density	593.709	0.226	355.574	0.128	−67.816	−0.024
Investment freedom	138.621	2.460 *			101.887	1.234
Labor freedom	−50.386	−1.065			91.948	1.105
Financial freedom	36.879	0.646			62.599	0.788
Trade freedom	138.137	1.293			26.930	0.196
OTT advertising revenue	-		100.066	3.415 **	97.702	3.312 **
Mobile broadband penetration			57.562	2.898 **	61.812	3.041 **
Fixed broadband penetration			174.644	1.205	176.466	1.214
Constant	−103,645.9	−4.395	−63,431.60	−1.651	−67,864.28	−1.703
Number of observations	265					
Hausman statistic (p -value)	3.209 (0.7821)		6.3890 (0.2702)		8.836 (0.4525)	
Model	Random effect		Random effect		Random effect	
Time and country controlled	yes		yes		yes	
R^2	0.137		0.239		0.257	
F	10.331 **		16.337 **		9.801 **	
Durbin–Watson stat	0.519		0.768		0.768	

* $p < 0.05$, ** $p < 0.01$.

Table 7 presents the results of panel regressions of outbound tourism model. Initially, four independent variables from the economic freedom index (Model 1) were included for the model with two control variables (income and population density). The initial result indicates that the income variable was statistically significant. When three other ICT infrastructure variables, OTT advertising revenue, mobile broadband penetration, and fixed broadband penetration, were included for the second model (Model 2) with two control variables, OTT advertising revenue and income variables were statistically significant. In the final model (Model 3), all independent variables were included for the model. The results of the final model indicate that income, OTT advertising revenue and labor freedom were statistically significant. A Hausman test was used to differentiate between the fixed effects and random effects model, as shown in Table 7. Based on the results of the Hausman test, the final outbound tourism model's p -value is 0.0006, which is less than 0.1, demonstrating that the fixed effects model is preferred. Therefore, in the outbound tourism model, heteroscedasticity was controlled among the countries.

For the final inbound tourism model, the total number of observations was 265. The R -squared for the final inbound tourism model was 0.257, and its within- F statistic was significant at the 0.01 level. In the final inbound tourism model, the coefficient for OTT advertising revenue was positive and significant at the 0.01 level specification. The coefficient for mobile broadband penetration was also positive and significant at the 0.01 level specification, which shows that it had a positive impact on inbound tourism. However, income, population density, fixed broadband penetration, investment freedom, labor freedom, financial freedom, and trade freedom had no significant impact on inbound tourism. For the final outbound tourism model, the total number of observations was 266. The R -squared for the inbound tourism model was 0.993, and its within- F statistic was significant

at the 0.01 level. The coefficient for income was positive and significant at the 0.01 level specification. The coefficient for OTT advertising revenue was also positive and significant at the 0.01 level specification. In the final outbound tourism model, labor freedom was positive and significant at the 0.05 level, which shows that it had a positive impact on outbound tourism. However, population density, mobile broadband penetration, fixed broadband penetration, investment freedom, financial freedom, and trade freedom had no significant impact on outbound tourism. Lastly, the Durbin–Watson statistics were examined for the assumption of the independence of errors. Though each Durbin–Watson statistic was less than 2.0, which meant that there was a positive autocorrelation, the value of the final model for inbound and outbound tourism increased compared to the initial model, indicating that the autocorrelation problem was solved to some extent.

Table 7. Panel regressions of outbound tourism.

Variables	Outbound Tourism					
	Model 1		Model 2		Model 3	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Income	20,055.67	4.481 **	9594.145	2.674 **	13,189.39	3.248 **
Population density	1400.353	0.427	384.855	0.108	−10,586.82	−0.766
Investment freedom	−46.905	−0.346			87.107	1.052
Labor freedom	120.102	1.070			197.672	2.328 *
Financial freedom	−263.796	−1.920			35.614	0.450
Trade freedom	85.011	0.327			107.164	0.783
OTT advertising revenue			149.840	5.200 **	145.487	5.008 **
Mobile broadband penetration			24.275	1.297	29.355	1.473
Fixed broadband penetration			179.450	1.259	188.883	1.264
Constant	−184,334.0	−4.012	−84,993.37	−2.194 *	−102,281.6	−1.453
Number of observations	266					
Hausman statistic (<i>p</i> -value)	10.530 (0.1040)		7.4704 (0.1879)		29.016 (0.0006)	
Model	Random effect		Random effect		Fixed effect	
Time and country controlled	yes		yes		yes	
R^2	0.064		0.243		0.993	
F	4.471 **		16.711 **		590.063 **	
Durbin–Watson stat	0.441		0.940		1.230	

* $p < 0.05$, ** $p < 0.01$.

