DIGITAL GOVERNANCE FOR SMART TOURISM: HOW ICT REGULATION DRIVES OUTBOUND TRAVEL GROWTH

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Abstract. *Outbound tourism has grown rapidly in recent years, partly due to the increasing use of digital technologies for travel planning and booking. This study examines how ICT regulatory maturity affects outbound tourism departures using cross-country panel data from the World Bank. Results show that stronger ICT regulations significantly increase outbound travel by improving digital access and reducing transaction costs. The preferred fixed-effects model indicates that a one-unit increase in ICT regulatory maturity raises outbound departures by about 75.1%. Robustness checks, including an instrumental-variable approach using lagged regulation, confirm that the findings are reliable. The study highlights digital regulatory governance as an important driver of outbound tourism in the era of smart tourism.*
Keywords: *ICT regulations, Outbound Travel, Smart Tourism*

Introduction

In recent years, outbound tourism has expanded rapidly driven by rising incomes and improved mobility. In addition, as travelers increasingly using online platforms to search travel information and make traveling plans, the digital environment has become a significant factor of cross-border travel. In this context, ICT regulatory maturity, which reflects the effectiveness of governing digital infrastructure, online services and data flow, plays an essential role in strengthening digital infrastructure, reducing information barriers and developing smart tourism services.

Despite growing concern for digitalization in tourism industry, prior empirical research largely focused on internet access and technological adoption, while paying limited attention to the governing efficiency of the ICT. To address this gap, this study aims to measure the impact of ICT regulatory maturity on outbound departures.

Literature Review

With digitalization reshaping the tourism field, the relationship between information and communication technology development and international tourism demand is attracting increasing attention. Researches focus on the fundamental importance of ICT infrastructure for global mobility, show that improvements in internet access, broadband penetration and digital server capacity could reduce information asymmetries and facilitate efficiency. Lee used international data based on a new panel quantile approach and found that fixed broadband subscription, mobile cellular usage and secure internet servers significantly raise tourist arrivals across a wide set of countries(C.-C. Lee et al., 2021).Similarly, Sangwon found that mobile broadband infrastructure and digital media service expansion correlate positively with international tourism demand between 2013 and 2020(S. Lee et al., 2022). In the European context, Jelena proved that ICT indices which including internet usage and digital development indicators exert strong effects on both outbound tourism expenditure and travel frequency(Petrovic & Milićević, 2019). Collectively, these studies establish a robust

foundation suggesting that ICT infrastructure forms the technical precondition for supporting outbound travels.

Moreover, a growing literature examines how smart tourism technologies and digital service ecosystems mediate the influence of ICT on tourism behavior. Smart tourism research emphasizes the integration of advanced ICT tools like mobile applications, real-time information systems, big data analytics, digital payments and online travel agencies into tourism service chains. Gretzel defined smart tourism as an ecosystem in which digital technologies transform service delivery, decision-making processes and tourist experiences by enabling seamless connectivity and personalization(Gretzel et al., 2015). Wu reviewed 278 studies spanning from 2012 to 2024 and concluded that digitalization substantially lowers search costs, increases travel transparency and enhances destination competitiveness, furtherly stimulate international travel demand(Wu et al., 2024). Furthermore, case-studies from developing economies illustrates that integrating ICT into tourism marketing and destination management improves visibility and tourist engagement. Mekonnen empirically studied the factors affecting the integration of ICT and tourism in Ethiopia, found that websites, online marketing and digital information platforms substantially enhance destination promotion effectiveness(Wagaw & Mulugeta, 2018).

At last, researchers also pay attention to the institutional and regulatory dimensions of digital transformation, emphasizing that ICT infrastructure and technologies operate within broader systems of governance. Digital governance, regulatory quality and ICT policy frameworks jointly impact how effectively digital services function and how much consumers trust online platforms. Gozgor used panel dataset from 151 countries from 2000 to 2019 showed that measures such as internet shutdowns, online surveillance and restrictive digital controls significantly reduce inbound tourist arrivals(Gretzel et al., 2015). Meanwhile, some researchers stress the importance of regulatory stability and supportive policy frameworks for ICT adoption in tourism. Iwona assessed the impact of information and communication technologies on the operation of the tourism sector, found that institutional support is essential for enabling ICT adoption in tourism marketing and destination management and regulatory and policy structures influence the efficiency of the tourism sector leveraging digital tools(Bak et al., 2022).

