아태연구 제32권 제2호 (2025) https://doi.org/10.18107/japs.2020.27.4.004

A New Test of the Tourism-Led Growth Hypothesis Using Unconditional Quantile Regression (UQR) with Panel Data

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| Abstract |

This study has attempted to sketch out testing Tourism-led Growth Hypothesis (TLGH) from 1995 to 2020 for 47 major countries worldwide. A confounder approach has been utilized in model specification, while Unconditional Quantile Regression (UQR) and Recentered Influence Function (RIF)-Oaxaca method are used for regressing and decomposing the factors. Unlike other studies used the income level as the quantile, this study employed the Pritchett (2000)'s different economic growth patterns for each country as a new quantile, then double quantile regression has been performed.

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As a result, first, we could reject the null-hypothesis that tourism growth has a positive impact on economic growth using tourism receipts variable, which the most of the previous literature used. Second, it is interesting to note that central government debt plays a big negative role in the group of low-growth countries, but not in the countries with high economic growth rates. Third, it is also worth noting that excessively high exchange rate (depreciation of the currency) might have a negative impact on economic growth rate in the low-growth patterns' countries. Finally, total exports has a positive impact on economic growth only in the groups of the high growth countries.

Moreover, this paper provides a policy implication from the decomposition results that the difference of means in growth rates between groups can not be explained by the variables used, but they siginificantly rely on country-specific effects.

▪ Key Word: Tourism-led growth hypothesis, confounder approach, unconditional quantile regression (UQR), RIF-Oaxaca decomposition

I. Introduction

Recently, many country's tourism revenues have benefited from the continuous expansion of the tourism industry after the COVID-19. Despite the spread of trade protectionism, the tourism industry is one of the fastest growing industries worldwide. A hot issue in the tourism industry, especially in less developed countries (LDCs), is testing whether the tourism development really boosts the entire economy, called tourism-led growth hypothesis (TLGH). However, it is difficult to generalize the impact of the TLG on the economy since the level of development in the tourism industry varies from country to country, continent to continent, and along

with government policy efficiency: The complexity of potential benefits and negative externalities in the relationship between tourism and economic impact is characterized by both vastness and heterogeneity of contents. There might be confounding variables (Bae, 2024), omitted variables (Lean, Chong and Hooy, 2021), and publication bias (Kumar et al., 2021) in specification of the models. Booming economy initiated by tourism industry may lead to a deindustrialization in other sectors, called *Dutch Disease effect*. (Copeland, 1991) It is also worth noting that Bae (2023) argued the efficiency of government's economic policies, including government fiscal policy and exchange rate policy, vary with different economic growth patterns. Bae (2024) also suggested some macroeconomic variables such as level of national or government debt, inflation, and exchange rate may act as confounder, then the regression results could be spurious.

Thus, this paper aims to build a model testing TLGH with various above-mentioned considerations, which are the main contribution of this study. First, confounding or omitted variable approach has been used; second, Unconditional Quantile Regression (UQR) method is utilized; third, Recentered Influence Function (RIF) - Oaxaca decomposition method is employed for decomposing means of each group from 1995 to 2020. Moreover, unlike other studies used the income level as the quantile, this study employed the Pritchett (2000)'s different economic growth patterns for each country as a new quantile, then double quantile regression within each quantile has been performed.

The second section will provide a literature survey on the methodology and characteristics of the TLGH testing using panel data. The third section contributes a model building with some econometric tests and manipulation. The fourth section performs an empirical study to test TLGH with newly manipulated model. The concluding remarks will be presented in the final section.

II. Literature Review on TLGH Testing with Panel Data

Voluminious literature examines the TLGH, since Balaguer and Cantavella-jorda (2002), including studies with single country's time-series, cross-sectional, and longitudinal data. A group of researchers are involved in using panel data since the advantages in conducting panel data study can justify cause-and-effect relationship, while cross-sectional studies cannot pin down the relationship, and a single country's time-series study only shows that country's characteristics which cannot be generalized. In this chapter, we review the research papers focusing on methodology using panel data.

In the literature of testing TLGH, one may recognize the literature in two methodologies. The first methodology, summarized in Table 1, focuses on testing the causal relationship and cointegration with OLS [Sofuoglu (2022)], Vector AutoRegressive (VAR) [Perles-Ribes and Moreno-Izquierdo (2024)] model, Vector Error Correction Model (VECM) [Bae (2024) and Lean, Chong, and Hooy (2014)], Autoregressive Distributed Lag (ARDL) model [Rasool et al. (2021)], Generalized Method of Moments (GMM) [Adeleye, B. N. (2023)], Adedoyin, Erum, and Bekun (2021) and Scarlett (2021)], EGARCH-M model [Chen and Song (2009)], and bootstrap cointegration test [Etokakapan, Bekun, and abubakar (2018)]. The second methodology includes various regression-based approaches and determinant analysis. (Table 2) Bae (2024) incorporated confounder approach with level of debt, exchange rate, and inflation variables. Lean, Chong and Hooy (2014) added exchange rate and international trade variables along with tourism receipts in the economic growth model for better model specification. Kumar et al. (2021) also considered publication bias in their principal component analysis (PCA). Besides, Adedoyin, Erum

and Bekun (2021) inserted the quality of information and communication technology (ICT) in testing TLGH, while Ali, Zaman and Islam (2018) also considered macroeconomic shocks in their model. Moreover, Sim and Zhou (2015) tested TLGH using oil prices, US stock return, and the dependence between their quantiles.