4. Discussion

The goal of this study is to examine whether information and communication technology (ICT) infrastructure, OTT market growth, and economic freedom affect international tourism in a country. Toward this end, the present study tested panel regression models of inbound tourism and outbound tourism utilizing the data from 50 countries covering the years 2013 to 2020. A total of 400 observations was employed for the panel-data analysis.

In the inbound tourism model, the empirical results indicate that OTT advertising revenue and mobile broadband infrastructure were statistically significant. In the inbound tourism model, high levels of OTT advertising revenue and mobile broadband penetration contribute to high levels of inbound tourism. The results of the outbound tourism model suggest that OTT advertising revenue, labor freedom, and income were statistically significant. These results suggest that, in the outbound tourism model, high levels of OTT advertising revenue, labor freedom, and income affect high levels of outbound tourism.

These results underscore that ICT infrastructure, such as broadband, and media, such as AVOD (advertising video-on-demand), e.g., YouTube, play key roles in promoting international tourism.

5. Conclusions

This study investigated whether ICT infrastructure, OTT market growth, and the level of economic freedom affect tourism at the national level. In the inbound tourism model, the empirical results indicated that both OTT advertising market revenue growth and mobile broadband penetration were key factors, but income, population, and all types of economic freedom were not statistically significant. These results are supported by many previous studies, which suggest that ICT, including mobile broadband infrastructure, influence international tourism demand in terms of visiting destinations [23,53–55]. The results also indicated that advanced mobile broadband networks, such as fourth generation (4G) and fifth generation (5G) networks, drive high levels of inbound tourism.

The results also underscored the strong link between OTT market growth, which indicates the ICT and media development in a country, and inbound tourism demand. Since the main characteristic of travel is mobility, the use of mobile technology in ICTs is essential. In addition, considering that more OTT users are opting for mobile devices over PCs for their OTT services, mobile broadband infrastructure is essential for using streaming video services [26]. Furthermore, considering that online marketing, such as social media strategy, is an essential component of smart tourism, marketing strategies through OTT services, such as YouTube and Facebook, play an important role in promoting inbound tourism.

Furthermore, as international tourism has achieved great progress under globalization, which has motivated potential tourists to have limitless broadband access for information, leisure, and social connection [18,56], it is also implied that the high levels of OTT market growth and use as a facilitating factor of globalization have induced high levels of demand for inbound tourism.

In the outbound tourism model, the results of the data analysis indicated that OTT market growth, labor freedom, and income are significantly associated with outbound tourism demand. As film-tourism experiences increase tourist engagement, it is suggested that the use of OTT, which provides a variety of and a large amount of video content, may increase users' travel motivations. It also seems that high levels of labor freedom, including regulations regarding laws inhibiting layoffs and regulatory restraints on hours worked, could promote high demand for overseas trips since ease and flexibility with regard to time are the essential requirements for planning a trip. In general, a low degree of labor freedom means that the instability and vulnerability of the labor market are relatively high, and such a labor environment can be a major obstacle for the public to travel abroad.

Interestingly, the OTT advertising revenue variable was statistically significant in both inbound and outbound tourism models. These results imply that ICT and media play key roles in promoting both outbound and inbound tourism. Considering that the impacts of digital transformation (DX) on the tourism industry are becoming stronger, these results are understandable.

This research has some limitations. First, a comparatively small number of observations were employed for the panel-data analysis. Moreover, data availability for more diverse ICT and media variables, such as social media diffusion, was not sufficient. Therefore, multiple measurements for dependent variables could not be employed in this study. For instance, as a measurement of international tourism, time-series data for tourist stay were not available for all countries. In addition, data availability issues constrained the generalizability of the empirical model and validity of research results. By incorporating diverse variables in empirical models, future studies may test more complex causal patterns between the diffusion of digital transformation and international tourism. In addition, employing multiple research methods and multiple measurements for variables, future studies may reveal more diverse results.

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