Methodology

This study investigates the impact of ICT regulatory quality on outbound tourism departures using a panel dataset derived from the **World Bank's World Development Indicators**. The sample covers *country–year observations* from 2007 to 2022. The dependent variable, **outbound departures**, measures the annual number of residents traveling abroad. To reduce right-skewness and allow for elasticity-type interpretation, the variable is converted into its natural logarithm.

The key explanatory variable is **ICT Regulatory Quality**, an index capturing the effectiveness of regulations governing the ICT sector, including licensing frameworks, competition policies, and digital governance. As ICT regulations shape market efficiency, digital accessibility, and the availability of reliable communication services, they are expected to influence individuals' propensity to travel abroad. Moreover, control variables commonly identified in tourism demand literature are included. Specifically, **GDP per capita** (constant USD) proxies for income effects; **exchange rate** reflects international price competitiveness; **urbanization rate** captures structural socioeconomic development; **internet penetration** measures the population's access to digital

information; **population size** controls for demographic scale; and **political stability** captures institutional conditions that may affect outbound travel behavior.

Table 1 Variable Description

Variable	Description	Source
ICT Regulatory	reflecting the maturity, effectiveness, and comprehensiveness of ICT regulatory frameworks.	world bank
outbound departure	the total number of outbound tourists departing from a country in a given year	world bank
Gdp per capita	Real GDP per capita in constant US dollars	world bank
Exchange rate	Official exchange rate(local currency per USD)	world bank
Urbanization rate	Percentage of the population living in urban areas	world bank
Internet penetration	Percentage of individuals using the internet	world bank
Population	Total population of the country	world bank
Political stability	The stability of politics in a country	world bank

The empirical model is specified as follow:

$$out_departure_{it} = \alpha + \beta_1 \text{ICT_regulatory}_{it} + \beta_2 X_{it} + \in_{it}$$

Where i and t denote country and year respectively, and X_{it} represents the vector of control variables. The study estimates an **Ordinary Least Squares** model as a baseline, followed by **country fixed-effects** models to address unobserved heterogeneity. Multicollinearity was assessed using **Variance Inflation Factors**, and all variables exhibited VIF values well below standard thresholds, indicating no severe multicollinearity. To determine whether FE or random effects should be preferred, the **Hausman test** was conducted. Results strongly rejected the null hypothesis that the RE estimator is consistent, confirming that the FE specification is theoretically and statistically appropriate.

Table 2 Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ict interp	863	74.759	19.926	8.5	100
lnout interp	851	7.953	1.568	1.59	11.95
lngdpp	862	9.496	1.099	5.83	11.81
exchange rate	837	8032529.8	2.324e+08	.21	6.723e+09
urbanization rate	864	71.337	17.168	17.62	100

internet penetration	863	62.661	25	3	100
lnpop	864	16.268	1.675	12.15	21.08
political stability	864	.207	.812	-2.02	1.62

Table 3 Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ict_interp	1.000							
(2) lnout_interp	0.333*	1.000						
	(0.000)							
(3) lngdpp	0.432*	0.339*	1.000					
	(0.000)	(0.000)						
(4) exchange_rate	-0.068	-0.036	-0.119*	1.000				
	(0.051)	(0.301)	(0.001)					
(5) urbanization_r~e	0.234*	0.266*	0.596*	-0.078*	1.000			
	(0.000)	(0.000)	(0.000)	(0.023)				
(6) internet_penet~n	0.513*	0.241*	0.770*	-0.085*	0.524*	1.000		
	(0.000)	(0.000)	(0.000)	(0.013)	(0.000)			
(7) lnpop	0.022	0.677*	-0.198*	0.002	-0.043	-0.170*	1.000	
	(0.520)	(0.000)	(0.000)	(0.946)	(0.202)	(0.000)		
(8) political_stab~y	0.253*	-0.096*	0.675*	-0.060	0.265*	0.509*	-0.520*	1.000
	(0.000)	(0.005)	(0.000)	(0.080)	(0.000)	(0.000)	(0.000)	

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4 Variance inflation factor

	VIF	1/VIF
lngdpp	5.057	.198
lnpop	3.653	.274
lnout interp	3.606	.277
political stability	2.719	.368
internet penetration	2.424	.412
urbanization rate	1.635	.611
exchange rate	1.018	.983
Mean VIF	2.873	.