Most findings like Sofuoglu (2022), Rasool et al. (2021), Scarlett (2021), and Tung (2021) did not reject the null hypothesis of TLG. However, some other studies required various preconditions in testing TLGH: Erdem and Tugcu (2013) mentioned that the validity of the hypothesis is strongly country-specific. Adeleye, A. T. et al. (2023) stated that the outcome of tourism receipts was positive and significant on economic growth for high income economies and lower middle-income economies, respectively. Aistov and Nikkolaeva (2019) found that the tourism specialization parameter is not statistically significant in pooled OLS, but significant in fixed and random effect models. Rather, countries with the higher average tourism specialization level are likely to have lower GDP growth rate. Etokakpan, Bekun and Abubakar (2018) did not find long-run relationships among variables, but in the short-run, both TLGH and ALGH are affirmed. Lean, Chong, and Hooy (2014) stated that TLGH is supported only in Malaysia, while it is rejected for Singapore. Maintaining a competitive exchange rate is vital to improve the tourism and economic growth. Pan et al. (2014) found the trade-off between employing export policies and tourism policies to promote economic growth. Moreover, Eilat and Einav (2006) found that the political risk is very important for tourism, and the exchange rate is a significant factor in testing TLGH. Their empirical result shows the exchange rate elasticity is about one for developed nations. Chen and Song (2009) also tested TLGH and supported it for Taiwan but not for Korea. A reciprocal relationship was found for Korea.

In testing TLGH, many studies which used quantile regression (QR)

analysis are available. A QR which was introduced by Koenker and Bassett (1978) has been widely used in many fields of economics, sociology, and education. Canay (2011) explains the methodology of QR for panel data. Table 3 compares Ordinary Least Squares (OLS) regression and QR method: OLS, which estimates conditional mean, starts with unrealistic statistical assumptions, including constant variance (homoskedasticity), linearity, and normality, while QR, estimates conditional median known as least-absolute value (LAV) models or minimum absolute deviation (MAD) models. They do not necessarily assume those critical statistical shackles. QR is a linear regression of the θ-quantile of the dependent variable on the independent variable. In addition, the different measures of central tendency and statistical dispersion of each quantile can be useful to obtain a more comprehensive analysis of the relationship between variables. Perhaps, the most useful and attractive econometric argument is that the QR method may mitigate the dependent variables' endogeneity problem. (Kunze, 2006) Furthermore, QR method is applicable for data with heteroskedasticity since division of heteroskedastic data into a few quantiles mitigates the heteroskedasticity. The main advantage using QR method is to see the whole pictures, not just over-generalized ideas extracted from regressions of the aggregate data (Cameron and Trivedi, 2022).

On the results of the empirical studies using QR method, Lolos, Palaios, and Papapetrou (2021) used asymmetric error-correction model (ECM) to test TLGH on Greece over the period 1977Q1-2020Q2. Their findings show that the long-run relationship between tourism and output exists. The effect is more pronounced at the lower quantiles of output while at the higher quantiles of output it becomes weaker and statistically insignificant. Tung (2022) studied four countries including Taiwan, China, Japan, and the US and the results are mixed with different quantiles for each country.

In addition, Unconditional Quantile Regression (UQR) method has been used in this study. Unlike Conditional Quantile Regression (CQR) method, UQR is a method to estimate how changes in the distribution of explanatory variables affect the unconditional quantiles of a dependent variable, which was initiated by Firpo, Fortin, and Lemieux (2009). UQR is a weighted average of the CQR (Alejo et al., 2021), which makes UQR takes and provides a way to detect misspecification. UQR is a special type of regression using Recentered Influence Function (RIF), introduced by Firpo, Fortin, and Lemieux (2018). In decomposition method, the RIF_Oaxaca method, which is a statistical technique that decomposes the difference in the means of an outcome variable (like wages and income) between two groups into contributions from differences in group characteristics and differences in the returns to those characters. Stata program has an RIF_Oaxaca option. [1)]

<Table 1> Review of Literature Testing TLGH Using Causality and Cointegration Method

Author(s)	Methodology	Special Features
Bae (2024)	VECM	Employed confounding process.
Perles-Ribes & Moreno-Izquierdo (2024)	VAR	Extending to tourism as optimal choice hypothesis & tourism-led genuine economic development hypothesis (TLGDH).
Adeleye, B. N. (2023)	PSCC, MMQR, and GMM	Role of information and communication technology in East Asia and the Pacific.
Sofuoglu (2022)	Cointegration test	Pedroni cointegration, Granger causality.

1) For further information of UQR and RIF_Oaxaca decomposition method, see Bae and Okabe (2024).

Author(s)	Methodology	Special Features
Rasool et al. (2021)	ARDL	ARDL cointegration test, BRICS countries.
Scarlett (2021)	System GMM	Non-linear specification.
Adedoyin, Erum and Bekun (2021)	GMM	Institutional quality moderates the impact of tourism on economic growth.
Etokakpan, Bekun and Abubakar (2018)	bootstrap panel cointegration	Testing TLGH versus agricultural-led GH (ALGH).
Lean, Chong, and Hooy (2014)	Panel Granger Cointegration test	Short run versus long run - different relationships exist.
Chen and Song (2009)	EGARCH-M model, Granger causality test	A classical, a robust, and quantile Grnager non-causality tests are used for Taiwan and Korea.

<Table 2> Review of Literature Testing TLGH Using Determinants Analysis

Author(s)	Methodology	Special Features
Bae (2024)	Fixed effect	Confounder approach, level of national debt, exchange rate variables are included.
Raifu and Afolabi (2024)	Structural breaks with fixed effects and FGLS	World's top ten tourism destinations.
Kumar et al. (2021)	Robust elasticity estimation	Publication bias, principal component analysis (PCA).
Ditzen et al. (2021)	Structural breaks method	xbreaks in STATA package.
Aistov and Nikkolaeva (2019)	Pooled-OLS	Parameters are only significant in fixed and random effect models.
Ali, Zaman, and Islam (2018)	SVAR	Various macroeconomic shocks

Author(s)	Methodology	Special Features
Sim and Zhou (2015)	Quantile Regression	Oil prices and US stock return are included.
Lean, Chong, and Hooy (2014)	Panel Fully Modified OLS (FMOLS)	Two control variables, international trade and exchange rate are used for Malaysia and Singapore.
Eilat, Yair and Liran Einav (2004)	Multinomial logit technique estimating demand	Political risk as an important factor determining tourism industry.

<Table 3> Comparisons of OLS with QR

Method	Estimating	Assumption of variance	Linearity	Normality	Sensitivity to outlier
OLS	conditional mean	homoskedasticity	linear	normal	sensitive
QR	conditional median	heteroskedesticity	linear	non-normal	robust

III. Model Building and Econometric Manipulation

1. Model Building

1) Economic Growth Patterns as a Quantile

Suppose that Korea's average economic growth rate from 1965 to 2010 is 7.5%. Does anyone get any types of information related to Korea's economy nothing but the number itself? Does it contain the fact that

Korea was suffering from the *Asian Financial Crisis* during the late 1990s? Pritchett (2000) stated that ignoring such breaks or turning points (see Appendix 1), including several economic and financial crises or country-specific events such as earthquakes and terrorist attacks in the same or different time periods in Latin America, Asia, the USA, and Europe will make economic growth theory redundant.

Thus, Pritchett (2000) utilized a concept of patterns of economic growth and one hundred eleven-grouped countries worldwide in 1960-1990 into Hills, Plateaus, Mountains, and Plains according to country's economic growth path. Besides, Bae (2023) regrouped 96 countries and Appendix 2 illustrates our 47-country samples in groups of SH (steep hills), H (hills), Plateaus (P), and Plains (PL). Most of Asia-Pacific countries are in SH group except Japan and Fiji (PL), while many European countries are in the H group. One of the advantages using the patterns of economic growth rather than absolute values of income as a quantile is that it indicates a direction of economic growth and current economic status as well: For instance, Japan with a long stagnant economic environment will be listed in the top group of income level when using income as a quantile, however, it is listed in the group of countries in PL, along with other low-growth countries in 1995-2020 in our study. The Pritchett (2000)'s method will show the characteristics of each group by economic growth patterns. Using the economic growth patterns as quantile, a double quantile system will be implemented to analyze the degree of economic growth by dividing it into three sub-quantiles (0.25, 0.50, and 0.75) in each quantile.

One more worth noting is the breaks (or turning points) in the long term data. Appnedix 1 illustrates the economic growth breaks for each country. According to Ditzen et al. (2021), they designed "xbreaks" to alleviate the breaks effect. In this study, we have depicted each country's breaks, which mainly related to two financial crises. Instead of using

"xbreaks", this paper drops the COVID-19 period data and utilizes four-year moving average (MA4) technique that mitigates the statistical noise and special breaks of the data. This results a similar effect as "xbreaks" in STATA program.

2) Confounding Problem[2)]

According to Pinzon (2016), suppose we are testing a causal relationship within a regression framework:

$$Y = f(X) + \epsilon \qquad \text{(Eq. 1)}$$

where Y is the outcome vector of interest, X shows a matrix of covariates, f(X) is a vector-valued function, and ϵ is a vector of unobservables, residuals or statistical white noise. Normally, we assume that the average value of ϵ is zero. However, if it is not zero, then the causal relationship is difficult to be tested since ϵ plays a role rather than being a white noise.

Also, assuming the following equation, rewritten from Eq. 1, is a true model,

$$Y = X_1\beta_1 + X_2\beta_2 + \epsilon \qquad \text{(Eq. 2)}$$

and $E(\epsilon|X_1, X_2) \neq 0$. However, estimating this model without inclusion of X_2 variables will be spurious with confounding factors of X_2.

The classical example of the confounding problems can be explained: Coffee drinkers have a greater risk of lung cancer. In testing this hypothesis directly, one can get the positive correlation or causality

2) This section is a summary of confounding problems in Bae (2024).

between two variables, coffee drinking and lung cancer. However, is it really true that there is a causal relationship between these two variables? Does coffee drinking really causes a lung cancer? Medically, no. Various studies show that the effect of smoking confounds the effect of coffee consumption. A larger proportion of smoking coffee drinkers gets lung cancer than non-smoking coffee drinkers.