Table 5 Hausman (1978) specification test

	Coef.
Chi-square test value	52.404
P-value	0

Result

Table 6 presents the estimation results for the impact of ICT regulatory quality on outbound tourism departures. Across all model specifications, the coefficient on **ICT Regulatory Quality** remains positive and statistically significant, confirming the hypothesized relationship between stronger digital regulatory environments and higher levels of outbound travel. In the preferred fixed-effects model, the estimated coefficient is **0.751**, significant at the **10% level** ($p < 0.1$), indicating that improvements in ICT regulation are positively associated with outbound tourism.

To address potential endogeneity concerns—such as reverse causality or omitted variable bias—this study employs a one-period lag of the key explanatory variable as an instrumental variable (IV). The rationale is that past ICT regulatory conditions are strongly correlated with current regulatory levels but unlikely to be directly affected by current outbound tourism demand, thereby satisfying both relevance and exogeneity requirements. Table 7 reports the results of the instrumental variable regressions and the associated endogeneity diagnostics.

The findings show that the lagged ICT regulatory indicator is a valid and significant instrument, as confirmed by the first-stage statistics. After accounting for endogeneity, the effect of ICT regulatory quality on outbound departures remains positive and statistically significant, with a magnitude comparable to the baseline fixed-effects estimates. This consistency across estimation methods indicates that endogeneity does not materially distort the relationship between ICT regulatory maturity and outbound tourism.

Table 6. Regression Results

	(1) ict_interp	(2) ict_interp
lngdpp	5.578***	5.188***
	(4.281)	(3.833)
exchange_rate	-0.000	-0.000
	(-1.128)	(-1.208)
urbanization_rate	0.823***	0.911***

	(5.205)	(5.537)
internet_penetration	0.288***	0.289***
	(14.318)	(13.917)
lnpop	21.445***	20.116***
	(4.820)	(4.402)
political_stability	-3.337***	-3.465***
	(-3.716)	(-3.788)
lnout_interp		0.751*
		(1.784)
_cons	-402.826***	-389.465***
	(-5.669)	(-5.339)
N	835	823
R^2	0.635	0.632
F	225.348	186.943

***p<0.01, **p<0.05, *p<0.10

Table 7 Regression Results

	(1)	(2)
	lnout_interp	ict_interp
llnout_interp	0.531***	1.108***
	(15.092)	(3.056)
lngdpp		4.519***
		(3.510)
exchange_rate		-0.000**
		(-2.016)
urbanization_rate		0.884***
		(5.538)
internet_penetration		0.269***
		(13.935)
lnpop		17.227***
		(3.991)
political_stability		-2.842***
		(-3.478)
_cons	3.744***	-335.860***
	(13.348)	(-4.844)
N	796	774
R^2	0.235	0.631
F	227.776	174.533

***p<0.01, **p<0.05, *p<0.10

Discussion

This study provides empirical evidence that ICT regulatory maturity plays an important role in shaping outbound tourism flows across countries. By integrating regulatory quality into tourism

demand analysis, the research expands existing literature that has traditionally focused on economic, social, and technological factors while overlooking the institutional foundations of digital environments. The estimation results consistently show that stronger ICT regulatory frameworks are associated with higher levels of outbound departures, suggesting that effective digital governance reduces information asymmetries, enhances online service reliability, and facilitates cross-border mobility through more efficient access to travel-related digital platforms.

From a policy perspective, the results imply that governments seeking to stimulate outbound tourism—or strengthen smart tourism ecosystems more broadly—should prioritize the development of coherent, transparent, and technologically adaptive ICT regulatory frameworks. Such policies not only enhance domestic digital environments but also strengthen individuals' confidence and capability to engage in international travel through digital channels. Future research may extend this analysis by exploring heterogeneous effects across income groups, considering dynamic policy changes, or examining interactions between ICT regulation and specific smart tourism technologies. In conclusion, this study underscores the growing importance of digital governance in shaping global tourism mobility.

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