Using a similar logics, is it true that tourism receipts cause economic growth to grow? There might be various macroeconomic variables play a confounding role in economic growth. For instance, a level of national or government debt impacts both tourism receipts and economic growth. Higher the level of debt in a certain country, lower the tourism receipts and economic growth, which depends on the amount of debt, amortization schedule, and time lag. After deduction of amortization from total debt, less revenues remain in the economy. For instance, *China Money* has flown into many countries including Laos: Laos has been struggling with soaring external debt, reaching 68% of total GDP in 2022, mostly from China (see Bae, 2024). It is certain that this financial burden causes tourism receipts to be shrunk. Other macroeconomic variables, including inflation and foreign exchange rate may act as confounding factors.

3) Spatiotemporal Model Specification

This study employs a model used by Sofuoglu (2022), Lean, Chong and Hooy (2014), and Bae (2024) used:

$$growth_{i,t,j} = \alpha + \delta Z_{i,t,j} + \beta X_{i,t,j} + \epsilon_{i,t,j} \quad \text{(Eq.3)}$$

where $growth_{i,t,j}$ is $i'th$ country's real GDP growth patterns in time t for quantile j. Z vector consists of variables that we are interested such as real tourism receipt, effective exchange rate, inflation rate, and central

government debt level (confounding variables). $X_{i,t,j}$ is a vector of control variables, including foreign direct investment (FDI), market concentration ratio, and total exports, all in real terms. $\epsilon_{i,t,j}$ is a statistical white noise. A double quantile regression was utilized to estimate the parameters. The market concentration ratio variable is used to assess the impact of economic concentration in tourism markets on economic growth. It helps to understand how the concentration of tourist receipts influences a country's economic outcome.

2. Econometric Manipulation

1) Panel Unit Root Test and Moving Average

There are a few econometric manipulations needed before performing a UQR analysis. First, panel data models require a stationarity test whether the data used would be stationary. Panel data contains more combined information and variation than pure time-series or cross-sectional data. It is also informed by many researchers that collectively testing for unit roots in panel data provides more powerful than testing individual series. Chen, Karavias, and Tzavalis (2021) introduced a panel unit root test developed by Karavias and Tzavalis (2014), and utilized in Stata program. It allows for breaks, many factors in real world such as *Asian Financial Crisis*, Great Depression, oil price shocks, and COVID-19, in the intercepts of the individual series or in both intercepts and linear trends. With 100 bootstrap replications, the following Table 4 reports the results for testing the null against the alternative hypothesis:

H_0 : All panel time series are unit root processes without breaks.
H_A : Any of the panel time series is not unit root processes without breaks.

As a result of the Augmented Dickey-Fuller (ADF) test and Philip-Perron's (PP) unit root tests, the time-series data of growth rate (growth) and tourism receipts (lnreceipt) were not found to be stationary at 0.05 level of ρ value. The debt variable (cgd) was found to be stationary at 0.0000 level of ρ value.

<Table 4> A Panel Unit Root Test and MA(4) Results

	ADF		PP(rho)		ADF after MA(4)	
Variables	test stat.	ρ value (MacKinnon)	test stat.	ρ value (MacKinnon)	test stat.	ρ value (MacKinnon)
growth	-1.696	0.433	-0.306	0.729	-3.210**	0.019
lnreceipt	-1.550	0.508	-7.921	0.205	-9.910***	0.000
cgd	-4.574***	0.000	-2.967	0.578	-	-
inflation	-2.545*	0.100	-25.842***	0.000	-2.592*	0.094
reer	1.223	0.996	-7.927***	0.000	-9.910***	0.000

▪ Note: ***, **, and * denote statistical significance at α=1%, 5%, and 10%, respectively.

2) Moving Average Smoothing Technique

According to Min and Choi (2016) and Bae (2023), Eq. 2 illustrates actual rate of GDP growth in N-time horizon $g_t(N)$: It contains three parts, steady state growth rate, $(y_t^* - y_{t-1}^*)$ in period t; dynamic growth rate, $(y_t^T - y_{t-1}^T)$, indicating change from steady state; and cyclical growth rate, $(y_t^C - y_{t-1}^C)$, unrelated to steady state growth rate. These three elements in time series data are called, fitting. In order to eliminate seasonal fluctuations, cyclical up (down) turns, or any other trend, and to increase the degree of fitness, smoothing technique is often employed. In this study, a four-period moving average [MA(4)] smoothing technique is utilized. growth and lnreceipt variables are found stationary after applying a four-period moving average. (see Table 4)

$$g_t(N) = y_t - y_{t-1} = (y_t^* - y_{t-1}^*) + (y_t^T - y_{t-1}^T) + (y_t^C - y_{t-1}^C) + \epsilon_t \quad \text{(Eq. 4)}$$

3) Multicollinearity, Heteroskcedasticity, and Endogeneity Problems

Variance Inflation Factor (VIF) measures the amount of multicollinearity in a set of multiple regression variables, and is widely used. The formula for VIF is:

$$VIF_i = \frac{1}{1 - R_i^2} \quad \text{(Eq. 5)}$$

where R_i^2 is unadjusted coefficient of determination for regressing the ith independent variable on the remaining ones. If the calculated VIF equals to 1, the variables are not correlated, if 1<VIF<5, then variables are moderately correlated, and if VIF>5, then variables are highly correlated that deleting some variables from independent variables might be needed. The results of VIF test from this study shows that real tourism receipts (lnreceipts) and market concentration ratio (mcr) shows VIF scores near from 5, moderate correlation, and other variables show no multicollinearity. The mean VIF is 2.23.

<Table 5> Results of VIF Test

variable	VIF	1/VIF
lnreceipt	4.90	0.20
cgd	1.11	0.90
inflation	1.06	0.94
reer	1.06	0.94
mcr	5.81	0.17
exports	1.48	0.67
fdi	1.14	0.87
mean VIF	2.23	0.45

A traditional regressional analysis often results in inefficient or biased estimates where the data contains heteroskedasticity, such as wages, income, and consumption and endogeneity in independent variables. In the presence of heteroskedasticity and endogeneity, a bulk of researchers including Fan and Lee (2019) shows that an improved inference for predictive QR with persistent predictors and conditional heteroskesastic errors. Breaking a set of data wich contains heteroskesaticity into a few quantiles relieves it to some degrees. Jung, Lee, and MacEachern (2014), Joe and Moon (2020), and Kunze (2006) also shows that QR method may mitigate the dependent variables' endogeneity in the wage equation.

IV. Empirical Study

1. Data Sources

We have a set of annual data from 1995 to 2020 for 47 countries, where data are available, excerpted from the World Bank: GDP per capita growth rate (growth), CPI (inflation), central government debt to GDP ratio (cgd), FDI to GDP ratio (fdi), and reer index. reer index is real effective exchange rate, which is the weighted average of a country's currency in relation to an index or basket of other major currencies (2010=100). Natural log of tourism receipts (lnreceipt) and growth rate of travel receipts (tgrowth) are from World Travel & Tourism Council (WTTC). Calculated growth rates (pattern) for each country were used from Bae (2023). In addition, the market concentration ratio (mcr), which is a ratio of the tourism industry's output (receipts) to total output (GDP) has been used to test if it affects the economic growth rate. This index provides a landscape of tourism industry's size and changing trends. Finally, ratio of total exports to GDP (exports) was used to test its role

in affecting the economic growth.

On the series of debt data, OECD produces general government debt to GDP ratio, while the World Bank produces central government debt to GDP ratio. The general government debt to GDP contains the gross debt of central and local governments. The difference between the two statistics for most of the countries is small, except countries like Canada (50.6% different). IMF produces the central government debt to GDP ratio with larger number of countries. Thus, we use World Bank's and IMF's figures. The debt level is also expressed by national debt which means either national (total) or central government. It is also called government debt which combines different layers of the government (national, municipal, and local). Public debt may include government debt and debt of other parts of the public sector, including public corporations. Finally, the debt service refers to the money required to cover the payment of interest and principal on a loan or other debt for particular time. (World Bank)

2. Descriptive Statistics Analysis

Table 6 shows some descriptive statistics, number of observations, mean, standard deviation, minimum value, and maximum value for the data used in 47 countries from 1995 to 2020: The mean of entire countries' economic growth rate (growth) is 2.8%, while that of tourism sector (tgrowth) shows only 0.7%. However, regarding to the standard deviation, tgrowth (0.235) is much larger than growth (0.039). Thus, one may state that tourism sector has the larger variation from it's mean value with lower growth rate. The tourism sector's receipts are more sensitive figures since the income elasticity in this sector is overly high.

<Table 6> Descriptive Statistics for Data Used

Variable	obs	Mean	Std. Dev.	Min	Max
growth	1,152	0.028	0.039	-0.235	0.434
tgrowth	1,152	0.007	0.235	-0.846	1.610
inflation	1,152	0.061	0.326	-0.03	10.583
cgd	1,152	0.491	0.315	0.031	2.181
fdi	1,152	0.054	0.218	-0.400	4.491
exports	1,152	-0.003	0.079	-0.525	0.454
reer	1,152	0.989	0.146	0.479	1.589
mcr	1,152	0.013	0.024	0.000	0.194

Table 7 shows a correlation matrix for the major variables interested in this paper by using our panel data for 47 countries. Unexpectedly, there is a negative correlation between tourism receipts (lnreceipt) and economic growth rate (growth), -0.070 at α=1%. There are also strong positive correlation between a level of central government debt (cgd) and tourism receipts (lnreceipt), while cgd has a strong and negative correlation with the economic growth. One may see a certain negative role of inflation on both tourism receipts and economic growth. The depreciation of exchange rate (reer) certainly affects tourism receipts, but no impact has been found on economic growth.

<Table 7> Correlation Matrix among the Variables Interested

	growth	lnreceipt	cdg	inflation	reer
growth	-	-0.070 (0.010)***	-0.203 (-0.000)***	-0.119 (-0.000)***	0.015 (0.592)
lnreceipt	-0.070 (0.010)***	-	0.212 (0.000)***	-0.050 (0.082)*	0.062 (0.033)**
cdg	-0.203 (-0.000)***	0.212 (0.000)***	-	-	-

	growth	lnreceipt	cdg	inflation	reer
inflation	-0.119 (-0.000)***	-0.050 (0.082)*	-	-	-
reer	0.015 (0.592)	0.062 (0.033)**	-	-	-

▪ Note: ***, **, and * stand for statistical significance at α=1%, 5%, and 10%, respectively.

3. Results of Empirical Study in UQR Estimation

Regressing Eq. 4 by UQR with fixed effects and 200 iterations of bootstrap results in Table 8. This paper used three quantiles in each group, q_0.25, q_05, and q_0.75 in each growth pattern quantile. First, it is striking to note that the tourism receipts (lnreceipt) affects economic growth negatively in q_0.5 (SH) and q_0.75 (H, P, and PL). It is comparable that tourism growth has positive impact on economic growth in q_0.5 (SH), q_0.25 and q_0.5 (H and P), and q_0.25 and q_0.75 (PL). Thus, one may reject the null hypothesis that the tourism growth (tgrowth) impacts the entire economic growth (growth) by using tourism receipts variable (lnreceipts). However, only partly, we do not reject the null hypothesis in using tourism growth variable instead of tourism receipts variable. In SH, both variables in q_0.5 show a weak (α=10%) statistical significance level. This can be explained by the fact that, compared to the tourism receipts variable (lnreceipts), the tourism growth variable (tgrowth) contains information for two years, meaning that it captures more clear relationship that changes over time.

Second, central government debt (cgd) has a negative impact on economic growth only in q_0.5 and q_0.75 of H, and all rifs in PL. It is interesting to note that central government debt plays a big negative role in PL group with lower economic growth rates, but not in the groups of countries with higher economic growth rates patterns. Third, inflation variable has a mixed effect on economic growth: In q_0.5 of SH group, it

has a positive impact on economic growth with α=5% level, however, in q_0.25 of H, it has a negative impact with α=5% level,

Fourth, real effective exchange rate (reer) seems to affect economic growth negatively only in q_0.50 and q_0.75 of PL. The higher the exchange rate (depreciation), the lower the economic growth rate is. It is worth noting that excessively high exchange rate might have a negative impact on economic growth in the low-growth patterns' countries. Fifth, it appears that market concentration ratio (mcr) does not affect economic growth regardless of the groups. Sixth, it also appears that total exports has a positive impact in q_0.50 of SH and all rifs in H. Both groups are high growth pattern countries.

<Table 8> Results of UQR Fixed Effects and Bootstrap Estimation

variable	SH			H			P			PL		
	q_0.25	q_0.50	q_0.75	q_0.25	q_0.50	q_0.75	q_0.25	q_0.50	q_0.75	q_0.25	q_0.50	q_0.75
lnreceipt	-0.004 (-1.06)	-0.005 (-1.91) *	-0.006 (-1.28)	0.002 (0.80)	-0.001 (-0.19)	-0.003 (-1.96) **	0.003 (1.64)	-0.002 (-1.43)	-0.008 (-3.47) ***	-0.002 (-1.27)	-0.002 (-1.16)	-0.006 (-2.55) ***
tgrowth	.014 (0.70)	0.022 (1.66) *	.028 (1.49)	0.044 (2.67) ***	0.021 (2.20) **	0.017 (1.52)	0.029 (1.98) **	0.020 (1.89) *	0.003 (0.12)	.036 (2.75) ***	.015 (1.33)	.036 (1.86) *
cgd	-0.016 (-0.87)	-0.013 (-1.19)	-0.010 (-0.56)	-0.018 (-1.41)	-0.019 (-2.17) **	-0.023 (-2.42) **	0.006 (0.86)	-0.007 (-1.10)	-0.007 (-0.83)	-0.020 (-1.70)*	-0.015 (-2.31) **	-0.019 (-2.47) **
inflation	-0.005 (-0.23)	0.029 (2.20) **	0.038 (1.55)	-0.042 (-2.07) **	-0.19 (-0.94)	-0.016 (-1.46)	-0.012 (-0.35)	-0.008 (-0.21)	-0.007 (-0.07)	-0.143 (-0.79)	-0.137 (-0.98)	-0.171 (-0.85)
reer	0.000 (0.27)	-0.000 (-0.80)	-0.001 (-1.24)	-0.000 (-0.28)	-0.000 (-0.31)	-0.001 (-0.88)	0.003 (0.42)	-0.004 (-0.48)	-0.011 (-0.56)	-0.001 (-1.45)	-0.001 (-1.75) *	-0.001 (-1.92) **
fdi	-0.073 (-0.44)	-0.017 (-0.19)	0.029 (0.17)	-0.004 (-0.27)	-0.006 (-1.04)	-0.006 (-1.08)	0.031 (1.17)	-0.026 (-1.04)	0.077 (1.35)	0.013 (0.33)	0.007 (0.20)	0.003 (0.07)
mcr	0.578 (0.81)	0.825 (1.58)	1.117 (1.28)	0.202 (0.47)	-0.284 (-0.94)	-0.162 (-0.65)	0.022 (0.37)	0.039 (0.77)	0.116 (1.22)	0.351 (1.44)	0.132 (0.80)	0.266 (1.20)
exports	0.003 (0.18)	0.023 (1.93) *	0.002 (0.91)	0.016 (1.99) **	0.023 (3.68) ***	0.022 (2.58) ***	0.001 (1.67) *	0.001 (0.58)	-0.001 (-0.95)	0.003 (0.10)	0.009 (0.38)	0.009 (0.43)

variable	SH			H			P			PL		
	q_0.25	q_0.50	q_0.75	q_0.25	q_0.50	q_0.75	q_0.25	q_0.50	q_0.75	q_0.25	q_0.50	q_0.75
cons	0.126	0.156	0.202	-0.027	0.043	0.127	-0.065	0.074	0.248	0.140	0.116	0.258
	(1.39)	(2.57) **	(1.78) *	(0.51)	(1.00)	(3.42) ***	(-1.70) *	(2.10) **	(3.80) ***	(1.79) *	(2.25) **	(3.15) ***
sigma u	0.016	0.010	0.013	0.018	0.011	0.009	0.015	0.015	0.019	0.018	0.011	0.015
sigma e	0.030	0.023	0.030	0.035	0.027	0.027	0.028	0.024	0.036	0.026	0.018	0.027
rho	0.231	0.150	0.158	0.020	0.134	0.105	0.295	0.282	0.226	0.331	0.263	0.251
F-stat	(1.56)*	(1.21)	(1.34)	3.36***	2.14**	1.80**	4.10***	4.13***	2.88***	(3.35)***	(2.47)***	(2.26)***

▪ Note: 1. rho represents fraction of variance due to u_i. 2. F test that all u_i=0 is provided. 3. : ***, **, and * stand for statistical significance at =1%, 5%, and 10%, respectively. The coefficients of time variable are not reported here since it is strongly significant in all quantiles and groups.

4. Results of RIF_Oaxaca Decomposition Estimation

From the RIF_Oaxaca decomposition estimation using a mean as RIF, we compared SH and H, SH and P, and SH and PL. Table 9 reports the results. In general, we found that the means of group differences are large, most of them are unexplained, suggesting that the difference comes from the country-specific effect.

<Table 9> Results of Decomposition

growth1 overall	SH & H	SH & P	SH & PL
group1	0.048 (19.81)***	0.048 (19.81)***	0.048 (19.81)***
group2	0.029 (17.43)***	0.015 (4.40)***	0.024 (10.92)***
Difference	0.019 (6.40)***	0.032 (7.87)***	0.024 (7.46)***
Explained	-0.007 (-1.13)	-0.001 (-1.24)	-0.008 (-1.24)
Unexplained	0.026 (3.87)***	0.034 (4.97)***	0.032 (4.72)***
RIF	Mean	Mean	Mean
group 1 group c group 2	2 X1*b1 X2*b1 X2*b2	2 X1*b1 X2*b1 X2*b2	2 X1*b1 X2*b1 X2*b2

▪ Note: ***, **, and * stand for statistical significance at α=1%, 5%, and 10%, respectively.

In all three comparisons, SH and H, SH and PL, and SH and P, the decomposition parts are statistically significant at α=1%, and so are the differences. In SH and H, the difference between means of groups shows 0.019 (1.9%), and explained part accounts for -0.007, while unexplained

part accounts for 0.026: One can expect that the unexplained part is greater than the total difference. Jann (2018) states that this negative contribution is plausible when the difference would be even greater than average mean of each group's economic growth rate. In SH and P, the difference between means of groups shows 0.032 (3.2%), larger than previous comparison, and unexplained part accounts for more than 100% of the difference as before. In SH and PL, the difference is 0.024 (2.4%), and unexplained part accounts for more than 100% of the difference as before. Thus, one may state from the decomposition of the groups analysis that the difference of means between groups can not be explained by the variables used, but they rely on country-specific effect.

V. Concluding Remark

This study tests the Tourism-led Growth Hypothesis (TLGH) with two different contributions in methodology: Confounding approach and standardization of the quantiles with economic growth pattern used by Pritchett (2000) and Bae (2024). We have used UQR method, which became popular in economics literature after Firpo, Fortin, and Lemieux (2009) introduced. A Recentered Influence Function (RIF)_Oaxaca decomposition method, which was initiated also by Firpo, Fortin and Lemieux (2018), was utilized.

Thus far, one may reject the null hypothesis that the tourism growth impacts the entire economic growth by using tourism receipts variable, which the most of literature used. However, only partly, we may not reject the null hypothesis by using tourism growth variable. On one hand, it is interesting to note that central government debt plays a big negative role in PL group with lower economic growth rates, but not in the groups of countries with higher economic growth rates patterns. On the other

hand, it is also worth noting that excessively high exchange rate might have a negative impact on economic growth in the low-growth patterns' countries, or it seems that the exchange rate systems in the low-growth countries do not work efficiently. Finally, total exports has a positive impact on economic growth in q_0.50 of SH and all qs in H. Both groups include the high growth pattern countries.

This paper provides a policy implication from the RIF_Oaxaca decomposition method that the difference of means in growth rates between groups, such as Asia-Pacific countries vs. Latin and Central American countries can not be explained by the variables used, but they rely significantly on country-specific effect, including development of political, economic, and legal institutions. The future research needs to focus on elucidating these country-specific effects in testing the relationship between economic growth and tourism-led growth.

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<Appendix 1> 47 Countries Used in the Study with Turning Points

	Asia-pacific Countries		European Countries		Latin and Central American Countries		Others
1	Australia (2000)	1	Bulgaria (2008)	1	Bolivia (2009)	1	Bahamas (2009)
2	Fiji (2009)	2	Croatia (2009)	2	Brazil (2010)	2	Bahrain (2008)
3	India (2008)	3	Finland (2009)	3	Columbia (1999)	3	Canada (2008)
4	Indonesia (1998)	4	Germany (2009)	4	Costa Rica (2005)	4	Guyana (2005)
5	Japan (1998,2007)	5	Hungary (2008)	5	Ecuador (2003)	5	Kuwait (2009)
6	S. Korea (1998, 2008)	6	Iceland (2008)	6	Paraguay (2000)	6	Mexico (2009)

	Asia-pacific Countries		European Countries		Latin and Central American Countries		Others
7	Lao PDR (2009)	7	Italy (2007)	7	Uruguay (2002)	7	Moldova (2009)
8	Malaysia (1998)	8	Latvia (2009)			8	Russian Fed. (2008)
9	New Zealand (2009)	9	Norway (2008)			9	Tunisia (2011)
10	Singapore (2009)	10	Poland 2008)			10	Uganda (2006)
11	Thailand (1998)	11	Portugal (2009)			10	US (2008)
12	Turkiye (2011)	12	Romania (2009)			11	US (2008)
		13	Spain (2008)				
		14	Sweden (2009)				
		15	Switzerland (2009)				
		16	UK (2009)				
		17	Ukraine (2009)				

▪ Note: Turning points of year(s) are in the parenthesis.

<Appendix 2> Patterns of Economic Growth Using Pritchett (2000)'s Definition

Devision	Definition	Countries
stiff hills (SH)	$g_a > 3\%,\ g_b > 3\%$	Bolivia, India, Indonesia, Lao PDR, Malaysia, Poland, Singapore, Turkiye, and Uganda
hills (H)	$g_a > 1.5\%,\ g_b > 1.5\%$	Australia, Bahrain, Columbia, Costa Rica, Ecuador, Finland, Hungary, Korea Rep. Malta, Moldova, New Zealand, Norway, Paraguay, Romania, Sweden, Thailand, and Uruguay
accelerators (AL) or denver	$g_a < 1.5\%,\ g_b > 1.5\%$	Paraguay
plateaus (PT)	$g_a > 1.5\%,\ g_b < 1.5\%$	Brazil, Bulgaria, Canada, Finland, Iceland, Kuwait, Latvia, Mexico, Russian Fed., Switzerland, Tunisia, UK, and US
mountains (M)	$g_a > 1.5\%,\ g_b =$ minus figures	Bahamas, Croatia, and Spain
plains (PL)	$g_a < 1.5\%,\ g_b < 1.5\%$	Fiji, Germany, Guyana, Italy, Japan, Portugal, Switzerland

▪ Source: Bae (2023)

| **논문투고일** : 2025년 04월 25일 |
| **논문심사일** : 2025년 05월 19일 |
| **게재확정일** : 2025년 05월 27일 |

| 국문초록 |

패널 데이터와 무조건 분위회귀 (UQR) 분석을 이용한 관광주도 성장가설의 새로운 검정

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본 연구의 목적은 1995년부터 2020년까지 자료획득이 가능한 47개 국가를 대상으로 관광주도성장가설 (TLGH)을 새로운 모형으로 검정하는 것이다. 즉, 새로운 모형에는 교란변수 접근법이 활용되었으며, 회귀분석으로는 무조건부 분위회귀(UQR) 분석과 재중심영향함수(RIF)_ Oaxaca 분해방법이 사용되었다. 또한, 소득수준을 분위의 단위로 사용하는 다른 연구들과는 달리 Pritchett (2000)이 제시한 경제성장패턴이 활용되었고, 각 패턴의 분위 안에서 성장률에 대한 이중적 분위분석이 실행되었다. 결과적으로, 첫째로, 본 연구에서는 대부분의 연구에서 사용된 관광수입을 변수로 사용하였을 때, 관광산업의 성장이 전체 경제성장에 이바지한다는 귀무가설을 기각하게 되었다. 둘째로, 중앙정부부채가 저성장국가에서는 큰 부정적인 역할을 하지만, 경제성장률이 높은 나라에서는 그렇지 않다는 것이 흥미롭다. 셋째로, 저성장국가에서 지나친 통화가치의 하락은 오히려 경제성장률에 부정적인 영향을 미칠 수 있다는 점도 주목할 만하다. 마지막으로, 총수출은 고성장 국가 그룹에서만 경제성장에 긍정적인 영향을 미친다는 것을 발견하였다. 또한, 본 연구의 분해결과에서는 그룹 간 경제성장률의 평균적인 차이는 본 연구에서 사용한 변수로는 설명할 수 없으며, 정치적, 경제적, 법적인 기관의 발전 등의 국가별 특징에 크게 의존한다는 정책점 시사점을 제시한다.

▪ 주제어: 관광주도 성장가설, 교란변수 접근법, 무조건부 분휘회귀분석, 재중심영향함수